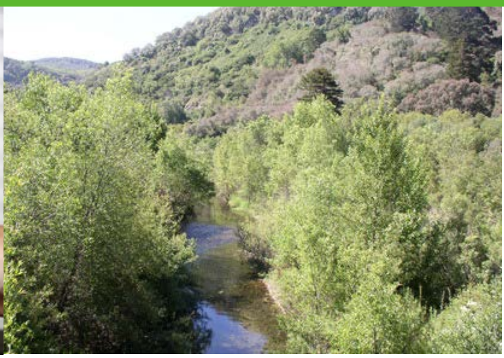
# VOLUME II: APPENDICES TO THE EIR

Pure Water Monterey
A Groundwater Replenishment Project

# CONSOLIDATED FINAL ENVIRONMENTAL IMPACT REPORT
FOR THE
# PURE WATER MONTEREY GROUNDWATER REPLENISHMENT PROJECT



## JANUARY 2016

*Prepared for:*

Monterey Regional Water Pollution Control Agency
in partnership with
Monterey Peninsula Water Management District

Partners for Pure Water Solutions
MRWPCA
Monterey Peninsula Water Management District

*Prepared by:*


Denise Duffy & Associates, Inc.
Environmental Consultants Resource Planners
947 Cass Street, Suite 5
Monterey, CA 93940
(831) 373-4341


DD&A

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# Scoping Report for the Pure Water Monterey Groundwater Replenishment Project Environmental Impact Report

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Denise Duffy & Associates, Inc.
PLANNING AND ENVIRONMENTAL CONSULTING

# SCOPING REPORT

## for the

## PURE WATER MONTEREY

## GROUNDWATER REPLENISHMENT PROJECT

## ENVIRONMENTAL IMPACT REPORT

March 2015

Prepared by:

Denise Duffy & Associates, Inc.

In association with Valerie Young, Hazen and Sawyer

Prepared for:

Monterey Regional Water Pollution Control Agency

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# 1. INTRODUCTION

In accordance with California Environmental Quality Act (CEQA) guidelines, the Monterey Regional Water Pollution Control Agency (MRWPCA) is preparing a Draft Environmental Impact Report (EIR) for the Monterey Peninsula Groundwater Replenishment Project (GWR Project or proposed project). The Draft EIR will assess the potential impacts from the proposed project on the physical environment. On May 30, 2013, MRWPCA began the CEQA scoping process to help determine issues, mitigation measures and alternatives to be evaluated in the Draft EIR by issuing a Notice of Preparation (NOP), provided in Appendix A. The NOP described the proposed project and identified opportunities for agencies and the general public to submit comments on topics to be considered in the EIR. The MRWPCA also held an in-person scoping meeting on June 18, 2013; the meeting was advertised in local papers and notice also provided in the circulated NOP. In Section 6 of this report, a summary of the Supplement to the May 2013 NOP is provided and the relevant comments received during that second scoping period are summarized.

This report provides an overview of the scoping process for the GWR Project, and summarizes the comments received during the scoping period. Comments from this report that are applicable to a particular topic in the EIR are described in the introduction to that topical section of the Draft EIR.

This report is intended to summarize and document the comments received during the two scoping periods: May 30, 2013 to July 2, 2013 and December 9, 2014 through January 8, 2015, including both verbal and written comments. The MRWPCA will use this report as a tool to ensure that scoping comments are considered during preparation of the Draft EIR.

# 2. PURPOSE OF SCOPING PROCESS

CEQA Guidelines Section 15082 specifies that, after deciding that an environmental report is required for a project, the lead agency must send to the Office of Planning and Research and each responsible agency and trustee agency a notice of preparation stating that an environmental impact report will be prepared.

> *"The notice of preparation shall provide the responsible and trustee agencies and the Office of Planning and Research with sufficient information describing the project and the potential environmental effects to enable the responsible agencies to make a meaningful response."*

Within 30 days after receiving the notice of preparation, each responsible and trustee agency and the Office of Planning and Research must provide the lead agency with specific detail about the scope and content of the environmental information related to the responsible or trustee agency's area of responsibility that must be included in the EIR. At a minimum the response shall identify:

> *"The significant environmental issues and reasonable alternatives and mitigation measures that the responsible or trustee agency, or the Office of Planning and Research, will need to have explored in the draft EIR."*

In order to expedite consultation, the lead agency may request one or more meetings between representatives of the agencies involved to assist the lead agency in determining the scope and content of the environmental information that the responsible or trustee agency may require.

CEQA Guidelines Section 15083 recognizes that the lead agency may also consult with any person or organization it believes will be concerned with the environmental effects of the project.

> *"Prior to completing the draft EIR, the Lead Agency may also consult directly with any person or organization it believes will be concerned with the environmental effects of the project. Many public agencies have found that early consultation solves many potential problems that would arise in more serious forms later in the review process. This early consultation may be called scoping. Scoping will be necessary when preparing an EIR/EIS jointly with a federal agency.*
> *(a) Scoping has been helpful to agencies in identifying the range of actions, alternatives, mitigation measures, and significant effects to be analyzed in depth in an EIR and in eliminating from detailed study issues found not to be important.*
> *(b) Scoping has been found to be an effective way to bring together and resolve the concerns of affected federal, state, and local agencies, the proponent of the action, and other interested persons including those who might not be in accord with the action on environmental grounds.*
> *(c) Where scoping is used, it should be combined to the extent possible with consultation under Section 15082. "*

MRWPCA distributed the notice of preparation to responsible and trustee agencies, and to the Office of Planning and Research, and invited responsible and trustee agencies to a scoping meeting. In addition, MRWPCA distributed the NOP to interested members of the public and organizations, and opened the scoping meeting to the public.

The comments provided by the public and agencies during the scoping process will help the MRWPCA identify issues, methods of analyses, and level of detail of information and analysis in the EIR. The scoping comments will also assist the MRWPCA in developing a reasonable range of feasible alternatives that will be evaluated in the EIR.

Scoping comments that pertain to CEQA will be considered during the preparation of the Draft EIR. Non-CEQA comments will be noted for the record in the final version of this scoping report. The MRWPCA and the EIR preparers, which includes specialists in each of the environmental subject areas covered in the EIR, will assess the comments received and determine how they should addressed. This consideration of scoping comments is intended to ensure that the EIR is both comprehensive and responsive to issues raised by the public and regulatory agencies, and satisfies all CEQA requirements.

Scoping is not conducted to resolve differences concerning the merits of a project or to anticipate the ultimate decision on a proposal. Rather, the purpose of scoping is to help ensure that a comprehensive EIR will be prepared that provides an informative basis for the decision-making process.

# 3. Overview of Scoping Process

## 3.1 Mailing List

In preparation for the scoping period, the MRWPCA developed a contact list of potentially affected persons and agencies that would have an interest in, or jurisdiction over, project-related actions proposed within the project area. The contact list included all known federal, state, responsible, and trustee agencies involved in approving or funding the project, as well as relevant local agencies and special districts with jurisdiction in the project area. The list was developed using the Monterey Peninsula Integrated Regional Water Management (IRWM) stakeholder list, the MRWPCA noticing distribution list, Monterey Peninsula Water Management District noticing distribution list, and the Greater Monterey County IRWM Regional Water Management Group.

## 3.2 Notice of Preparation

A Notice of Preparation was prepared in compliance with the CEQA Guidelines Section 15082 (Appendix A). The NOP solicited comments on the scope of environmental issues as well as alternatives and mitigation measures that should be explored in the EIR. The NOP provides background information on relevant water supply conditions, briefly describes the proposed GWR Project, identifies the location of the project and describes the probable environmental issue effects of the project to be analyzed in the EIR. Public agencies were invited to comment on the scope and content of the environmental information that is relevant to each agency's statutory responsibilities with regard to the proposed GWR Project. Members of the public were also invited to provide their comments on the scope of the EIR. The public scoping period began on May 31, 2013 and ended at 5:00 PM on Tuesday, July 2, 2013, which provided the required 30-day scoping comment period. To initiate the required scoping period, 15 copies of the NOP with the required transmittal, were submitted via overnight mail to the Governor's Office of Planning and Research (OPR) State Clearinghouse. The OPR State Clearinghouse distributes the NOP to applicable state agencies and departments, including the State Water Resources Control Board, Division of Financial Assistance, a state agency division that will act as designated lead for federal environmental regulatory compliance (i.e., CEQA-plus) for the Clean Water State Revolving Fund Program, which is partially funded by the U.S. Environmental Protection Agency. In addition, the NOP was distributed electronically and by mail to over 638 government agencies, non-government organizations, private companies, and individuals (see Appendix B for an overview of NOP recipients).

## 3.3 Other Notifications

- Notice of Availability (NOA) of the NOP was published in the following newspapers:
    - Monterey Herald on June 2 and 9, 2013
    - Californian – Salinas on June 5 and 12, 2013
    - Coast Weekly, Carmel Pine Cone and Cedar Street Times (various dates June 2012)
- NOA was posted at the MRWPCA Office (5 Harris Ct, Monterey, CA 93940) and at the MRWPCA Wastewater Treatment Plant (14811 Del Monte Boulevard , Marina, CA 93933)
- NOP was posted on the MRWPCA GWR Project website

- NOP was sent to the following libraries for public posting:
    - Carmel Harrison Library
    - Carmel Valley Public Library
    - Castroville Public Library
    - California State University Monterey Bay Library
    - Marina Library
    - Monterey Library
    - Monterey Peninsula College Library
    - Pacific Grove Library
    - Salinas Public Library
    - Seaside Library

MRWPCA also made additional outreach efforts for the public scoping meeting through print and social media. A press release was sent to media outlets in the Monterey Bay region identifying the project, the NOP scoping period and the date and time for the public scoping meeting. An "evite" event invitation was also set up on social media for the NOP Public Scoping meeting with a link to the GWR website reaching approximately 150 people.

### 3.4 PUBLIC SCOPING MEETING

The MRWPCA held a public scoping meeting on Thursday, June 18, 2013 from 6:00 to 8:00 PM at the Oldemeyer Center: Dance Hall Room, 986 Hilby Avenue, Seaside, CA 93955. The scoping meeting included a presentation of the information contained in the NOP, an overview of the CEQA process, and provided attendees an opportunity to comment on the scope of the EIR (see presentation in Appendix C-1). A total of 37 people attended the scoping meeting including: government representatives, non-governmental organizations, and local citizens (see Appendix C-2). Comments received during the scoping meeting were documented during the meeting on flipcharts (see Appendix C-3), and also summarized in meeting notes (see Appendix C-4).

## 4. SUMMARY OF SCOPING COMMENTS

During the scoping period, MRWPCA received comments in the form of personal communication (from one individual), emails, and letters. Verbal comments were received at the scoping meeting held on June 18, 2013. This section contains a summary of all verbal and written comments received. The meeting notes from the scoping meeting are included in Appendix C-3 and C-4 and copies of written comments are included in Appendix D.

The MRWPCA consultant team and staff reviewed all of the scoping comments, numbered the individual comments within each letter, prepared a one- to two-sentence summary of each comment, and grouped the comments into the following issue, and sub-issue categories:

- General/Procedural Comments
- Comments on Project Description and Alternatives *[Note: A matrix of the type of comment, or sub-issue category, within this general category of comments is also provided.]*

- National Environmental Policy Act Process, including Federal Regulatory Compliance
- Permits/Authorizations/Agreements/Rights of Way
- Comments on Specific EIR Topical Issues
    - Agriculture and Forestry
    - Air Quality/Greenhouse Gas
    - Biological Resources
    - Climate Change Effects on Project
    - Cultural Resources
    - Hazards / Public Health and Safety related to Drinking Water Quality
    - Land Use/Consistency with Plans and Policies
    - Groundwater Hydrology
    - Growth Inducing Impacts
    - Hydrology and Water Quality: Surface Water
    - Traffic during Construction
    - Utilities
    - Water Demand/Supplies
    - Cumulative Impacts
- Issues Not Analyzed under CEQA
    - Economics /Cost, except as it may result in indirect physical impacts to the environment

The comment summaries seek to capture the main point of every comment in a way that will facilitate addressing the comment in the EIR and the CEQA process, more generally. The full version of comment letters are provided in Appendix D and this Appendix should be reviewed together with this scoping report. [Some individual comments apply to multiple topical areas, and will be considered in all pertinent topical areas of the EIR.]

## 4.1 List of Letters/Commenters and Acronyms

A. Eleanor Citen (EC)
B. Water Plus (WP)
C. State Water Resources Control Board (SWRCB)
D. U.S. Army Garrison, Presidio of Monterey, Directorate of Public Works, Master Planning (USA POM)
E. Department of Parks and Recreation (DPR)
F. Coalition of Peninsula Businesses (CPB)
G. Farm Bureau Monterey (FBM)
H. Monterey County Resource Management Agency (MCRMA)
I. California State Lands Commission, Division of Environmental Planning and Management (CSLC)
J. Monterey Regional Waste Management District (MRWMD)
K. Peter Le (PL)
L. California Department of Public Health, Drinking Water Program, Environmental Review Unit (CDPH)
M. Seaside Basin Watermaster (SBW)
N. Monterey Peninsula Water Management District (MPWMD)
O. City of Pacific Grove (CPG)
P. City of Seaside (CSe)
Q. City of Monterey (CM)
R. Marina Coast Water District (MCWD)
S. Fort Ord Community Advisory Group (FOCAG)
T. City of Salinas (CSa)
U. Bill Carrothers (BC)

<u>List of Commenters at the Public Scoping Meeting</u>

MTG-A. Bill Carrothers
MTG-B. Ron Weitzman (these comments were also submitted in written form "Letter B")
MTG-C. George Riley
MTG-D. Helen Rucker
MTG-E. Bill Carrothers (a second time)
MTG-F. Ron Weitzman (a second time)
MTG-G. Helen Rucker (a second time)

## 4.2 Comments on General CEQA and Procedural Issues

C-15: The Water Board staff requests that they receive the draft CEQA document and that they receive notice to all associated hearings and meetings. (SWRCB)

H-5: Monterey County Resource Management Agency requests a copy of the Administrative Draft EIR. (MCRMA)

I-1 California State Lands Commission (CSLC) is a trustee agency and if the GWR Project involves work on sovereign lands, the CSLC will act as a responsible agency. (CSLC)

I-14: Mitigation measures should be specific, feasible and enforceable obligations. (CSLC)

K-9: Requests that MRWPCA staff make a presentation to the MCWD Board on their expectations of the MCWD roles on this proposed project. (PL)

O-1: The City of Pacific Grove is in support of the goals to expand recycled water uses. (CPG)

O-2: Pacific Grove is developing its own recycled water project, the Pacific Grove Local Water Project, to provide non-potable water to multiple sources. (CPG)

T-3: City of Salinas believes funding for public outreach is currently inadequate for the scale of the project. Two large economic entities need to agree and approve the project in addition to multiple local jurisdictions, agencies and citizen groups, state and federal entities. It is highly visible and controversial making it especially important that good communication and agreement be attained. A broad array of media platforms need to be used to communicate the project honestly and transparently and to avoid past mistakes. It is imperative that the communications strategy be at the highest level of skill and effort. A rethinking of communications strategy is in order to guarantee success, as will a rethinking of funding. (CSa)

MTG A1-1: This project will need an outstanding hydrologist that is very familiar with the Seaside Basin, a superb water engineer, and a gifted leader.

MTG-C1: Will the EIR explore or include any of the positive impacts in addition to the negative impacts?

MTG-D1: Concerned about the outreach that was done for this meeting and the project in general; noted that few residents were in attendance.

MTG-D2: It is important that "non-experts" are included in the scoping and made aware of project issues.

## 4.3 Comments on Project Description and Alternatives

*NOTE: Table 1 at the end of this report contains a matrix that summarizes the applicability of the comment to the following issues: (1) overall project objectives, purpose and need, (2) alternatives consideration/analysis, (3) project description: mapping / background, (4) relationship to the California Public Utilities Commission's (CPUC's) EIR on the Monterey Peninsula Water Supply Project (MPWSP), and (5) the various project description elements/components, including source water, treatment product water conveyance, concentrate disposal, and injection/recharge.*

D-3: The EIR should explain environmental reasons for selecting and eliminating alternative technologies, or "barriers" for treatment of water. (USA POM)

F-1: The project description should be amended to establish a clearer project purpose and goal. The project's relationship and/or inter-relationship with the regional water project pending before the CPUC should be explained. Whether the GWR Project is intended to be a stand-alone project or as a supplement to Cal-Am's project should be explained. (CPB)

F-8: The EIR should study the GWR project as an independent source of additional Peninsula water supply. (CPB)

H-4: The EIR should include alternate locations of facilities to minimize environmental impacts in alternative analysis. (MCRMA)

I-3: The EIR should provide more detailed project maps and exact locations of injection wells. (CSLC)

I-4: The CSLC identify the project objectives and the project components as described in the NOP. (CSLC)

I-5: The project description should be as precise as possible; it should describe the details of all allowable activities and the timing and length of activities. (CSLC)

I-11: The EIR should consider the effects of sea level rise both on the project and the rate of saltwater intrusion. A project alternative should be provided that would be more resilient to sea level rise. (CSLC)

K-2: The EIR should explain why 3,500 AFY is the target amount of water produced. The EIR should show calculations on this based on this goal number for both existing and future conditions. (PL)

K-3: Will this project utilize the MCWD designs for modified regional treatment plant that were part of the RUWAP project and will this portion of the GWR project be paid by MCWD? What additional work on the regional treatment plant that will be done on this project? How does MRWPCA identify and separate all costs for two different projects? (PL)

K-4: What are the impacts of the GWR project on the MCWD recycled water project? What is the required separation between MRWPCA recycled pipes and MCWD recycled pipes? (PL)

K-5: The EIR should consider the alternative of recharging the Seaside Aquifer with excess inter flow water from the Salinas River. (PL)

K-6: How do the discharges of the proposed advanced water treatment plant and secondary source water affect the MCWD brine disposal capacity and the total capacity of the existing outfalls? (PL)

M-1: GWR project will not "replenish" the Seaside Groundwater Basin, as the NOP claims. It will act as an interim storage basin for the injected water until it is pumped out for municipal use. (SBW)

M-3: The map provided in the NOP does not clearly show were the facilities are to be located; provide detailed maps of recharge facilities. (SBW)

M-4: The NOP states that Cal Am owns 12 wells within the Seaside Groundwater Basin, this should be changed to, "Cal Am *currently operates* 12 production wells in the Seaside Groundwater Basin." (SBW)

M-5: The description of the Watermaster should be changed to, "The Watermaster Board of Directors consists of nine entities, one representative from each…" The next-to-last sentence on page seven should read, "Water levels were found to be below sea level in *portions of* both…" (i.e., add "portions of") (SBW)

M-6: The secondary goal of assisting in the prevention of seawater intrusion in the Seaside Groundwater Basin should be removed or clarified, per comment M- 1. (SBW)

M-7: Due to the known contamination in Blanco Drain and Reclamation Ditch waters, the GWR treatment facilities should be designed to address all potential pollutants to produce water of suitable quality for injection into the Seaside Groundwater Basin, which is used for potable water supply. (SBW)

M-8: The first sentence on page 17 should be revised to read, "With groundwater levels currently below sea level in *portions of* both ..." (SBW)

O-3: In order to comply with State Water Board requirements for discharges to Areas of Special Biological Significance, Pacific Grove may divert a portion of (approximately 2,500 gpm to 12,000 gpm) its storm water to the MRWPCA treatment plant for use in the GWR project. (CPG)

O-4: Address the facilities that would be required to convey additional storm water from Pacific Grove. (CPG)

O-5: The benefits to local MS4 discharges should be acknowledged in the Project Objectives. (CPG)

P-1: Could the project scope be expanded to also consider recharging the Carmel River as either an alternative or as an option? (CSe)

P-4: Project design is not finalized and the NOP contains language describing possible adverse constraints; change language to allow flexibility in the final project design to facilitate project implementation. (CSe)

P-5: Please clarify the areas and how much land in the City of Seaside are being referred to as the "Coastal Recharge Facilities" and the "Inland Recharge Facilities" as shown in Figure 2. (CSe)

P-6: Correct or clarify the NOP statement that the proposed inland recharge facilities are within a City-planned utility corridor; no City-planned utility corridor in the area shown in Figure 2. (CSe)

P-7: Please clarify where the four deep injection wells noted under the description of Inland Recharge Facilities on page 17 would be built, including well containment, back flush pit, fencing, treatment facility, etc. (CSe)

P-9: Clarify or remove page 17 statement regarding recharge ability of shallower wells in the Coastal Recharge Facilities. The statement describes the potential facilities but also appears to discount the value of the facilities when addressing recharge capability. (CSe)

P-10: Clarify statement on page 17 of NOP regarding available land within the City of Seaside. Suggest "The locations for the proposed coastal recharge facilities were determined based on an analysis of *potentially* available land and known aquifer characteristics." (i.e., add "potentially") (CSe)

Q-1: Concerns about the process and rationale behind the project definition. In order to ensure an adequate environmental review the definition and understanding of the project must be clear, for this the scope of the project might need revision. Lack of clarity behind the background of how the project scope was defined. If revision is necessary, now is a good time for it. (CM)

Q-2: Has MRWPCA considered sources water from the perspective of dry weather patterns or wet weather flows from storm drains? Identification of sources is not consistent in the NOP. (CM)

Q-5: Will there be any credits to member entities for flows that go into the GWR and if there are, will there be any quantification of what those credits will be? (CM)

R-2: Encourages MRWPCA to explore alternative source water volumes above the 3,500 AFY total specified in the NOP. (MCWD)

R-4: Requests inclusion of potential for use of Marina Coast Water District's recycled water facilities for conveyance of GWR water from AWT facility to Seaside Groundwater Basin, given appropriate compensation to the district for that access. (MCWD)

R-5: Recommends exploration of long-term plan for GWR Project. Will project continue injecting water into the Seaside Groundwater Basin once the Basin is recharged and operating within protective groundwater elevations and sustainable yield? Are there other uses for AWT water? Sending AWT water north to combat seawater intrusion in the Salinas Valley Groundwater Basin is a possibility. (MCWD)

R-6: MCWD encourages MRWPCA to evaluate alternatives that include variable seasonal flow rates of source waters without the need for including secondary or tertiary effluent sources. The seasonal flow of water sources for the AWT facility is an operational consideration if the outflow is to be at a single predictable rate. (MCWD)

T-4: Recommends clarification and emphasis on project's independent justification, purpose and utility. This is especially true for any desalination project, there is a lot of discussion of them as though they are connected. (CSa)

T-5: Regarding options A and B pipeline routing, between City of Salinas agricultural wash water settling ponds and the MRWCPA treatment facilities, please also address the pipeline from City of Salinas pump station to treatment facilities. (CSa)

T-7: Recommend clarification about whether source waters are from one specific source "…or a combination of the following sources…" and delineate how the determination will be made, and when. (CSa)

T-8: Recommend that MRWPCA remain flexible, if possible, with regard to detail of pipe size, capacity, pump location and size. That CEQA studies focus on routing and environmental factors rather than system design as that is not yet finalized. Also, if more than 3,500 AFY can be sourced, would environmental processing need to be repeated or is it possible to avoid going through the process again if system capacity were to increase? (CSa)

T-9: Regarding page 13, recommend that MRWPCA consider two conveyance pipelines be laid rather than one, for both source and recycled water. This would accomplish both cost savings and give MRWPCA a leg up as a regional source of recycled water. The second pipeline may remain temporarily unused, but could be put to use later for recycled water or for greater intake of source water and the economics of scale would be very beneficial in the long term. (CSa)

MTG-C2: Will other alternatives to the project (besides those already included) be addressed in the EIR?

MTG-F1: Is it possible that a larger scale version of the GWR project can solve the entire water supply issue, therefore eliminating the need for a desalination plant?

## 4.4 Comments on NEPA Process, including Federal Regulatory Compliance

C-3: The CWSRF Program is partially funded by the USEPA, and therefore, it requires CEQA-Plus environmental documentation and review for project. The Water Board will consult directly with responsible agencies. Any environmental issues raised by these agencies must be resolved prior to Water Board approval of CWSRF financing. The project must demonstrate compliance with following environmental regulations (SWRCB):

- Endangered Species Act Section 7 (also comment C-4) (SWRCB)
- National Historic Preservation Act Section 106 (also comment C-6) (SWRCB)
- Federal Clean Air Act conformity (also comment C-8) (SWRCB)
- California Coastal Zone Management Act (also comment C-9) (SWRCB)
- Clean Water Act Section 404 (also comment C-10) (SWRCB)
- Farmland Protection Policy Act (also comment C-11) (SWRCB)
- Migratory Bird Treaty Act (also comment C-12) (SWRCB)
- Flood Plain Management (also comment C-13) (SWRCB)
- Wild and Scenic Rivers Act (also comment C-14) (SWRCB)

T-1: Project may be eligible for federal funding. City of Salinas advises that CEQA could be used to develop NEPA if done correctly, and assist with federal funding. (CSa)

## 4.5 Comments on Permits/Authorizations/Agreements/Rights of Way

I-2: The CSLC has jurisdiction and management of Tidelands, submerged lands, and beds of navigable lakes and waterways. All tidelands and submerged lands, granted or ungranted, as well as navigable lakes and waterways, are subject to the protections of the Common Law Public Trust. (CSLC)

E-1: The Department is concerned about the installation of the product water pipeline within the TAMC ROW, and the access that would be taken through FODSP. This access must be coordinated in advance (up to 18 months for temporary construction easements). Department staff should be included in any meetings that involve the use of FODSP. (DPR)

F-2: If use of CSIP facilities are used as part of the project, the rights landowners for use of reclaimed water up to the first 19,500 AFY and MRWPCA's right to divert any portion of that water must be explained. (CPB)

F-3: Source waters must be clearly identified and the status of agreements for acquisition must be disclosed. Legal rights to the use the source water and then the distribution of recycled water need to be clearly established and legal disputes must be resolved, and if necessary, water supply must be sufficient to meet the assurances to the agricultural community and provide water for sale to Cal Am for drinking water. (CPB)

G-2: There must be a clear understanding of what water rights are used for the project. Orange County proved that technology and science support the benefits of this type of program. (FBM)

G-3: Monterey County Farm Bureau hopes the CEQA process will identify additional water sources that can be used to, and potential be contracted for, supplying reclaimed water for this program. (FBM)

H-1: This project will require Use Permits and Coastal Development Permits. Monterey County will be the responsible agency. (MCRMA)

H-6: Monterey County Resource Management Agency recommends that a Pre-Application meeting be scheduled as soon as possible. (MCRMA)

J-1: The Monterey Regional Waste Management District is responsible for approving the Electric Power Purchase Agreement as well as approving construction access and right of way easements. (MRWMD)

K-7: What is involved in the cooperation between MRWPCA and MCWD involve as described in page 11 of the NOP? (PL)

K-8: Has MRWPCA communicated with any staff from MCWD on its proposal to use partially completed recycled water systems? How does this project affect MCWD access to the acquired Armstrong Ranch property? (PL)

L-1: The CDPH is responsible for issuing water permits when there are changes to water supply. The CDHP will need to issue a new or amended water supply permit for the proposed project should the project proceed under the alternatives described. The CDHP will be a responsible agency under CEQA. (CDPH)

L-2: The project must comply with any draft of adopted (groundwater recharge and reuse) regulations. Frequent communication with CDPH is recommended. (CDPH)

M-10: The permit required from the Watermaster is called, "Agreement for Storage and Recovery of on-Native Water from the Seaside Groundwater Basin." (SBW)

P-2: The project proposes to use storm water as a potential water source. Does it propose to revise the MRWPCA NPDES Permit to allow storm water to be conveyed and treated by the existing sewer facilities? (CSe)

P-11: The EIR should include Seaside Highlands Homeowners Association in the "Potential Permits and Approvals Required" if some of the land being considered for Coastal Injection Wells is within their jurisdiction. (CSe)

Q-6: Existing and pending regulatory reasons mandate the flow of both dry and some wet weather storm drain flows to the MRWPCA STP, with the goal of removing pollutants from the receiving water (Monterey Bay). Have there been any discussions with the State Water Resources Control Board regarding the potential for discharging filter reject concentrate as described in the NOP into the receiving water that the diversions are intended to protect? (CM)

R-3: MCWD's senior right to return water from MRWPCA's treatment plant must be recognized when discussing available plant output. MCWD is willing to consider leasing a portion of those rights for a predetermined period. (MCWD)

T-2: The project should attain permits as soon as possible. The Water Board can take up to two years for issuance or revision of permits. Permitting should be done concurrently with environmental study processes. Recommend consulting with the Water Board early to clarify the process, and to explore the possibility of "Master Permits". (CSa)

## 4.6 Comments on Specific EIR Topical Issues

Agriculture and Forestry

C-11: The project must comply with the Farmland Protection Policy Act. (SWRCB)

H-3: If protected trees are to be removed, a Forest Management Plan is required. (MCRMA)

Air Quality/Greenhouse Gas

C-8: The project must be in compliance with Federal Clean Air Act by providing air quality studies. If the project is in a non-attainment area, it must also provide a summary of estimated emission for the project, and if the emission are above de minimis levels, but project is sized to meet the needs of the current population, show how this increase was calculated. (SWRCB)

I-10: The EIR should include a GHG emissions analysis that identifies thresholds, calculates emissions, determines significance, and identifies mitigation. (CSLC)

Biological Resources

C-3: The project must demonstrate compliance with following environmental regulations (SWRCB):

- Endangered Species Act Section 7 (also comment C-4) (SWRCB)
- California Coastal Zone Management Act (also comment C-9) (SWRCB)
- Clean Water Act Section 404 (also comment C-10) (SWRCB)
- Migratory Bird Treaty Act (also comment C-12) (SWRCB)

C-5: The Water Board will consult with USFWS and/or NMFS to determine of the project will have any direct or indirect effects on federally listed threatened, endangered, or candidate species on the site and surrounding areas. They will also identity measures to reduce such effects. (SWRCB)

E-2: The Department is concerned about construction equipment on park roads and trails, traffic control needs, and impacts to natural resources. (DPR)

I-6: The EIR should analyze all potentially significant effects on sensitive species and habitats and identify mitigation measures. CDFW CNDDB and USFWS Special Status Species databases should be used, and consultation with these agencies should occur and be documented. (CSLC)

I-7: The EIR should examine if any elements of the Project would favor non-native species. CDFW's Invasive Species Program can assist with this and help develop mitigation. (CSLC)

I-8: The EIR should evaluate noise and vibration impacts on fish and birds and include mitigation measures for these impacts. Consultation with CDFW, USFWS, and NOAA is recommended. (CSLC)

I-9: The EIR should evaluate impacts to biological resources associated with frac-out, and include mitigation measures. CSLC may request documentation of mitigation for frac-out prior to issuing a lease and provides an example of a Contingency and Resource Protection Plan. (CSLC)

Climate Change Effects on Project

I-11: The EIR should consider the effects of sea level rise both on the project and the rate of saltwater intrusion. A project alternative should be provided that would be more resilient to sea level rise. (CSLC)

Cultural Resources

C-3/C-6: The EIR should demonstrate compliance with the National Historic Preservation Act Section 106. (SWRCB)

C-7: The EIR must identify Area of Potential Effects; records search request must include an area larger than the APE. (SWRCB)

I-12: The EIR should evaluate impacts to submerged cultural resources; contact Pam Griggs (Senior Staff Counsel) to obtain shipwrecks data. Any submerged archaeological site of submerged historic resource that has remained in State waters for more than 50 years is significant. (CSLC)

I-13: Title to shipwrecks, archaeological sites and historic resources on or in the tide and submerged lands are vested in the State and under jurisdiction of the CSLC. (CSLC)

Hazards / Public Health and Safety related to Drinking Water Quality

A-1: Does not support the use of wastewater in the GWR Project because it contains many chemicals. She supported this statement with various materials from Aquafornia. She suggested that Mr. Holden attend meetings in Southern California in order to get excess water from their OC project. (EC)

B-1: The EIR should address toxins in each potential water source. Address discharge rate and natural capacity of Seaside aquifer and flow rate between injection and extraction wells. (WP)

D-1: The EIR should address the quality of recycled water after treatment, questions the effect of injecting recycled wastewater on Seaside Basin groundwater quality; EIR should be thorough and flawless leaving no unanswered questions about safe drinking water. (USA POM)

D-3: The EIR should explain the environmental reasons for selecting and eliminated alternative technologies, or “barriers” for treatment of water. (USA POM)

F-4: The EIR should include previously conducted studies showing contamination of the source waters. It should also explain how the contamination will be dealt with to meet California Department of Public Health standards. Examples of this should be provided. (CPB)

K-7: What is the current residence time of the recharged water as specified by the State? (PL)

M-7: Due to the known contamination in Blanco Drain and Reclamation Ditch waters, the GWR treatment facilities should be designed to address all potential pollutants to produce water of suitable quality for injection into the Seaside Groundwater Basin, which is used for potable water supply. (SBW)

R-7: The EIR should confirm with CDPH the required residence time between injection and extraction for all proposed water sources prior to the publication of the Draft EIR. (MCWD)

R-8: The EIR should confirm that the capacity of the Seaside Groundwater Basin is sufficient, within that predetermined residence time, for the injection of the GWR project water. (MCWD)

S-1: The EIR scope should include assessing existing hazards to drinking water, potential increasing hazards due to migration and leaching of toxic chemicals from former training ranges. (FOCAG)

S-2: Fort Ord is a National Superfund Site, with known contamination of area groundwater; consider the possibility of leaching and migration of chemicals into underground aquifers. Concern for whether the full extent of contamination, including constituents below thresholds, is known and whether these chemicals are a health hazard. Are the human health risks known for this level of exposure? What are the synergistic effects of munitions chemicals and pesticides on organisms? Are there studies available on the effects of low level exposure to these chemicals? (FOCAG)

S-3: The commenter expressed concerns for public communication, identification, record keeping, reporting, "out-gassing," and clean-up/remediation of chemicals and pesticides at very low levels in training areas, including Site #39 (including those in Tables 3, 4, 5, and 6 attachment to letter). (FOCAG)

S-4: Review of the cited cleanup documents did not support the Army's claim that presence of pesticides were evaluated and addressed by clean-up activities. There are several hundred chemicals potentially leaching out of ordnance into the ground as well as residual chemicals from weapons/ordnance training and pyrotechnics. Herbicides were widely used. (FOCAG)

S-5: The detection equipment used to clear this site is incapable of detecting nonmetallic, and deeply buried munitions. Munitions found onsite may not be reliably detected within 4 feet of the surface. (FOCAG)

S-6: a) What is the migration and fate of munitions and pesticide chemicals into this drinking water supply? b) Where did all the chemicals go? c) What Fort Ord document fully investigated the potential munitions and pesticide contamination? d) Is there ongoing monitoring and reporting of the potential munitions and pesticide contamination of the Seaside Groundwater Basin? Where is it? e) What might construction, development, and irrigating in the area above the Seaside Groundwater Basin do for migrating chemicals? (FOCAG)

Land Use/Consistency with Plans/Policies

H-1: The EIR should include an analysis of the project's consistency with the Monterey County General Plan, Land Use Plans, Title 20 and Title 21; this analysis should include appropriate maps. (MCRMA)

P-6: The NOP references a location for the proposed inland recharge facilities and states that it is a City planned utility corridor. This is not accurate as there is no City planned utility corridor in the area shown in Figure 2. Please clarify this point. (CSe)

R-1: MCWD encourages incorporation of GWR with the Greater Monterey County Integrated Regional Water Management Plan (IRWMP) and Monterey Peninsula IRWMP. (MCWD)

Groundwater Hydrology

(Note: Some of these comments are related to Hazards/Public Health, so are also included in that topical issue.)

B-1: The EIR should address discharge rate and natural capacity of Seaside aquifer and flow rate between injection and extraction wells. (WP)

K-7: What is the current State-required residence time of recharged water? (PL)

M-1: The GWR project will not "replenish" the Seaside Groundwater Basin, as the NOP claims. It will act as an interim storage basin for the injected water until it is pumped out for municipal use. (SBW)

N-1: Monitoring of the Santa Margarita aquifer shows that not all water injected would be expected to be extracted; this effect should be better understood. (MPWMD)

N-2: The EIR should contain an evaluation of both the travel time and volume of water moved between injection and extraction sites in order to determine what portion of injected water can be safely extracted and when. To minimize the potential of seawater intrusion a "buffer" amount of water could be injected before extraction occurs. (MPWMD)

R-7: The EIR should confirm with CDPH the required residence time between injection and extraction for all proposed water sources prior to the publication of the Draft EIR. (MCWD)

R-8: The EIR should provide information on whether the capacity of the Seaside Groundwater Basin is sufficient, within that predetermined residence time, for the injection of the GWR project water. (MCWD)

R-9: MCWD requests confirmation from CDPH of the horizontal distance required between points of injection and extraction in the event those two modes of operation are simultaneously occurring, prior to producing the Draft EIR. Will spacing and limited horizontal distance between recharge facility and Bay preclude the use of the facility for GWR? (MCWD)

Growth Inducing Impacts

F-7: The EIR should include a review of the growth-inducing impacts associated with this project. (CPB)

Hydrology and Water Quality: Surface Water

K-5: How do the discharges of the proposed advanced water treatment plant and secondary source water affect the MCWD brine disposal capacity and the total capacity of the existing outfalls? (PL)

Q-7: Existing and pending regulatory reasons mandate the flow of both dry and some wet weather storm drain flows to the MRWPCA STP, with the goal of removing pollutants from the receiving water (Monterey Bay). Have there been any discussions with the State Water Resources Control Board regarding the potential for discharging filter reject concentrate as described in the NOP into the receiving water that the diversions are intended to protect? (CM)

MTG-E3: The EIR should address the quality of water that would be sent to the outfall location as opposed to that of the water sent to Seaside for injection.

MTG-E1: The EIR should include information about industrial and environmental hygiene.

Traffic during Construction

E-2: The Department of Parks and Recreation is concerned about construction equipment on park roads and trails, traffic control needs and impacts to natural resources. (DPR)

H-2: Construction staging areas should be described in the project description and temporary construction impacts should be included in a traffic analysis. (MCRMA)

P-8: The EIR should provide information regarding traffic control and construction to coordinate with the City of Seaside on the implementation of the underground pipeline within the City. (CSe)

Utilities

P-3: Space is limited in the Product Water Conveyance Alignment (Option 2) right of way that follows Cal-Am's proposed pipeline alignment. It is a public right of way in the City of Seaside that would be significantly disruptive. MRWPCA and Cal-Am should coordinate installation to minimize impacts. (CSe)

Water Demand/Supplies

F-2: If use of CSIP facilities are used as part of the project, the rights of landowners for use of reclaimed water up to the first 19,500 AFY and MRWPCA's right to divert any portion of that water must be explained. (CPB)

F-5: The EIR should project the effect of water conservation measures on the amount of inflow and assess MRWPCA's ability to produce reclaimed wastewater. (CPB)

F-6: The EIR should address the effect of increased emphasis on water conservation, recycling and reduction in agricultural and urban runoff on the supply of source water. (CPB)

G-1: The agricultural community asserts that additional sources of water must be obtained in order to satisfy the desired amount of reclaimed water. Until this issue is settled they reserve their support for the project. (FBM)

K-1: The EIR needs to analyze if the project will have an effect on the amount of water supplied to the Marina Coast Water District. If MCWD utilizes it full 2.1 MGD recycled water, will this decrease the amount available for the project? Similarly, if 19,500 AFY is allotted to the agricultural community, how does this affect the proposed project? (PL)

M-2: The Watermaster would prefer that additional water be provided to replenish the Seaside Groundwater Basin to raise groundwater levels to protective elevations. The EIR should address the possible future expansion of the GWR project to provide this additional water. (SBW)

Q-3: Is the 3,500 AFY limitation a function of source water availability or system capacity? Why was a greater capacity not considered so that all member entities could contribute all non-storm/dry weather flows as well as some portion of storm water flows? (CM)

Q-4: How will the member entities ability to convey non-storm and storm water flows be apportioned? Will enlargements in the conveyance systems need to be made for equitable distribution of apportionment? (CM)

T-6: The scale of the project may be inadequate to process the 9,500 to 12,500 AFY of source water available. The remaining source water could be recycled and used for irrigation; however, the discussion of this opportunity has been limited with regard to its processing and distribution. The same applies to the tertiary treatment. Designing the facility for ease and rapidity of expansion is highly recommended. (CSa)

MTG-E2: The EIR should address the potential for operational failures at the Water Treatment Plant.

Cumulative

S-1: The EIR should consider proposed other ground disturbing activities including a horse park. (FOCAG)

P-3: Space is limited in the Product Water Conveyance Alignment Option 2 that follows Cal-Am's proposed pipeline alignment; that is a public right of way in the City of Seaside that would be significantly disruptive, MRWPCA, and Cal-Am should coordinate installation to minimize impacts. (CSe)

## 4.7 Issues Not Analyzed under CEQA

Economics /Cost

C-1: The State Water Board understands that the MRWPCA may be pursuing CWSRF financing for the GWR project, and states that they are a funding agency and an agency with jurisdiction by law. (SWRCB)

D-2: Mr. Guidi requests that the EIR analyze the cumulative socio-economic impacts of this project in conjunction with other regional water projects in the area. He asks that the economic ripple effects of rate be analyzed. An estimated cost (in AF/yr) should be provided and compared to other water supply projects. (USA POM)

K-3: Will this project utilize the MCWD designs for modified regional treatment plant that were part of the RUWAP project and will this portion of the GWR project be paid by MCWD? What additional work on the regional treatment plant that will be done on this project? How does MRWPCA identify and separate all costs for two different projects? (PL)

T-1: Varied and significant potential funding required for the project, including potential federal funding. City of Salinas Industrial Wastewater Improvement project is receiving some funding from federal Economic Development Grant, and possibly Community Development Block Grant as well. City of Salinas advises that CEQA could be used to develop NEPA, and assist with federal funding.

U-1: Provide costs associated with scaling up the proposal, and what it would cost to design the project to have the potential for future capacity increases, including (1) cost of storage facility for excess effluent , (2) cost of solar energy for a desal-only project, (3) amount of required diluent , (4) cost comparison with desal-only project. (BC)

MTG-G1: Is the cost of the GWR project greater or less than the cost of a typical desalination plant?

MTG-G2: Who will bear the cost of this project; will local residents with lower incomes be able to afford to live in this area?

# 5. Consideration of Issues Raised in Scoping Process

This Scoping Report documents the process and results of soliciting and receiving comments on the scope of the EIR from interested agencies and the public. The scoping process assists the lead agency in determining those issues that other agencies, jurisdictions, groups, and public consider to be important to address in the GWR Project EIR. Every issue that has been raised during the Scoping Process that falls within the scope of CEQA will be considered in preparation of the EIR and will be addressed to the extent possible.

# Table 1
# Matrix of Scoping Comments on Project Description and Alternatives

| | Overall Purpose, Need, Objectives | Alternatives Suggested | Project Description: Mapping / Background | Relation to CPUC MPWS Project | Project Description Component | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Source Water | Treatment | Disposal of Reverse Osmosis Concentrate | Product Water Conveyance | Injection/ Recharge |
| D-3: Explain environmental reasons for selecting and eliminated alternative technologies, or "barriers" for treatment of water. | | X | | | X | | | | |
| F-1: Amend project description to establish a clearer project purpose and goal. The project's relationship and/or inter-relationship with the regional water project pending before the PUC, should be explained. Whether the GWR Project is intended to be a stand-alone project or as a supplement to Cal-Am's project should be explained. | X | | | X | | | | | |
| F-8: Study the GWR project as an independent source of additional Peninsula water supply. | X | X | | | | | | | |
| H-4: Include alternate locations of facilities to minimize environmental impacts in alternative analysis. | | X | | | | | | | |
| I-3: Provide more detailed project maps and exact locations of injection wells. [injection] | | | | | | | | | X |
| I-4: The CSLC reiterates the project objectives and the project components as described in the NOP. | | | | | | | | | |
| I-5: Make project description should be as precise as possible; it should describe the details of all allowable activities and the timing and length of activities. | X | | | | | | | | |
| I-11: The EIR should consider the effects of sea level rise both on the project and the rate of saltwater intrusion. A project alternative should be provided that would be more resilient to sea level rise. | | X | | | | | | | |
| K-2: Explain why 3,500 AFY is the target amount of water produced. The EIR should show calculations on this based on this goal number for both existing and future conditions. | X | | | | | | | | |
| K-3: Will this project utilize the MCWD designs for modified regional treatment plant that were part of the RUWAP project and will this portion of the GWR project be paid by MCWD? What additional work on the regional treatment plant that will be done on this project? How does MRWPCA identify and separate all costs for two different projects? | | | | | | X | | | |
| K-4: What are the impacts of the GWR project on the MCWD recycled water project? What is the required separation between MRWPCA recycled pipes and MCWD recycled pipes? | | | | | X | | | X | |
| K-5: The EIR should consider the alternative of recharging the Seaside Aquifer with excess winter flow water from the Salinas River. | | X | | | X | | | | |
| K-6: How do the discharges of the proposed advanced water treatment plant and secondary source water affect the MCWD brine disposal capacity and the total capacity of the existing outfalls? | | | | | | | X | | |

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| | | | | | Source Water | Treatment | Disposal of Reverse Osmosis Concentrate | Product Water Conveyance | Injection/ Recharge |
| M-1: GWR project will not "replenish" the Seaside Groundwater Basin, as the NOP claims. It will act as an interim storage basin for the injected water until it is pumped out for municipal use. | X | | X | | | | | | X |
| M-3: The map provided in the NOP does not clearly show were the facilities are to be located; provide detailed maps of recharge facilities. | | | X | | | | | | |
| M-4: The NOP states that Cal Am owns 12 wells within the Seaside Groundwater Basin, this should be changed to, "Cal Am *currently operates* 12 production wells in the Seaside Groundwater Basin." | | | X | | | | | | |
| M-5: The description of the Watermaster should be changed to, "The Watermaster Board of Directors consists of nine entities, one representative from each…" The next-to-last sentence on page seven should read, "Water levels were found to be below sea level in *portions of* both…" (i.e., add "portions of") | | | X | | | | | | |
| M-6: The secondary goal of assisting in the prevention of seawater intrusion in the Seaside Groundwater Basin should be removed or clarified, per comment M- 1. | X | | | | | | | | |
| M-7: Due to the known contamination in Blanco Drain and Reclamation Ditch waters, the of the GWR treatment facilities should be designed to address all potential pollutants to produce water of suitable quality for injection into the Seaside Groundwater Basin, which is used for potable water supply. | | | | | X | X | | | |
| M-8: The first sentence on page 17 should he revised to read, "With groundwater levels currently below sea level in portions of both ..." | | | X | | | | | | |
| O-3: In order to comply with State Water Board requirements for discharges to Areas of Special Biological Significance, Pacific Grove may divert a portion of (approximately 2,500 gpm to 12,000 gpm) its storm water to the MRWPCA treatment plant for use in the GWR project. | | X | | | X | | | | |
| O-4: Address the facilities that would be required to convey additional storm water from Pacific Grove. | | X | X | | X | | | | |
| O-5: The benefits to local MS4 discharges should be acknowledged in the Project Objectives. | X | | | | | | | | |
| P-1: Could the project scope be expanded to also consider recharging the Carmel River as either an alternative or as an option? | | X | | | | | | X | X |
| P-4: Project design is not finalized and the NOP contains language describing possible adverse constraints; change language to allow flexibility in the final project design to facilitate project implementation. | | | X | | | | | | |
| P-5: Please clarify the areas and how much land in the City of Seaside are being referred to as the "Coastal Recharge Facilities" and the "Inland Recharge Facilities" as shown in Figure 2. | | | | | | | | | X |

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| | | | | | Source Water | Treatment | Disposal of Reverse Osmosis Concentrate | Product Water Conveyance | Injection/ Recharge |
| P-6: Correct or clarify the NOP statement that the proposed inland recharge facilities are within a City-planned utility corridor; no City-planned utility corridor in the area shown in Figure 2. | | | X | | | | | | X |
| P-7: Clarify where the four deep injection wells noted under the description of Inland Recharge Facilities on page 17 would be built, including well containment, back flush pit, fencing, treatment facility, etc. | | | | | | | | | X |
| P-9: Clarify or remove page 17 statement regarding Coastal Recharge Facilities since it describes potential facilities but appears to discount the value of the facilities for recharge. | | | | | | | | | X |
| P-10: Clarify statement on page 17 of NOP regarding available land within the City of Seaside. Suggest "The locations for the proposed coastal recharge facilities were determined based on an analysis of *potentially* available land and known aquifer characteristics." (i.e., add "potentially") | | | | | | | | | X |
| Q-1: Explain the process and rationale behind the project definition. In order to ensure an adequate environmental review the definition and understanding of the project must be clear, for this the scope of the project might need revision. Lack of clarity behind the background of how the project scope was defined. If revision is necessary, now is a good time for it. | | | X | | | | | | |
| Q-2: Has MRWPCA considered sources water from the perspective of dry weather patterns or wet weather flows from storm drains? Identification of sources is not consistent in the NOP. | | X | | | X | | | | |
| Q-5: Will there be any credits to member entities for flows that go into the GWR and if there are, will there be any quantification of what those credits will be? | | X | | | X | | | | |
| R-2: Explore alternative source water volumes above the 3,500 AFY total specified in the NOP. | X | X | | | X | | | | |
| R-4: Include potential for use of Marina Coast Water District's recycled water facilities for conveyance of GWR water from AWT facility to Seaside Groundwater Basin, given appropriate compensation to the district for that access. | | X | | | | | | X | |
| R-5: Recommends exploration of long-term plan for GWR Project. Will project continue injecting water into the Seaside Groundwater Basin once the Basin is recharged and operating within protective groundwater elevations and sustainable yield? Are there other uses for AWT water? Sending AWT water north to combat seawater intrusion in the Salinas Valley Groundwater Basin is a possibility. | X | X | | | | | | | |
| R-6: Encourages MRWPCA to evaluate alternatives that include variable seasonal flow rates of source waters without the need for including secondary or tertiary effluent sources. The seasonal flow of water sources for | | X | | | X | X | | | |

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| | | | | | Source Water | Treatment | Disposal of Reverse Osmosis Concentrate | Product Water Conveyance | Injection/ Recharge |
| the AWT facility is an operational consideration if the outflow is to be at a single predictable rate. | | | | | | | | | |
| T-4: Recommends clarification and emphasis on project's independent justification, purpose and utility. This is especially true for any desalination project, there is a lot of discussion of them as though they are connected. | X | | | X | | | | | |
| T-5: Regarding options A and B pipeline routing, address the pipeline from City of Salinas pump station to treatment facilities. | | X | | | | | | | |
| T-7: Clarify whether source waters are from one specific source "…or a combination of the following sources…" and delineate how the determination will be made, and when. | | X | | | X | | | | |
| T-8: MRWPCA should remain flexible, if possible, with regard to detail of pipe size, capacity, pump location and size. That CEQA studies focus on routing and environmental factors rather than system design as that is not yet finalized. Also, if more than 3,500 AFY can be sourced, would environmental processing need to be repeated or is it possible to avoid going through the process again if system capacity were to increase? | X | X | | | X | | | | |
| T-9: Regarding page 13, MRWPCA should consider two conveyance pipelines be laid rather than one, for both source and recycled water. This would accomplish both cost savings and give MRWPCA a leg up as a regional source of recycled water. The second pipeline may remain temporarily unused, but could be put to use later for recycled water or for greater intake of source water and the economics of scale would be very beneficial in the long term. | | X | | | X | | | | |
| MTG-C2: Will other alternatives to the project (besides those already included) be addressed in the EIR? | | X | | | | | | | |
| MTG-F1: Is it possible that a larger scale version of the GWR project can solve the entire water supply issue, therefore eliminating the need for a desalination plant? | X | X | | | | | | | |

# 6. SUPPLEMENT TO THE MAY 2013 NOTICE OF PREPARATION

As a result of ongoing engineering and technical evaluations and regional coordination efforts that occurred after the 2013 scoping process was completed, MRWPCA updated the project description and prepared a Supplement to the May 2013 NOP in December 2014. The purpose of the Supplement to the NOP was to provide public agencies, interested parties, and members of the public with an opportunity to comment on the scope of the EIR related to updates to the project description. The Supplement to the NOP was made available through the same distribution methods that were used for the May 2013 NOP. The public comment period on the Supplement to the NOP ran from December 10, 2014 to January 8, 2015. A copy of the Supplement to the NOP is included in this scoping report as Appendix E.

MRWPCA received 12 comment documents on the Supplement to the 2013 NOP. A list of the commenters, the date the comment document was received, and a summary of topics raised in the comment documents are included in Table 2. As with the comments that were received during the 2013 scoping process, topics that have been raised in the comment documents on the Supplement to the NOP that fall within the scope of CEQA will be considered in preparation of the EIR and will be addressed to the extent possible.

| Table 2: Summary of Comment Letters Received on Supplement to 2013 NOP (in date order) | | | |
|---|---|---|---|
| **Commenter (type of document)** | **Type of Commenter** | **Date of Comment** | **Comment Summary** |
| California Office of Planning and Research – State Clearinghouse (letter) | State agency | December 9, 2014 | • Copy of letter transmitting Supplemental NOP to State agencies for 30-day review. |
| Water Plus (email) | Organization | December 8, 2014 | • Project must meet State health requirements for injecting recycled water into a drinking water basin.<br>• Substantiate the claim that the GWR project enhances water supply diversification.<br>• Include energy information on project.<br>• Identify source/quantity of water supply for GWR project and fate of treatment residuals. |
| California Native American Heritage Commission (letter) | State agency | December 24, 2014 | • Letter provides recommendations about information and impact analysis to be included in the EIR relative to archaeological resources; also provides list of Native American contacts in Monterey County for CEQA consultation. |
| Peter Le (email) | Individual | January 4, 2015 | • Provide information on how GWR project would affect recycled water rights of Marina Coast Water District (MCWD).<br>• Identify additional work at treatment plant needed for the project and cost to MCWD.<br>• Identify the required separation between GWR distribution pipes and MCWD recycled water pipes.<br>• Consider an alternative of using excess winter flow from Salinas River as recharge water for the Seaside aquifer.<br>• Discuss effect of project on MCWD brine disposal capacity in MRWPCA outfall.<br>• Discuss how project may affect MCWD access to its property at Armstrong Ranch.<br>• Identify if GWR EIR will use or reference MCWD's RUWAP EIR. |
| Surfrider Foundation (letter) | Organization | January 7, 2015 | • Consider alternatives that avoid or minimize impacts to aquatic life from proposed Tembladero Slough diversion. |
| Monterey Peninsula Airport District (letter) | Local agency | January 8, 2014 | • Proposed Lake El Estero diversion site is located within Monterey Airport Influence Area and must be referred to the Airport Land Use Commission for consistency determination. |
| City of Monterey Department of Plans & | Local agency | January 8, 2015 | • Recommends meeting to further refine details of the Lake El Estero diversion component of the project, and potential need for a focused watershed study. |

| Table 2: Summary of Comment Letters Received on Supplement to 2013 NOP (in date order) | | | |
|---|---|---|---|
| **Commenter (type of document)** | **Type of Commenter** | **Date of Comment** | **Comment Summary** |
| Public Works (letter) | | | • Provides information on groundwater level and quality data for the shallow aquifer beneath Lake El Estero.<br>• Diversion of Lake El Estero discharges to the regional treatment plant may provide environmental benefits for water quality.<br>• Consider impacts to biological resources at Lake El Estero.<br>• Consider impacts to cultural resources at Lake El Estero.<br>• Discuss whether portions of the project are in the Coastal Zone within City of Monterey.<br>• Identify regulatory permits required for the whole of the project. |
| California State Water Resources Control Board (letter) | State agency | January 8, 2015 | • Provides information (brochures) on the SRF Program environmental review process and additional federal requirements. |
| California State Department of Transportation (letter) | State agency | January 8, 2015 | • Advises that any work within State right-of-way will require an encroachment permit issued from Caltrans. |
| California State Lands Commission (letter) | State agency | January 8, 2015 | • Provides information on role of State Lands Commission (SLC), and requests more detailed information on location and extent of proposed facilities within the Salinas River and sloughs.<br>• Attaches letter sent by SLC on the May 2013 NOP. |
| City of Seaside – Resource Management Services | Local agency | February 6, 2015 | • Monitoring wells will need to be relocated in the future if City approves development for the area.<br>• Any proposed above-grade features in Seaside shall be screened to minimize visual impacts.<br>• Requests that GWR pipelines follow same route used for the Cal Am water supply project. MRWPCA and Cal Am work within Seaside right-of-way should be performed concurrently. Try to locate facilities within Seaside to areas classified as Utility Corridor or Borderlands under the Habitat Management Plan. |

# Appendix A

# Monterey Peninsula Groundwater Replenishment Project

## Notice of Preparation

## May 30, 2013

# NOTICE OF PREPARATION

## Monterey Peninsula Groundwater Replenishment Project Environmental Impact Report

## Introduction

In accordance with the provisions of the California Environmental Quality Act, the Monterey Regional Water Pollution Control Agency (MRWPCA), as California Environmental Quality Act lead agency, is preparing an Environmental Impact Report (EIR) for the proposed Monterey Peninsula Groundwater Replenishment Project (GWR Project). The GWR Project would create a reliable source of water supply by taking highly-treated water from a new advanced water treatment plant, and recharging the Seaside Groundwater Basin (or Seaside Basin) with the treated water using a series of shallow and deep injection wells. Once injected into the Seaside Basin, the treated water would mix with the groundwater present in the aquifers and be stored for future use. The primary purpose of the GWR Project is to provide 3,500 acre-feet per year (AFY) of high quality replacement water to California American Water Company (or Cal-Am) for delivery to its customers in the Monterey District service area; thereby enabling Cal-Am to reduce its diversions from the Carmel River system by this same amount.[1] Cal-Am is under a state order to secure replacement water supplies by December 2016.

This document serves as the Notice of Preparation (NOP) for the EIR for the GWR Project and solicits comments on the scope of environmental issues as well as alternatives and mitigation measures that should be explored in the EIR. Public agencies are invited to comment on the scope and content of the environmental information that is relevant to each agency's statutory responsibilities with regard to the proposed GWR Project. Members of the public also are invited to provide their comments on the scope of the EIR. **The 30-day public scoping period begins on May 31, 2013 and closes at 5:00 PM on Tuesday, July 2, 2013. A public scoping meeting will be held on Tuesday, June 18, 2013 from 6:00 to 8:00 PM at the Oldemeyer Center, Dance Room (986 Hilby Avenue, Seaside, CA 93955).** This NOP provides background information on relevant water supply conditions, briefly describes the proposed GWR Project, and identifies the environmental issue areas that will be analyzed in the EIR.

[1] Cal-Am is an investor-owned public utility that serves approximately 38,500 customers in the Monterey Peninsula area. Cal-Am's Monterey District service area is shown in Figure 1.

## Project Location

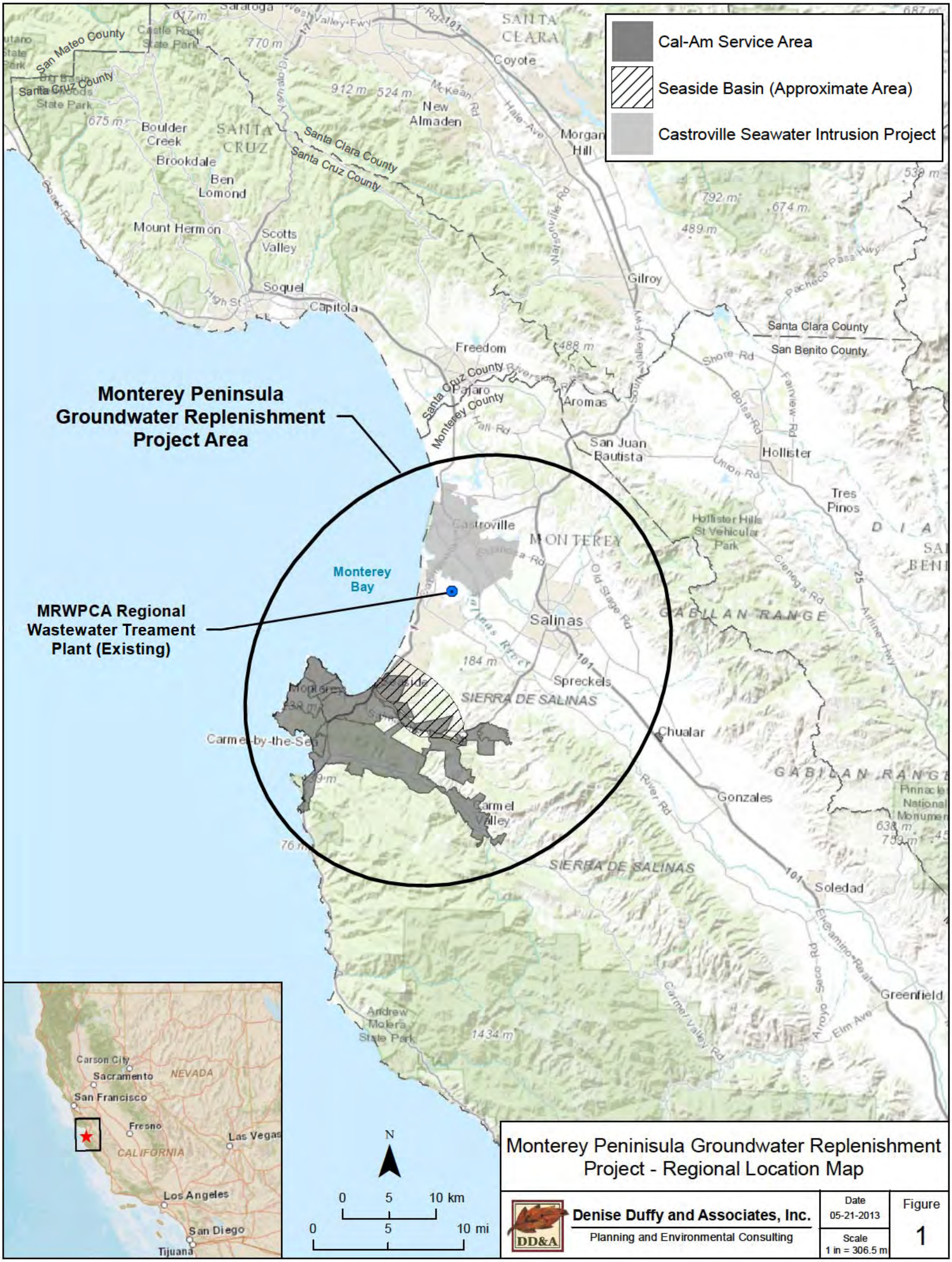
The GWR Project would be located within northern Monterey County and would include facilities located within the unincorporated areas of the Salinas Valley and the cities of Marina and Seaside as shown in **Figures 1** and **2**. The GWR Project would replenish the Seaside Basin, and would provide a portion of the replacement water supplies needed for Cal-Am's Monterey District service area.

## Project Background

MRWPCA was established in 1979 under a Joint Powers Authority agreement between the City of Monterey, the City of Pacific Grove and the Seaside County Sanitation District. MRWPCA operates the regional wastewater treatment plant, including a water recycling facility (collectively known as the Regional Treatment Plant), a non-potable water distribution system known as the Castroville Seawater Intrusion Project, sewage collection pipelines, and 25 wastewater pump stations. MRWPCA member communities include Pacific Grove, Monterey, Del Rey Oaks, Seaside, Sand City, Fort Ord, Marina, Castroville, Moss Landing, Boronda, Salinas, and other unincorporated areas in northern Monterey County. See **Figure 1**.

MRWPCA's Regional Treatment Plant is located two miles north of the City of Marina, on the south side of the Salinas River, and has a permitted capacity to treat 29.6 million gallons per day (mgd) of wastewater effluent.[2] At the Regional Treatment Plant, water is treated to two different standards: 1) Title 22 California Code of Regulations standards (tertiary filtration and disinfection) for unrestricted agricultural irrigation use, and 2) secondary treatment for discharge through the ocean outfall. Influent flow that has been treated to a tertiary level is distributed to nearly 12,000 acres of farmland in the northern Salinas Valley for irrigation use (the Castroville Seawater Intrusion Project). The Regional Treatment Plant primarily treats municipal wastewater, but also accepts some dry weather urban runoff and other discrete wastewater flows.

[2] The Regional Treatment Plant currently treats approximately 19 million gallons per day of municipal wastewater from a total population of about 250,000 in the northern Monterey County area shown generally in Figure 1.




Monterey Peninisula Groundwater Replenishment Project - Regional Location Map

Denise Duffy and Associates, Inc.
Planning and Environmental Consulting

| Date | Figure |
|---|---|
| 05-21-2013 | 1 |
| Scale 1 in = 306.5 m | |

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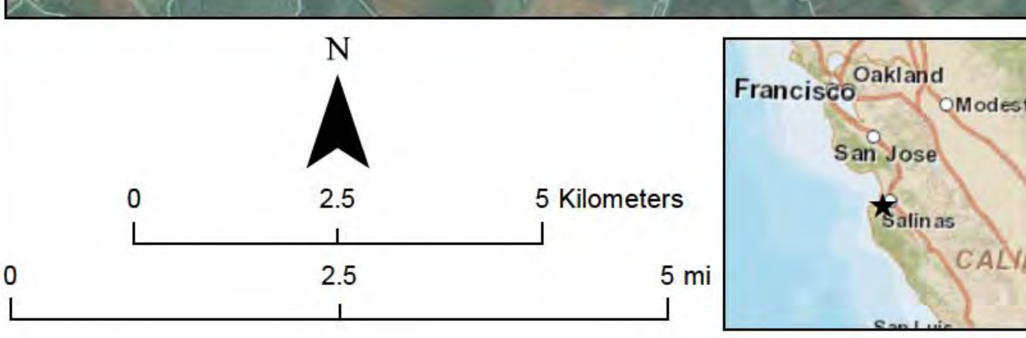


Monterey Peninsula Groundwater Replenishment Project - Overview of Key Facilities Map

Denise Duffy and Associates, Inc.
Planning and Environmental Consulting

Date 05-28-2013

Scale 1 inch equals 1.5 miles

Figure 2

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### *Seaside Groundwater Basin*

The Seaside Basin underlies an approximately 19-square-mile area at the northwest corner of the Salinas Valley, adjacent to Monterey Bay (see Figure 1). The hydrogeology of the Seaside Basin has been the subject of numerous studies beginning with a California Department of Water Resources study in 1974. Monitoring data gathered since 1987 shows that water levels have been trending downward in many areas of the basin. A steep decline since 1995 in the northern coastal portion of the basin, where most of the groundwater production occurs, has coincided with increased extraction in that area after the State Water Resources Control Board required Cal-Am to reduce its Carmel River diversions, and instead maximize its pumping in the Seaside Basin.[3]

Groundwater is currently extracted from approximately 37 wells by 20 well owners in the Seaside Basin. Cal-Am owns 12 wells and pumps approximately 80% of the water produced in the basin. In addition, Cal-Am and Monterey Peninsula Water Management District operate a Seaside Basin Aquifer Storage and Recovery system that stores excess Carmel River water supplies during the wet season in the groundwater basin and recovers the banked water during the following dry season for consumptive use. The estimated average yield of the existing Aquifer Storage and Recovery facilities is 1,920 AFY, but varies yearly based on rainfall due to the requirement to maintain adequate Carmel River instream flows.

Historical and persistent low groundwater elevations caused by pumping have led to concerns that seawater intrusion may threaten the Basin's groundwater resources. In 2006, an adjudication process (Cal-Am v. City of Seaside et al., Case No. M66343) led to the issuance of a court decision that created the Seaside Basin Watermaster (Watermaster). The Watermaster consists of nine representatives, one representative from each: Cal-Am, City of Seaside, Sand City, City of Monterey, City of Del Rey Oaks, Monterey Peninsula Water Management District and Monterey County Water Resources Agency, and two representatives from landowner groups. The Watermaster has evaluated water levels in the basin and has determined that while seawater intrusion does not appear to be occurring at present, current water levels are lower than those required to protect against seawater intrusion. Water levels were found to be below sea level in both the Paso Robles (the shallower aquifer) and the Santa Margarita aquifers of the Seaside Basin in 2012; therefore, it is recognized that recharge into both aquifers would be beneficial for protection against seawater intrusion.

### *State Orders to Reduce Carmel River Diversions*

The 255-square-mile Carmel River Basin is bounded by the Santa Lucia Mountains to the south and the Sierra del Salinas to the north. The Carmel Valley aquifer, which underlies the alluvial portion of the Carmel River downstream of San Clemente Dam, is about six square-miles and is approximately 16 miles long. In the summer and fall, the alluvial aquifer is drawn down by private pumpers that extract approximately 2,200 to 2,400 AFY, and Cal-Am that pumps approximately 7,880 AFY.[4] Historically, this combined pumping has resulted in dewatering of the lower six miles of the river for several months in most years and up to nine miles in dry and critically dry years. Recharge of the aquifer is derived mainly

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[3] See discussion of SWRCB Order No. 95-10 in the following section.

[4] This pumping quantity is based on the mean water production from the Carmel Valley Alluvial Aquifer between Water Year 2010 and Water Year 2012.

from river infiltration which comprises 85% of the net recharge.[5] The aquifer is replenished relatively quickly each year during the rainy season, except during prolonged periods of extreme drought.

In 1995, the State Water Resources Control Board issued Order No. WR 95-10, which found that Cal-Am was diverting more water from the Carmel River Basin than it was legally entitled to divert. The State Board ordered Cal-Am, instead, to maximize diversions (to the extent feasible) from the Seaside Basin. In addition, a subsequent Cease and Desist Order (SWRCB 2009-0060) issued in 2009 requires Cal-Am to secure replacement water supplies for its Monterey District service area by December 2016 and reduce its Carmel River diversions to 3,376 AFY by the 2016-17 timeframe. Cal-Am estimates that it needs 9,752 AFY[6] of replacement water supplies to reduce its Carmel River diversions to the degree required by the Cease and Desist Order and to reduce its pumping in the Seaside Basin in accordance with the Watermaster's pumping mandates.

Cal-Am, working with local agencies, has proposed construction and operation of a Cal-Am owned and operated desalination project (known as the Monterey Peninsula Water Supply Project)[7] either to provide all of the replacement water needed to comply with the Cease and Desist Order and the Seaside Basin Adjudication, or part of the replacement water if the GWR Project would be capable of producing the rest of the replacement water in a timely manner and at a reasonable cost. The California Public Utilities Commission, as the California Environmental Quality Act lead agency for the Monterey Peninsula Water Supply Project, published a Notice of Preparation of an EIR in October 2012 and intends to circulate a Draft EIR in July 2013.

### *GWR Project Relationship to the Monterey Peninsula Water Supply Project*

The GWR Project is designed to provide part of the replacement water needed for Cal-Am to comply with the Cease and Desist Order and the Seaside Basin Adjudication. The GWR Project could not produce all of the needed replacement water, but the primary goal of the project is to produce 3,500 AFY to be used by Cal-Am in order to reduce its Carmel River diversions by that same amount. The GWR Project could provide this quantity of replacement water regardless of whether the California Public Utilities Commission approves Cal-Am's application to construct and operate a desalination plant. In other words, the GWR Project could accomplish its objective, and be useful to reducing Carmel River diversions, independent from approval of Cal-Am's proposed desalination plant. While the GWR Project could proceed as an independent project, the GWR Project is related to the Monterey Peninsula Water Supply Project in that the GWR Project could reduce the size of Cal-Am's proposed desalination plant. Further, MRWPCA would not construct the GWR Project unless the California Public Utilities Commission

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[5] U.S. Geological Survey 1984. *Analysis of the Carmel Valley Alluvial Aquifer Groundwater Basin, Monterey County, California.* USGS WRI Report 83-4280; see page 13.

[6] Supplemental Testimony of Richard C. Svindland, January 11, 2013, Attachment 1, Application A.12-04-019 (*Application of CAW for Approval of the Monterey Peninsula Water Supply Project and Authorization to Recover All Present and Future Costs in Rates*)"

[7] In April 2012, California American Water submitted Application A.12-04-019 (*Application of CAW for Approval of the Monterey Peninsula Water Supply Project and Authorization to Recover All Present and Future Costs in Rates*) to the California Public Utilities Commission that is intended to secure replacement water supplies for the Monterey District associated with the regulatory orders and legal decisions described in this section. The MPWSP includes many of the same elements previously analyzed in the Coastal Water Project EIR (CPUC/ESA, 2009); however, key components, including the seawater intake system and desalination plant, have been relocated and/or modified under the current proposal and the current proposal is for private (Cal-Am) ownership of the intake system, desalination facility and conveyance pipeline.

approves a Water Purchase Agreement that authorizes Cal-Am to purchase the water that is produced by the GWR Project.

On April 20, 2012, the Monterey Peninsula Water Management District, MRWPCA, and Cal-Am entered into a Groundwater Replenishment Project Planning Term Sheet and Memorandum of Understanding to Negotiate in Good Faith to, among other things, enable planning and environmental evaluation of a GWR project by the following:

- to commit themselves to evaluate the ways in which a groundwater replenishment project could be effectively accomplished;
- to commit themselves to negotiate in good faith to reach agreement on such a project, should it be deemed viable;
- for MRWPCA to commit to act as lead agency to achieve California Environmental Quality Act compliance for such a project, should it be deemed viable;
- for Monterey Peninsula Water Management District to assist MRWPCA in providing the necessary financial support for planning and California Environmental Quality Act compliance; and
- to identify non-binding preliminary terms of a GWR Project agreement.

In its application to the California Public Utilities Commission for approval of the Monterey Peninsula Water Supply Project, Cal-Am proposed a three-pronged approach to replace most of its Carmel River diversions, as required by the Cease and Desist Order. The three prongs consist of: (1) desalination, (2) groundwater replenishment, and (3) aquifer storage and recovery. Cal-Am's application described the groundwater replenishment "prong" as follows and identified it as water supply that would reduce the capacity of the desalination component by 3,500 AFY:

> *"California American Water has entered into a Memorandum of Understanding with the MRWPCA and MPWMD to collaborate on developing the Groundwater Replenishment Project, included as Appendix A. If the Groundwater Replenishment Project has reached certain milestones by the time California American Water begins construction of the desalination plant (currently estimated to be near the end of 2014) and the cost of the water from it is reasonable, California American Water will be able to reduce the size of its proposed desalination plant. California American Water proposes to do this by filing a Tier 2 advice letter."*

# Project Objectives

The primary objective of the GWR Project is to replenish the Seaside Basin to produce 3,500 acre-feet per year (AFY) of high quality water that would replace a portion of Cal-Am's water supply as required by state orders. To accomplish this primary objective, the GWR Project would need to meet the following objectives:

- Be capable of commencing operation, or of being substantially complete, by the end of 2016 or, if after 2016, no later than necessary to meet Cal-Am's replacement water needs;
- Be cost-effective such that the project would be capable of supplying reasonably-priced water; and

- Be capable of complying with applicable water quality regulations intended to protect public health.

Secondary objectives of the GWR Project include the following:

- Assist in preventing seawater intrusion in the Seaside Basin;
- Assist in diversifying Monterey County's water supply portfolio;
- Provide additional water to the Regional Treatment Plant that could be used for crop irrigation through the Salinas Valley Reclamation Project and Castroville Seawater Intrusion Project system.

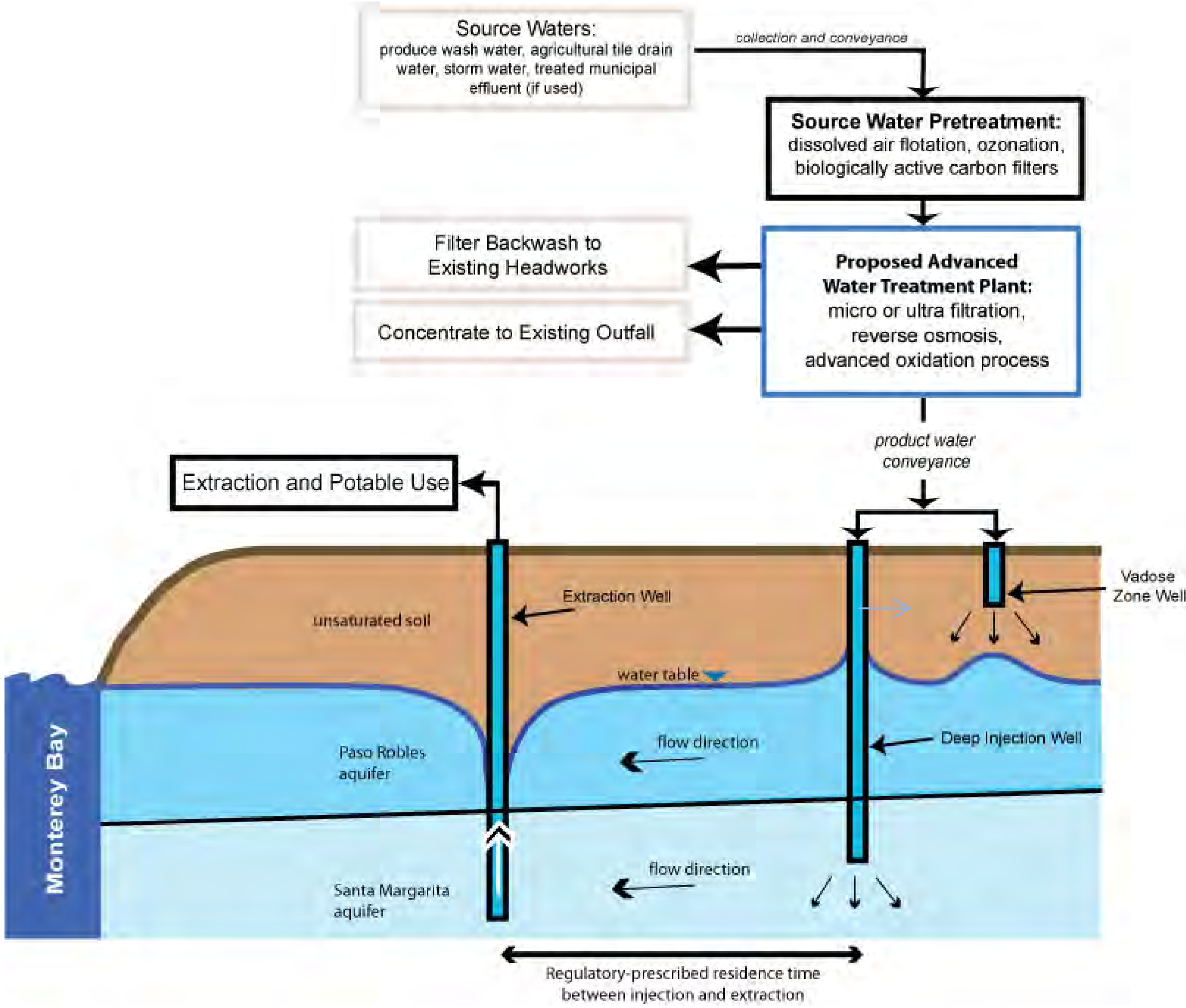
# Proposed Project

MRWPCA's GWR Project proposes to produce and deliver high quality treated water for replenishment of the Seaside Basin with the goal of enabling Cal-Am to reduce diversions from the Carmel River and its alluvial aquifer in compliance with the State Water Resources Control Board's Cease and Desist Order and to comply with the Seaside Basin Adjudication. The location of the GWR Project is shown in **Figure 1**. The GWR Project would include the following new facilities as shown in **Figure 2** and described in the following sections:

- *Source Water Conveyance Facilities*: diversion and collection facilities, including pipelines and pump stations to convey source water to the new treatment facilities,
- *Treatment Facilities:* pretreatment facilities, a new Advanced Water Treatment Plant, and associated facilities at the existing Regional Treatment Plant site to filter and treat the source water,
- *Product Water Conveyance Facilities:* pipelines, pump stations, and appurtenant facilities along one of two optional alignments to convey the treated water to the Seaside Basin, and
- *Replenishment/Recharge Facilities:* pipelines, deep injection and shallow (vadose zone) wells, and backflush facilities to be located at one or both of two optional locations (coastal and/or inland recharge sites) within the Seaside Basin boundaries.

A process diagram illustrating the operation of the GWR Project is provided in **Figure 3**. MRWPCA would construct, own, and operate the GWR Project facilities from source water collection and conveyance through injection into the Seaside Basin. After the recharged water resides within the subsurface soils and aquifer for the prescribed amount of time, the water would be extracted by others at existing municipal water supply wells.

**Figure 3. Overall GWR Project Process Schematic**




MRWPCA is coordinating with Cal-Am, Monterey Peninsula Water Management District, the Seaside Basin Watermaster, the City of Seaside, the City of Salinas, the Marina Coast Water District, Monterey County Water Resources Agency, and other public agency stakeholders regarding the GWR Project. The GWR Project would be designed and implemented in compliance with applicable regulatory requirements to protect public health. In particular, it is anticipated that the California Department of Public Health may require specific residence times for recharged water within the aquifer prior to extraction, which would be verified using tracer tests, if required, and groundwater monitoring.

### *Source Water Conveyance Facilities*

The GWR Project would use a combination of the following source waters as influent to the GWR Treatment Facilities:

- City of Salinas (City) Treatment Plant water,
- Blanco Drain water,
- Storm water collection systems of the City of Salinas and other MRWPCA member entities,
- Secondary or tertiary effluent from the Regional Treatment Plant, and
- Reclamation Ditch water.

A combination of these sources may be needed to meet the GWR Project objectives. The characteristics and availability of these water sources vary seasonally. Therefore, the GWR Project would be designed to accommodate a variety of flows, water quality characteristics, and delivery schedules. The following describes the potential source water types and facilities:

*City of Salinas (City) Treatment Plant water.* The City collects, transports, and treats water predominantly from food processing facilities within the City. Most of this water originates from the washing of produce for packaging (such as bagged lettuce). The water passes through existing pipelines to the City Treatment Plant located on the northwest side of Davis Road adjacent to the Salinas River. The water is aerated and sent to ponds and drying beds where it percolates into the shallow groundwater aquifer or evaporates.

If used as source water for the GWR Project, this water source would be collected at the City Treatment Plant and conveyed using new pipelines and pump stations to the MRWPCA's new GWR Project treatment facilities at the existing Regional Treatment Plant. One new pump station would be located at the City Treatment Plant. The maximum capacity of the pump station would be 10 mgd to allow for maintenance and operational flexibility. The conveyance would be through a new 27-inch diameter pipeline constructed along one of the following two potential routes between the City Treatment Plant and the proposed new Blanco Drain pump station (described below and shown on Figure 2):

- *City Treatment Plant Conveyance Option A.* Approximately 30,000 feet of new pipeline that would follow the farm roads north of and parallel to the Salinas River outside of the riparian vegetation area to the proposed new Blanco Drain pump station, or

- *City Treatment Plant Conveyance Option B.* Approximately 33,000 feet long of new pipeline that would follow paved roads (Blanco Road, Cooper Road, and Nashua Road), and some unpaved farm roads to the new proposed Blanco Drain pump station.

*Blanco Drain water.* The Blanco Drain is an existing system of dirt ditches and short pieces of pipe that collects and conveys agricultural tile drain water[8] and some storm water from about 6,000 acres of land to the Salinas River. The drainage area extends approximately from Highway 1 to Highway 68 along the Salinas River as it crosses Cooper, Blanco, Hitchcock, and Davis Roads. The water flows to an existing pump station owned and operated by Monterey County Water Resources Agency about 4,100 feet northwest of the intersection of Nashua and Cooper Roads. At this point, the water is pumped approximately 600 feet and then discharged to the Salinas River approximately 1,100 feet southeast and

[8] Tile drainage is an agriculture practice that removes excess water from soil subsurface.

upstream of the existing Salinas River Diversion Facility. The Salinas River Diversion Facility is a seasonal diversion structure operated by the Monterey County Water Resources Agency for the purpose of augmenting the irrigation water supplies for the Castroville Seawater Intrusion Project agricultural land areas (see Figure 1 for the location of the Castroville Seawater Intrusion Project and see Figure 2 for the existing agricultural irrigation supply pipelines).

If Blanco Drain water or City Treatment Plant water is used by the GWR Project as source water, then a new Blanco Drain pump station (see Figure 2) would be built near the site of the existing Monterey County Water Resource Agency pump station. A new 9,000-foot long, 30-inch diameter pipeline would transport water from the proposed new Blanco Drain pump station to the new GWR Project treatment facilities at the Regional Treatment Plant. Directional drilling would be used to cross under the Salinas River, and then the pipeline would be placed along the boundary of the Monterey Regional Waste Management District property to the MRWPCA's existing Regional Treatment Plant site.

*Storm water from the City of Salinas and other MRWPCA member entities.* Storm water from Salinas and other member entities may also be used for source water for the GWR Project. Storm water from the southwestern portions of the City of Salinas currently travels through existing pipelines to an existing City storm water pump station at the site of MRWPCA's existing Salinas Pump Station (see Figure 2, "Existing Salinas Pump Stations"). The water is then conveyed through an existing 66-inch diameter pipeline to an outfall structure on the Salinas River approximately 1,800 feet southeast of Davis Road (see Figure 2, "Existing Storm Water Outfall").

If this storm water is used as source water for the GWR Project (to augment treated wastewater), then dry weather and low flows of storm water would be conveyed by a new short, on-site pipeline from the City's Salinas storm water pump station to the MRWPCA's Salinas Pump Station and from there to the existing Regional Treatment Plant site. Alternatively, dry weather and low flows of storm water from the Salinas storm water pump station could be used directly for the new GWR Project through existing conveyance systems to the City Treatment Plant near Davis Road adjacent to the Salinas River. Storm water conveyance may occur using either: (1) the City's existing 33-inch diameter pipeline, or (2) when completed, the City's future proposed 42-inch diameter pipeline, both of which would provide a connection from the Salinas Pump Station site to the City Treatment Plant.

To capture and use storm water from the southwestern portions of Salinas during storm events (i.e., high flows), a new extension of the City's existing 66-inch diameter pipeline would be required to convey the storm water to the City Treatment Plant. A new, approximately 2,700-foot long, 66-inch diameter pipeline would be placed along unpaved farm roads adjacent to the Salinas River to convey water between the storm water outfall and the City Treatment Plant (see Figure 2). A new pump station, pipelines and appurtenant facilities at or near the City Treatment Plant would allow the GWR Project to conjunctively operate with the City Treatment Plant process in managing the flow of water through the ponds systems and, ultimately, to the new GWR Project treatment facilities using one of the City Treatment Plant conveyance pipelines (see Options "A" or "B" as shown on Figure 2 and described above under *"City of Salinas (City) Treatment Plant water"*).

Other MRWPCA member entities could also send storm water to the Regional Treatment Plant for use by the GWR Project by adding storm water into existing pipelines, manholes, or pump stations within the MRWPCA wastewater collection system.

*Secondary or tertiary effluent from the Regional Treatment Plant.* At the existing Regional Treatment Plant, water is treated to two different standards: 1) tertiary treatment for unrestricted agricultural irrigation use, and 2) secondary treatment for discharge through the ocean outfall. If water treated to secondary standards were used as source water for the GWR Project, then effluent would be withdrawn from the existing 60-inch diameter secondary effluent pipe at the Regional Treatment Plant. A new pump station at the Regional Treatment Plant would pump secondary treated water to the new GWR Project treatment facilities through a new 18-inch diameter pipeline approximately 1,900 feet long. If water treated to tertiary standards were used as source water for the GWR Project, then effluent would be withdrawn from an existing filtered effluent pipeline located at the Regional Treatment Plant (between the Filter Building and the Chlorine Contact Basins). A new pump station would be located adjacent to the Filter Building and would pump tertiary treated water to the new GWR Project treatment facilities through a new 18-inch diameter pipeline approximately 600 feet long.

*Reclamation Ditch water.* The Reclamation Ditch is operated by the Monterey County Water Resources Agency, and a portion of this ditch is shown on Figure 2 just north of Highway 183. The watershed of the Reclamation Ditch includes 157 square miles mostly within Monterey County. The watershed drains the northwestern slopes of the Gabilan Range as well as much of the City of Salinas and its surrounding lands. The Reclamation Ditch system is a network of excavated earthen channels used to drain surface runoff generated in the watershed. Urban runoff from the City of Salinas also drains into various channels of the Reclamation Ditch system via numerous storm water outfalls. The system drains into Tembladero Slough, then the Old Salinas River Channel, and ultimately into Moss Landing Harbor through the Potrero Tide Gates. The Reclamation Ditch system conveys and collects storm water and provides flood control during the winter, but consists mostly of agricultural tile drain water from the land north and west of the City of Salinas during the summer months.

If this source water is used by the GWR Project, the Reclamation Ditch water would be collected about 500 feet northwest of the intersection of Davis and W. Market/Highway 183 Roads. The water would enter a new pump station (see "Reclamation Ditch Pump Station" on Figure 2) constructed at that same location, and then would be pumped to an existing sewer pipeline that flows to MRWPCA's existing Salinas Pump Station. From that point, the Reclamation Ditch water would be comingled with sewage, pumped, and conveyed through an existing pipeline to the Regional Treatment Plant.

### Treatment Facilities

The new proposed Advanced Water Treatment Plant would produce water suitable for subsurface application in the Seaside Basin. Because one or more potential source waters would contain municipal wastewater, the GWR Project proposes to meet the regulations of the California Department of Public Health for indirect potable reuse. The Department of Public Health has prepared Draft Groundwater Recharge Regulations (March 2013) that require full advanced water treatment for projects that intend to recharge groundwater through injection wells directly into aquifers, including requiring reverse osmosis membranes used in advanced treatment to have 99% sodium chloride removal. The regulations also limit the concentration of total organic carbon and total nitrogen values. Specified treatment levels for pathogen reduction and treatment of chemicals of emerging concern would be required to satisfy Department of Public Health permitting requirements. The GWR Project would be designed to comply with the Draft Groundwater Recharge Regulations if final regulations have not been adopted by the time of its construction. Once final regulations are adopted, the GWR Project would comply with the final, adopted regulations. This will ensure that the GWR Project meets or exceeds all standards adopted to protect public health.

The GWR Project would include pretreatment of source waters, as needed, including pre-screening, ozone treatment, biological active carbon filtration, and dissolved air flotation. The Advanced Water Treatment Plant would include microfiltration or ultrafiltration, reverse osmosis, and advanced oxidation/disinfection using ultraviolet light with hydrogen peroxide. Post treatment and conditioning would most likely consist of decarbonation and possible introduction of pH adjusting and/or softening chemicals. Reverse osmosis concentrate would flow through a new concentrate pipeline and receiving station (allowing for mixing, sampling for water quality and flow rate) both proposed to be located within the Regional Treatment Plant site.

After mixing and sampling, the concentrate would be discharged into the on-site portion of the existing Regional Treatment Plant ocean outfall system.[9] Filter backwash waste would be routed to the Regional Treatment Plant headworks for secondary treatment, and if demand exists, tertiary treatment and use in the Castroville Seawater Intrusion Project system for agricultural irrigation.

### *Product Water Conveyance Facilities*

MRWPCA proposes to construct a pipeline, measuring up to 36 inches in diameter, to convey the advanced treated (or "product") water from the Advanced Water Treatment Plant to the Seaside Basin for injection, along one of two potential alignments as shown in **Figure 2**.

- Product Water Conveyance Option 1 would follow a portion of the recycled water pipeline alignment of the previously approved, and partially-constructed, Regional Urban Water Augmentation Program Recycled Water Project. The pipeline would be located primarily along paved roadway rights-of-way within urban areas. The Recycled Water Project was approved by the Marina Coast Water District in 2005; however, only portions of the recycled water distribution system have been built and no recycled water has been delivered to urban users. If not committed to use with recycled water for irrigation at the time of GWR Project construction, the MRWPCA may pursue using a portion or portions of the pipeline originally proposed for the Recycled Water Project by Marina Coast Water District (i.e., converting the purpose of the pipeline for use by the GWR Project). MRWPCA is exploring the feasibility of several options, including shared use of the pipeline with Marina Coast Water District, use of the pipeline by the GWR Project only, and construction of a new parallel pipeline within the same or a parallel right of way and easement, including accommodating any regulatory-required separation distances from pipelines carrying potable and recycled water.

- Product Water Conveyance Alignment Option 2 would follow a portion of the potable product water conveyance pipeline alignment of Cal-Am's proposed desalination project that is currently the subject of California Public Utilities Commission application A.12-04-019. The pipeline alignment would start at the northern boundary of the Regional Treatment Plant access road, then

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9 The RTP's existing Waste Discharge Requirements permit allows up to 375,000 gallons per day of concentrate to be disposed through the outfall without amendment or revision to the permit; the GWR Project would exceed that amount so would require a permit amendment.

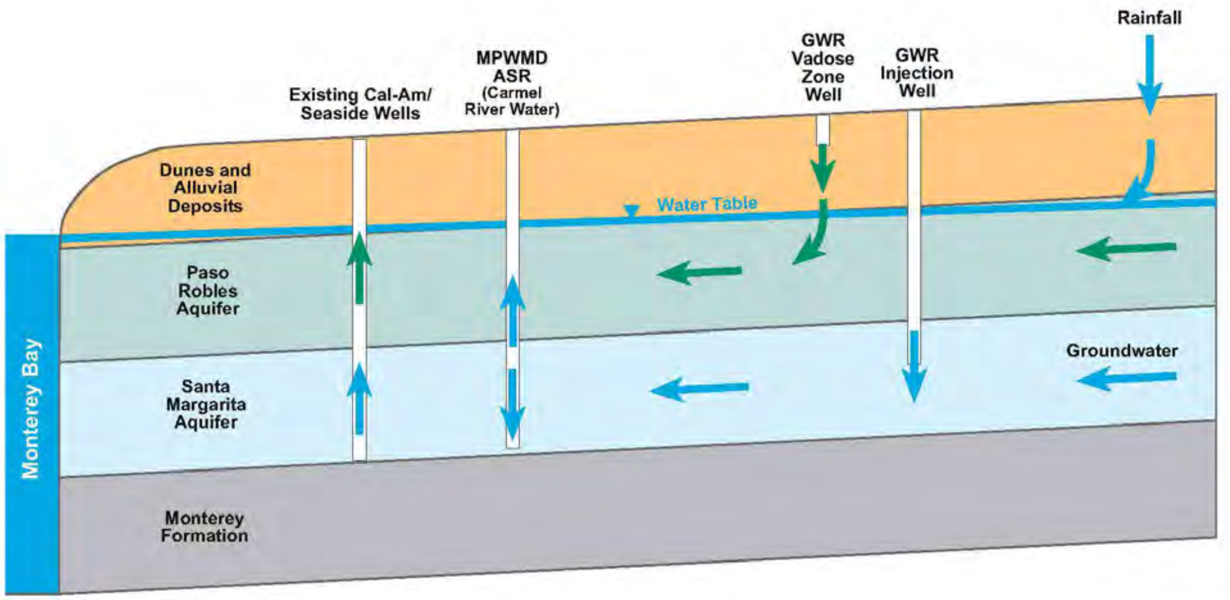
follow Charlie Benson Road to the west to Del Monte Boulevard. Alternatively, the pipeline to Del Monte Boulevard could follow the existing MRWPCA outfall pipeline alignment from the western boundary of the Regional Treatment Plant. This pipeline alignment would turn south on Del Monte Boulevard and be located either within the roadway or within land owned by the Transportation Agency for Monterey County adjacent to the roadway. After Del Monte Boulevard crosses under Highway 1, the pipeline is currently proposed to be within or parallel to the Transportation Agency's land that follows the former rail line in that location. The pipeline would continue south past Fort Ord Dunes State Park and into the City of Seaside turning east at Auto Center Parkway and Del Monte Boulevard. At this point, the pipeline would turn east following Auto Center Parkway/La Salle Avenue until either Lincoln or Havanna Streets to connect the pipeline to San Pablo Avenue. For more information about this alignment option, see the relevant CPUC NOP dated October 2012 at: www.cpuc.ca.gov/Environment/info/esa/mpwsp/index.html.

Each pipeline alignment option would also require one or more pump stations, flow control valves, and other appurtenant facilities. In addition, pipelines to connect the above alignment options to the coastal and/or inland recharge sites (described below) would be required. The selection of the appropriate pipeline alignment/locations and/or performance standards for determining the locations will be assessed as part of a feasibility study that MRWPCA is currently conducting.

### *Replenishment/Recharge Facilities*

The GWR Project would include subsurface groundwater recharge facilities, including shallow (or vadose zone) and deep injection wells located at inland and, if feasible, coastal locations within the Seaside Basin. The vadose zone wells would inject water into the unsaturated soils overlying the uppermost aquifer (the unconfined Paso Robles Aquifer), and the deeper wells would directly replenish the confined Santa Margarita Aquifer. A conceptual diagram of the GWR Project recharge operations is provided in **Figure 4**.

**Figure 4. GWR Recharge Concept Schematic**



With groundwater levels currently below sea level in both the shallower Paso Robles and deeper Santa Margarita aquifers, recharge into both aquifers would be beneficial for protection against seawater intrusion. Most of the existing groundwater pumping for potable use is from wells perforated in the Santa Margarita Aquifer. Accordingly, the Santa Margarita Aquifer is targeted to receive most of the GWR Project water through direct injection. The GWR Project may also recharge high quality water into the Paso Robles Aquifer using shallower vadose zone wells. This proposed configuration of injection wells is intended to provide maximum flexibility for well operation and for optimizing both short-term groundwater production and long-term storage in the Basin.

The design for injection wells at each location has been developed based on the current understanding of the subsurface conditions and typical well capacities. The groundwater modeling evaluation to be conducted as part of the EIR will be used to optimize the number, type, location, and design of GWR Project wells. The following sections describe the proposed inland and coastal recharge facilities.

*Inland Recharge Facilities*. The inland recharge location is assumed to include four deep injection wells and four vadose zone wells that would be located in an approximate 3,000-foot long strip of land about 1,000 feet south of Eucalyptus Road and east of General Jim Moore Boulevard. MRWPCA has been working with the City of Seaside and the Fort Ord Reuse Authority to identify an acceptable location for the proposed inland recharge facilities, and the location that currently appears to be feasible is a City-planned utility corridor as shown in **Figure 2**. Wells would be placed approximately 1,000 feet apart to minimize pumping interference between the wells. Collectively, the eight wells at the inland location would be designed to recharge up to approximately 6,000 gallons per minute (gpm) of water into the Seaside Basin to allow for backup, well maintenance, and other operational benefits (such as optimization of replenishment effectiveness) while still meeting the annual volume objectives. It is anticipated that recharge amounts allocated to each well type and target aquifer could readily be adjusted based on basin conditions that will be determined through ongoing monitoring. Monitoring wells would be constructed in key locations surrounding the recharge facilities to measure water quality and water levels and to measure for tracer constituents during tracer tests that may be required by regulatory agencies. Well operations will be adapted to the results of the monitoring so that the GWR Project continually complies with applicable regulatory and permitting requirements established to protect human health and water quality.

*Coastal Recharge Facilities.* The coastal recharge facilities would include three deep injection wells and four vadose zone wells located on two undeveloped parcels immediately east of Highway 1 and west of the Bayonet and Black Horse Golf Course, as shown in **Figure 2**. Collectively, these wells would be able to recharge about 3,150 gpm of water. Due to the shallower water table at the coast, vadose zone wells would be shallower, and the long-term ability of the coastal wells to replenish both the Santa Margarita and Paso Robles aquifers would likely be less than the replenishment ability of the inland wells. The locations for the proposed coastal recharge facilities were determined based on an analysis of available land and known aquifer characteristics. The Seaside Watermaster requested the inclusion of the coastal recharge facilities in the GWR Project due to the potential benefit they may provide to preventing seawater intrusion and that organization has begun an analysis of the potential benefits of these facilities on the Seaside Basin.

*Maintenance and Monitoring Characteristics.* As previously described, the GWR Project would be operated based on a total annual recharge volume of 3,500 AFY to replace water supplies for Cal-Am's Monterey District service area. It is anticipated that well maintenance and rehabilitation would occur on an as-needed basis. A monitoring program, including tracer tests if required by regulatory agencies, would be implemented and coordinated with other ongoing monitoring programs in the Seaside Basin to allocate water between vadose zone and deep injection wells, and to ensure adequate residence time of the GWR Project water in the Seaside Basin in compliance with regulatory and permitting requirements adopted to protect public health. The GWR Project would be designed to allow for operational flexibility, allowing variation in the amounts of recharge by well over time.

### *Extraction*

After the GWR Project water achieves residence time in the Seaside Basin in accordance with regulatory requirements, extraction of groundwater that includes GWR Project water would occur using existing potable wells, disinfection treatment processes, and distribution systems. No new extraction wells are proposed as part of the GWR Project. Because the GWR Project water would be produced in accordance with California Department of Public Health requirements which are protective of public health, and because the water would meet the applicable residence time requirements within the groundwater basin, no additional treatment beyond current operations would be required after the water is extracted. The amount and quality of water to be extracted and used would be monitored pursuant to applicable regulatory requirements.

## Construction Methods and Schedule

The GWR Project is proposed to be constructed with typical construction methods and equipment, although directional/horizontal drilling may be used for potential source water pipeline crossing(s) of the Salinas River and installation through major intersections along the pipeline corridor. A schedule has been developed for the planning, design, and construction components of the project with a target date of December 2016 for initial groundwater recharge activities to commence.

## Permits and Agreements Anticipated to be Required

As previously discussed, the Monterey Peninsula Water Management District, MRWPCA, and Cal-Am jointly entered into a Groundwater Replenishment Project Planning Term Sheet and Memorandum of Understanding to Negotiate in Good Faith on April 20, 2012. MRWPCA would need to enter into other agreements with entities/agencies who may control the source waters and rights of way, including but not limited to: 1) Monterey County Water Resources Agency to obtain water from Blanco Drain and Reclamation Ditch sources; 2) Monterey County Water Resources Agency, Marina Coast Water District, or both, for use of Regional Treatment Plant effluent and use of various water conveyance facilities and rights of way; and 3) the City of Salinas for source water from its Treatment Plant and stormwater system, and for possible electrical power purchase. MRWPCA would also need to enter into a water purchase agreement with the Monterey Peninsula Water Management District (contingent on a water purchase agreement between Cal-Am and the Monterey Peninsula Water Management District) for the GWR Project water. Other agreements not currently identified may also be required.

**Table 1** is an initial list of agencies and entities that may be involved in permitting and/or approving one or more aspects of the GWR Project. This list is preliminary and may require revision as the GWR Project's design, including construction and operational characteristics, are further developed.

| Table 1: Potential Permits and Approvals Required | |
|---|---|
| **Agency /Entity** | **Permitting Regulation/Approval Requirement** |
| **Federal Agencies** | |
| U.S. Environmental Protection Agency | Class V Underground Injection Control Program (Part C, Safe Drinking Water Act [SDWA]) |
| Monterey Bay National Marine Sanctuary | Review and coordination of all RWQCB 404, Section 10, and NPDES permits |
| U.S. Fish and Wildlife Service | Endangered Species Act compliance (ESA Section 7 consultation) |
| | Fish and Wildlife Coordination Act (16 USC 661-667e; Act of March 10, 1934; ch. 55; 48 stat. 401) |
| U.S. Dept. of Interior: NOAA – Fisheries | Endangered Species Act compliance (ESA Section 7 consultation) |
| Army Corps of Engineers | Nationwide Section 404 Permit (Clean Water Act, 33 USC 1341) |
| | Section 10, Rivers and Harbors Act Permit (33 U.S.C. 403) |
| Federal Aviation Administration | Form SF 7460-1 Notice of Proposed Construction & Alteration for Airport Airspace Aeronautical |
| **State Agencies** | |
| California Public Utilities Commission | Coordination regarding the MPWSP Certificate of Public Convenience and Necessity (Application No. 12-04-019) |
| State Water Resources Control Board, Regional Water Quality Control Board | General Construction Activity Storm Water Permit (WQO 99-08-DWQ) |
| | Water rights permit for development of new surface water diversions |
| | Waste Discharge Requirements (Water Code 13000 et seq.) |
| | 401 Water Quality Certification (CWA Section 401) |
| | National Pollutant Discharge Elimination System (NPDES) Permit (CWA Section 402) |
| California State Lands Commission | Right-of-Way Permit (Land Use Lease) (California Public Resource Code Section 1900); Lease amendment |
| California Department of Fish and Wildlife | Incidental Take Permits (CA Endangered Species Act Title 14, Section 783.2) |
| | Streambed Alteration Agreement (California Fish and Game Code Section 1602) |
| California Coastal Commission | Coastal Development Permit (Public Resources Code 30000 et seq.) |
| California Department of Public Health | Permit to Operate a Public Water System (California Health and Safety Code Section 116525) |
| | Approval for Recharge of Highly Treated Water |
| California Department of Transportation | Encroachment Permit (Streets and Highway Code Section 660) |
| California State Historic Preservation Officer | Section 106 Consultation, National Historic Preservation Act (16 USC 470) |
| California State University Monterey Bay | Right of Way Agreements and/or Easements |
| **Regional/Local Agencies** | |
| City of Salinas | Electricity Power Purchase Agreement |
| Cities of Seaside and Marina, Sand City, Salinas (potential) | Use Permits, encroachment/easement permits, grading permits and erosion control permits may be required pursuant to local city/County codes. |
| Fort Ord Reuse Authority | Coordination with FORA for Right of Entry |
| Monterey Bay Unified Air Pollution Control District | Authority To Construct (Local district rules, per Health and Safety Code 42300 et seq.) and Permit To Operate (Local district rules) |
| Monterey County Health Department, Environmental Health Division | Well Construction Permit (MCC, Title 15 Chapter 15.08, Water Wells) |
| | Hazardous Materials Business Plan (Health and Safety Code Chapter 6.95) |
| | Hazardous Materials Inventory (Health and Safety Code Chapter 6.95) |
| | Review of Discharges/WDR modifications |
| | Variation on Monterey County Noise Ordinance (MCC 10.60.030) |
| Monterey County Public Works Department | Encroachment Permit (Monterey County Code (MCC) Title 14 Chapter 14.040) |
| Monterey County Resource Management Agency | Use Permit (MCC Chapter 21.72 Title 21) may be required pursuant to County codes. |
| | Coastal Development Permit. (Public Resources Code 30000 et seq.) |
| | Grading Permit (M.C.C., Grading and Erosion Control Ordinance, Chapter 16.08 – 16.12) |
| | Erosion Control Permit (MCC, Grading and Erosion Control Ordinance, Chapter 16.08 – 16.12) |
| Monterey County Water Resource Agency | Coordination/agreements for components within MCWRA-controlled waterways and involving the Castroville Seawater Intrusion Project and Salinas Valley Reclamation Project |
| Monterey Peninsula Water Management District | Water System Expansion Permit (Monterey Peninsula Water Management District Board of Directors Ordinance 96) |
| Monterey Reg. Waste Management District | Electric Power Purchase Agreement |
| Seaside Basin Watermaster | Permit for Injection/Extraction |
| Transportation Agency of Monterey County | Easement |
| Water Agencies (other) | Participation/purchase agreements |
| **Private Entities** | |
| Landowners | Land lease/sale; easements and encroachment agreements |
| California American Water Company | Water purchase agreement with Monterey Peninsula Water Management District |
| PG&E | Electric Power Will-Serve Letter/Purchase Agreement |

## Environmental Effects to be Analyzed

The GWR Project EIR will evaluate potential environmental effects associated with construction, operation, and maintenance activities. The EIR will assess the following issues of potential environmental effect:

*Aesthetic Resources*: Project facilities would be sited in potentially scenic and open space areas; however most facilities would be underground or located on existing water and wastewater facility sites. Those facilities that are not located on existing water and wastewater facility sites would be designed to visually blend into the environment through use of vegetative screening and/or appropriate paint colors. The EIR will evaluate visual/aesthetic impacts related to the GWR Project's above-ground facilities.

*Air Quality and Greenhouse Gas Emissions*: The EIR will evaluate construction- and operation-related emissions of criteria air pollutants. The GWR Project will be evaluated in accordance with all applicable federal, state, and regional rules and guidelines. Potential human health risks at nearby sensitive receptors from emissions of diesel particulate matter and toxic air contaminants during construction and operations will be addressed. The EIR will also address greenhouse gas (GHG) emissions during construction and operations, and describe any potential conflict the GWR Project may have with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHG.

*Biological Resources*: The EIR will evaluate potential impacts on terrestrial special-status animal and plant species, sensitive habitats, mature native trees, and migratory birds believed to occur in the GWR Project area. The GWR Project may result in changes to the quantity and quality of the treatment plant effluent discharged through the existing MRWPCA outfall to Monterey Bay; therefore, potential effects on marine resources will be evaluated. The EIR will include a summary of the federal Endangered Species Act Section 7 compliance activities and will recommend feasible mitigation measures to reduce significant impacts on biological resources.

*Cultural Resources*: The EIR will review cultural resource records and evaluate potential impacts on historic, archaeological, and paleontological resources, and human remains in the Project area. The EIR will include a summary of the National Historic Preservation Act Section 106 compliance activities. Standard mitigation measures to protect cultural resources will be included in the EIR.

*Geology and Soils*: Construction and operation will occur in a seismically active region. As such, the proposed GWR Project structures could be subject to potential seismic and geologic hazards. The EIR will identify potential seismic, liquefaction, landslide, soil erosion, and expansive soil impacts expected to result from development of the proposed GWR Project. Standard building requirements would be included to protect buildings and structures from seismic risks.

*Hazards and Hazardous Materials*: The EIR will summarize documented soil and groundwater contamination in the Project area, and evaluate the potential for hazardous materials to be encountered during construction. The analysis will also consider the proper handling, storage, and use of hazardous chemicals that may be used during construction and operation. Existing hazardous materials regulatory requirements would be followed to protect workers and the public from exposure to hazardous materials. Airport safety hazards will also be addressed.

*Hydrogeology and Groundwater Quality*: Construction and operation of the Project could affect groundwater levels and quality in the Seaside, Carmel Valley, and Salinas Valley Groundwater Basins.

Through the use of groundwater modeling and hydrogeologic analyses, the EIR will evaluate changes in local groundwater quality, storage, and levels within the groundwater basins as a whole and their subbasins, as appropriate. Potential effects on the seawater/freshwater interface (i.e., seawater intrusion) will also be evaluated. The project would be designed to comply with California Department of Public Health and Regional Water Quality Control Board standards and requirements to protect public health and water quality.

*Hydrology and Surface Water Quality*: Construction and operation of the Project could affect surface water quality and hydrologic systems/processes in the construction areas. Potential impacts to be evaluated include alteration of drainage patterns and increase in stormwater flows due to increase in the amount of impervious surfaces, and degradation of surface water quality as a result of erosion and sedimentation, hazardous materials release during construction, and construction dewatering discharges. The project would be designed to comply with standard construction and operational requirements and permits under the National Pollutant Discharge Elimination System and Waste Discharge Requirements.

*Land Use and Planning*: Implementation of the proposed GWR Project includes construction and operation of new facilities and water supply infrastructure. The EIR will evaluate the proposed GWR Project for consistency with established plans, policies, and regulations, as well as compatibility with the existing and future land use patterns in the GWR Project area, including adjacent land uses. The proposed GWR Project's functional and physical compatibility with surrounding uses will also be analyzed. Because most conveyance facilities will be underground, and because the proposed treatment facilities would be located at the existing Regional Treatment Plant, significant effects on land use patterns are not anticipated.

*Noise*: The EIR will evaluate construction- and operation-related noise and vibration increases and associated effects on ambient noise levels, relative to applicable noise standards, and will address the potential for impacts to nearby sensitive land uses.

*Population and Housing*: Implementation of the proposed GWR Project would enhance the reliability of the water supply within the Monterey Peninsula area, but the project would provide replacement water rather than new water to serve growth. The EIR will describe the relationship of water supply to population growth in the area. The EIR will identify current population and employment projections and identify local planning jurisdictions with the authority to approve growth and mitigate secondary effects of growth.

*Transportation and Traffic*: The EIR will generally describe the types of construction activities that would generate temporary increases in traffic volumes along local and regional roadways. The installation of pipelines within or adjacent to road rights-of-way could result in temporary lane closures and traffic delays. The analysis will use information about construction activities (e.g., the numbers of trucks and workers) to the extent such information is available. The analysis will generally describe the types of traffic control plan measures that would be used to reduce impacts to vehicular traffic, traffic safety hazards, public transportation, and other alternative means of transportation.

*Other Environmental Issues*: Other environmental issues that will be evaluated in the EIR include the Project's potential impacts on public services and utilities, including the Project's beneficial effect on water supply reliability; water rights for project source water; effects on energy delivery systems due to fossil-fuel resource use; and effects on agricultural, mineral, and forest resources. The EIR also will evaluate potential growth-inducing impacts that could result from implementation of the Project. The EIR will address whether the Project could result in impacts that would be significant when combined with the impacts of other past, present and reasonably foreseeable future projects (i.e., cumulative impacts).

*Alternatives*: California Environmental Quality Act requires that an EIR evaluate a reasonable range of feasible alternatives to the project, or to the location of the project, that would attain most of the basic project objectives but that could avoid or substantially lessen any of the significant effects of the project. The EIR will identify the potentially significant impacts of the proposed Project. The findings of the EIR impact analysis will guide the refinement of an appropriate range of feasible alternatives to be evaluated in the EIR that would avoid or substantially lessen significant impacts, while still meeting the project objectives. MRWPCA is seeking comments from agencies, stakeholders and the public regarding feasible alternatives for evaluation in the EIR. The EIR will include, at a minimum, a discussion of impacts associated with the No Project Alternative.

## Environmental Review Process

The MRWPCA has determined that the GWR Project may have a significant effect on the environment and an EIR is required. The MRWPCA is the Lead Agency for California Environmental Quality Act purposes. The MRWPCA anticipates seeking State Revolving Fund funding from the California State Water Resources Control Board. Therefore, the requirements of California Environmental Quality Act-Plus will be met and the analysis in the EIR will be conducted in compliance with those requirements. Currently, the potential for federal funding or permitting for the project is unknown; however, if a federal agency must issue a discretionary permit for the GWR project or approve some component of the project such as funding, compliance with the National Environmental Policy Act may be necessary.

The first step in the environmental review process is the formal public scoping process, for which this NOP has been prepared. Following the public scoping period, the Draft EIR will be prepared and circulated for a 45-day public review period. Public comments on the Draft EIR will be accepted in writing during the review period or verbally at a formal public meeting to be held by the MRWPCA. The MRWPCA will then prepare written responses to the comments on environmental issues raised during the public review period, and a Response to Comments document will be prepared. That document will be considered by the MRWPCA, along with the Draft EIR and any revisions to the draft based on responses to comments, for certification as the Final EIR.

## Scoping and Public Meeting

The California Environmental Quality Act mandates that a scoping meeting be held for projects of statewide, regional or area-wide significance. To ensure that the public and regulatory agencies have an opportunity to ask questions and submit comments on the scope and content of the EIR, a scoping meeting will be held during the NOP review period. The location and date of the scoping meeting is:

**Date: Tuesday, June 18, 2013**

**Time: 6:00-8:00 PM**

**Location: Oldemeyer Center, Dance Room (986 Hilby Avenue, Seaside, CA 93955)**

The scoping meeting will start with a brief presentation providing an overview of the proposed GWR Project. Following the presentation, interested parties will be provided an opportunity to interact with MRWPCA staff and its technical consultants. Participants are encouraged to submit written comments; comment forms will be supplied at the scoping meeting. Written comments may also be submitted anytime during the NOP scoping period to the mailing address, fax number, or email address listed below.

Due to the time limits mandated by State law, your response must be sent at the earliest possible date, but not later than 30 days after receipt of this notice. The scoping comment period will close at **5:00 PM** on **Tuesday, July 2, 2013.** Please include a name, address, email address, and telephone number of a contact person in your agency for all future correspondence on this subject. **Please send your comments to:**

**Monterey Regional Water Pollution Control Agency**
**ATTN: Bob Holden**
**5 Harris Court, Bldg D**
**Monterey, CA 93940**

**Phone: (831) 372-3367 or (831) 422-1001**
**Fax: (831) 372-6178**
**E-mail: GWR@mrwpca.com**

This Notice of Preparation is available electronically at the MRWPCA website:

www.mrwpca.org.

# APPENDIX B

# DISTRIBUTION LISTS FOR THE NOTICE OF PREPARATION

MAY 30, 2013

**Monterey Peninsula Groundwater Replenishment Project**
**NOP Distribution by Category (May 30, 2013)***
***Notice sent to one or more individuals at each group/institution listed below.**

**Academic/Education**
- California State University Monterey Bay: Division of Science & Environment Policy
- Carmel Unified School District
- Center for Ocean Solutions
- CSUMB
- Marine Pollution Studies Lab - UC Davis
- Monterey Bay Aquarium Research Institute
- Monterey Peninsula Unified School District
- Monterey School Board
- Moss Landing Marine Laboratories
- Stanford University- Hopkins Marine Station
- UC Berkeley Hastings Reserve
- UCMBEST
- Watershed Institute at CSUMB
- York School

**City**
- City of Carmel-by-the-Sea
- City of Del Rey Oaks
- City of Greenfield
- City of Marina
- City of Monterey
- City of Monterey/MPRWA
- City of Pacific Grove
- City of Salinas
- City of Seaside and Seaside County Sanitation District
- City of Soledad
- City of Gonzales
- King City
- Monterey Peninsula Chamber of Commerce

**CPUC EIR Team**
- CPUC
- ESA
- Sedgwick, LLP

**DAC/Social equity**
- California Rural Legal Assistance League
- Center for Community Advocacy
- CHISPA (Community Housing Improvement Systems and Planning Association)
- Environmental Justice Coalition for Water
- Ford Ord Environmental Justice Network
- Foundation for Housing Assistance of Monterey County
- LEAGUE OF UNITED LATIN AMERICAN CITIZENS
- Military and Veterans Affairs
- Monterey County Department of Health Services
- Monterey County Housing Authority
- Monterey County Social Services Department
- Monterey County Welfare Department
- Monterey Senior Center
- National Association for the Advancement of Colored People
- Oldemeyer Senior Center
- Rural Communities Assistance Corporation

Seaside Family Health Center
Shelter Outreach Plus/ I Help Program

**Federal**

Department of Interior, Bureau of Reclamation
Monterey Bay National Marine Sanctuary
National Oceanic and Atmospheric Administration Fisheries
U.S. Army
U.S. Army Corps of Engineers
U.S. Army Corps of Engineers - BRAC office
U.S. Army, DPW
U.S. Army, Master Plans
U.S. Department of Interior, Bureau of Reclamation
U.S. Department of Agriculture Natural Resources Conservation Service
U.S. Fish and Wildlife Coastal Program
U.S. Fish and Wildlife Service
U.S. Forest Service
U.S. Geological Survey
U.S. Navy

**GMC IRWM**

Individual
Monterey County

**GWR Consultant Team**

Archaeological Consulting
Brezack & Associates
Denise Duffy & Associates, Inc.
GHD
Illingworth & Rodkin
Independent Consultant
Monterey Regional Water Pollution Control Agency
Nellor Environmental Associates
Perkins Coie
SPI
Todd Engineers
Trussel Technologies
Valerie Young Consultants

**Library**

Carmel Harrison Library
Carmel Valley Public Library
Castroville Public Library
CSUMB Library
Marina Library
Monterey Library
Monterey Peninsula College Library
Pacific Grove Library
Salinas Public Libraries
Seaside Library

**Native American**

**Press/Media**

Cedar Street Times
Coast Weekly
Monterey Herald
Salinas Californian

**Private Company/Individual**

**Regional/County/Special District**

Agriculture Water Quality Alliance
Association of Monterey Bay Area Governments
Carmel Area Wastewater District
County Clerk
County of Monterey and Clerk's Office
Fort Ord Reuse Authority
Marina Coast Water District
Marina Coast Water District
Monterey Peninsula Water Management District
Monterery Peninsula Water Management District
Monterey Bay Unified Air Pollution Control District
Monterey County
Monterey County Ag Commissioner's Office
Monterey County Environmental Health
Monterey County Farm Bureau
Monterey County Health Dept., Division of Environmental Health
Monterey County Local Agency Formation Commission
Monterey County Office of Emergency Services
Monterey County Public Works
Monterey County Public Works
Monterey County Public Works/Monterey County Service Area 50
Monterey County Resource Conservation District
Monterey County Resource Management Agency
Monterey County Water Resources Agency
Monterey Peninsula Airport District
Monterey Peninsula Regional Park District
Monterey Peninsula Water Management District
Monterey Regional Waste Management District
Moss Landing Harbor District
Pebble Beach Community- Service District
Pebble Beach Community Service District (also, PGUSD)
Santa Lucia Preserve
Seaside Basin Watermaster
Transportation Agency for Monterey County

**State**

California Coastal Commission
California Coastal Commission
California Coastal Conservancy
California Department of Fish & Game: Fisheries
California Department of Fish and Game
California Department of Fish and Wildlife
California Department of Parks and Recreation
California Department of Public Health
California Department of Public Health: Drinking Water
California Department of Transportation
California Department of Water Resources
California State University Monterey Bay
California State Water Resources Control Board
California State Water Resources Control Board: Division of Water Rights
Central Coast Regional Water Quality Control Board

**Surrounding Counties**

Fresno County Clerk
San Benito County, Office of the County Clerk
San Luis Obispo County

**San Luis Obispo County, Department of Planning and Building**
**Santa Cruz County**

**Monterey Peninsula Regional Water District List**

**Monterey Peninsula Water Management District List**

**Non-Governmental Organizations**

**Ag Land Trust**
**Big Sur Land Trust**
**Bike Racing—CCCX Cycling**
**California Native Plant Society, Monterey Chapter**
**Carmel River Watershed Conservancy**
**Carmel Valley Association**
**Central Coast Agricultural Water Quality Coalition**
**Central Coast Water Quality Preservation, Inc**
**Central Coast Wetlands Group**
**Citizen**
**Citizen Watershed Monitoring Network**
**Citizens for Public Water**
**Citizens for Responsible Growth**
**Coastal Watershed Council**
**Conserve Collaborate**
**Del Monte Forest Foundation**
**Del Monte Forest Property Owners**
**Ecology Action**
**Elkhorn Slough Foundation**
**FORT Friends (Fort Ord Recreation Trails Friends)**
**Fort Ord Recreation Users**
**Friends of Fort Ord Warhorse**
**Friends of the River**
**Greater Monterey County IRWMP**
**Keep Fort Ord Wild**
**LandWatch Monterey County**
**League of Women Voters of the Monterey Peninsula**
**Marina Equestrian Center**
**Monterey Bay Citizen Watershed Monitoring Network**
**Monterey Bay Conservancy**
**Monterey Bay Youth Camp**
**Monterey Coastkeeper/The Otter Project**
**Monterey County Hispanic Chamber of Commerce**
**Monterey County Hospitality Association**
**Monterey County Vintner & Grower Association (MCVGA)**
**Monterey Search and Rescue Dogs, Inc.**
**MORCA (Monterey Off-Road Cycling Association, a Chapter of IMBA)**
**NAACP, Monterey County**
**Planning and Conservation League**
**Policy Link**
**Salinas River Channel Coalition**
**Sand City**
**Santa Lucia Conservancy**
**Save Our Shores**
**Save The Whales**
**Sierra Club**
**Step Up 2 Green / Sustainability Academy**
**Surfrider Foundation**
**Sustainable Marina (residents group)**

| | |
|---|---|
| Sustainable Seaside (residents group) | |
| The Nature Conservancy | |
| The Otter Project | |
| Trout Unlimited | |
| U.S. Green Building Council | |
| Ventana Wilderness Alliance | |
| Ventana Wildlife Society | |
| **Political Entity** | |
| **Private Individual Companies** | |
| **Grand Total** | |

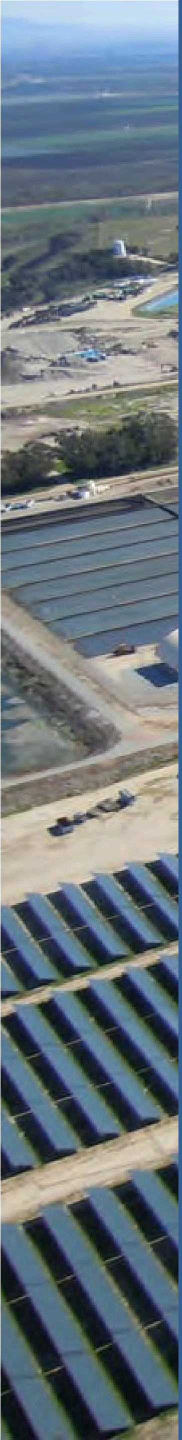
**Monterey Peninsula Groundwater Replenishment Project NOP**
**Certified Mail Receipts**
**Delivered by June 1, 2013 – June 4, 2013**

| |
|---|
| California Department of Transportation |
| California State University Monterey Bay Library |
| Carmel Harrison Library |
| Carmel Valley Public Library |
| Castroville Public Library |
| Community Housing Improvement Systems and Planning Association, Inc. |
| Foundation for Housing Assistance of Monterey County |
| Marina Library |
| Mayor Fred Ledesma, Soledad |
| Mayor Joe Gunter, Salinas |
| Mayor John Huerta Jr., Greenfield |
| Mayor Robert Cullen, King City |
| Monterey County Clerk |
| Monterey County Department of Health Services |
| Monterey County Housing Authority |
| Monterey County Military and Veterans Affairs |
| Monterey County Social Services Department |
| Monterey County Welfare Department |
| Monterey Library |
| Monterey Peninsula College Library |
| Monterey Senior Center |
| Monterey, City of |
| Oldemeyer Senior Center |
| Pacific Gas & Electric Local Office |
| Pacific Gas & Electric Service Planning Office |
| Pacific Grove Library |
| Salinas Public Libraries |
| Sand City, City of |
| Seaside Family Health Center |
| Seaside Library |
| Seaside, City of |
| Shelter Outreach Plus/I Help Program |

APPENDIX C-1

GWR PUBLIC SCOPING MEETING - PRESENTATION

JUNE 18, 2013



# Monterey Peninsula Groundwater Replenishment (GWR) Project

## Environmental Impact Report Scoping Meeting

Tuesday, June 18, 2013

Oldemeyer Center, Seaside

6:00 - 8:00 PM

# Agenda

1) Introductions
2) Overview of Groundwater Replenishment Project
3) Overview of CEQA / Scoping Requirements
4) EIR Environmental Issues / Topics
5) Agency and Public Comments

# GWR CEQA & Technical Teams

**Lead Agency**

Monterey Regional Water Pollution Control Agency

**Project Partner Agency**

Monterey Peninsula Water Management District

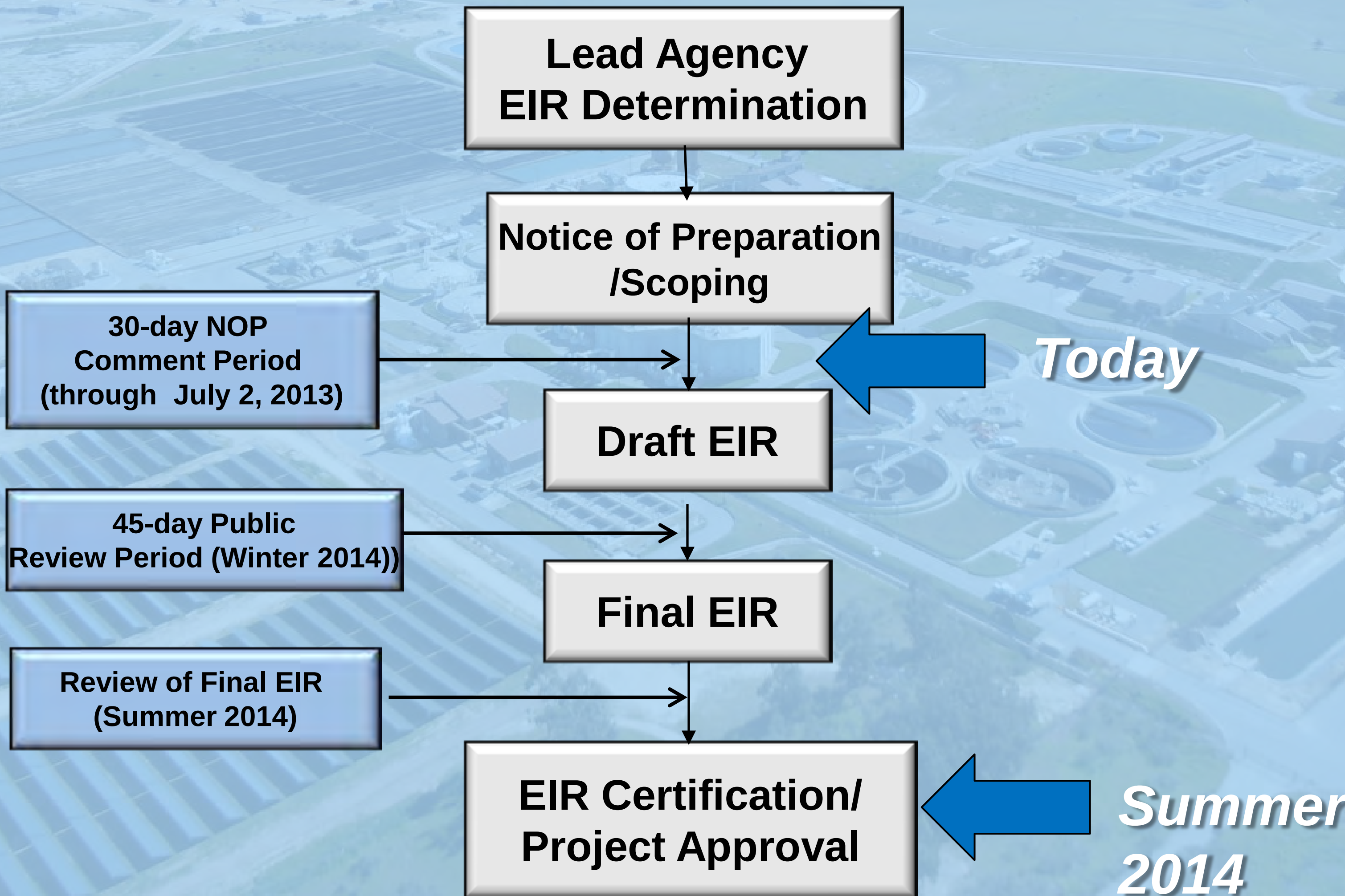
**CEQA Consultants**

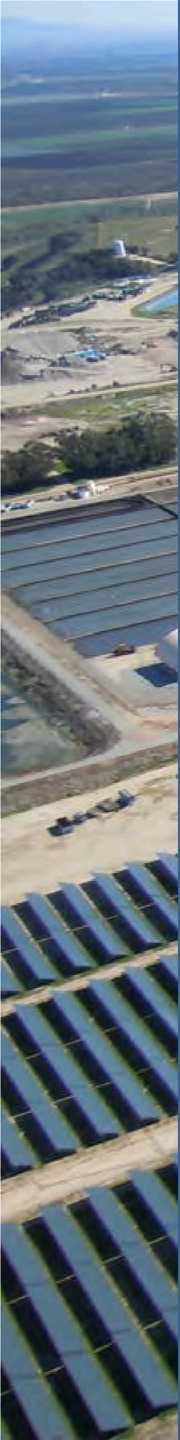
Denise Duffy & Associates, Inc. (EIR consultants)
Valerie Young, AICP (CEQA Oversight)
Perkins Coie LLP (CEQA Attorney)

**Technical Consultants**

Treatment design and technology, hydrogeology/groundwater, regulatory specialists, funding and feasibility studies, civil engineering, noise, air quality, cultural resources, public health, biologists, hydrologists, wetland scientists

# GWR CEQA Process



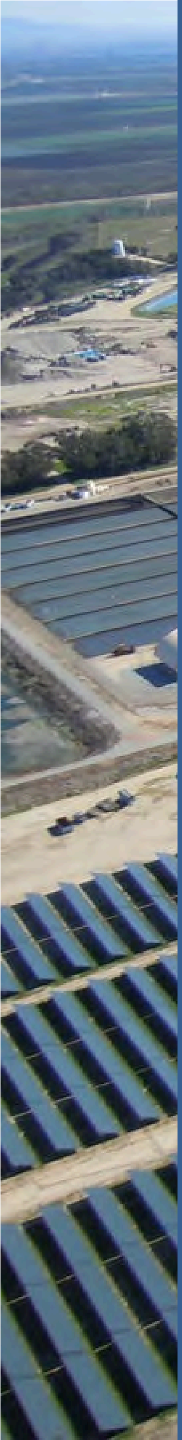


# GWR Overview

To produce and deliver 3,500 AFY high quality treated water for replenishment of the Seaside Basin to reduce Cal-Am diversions from the Carmel River alluvial aquifer.

Facilities would include:

- Source Water Conveyance Facilities
- Treatment Facilities
- Product Water Conveyance Facilities
- Replenishment/Recharge Facilities

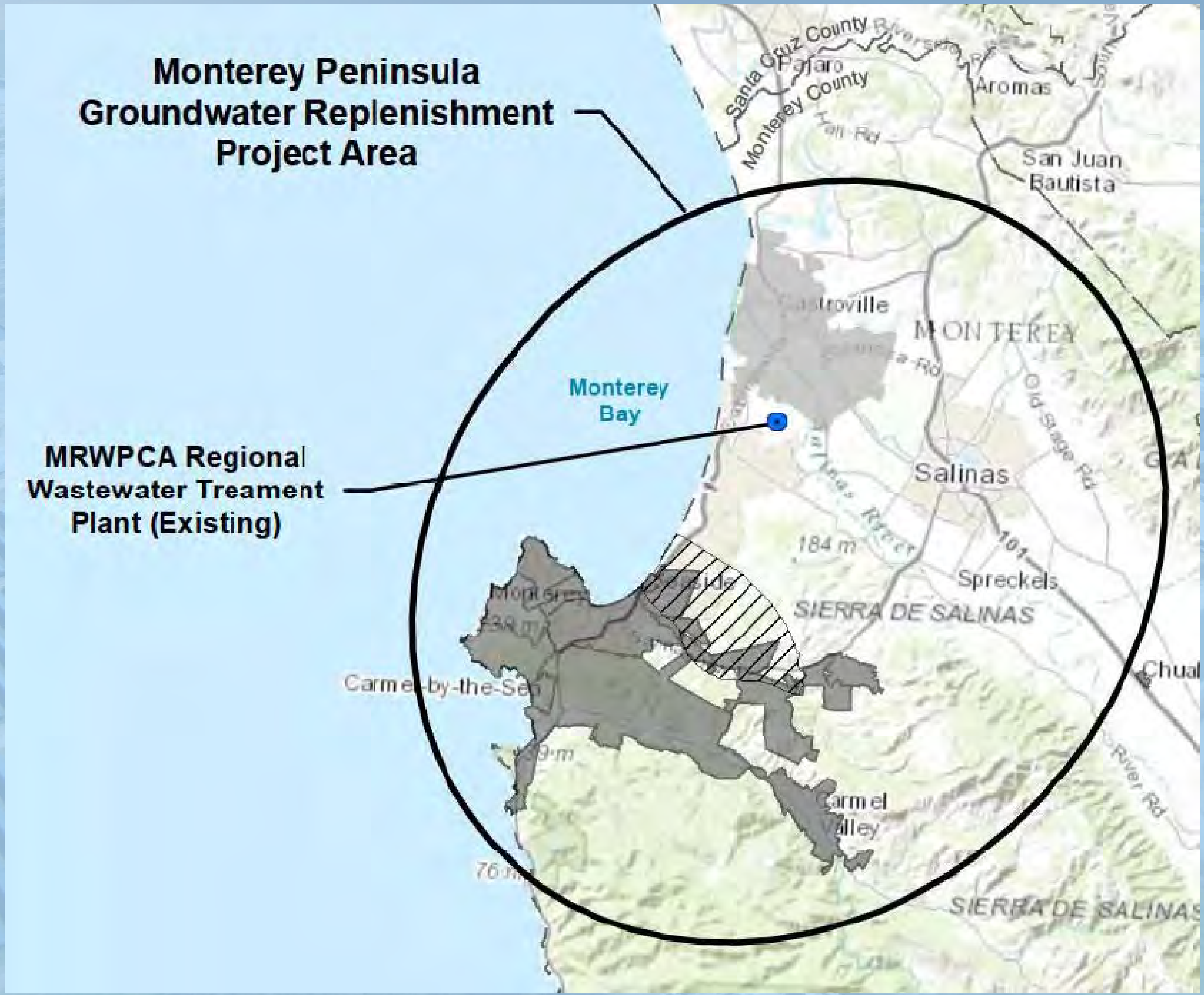


# About MRWPCA

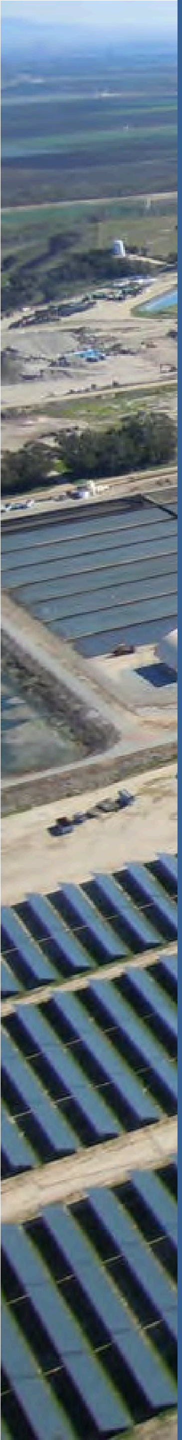
- Operates the regional wastewater treatment plant
- Maintains 25 wastewater pump stations
- Manages the water recycling facility
- Operates the distribution system that provides irrigation water to 12,000 acres of farmland.

*The agency serves Del Rey Oaks, Monterey, Pacific Grove, Salinas, Sand City, Seaside, Boronda, Castroville, Moss Landing, Fort Ord, Monterey County, and Marina.*

# Project Location Overview



# Seaside Groundwater Basin

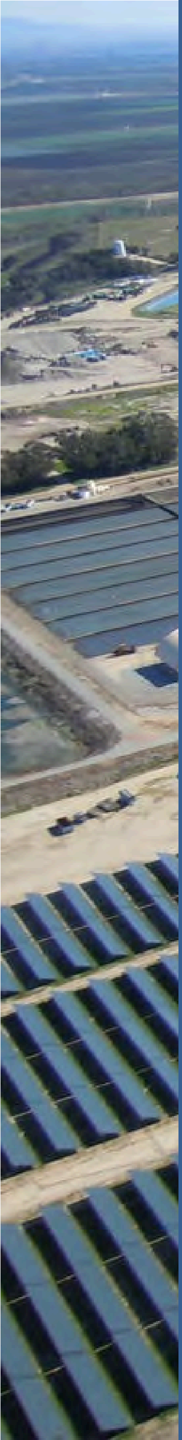


# State and Judicial Orders Reduce Cal-Am Water Supply

- State Water Resources Control Board Order No. WR 95-10 found Cal-Am was diverting more Carmel River water than allowed.
- Cease and Desist Order (CDO) follows that requires new water supply by the end of 2016.
- Seaside Basin Adjudication in 2006 found basin overdraft may result in seawater intrusion; requires reduction in pumping.

# GWR Relationship to Monterey Peninsula Water Supply Project

- Can provide part of the replacement water needed for Cal-Am for CDO and Adjudication.
- Primary goal is to produce 3,500 AFY to reduce Cal-Am’s Carmel River diversions.
- Independent project; can be implemented with or without Monterey Peninsula Water Supply Project, but if built reduces the size of the desalination plant needed.



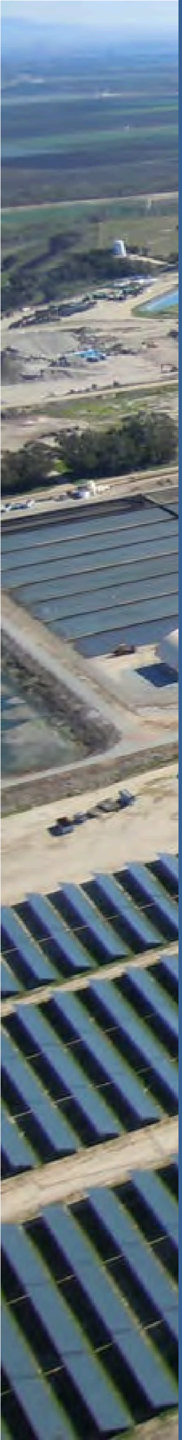
# Primary Project Objectives

Replenish the Seaside Basin with 3,500 AFY of high quality water that would replace a portion of Cal-Am’s water supply by meeting the following objectives:

- Commence operation, or be substantially complete, by end of 2016 or, if after 2016, no later than necessary to meet Cal-Am’s replacement water needs;
- Be cost-effective and capable of supplying reasonably-priced water; and
- Comply with applicable water quality regulations intended to protect public health.

# Secondary Project Objectives

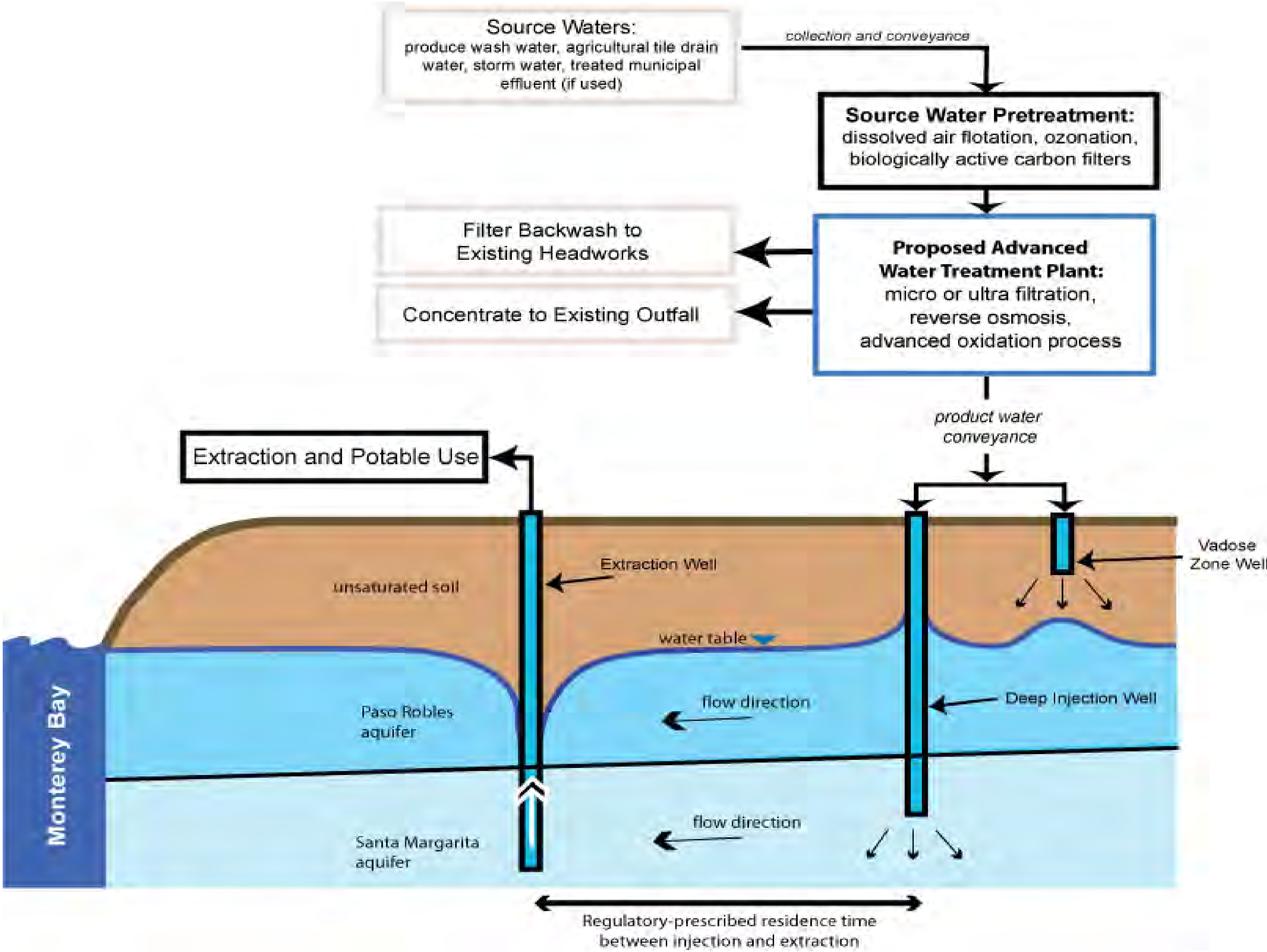
- Assist in preventing seawater intrusion in Seaside Basin;
- Diversify region’s water supply portfolio; and
- Provide additional water for crop irrigation through the Salinas Valley Reclamation Project and Castroville Seawater Intrusion Project system.



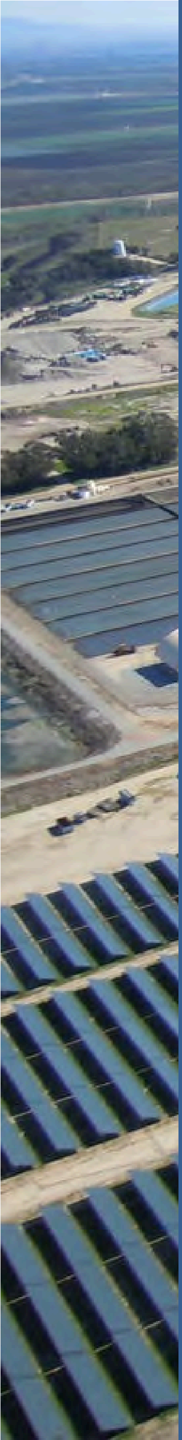
# Overview of GWR Facilities

- **Source Water Conveyance Facilities:** pipelines/pump stations to convey source water to treatment facilities,
- **Treatment Facilities:** pretreatment facilities, a new Advanced Water Treatment Plant at the existing WWTP,
- **Product Water Conveyance Facilities:** to convey water to the Seaside Basin, and
- **Replenishment/Recharge Facilities:** pipelines, deep and shallow (vadose zone) injection wells, and backflush facilities at coast and/or inland within Seaside Basin.

Existing Ocean Outfall Facilities
(Approximate Location)
Option "2" Alternate Route
Existing Regional
Treatment Plant
Proposed GWR Project
Treatment Facilities
Proposed Blanco Drain
Pump Station
Reclamation Ditch
Cooper Rd
183
1
Option "1"
Option "A"
Blanco Drain
W. Market St
Monterey Bay
Option "2"
Option "B"
Proposed Reclamation
Ditch Pump Station
Blanco Rd
Salinas River
Davis Rd
Marina
Imjin Pky
Salinas
Existing Salinas
Pump Stations
Reservation Rd
2nd Ave
Proposed Storm Water
Collection Pipe
1
General Jim Moore Blvd
Existing City of Salinas
Treatment Plant\Ponds
Coastal Recharge
Facilities
Monterey Rd
Existing Salinas
Storm Water Outfall
Inland Recharge Facilities
Sand
City
Del Monte Rd
Fremont Blvd
Seaside
68



Source Waters:
produce wash water, agricultural tile drain water, storm water, treated municipal effluent (if used)
collection and conveyance
Source Water Pretreatment:
dissolved air flotation, ozonation, biologically active carbon filters
Filter Backwash to Existing Headworks
Concentrate to Existing Outfall
Proposed Advanced Water Treatment Plant:
micro or ultra filtration, reverse osmosis, advanced oxidation process
product water conveyance
Extraction and Potable Use
Vadose Zone Well
Extraction Well
unsaturated soil
water table
Monterey Bay
Paso Robles aquifer
flow direction
Deep Injection Well
Santa Margarita aquifer
flow direction
Regulatory-prescribed residence time between injection and extraction



# Source Water Collection

A combination of the following will be processed by the Advanced Water Treatment Plant:

- City of Salinas Treatment Plant water
- Blanco Drain water
- Storm water collection systems of the City of Salinas and other MRWPCA member entities
- Reclamation Ditch water
- Secondary or tertiary effluent from the Regional Treatment Plant

# Source Water Collection

# Salinas Treatment Plant Ponds

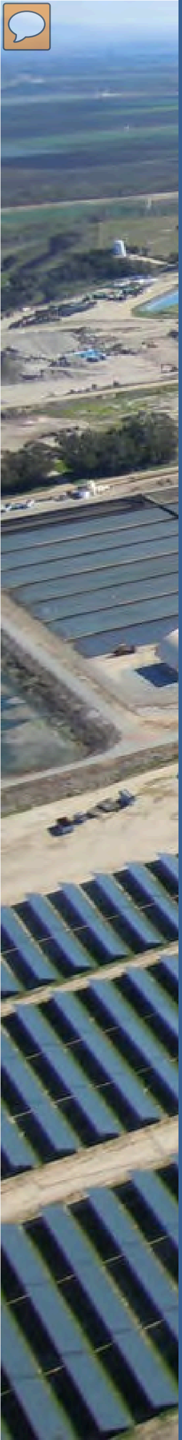
# Blanco Drain

# Salinas Storm Water Outfall

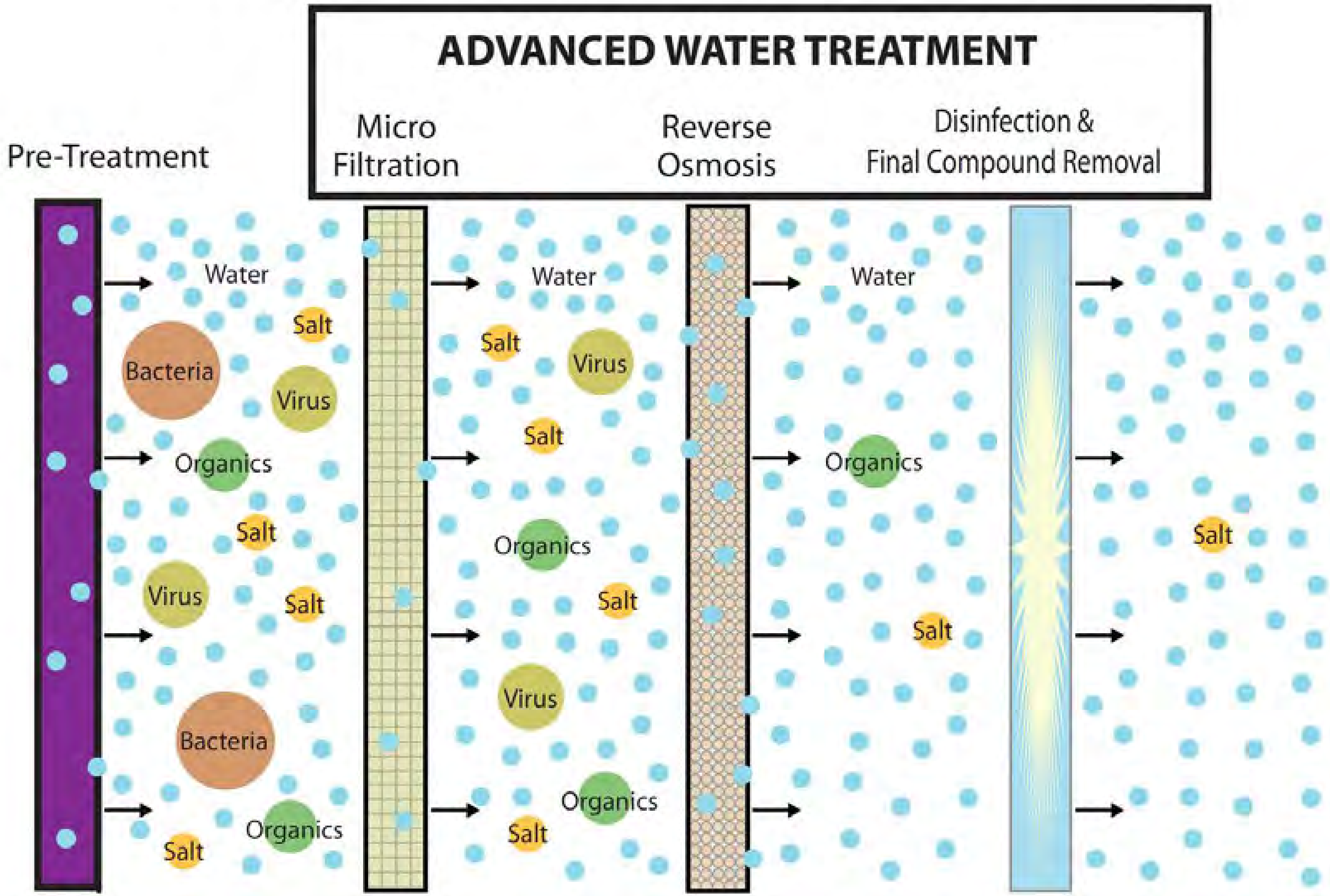
# Salinas Pump Station

# Reclamation Ditch

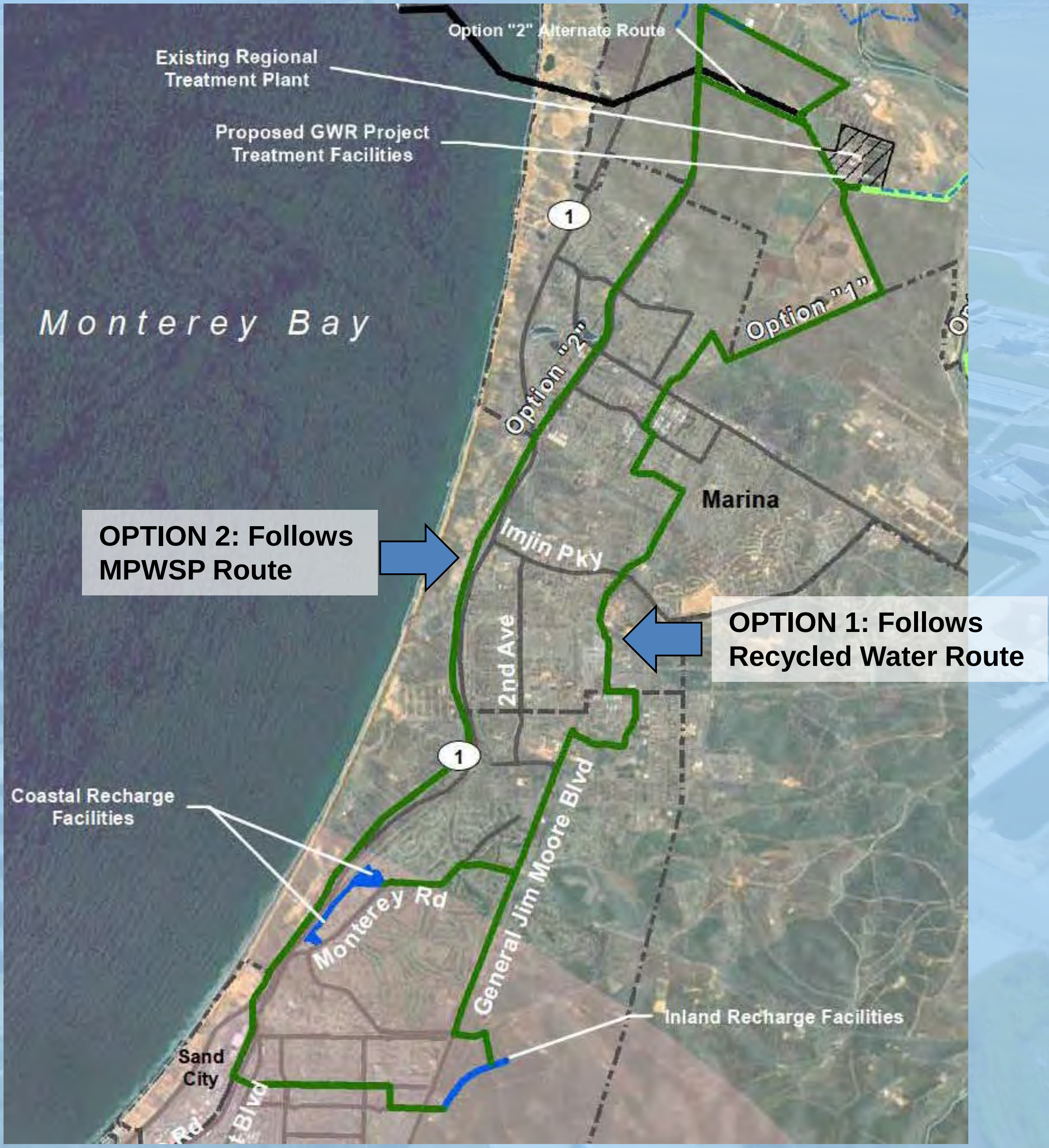
# GWR Treatment Plant Site



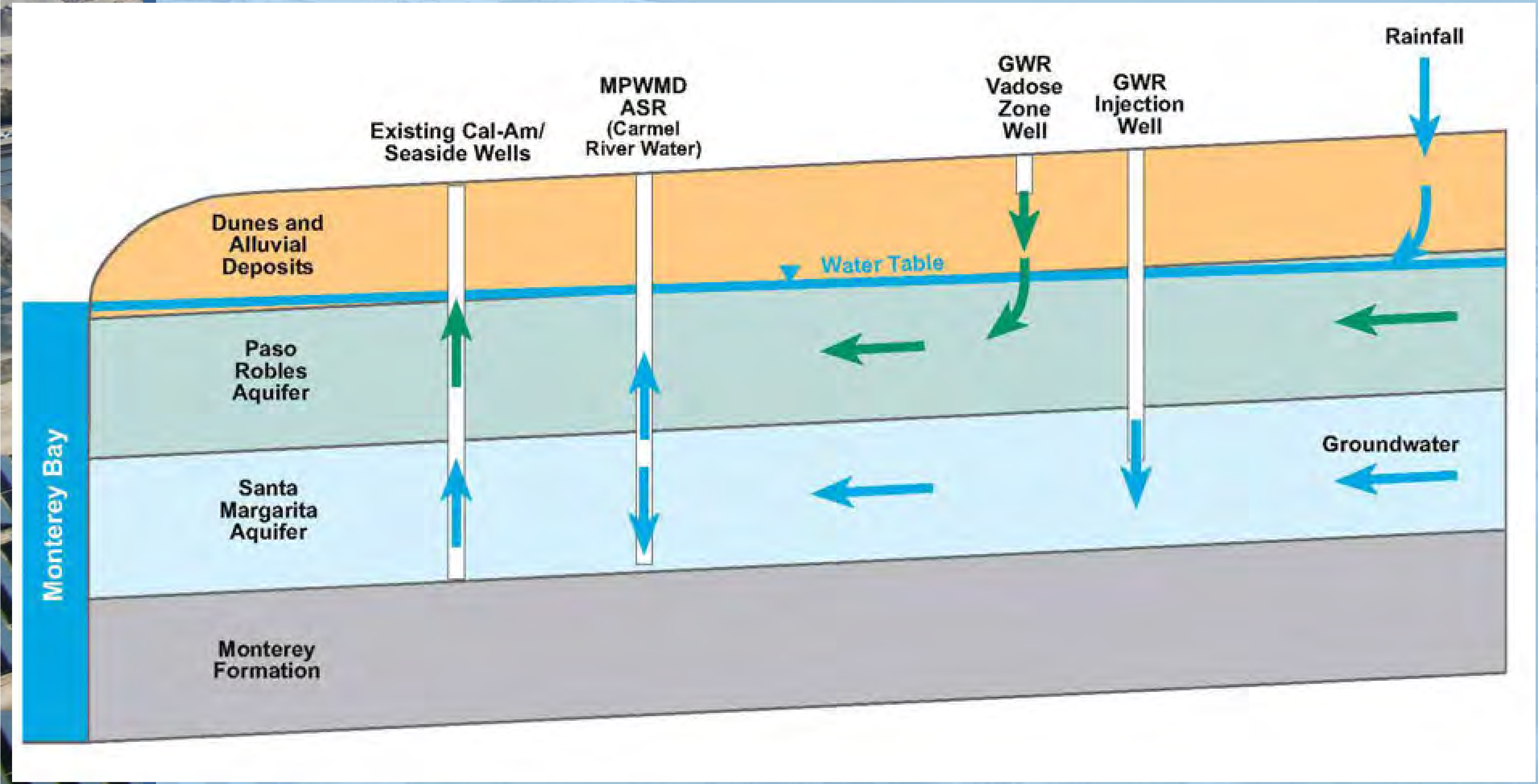
# Proposed Water Purification Process

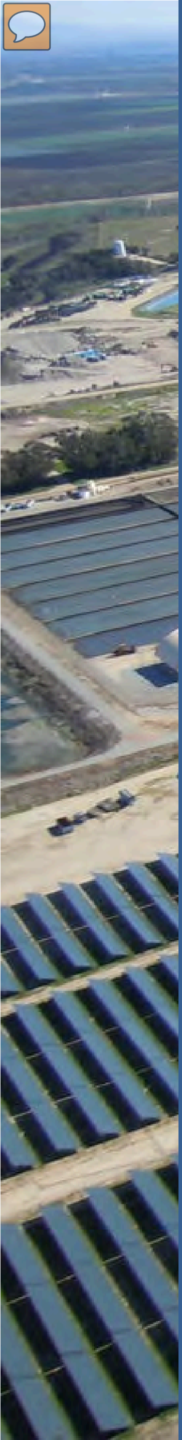


# Product Water Conveyance



# GWR Recharge Concept Schematic

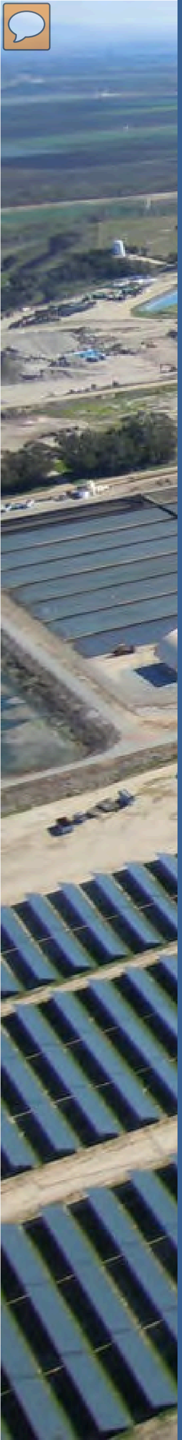




# California Environmental Quality Act Purpose

*CEQA Guidelines §15002(a)*

- Inform decision-making
- Prevent significant damage to environment
- Public disclosure



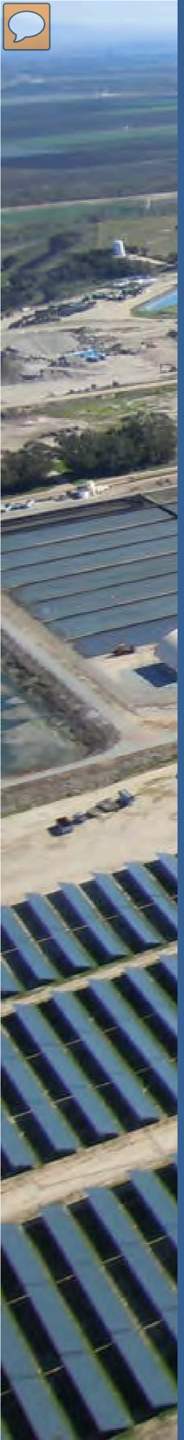
# Environmental Impact Report Purpose

*CEQA Guidelines §15121*

- Disclose the environmental effects of a proposed project
- Identify mitigation measures to avoid, reduce, minimize significant environmental effects
- Evaluate reasonable alternatives

# Key Topics in EIR

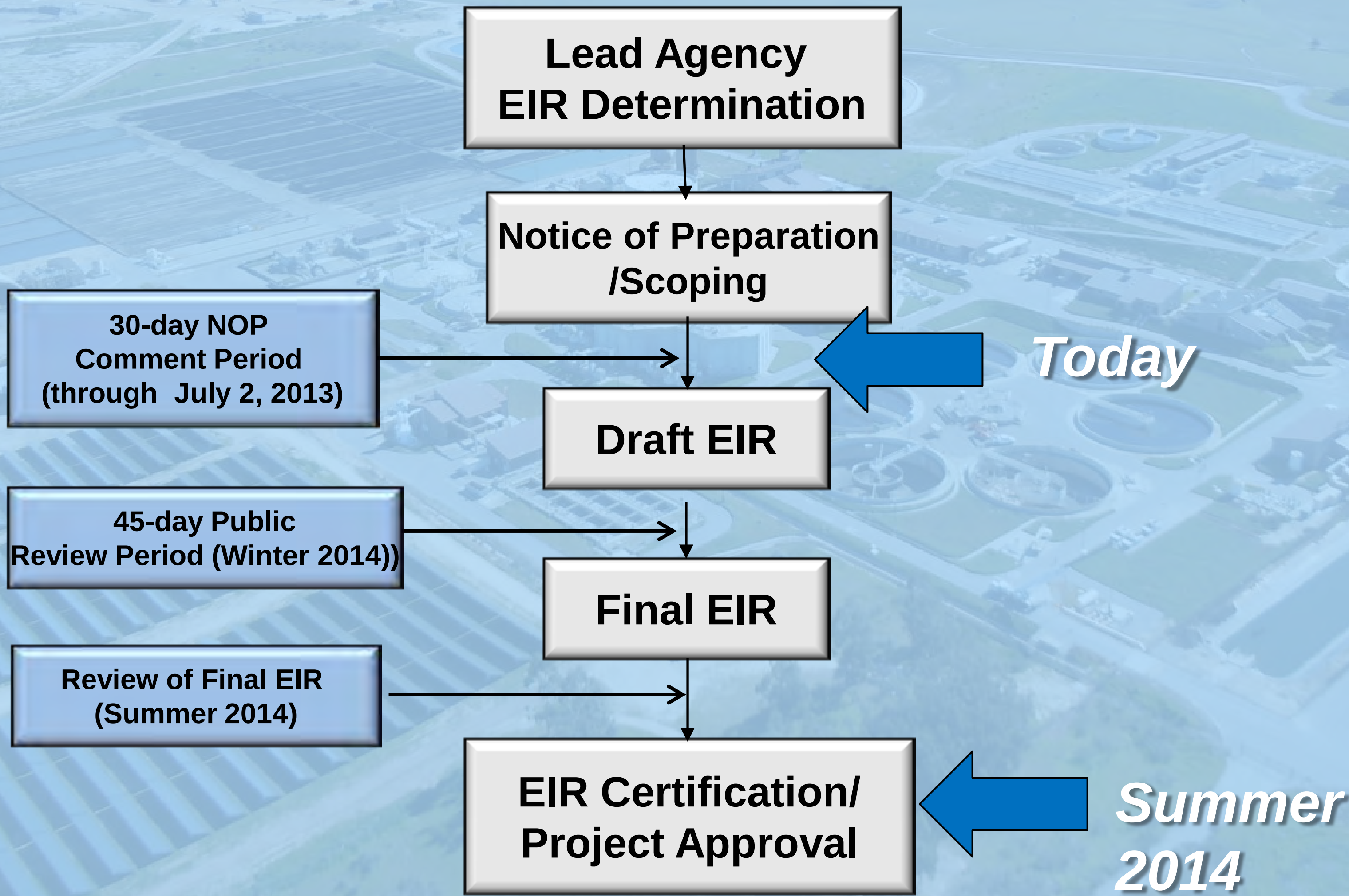
- Surface Water Hydrology/Quality
- Groundwater Hydrology/Quality
- Water Supply Quality/Public Health
- Construction vs. Operational Impacts
- Direct and Indirect Adverse Impacts
- Other CEQA-required issues



# Purpose of Meeting: Define Scope/Content of EIR

- Verbal comments and comment cards accepted after presentation tonight
- Please follow-up with written comments today or through July 2nd at 5:00 PM.
- EIR scope /content may be modified per comments
- All comments to be assembled in scoping memo and addressed in EIR

# GWR CEQA Process

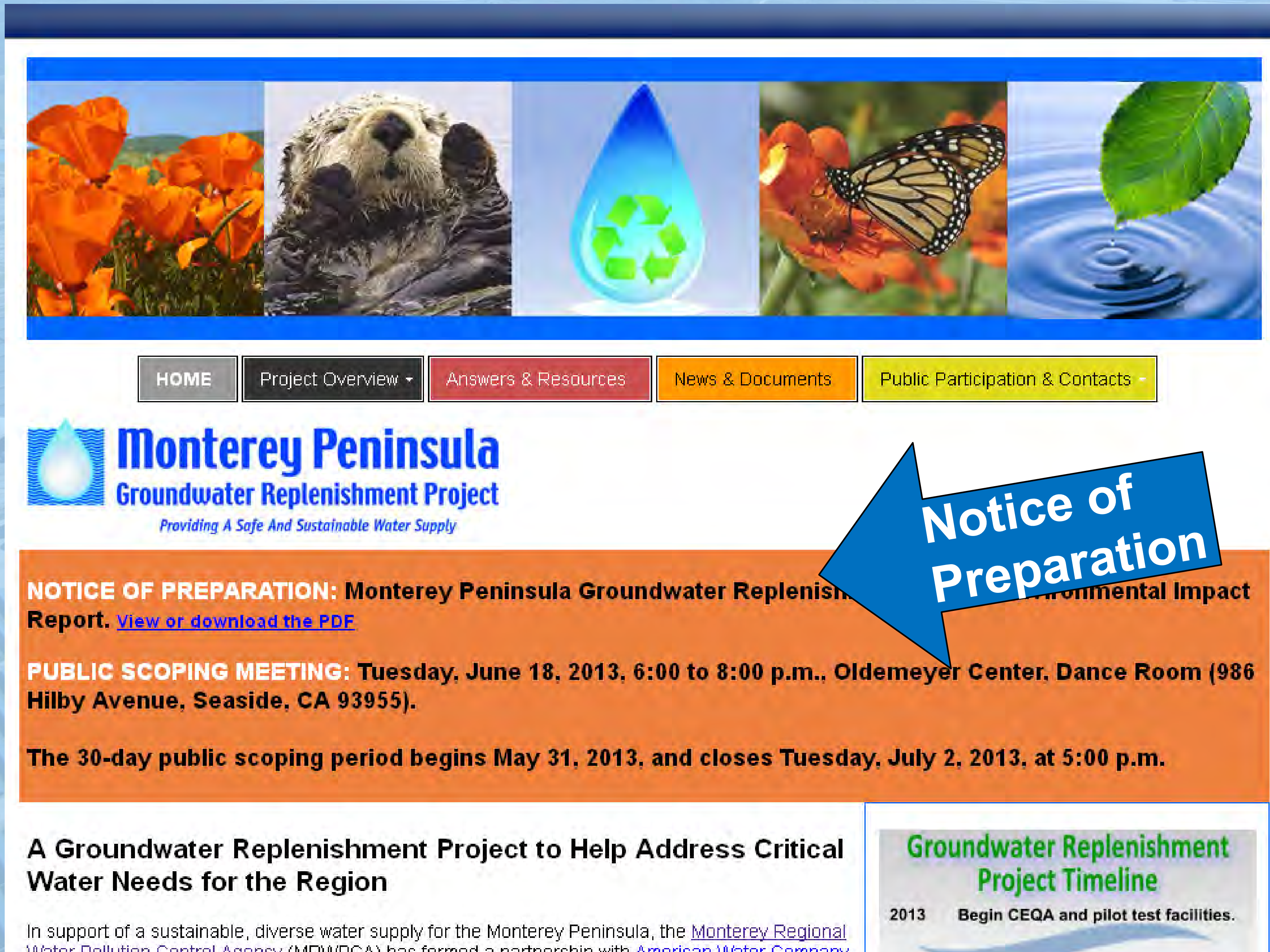


# For More Information

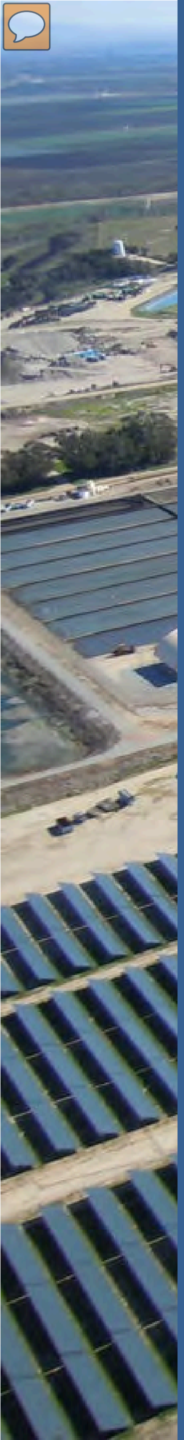
*Monterey Peninsula Water Pollution Control Agency's*

*Groundwater Replenishment Website:*

*http://www.mpwaterreplenishment.org/*



HOME
Project Overview
Answers & Resources
News & Documents
Public Participation & Contacts
Monterey Peninsula
Groundwater Replenishment Project
Providing A Safe And Sustainable Water Supply
Notice of Preparation
NOTICE OF PREPARATION: Monterey Peninsula Groundwater Replenis
ironmental Impact
Report. View or download the PDF
PUBLIC SCOPING MEETING: Tuesday, June 18, 2013, 6:00 to 8:00 p.m., Oldemeyer Center, Dance Room (986 Hilby Avenue, Seaside, CA 93955).
The 30-day public scoping period begins May 31, 2013, and closes Tuesday, July 2, 2013, at 5:00 p.m.
A Groundwater Replenishment Project to Help Address Critical Water Needs for the Region
In support of a sustainable, diverse water supply for the Monterey Peninsula, the Monterey Regional Water Pollution Control Agency (MRWPCA) has formed a partnership with American Water Company
Groundwater Replenishment Project Timeline
2013 Begin CEQA and pilot test facilities.



# Comments on Scope of EIR

***Please provide comments that focus on the scope and content of the EIR.***

***Comments Due: 5:00 pm on July 2, 2013***

Ways to comment:

1. provide verbal comments tonight,
2. transmit tonight on comment cards, or
3. send to Bob Holden at:

gwr@mrwpca.com or
5 Harris Court, Bldg D
Monterey, CA 93940

# Public Comments

# APPENDIX C-2

# GWR PUBLIC SCOPING MEETING - SIGN-IN SHEET

# JUNE 18, 2013

Attendee List for GWP Scoping Meeting on 6-18-13

| Name | Company | E-mail |
|---|---|---|
| 1. Roger Masuda | Marina Coast WD | rmasuda@calwaterlaw.com |
| 2. Jim Cullem | MPRWA Executive Director | jcullem@harris-assoc.com |
| 3. Bob Schubert | Monterey County Planning | schubert@co.monterey.ca.us |
| 4. Eric Zigas | ESA | ezigas@esassoc.com |
| 5. Ken Ekelund | MCWRA Board of Directors | kenekelund@redshift.com |
| 6. George Riley | Citizens for Public Water | georgetriley@gmail.com |
| 7. Robert Guidi | Department of Army | robert.g.guidi.civ@mail.mil |
| 8. Joe Oliver | MPWMD | Joe@mpwmd.net |
| 9. Helen Rucker | City of Salinas | hrucker@mpusd.k12.ca.us |
| 10. Gary Pelear | | |
| 11. David Chardavoyne | MCWRA | chardavoyneDE@co.monterey.ca.us |
| 12. Dave Pacheco | City of Seaside | dpacheco@ci.seaside.ca.us |
| 13. Judi Lehman | MPWMD | jlehman@redshift.com |
| 14. Robert Johnson | MCWRA | johnsonr@co.monterey.ca.us |
| 15. Kenneth Mishi | | |
| 16. Terry Applebury | APT | |
| 17. Peter Le | | peter381@sbcglobal.net |
| 18. Rudy Fischer | MRWPCA | rudyfischer@earthlink.net |
| 19. Jonathan Lear | MPWMD | jlear@mpwmd.net |
| 20. Kelly Nix | Carmel Pine Cone | kelly@carmelpinecone.com |
| 21. Ron Weitzman | Water Plus | ronweitzman@redshift.com |
| 22. Brain True | MCWD | btrue@mcwd.org |
| 23. Bill Carrothers | | cih5102@earthlink.net |
| 24. Carmelita Garcia | | |
| 25. Keith Israel | MRWPCA | keith@mrwpca.com |
| 26. Bob Holden | MRWPCA | bobh@mrwpca.com |
| 27. Mike McCullough | MRWPCA | mikem@mrwpca.com |
| 28. Chayito Ibarra | MRWPCA | chayito@mrwpca.com |
| 29. Dave Stoldt | MPWMD | dstoldt@mpwmd.dst.ca.us |
| 30. Denise Duffy | DD&A | dduffy@ddaplanning.com |
| 31. Alison Imamura | DD&A | aimamura@ddalanning.com |
| 32. Michael Gonzales | DD&A | mgonzales@ddaplanning.com |
| 33. Rayanne Bethke | DD&A | rbethke@ddaplanning.com |
| 34. Diana Buhler | DD&A | dbuhler@ddaplanning.com |
| 35. Valerie Young | | valerieyoung@rcn.com |

# APPENDIX C-3

# GWR PUBLIC SCOPING MEETING – VERBAL COMMENTS OF FLIPCHARTS

# JUNE 18, 2013

GWR Scoping #1
6/18/13

① BILL CARROTHERS
- need outstanding hydrologist (knows Seaside Basin)
- " " water engineer
- " gifted leader

KEITH INTRODUCE TEAM

② RON WEITZMAN - WATERPLUS
- evolved in positive way by not relying on effluent
- EIR: ① toxins in water sources
  - ② - discharge rate to Basin (capacity to inject)
  - ③ - storage facility (will there be losses?)
  - ④ - solar energy
  - ⑤ - diluent requirement
  - ⑥ - flowrate btw injection & extraction wells
  - ⑦ - cost comparison to desal only
  - pollutants different than effluent ("beyond" Orange County)

GWR Scoping #2
6/18/13

③ GEORGE RILEY
- will the EIR explore/include positive/benefical impacts along with negative/adverse impacts
- what are the alternatives to the project?

④ HELEN RUCKER
- went to OCWD / drank the water
- surprised not to see more people here
- what outreach was done?
- make public outreach a priority, reach out to non-experts, normal public

⑤ BILL CARROTHERS
- concern for industrial/environmental hygiene
- potential for upsets at treatment plant
- what is in source water that makes it through treatment to the outfall.

GWR SCOPING #3
6/18/13

⑥ RON WEITZMAN
- can GWR solve the entire water supply issue? (i.e. is desal really needed) (A BIGGER PROJECT)

⑦ HELEN RUCKER
- COST OF GWR, IS IT ON TOP OF THE DESAL PLANT COST?
- CHANGE IN WATER RATES AND EFFECTS ON LOW-MOD INCOME HOUSEHOLDS.

# Appendix C-4

# GWR Public Scoping Meeting – Meeting Notes

# June 18, 2013

# GROUNDWATER REPLENISHMENT (GWR) PROJECT

# NOP SCOPING MEETING NOTES

OLDEMEYER CENTER
986 HILBY AVENUE
SEASIDE, CA 93955
TUESDAY, JUNE 18, 2013
6:00 P.M. - 8:00 P.M.

## MEETING PRESENTERS

Keith Israel
Denise Duffy
Bob Holden
Alison Imamura

## MEETING ATTENDEES

(See attached attendee list)

## MEETING NOTES

### PRESENTATION OUTLINE (COPY OF PRESENTATION IS ATTACHED)

**(Keith Israel)**

**Title Slide and Introduction**

**(Dave Stoldt, MPWMD)**

**MPWMD role, costsharing**

**(Denise Duffy)**

**GWR CEQA & Technical Teams**

**(Bob Holden)**

**GWR CEQA Process**
**GWR Overview**
**About MRWPCA**
**Project Location Overview**
**Seaside Groundwater Basin**
**State and Judicial Orders Reduce Cal-Am Water Supply**
**GWR Relationship to Monterey Peninsula Water Supply Project**
**Primary Project Objectives**
**Secondary Project Objectives**
**Overview of GWR Facilities**
**Source Water Collection**
**Salinas Treatment Plant Ponds**

**Blanco Drain**

**Salinas Storm Water Outfall**

**Salinas Pump Station**

**Reclamation Ditch**

**GWR Treatment Plant Site**

**Proposed Water Purification Process**

**Product Water Conveyance**

**GWR Recharge Concept Schematic**

**(Alison Imamura)**

**California Environmental Quality Act Purpose**

**Environmental Impact Report Purpose**

**Key Topics in EIR**

**Purpose of Meeting: Define Scope/Content of EIR**

**GWR CEQA Process**

**For More Information**

**(Denise Duffy)**

**Comments on Scope of EIR**

## PUBLIC COMMENTS

**1. Bill Carrothers**

- This project will need an outstanding hydrologist that is very familiar with the Seaside Basin.
- This project with also need a superb water engineer.
- A gifted leader will be essential – Keith Israel (MRWPCA)

**2. Ron Weitzman, WaterPlus (these comments were also submitted in written form)**

WaterPlus suggest that the EIR for the GWR address the following items:

1. Toxins in each potential water source
2. Discharge rate and natural capacity of Seaside aquifer
3. Cost of storage facility for excess effluent
4. Cost of solar energy for a desal-only project
5. Amount of required diluent
6. Flow rate of injection & extraction wells
7. Cost comparison with desal-only project

Justification:

Items 1, 5, and 6 are important because the currently proposed GWR project includes sources of supply water besides sewer water, the principal source in previous versions of the project proposal. These additional sources, as well as sub-surface injection for potable use (rather than to retard saltwater intrusion), go beyond the precedent of Orange County and include pollutants not addressed there. Public Health concerns are a major issue of the project as currently proposed.

Item 2 is important because GWR involves storage of water over time in the Seaside aquifer, which is considered to be quite porous. The capacity of the aquifer and its discharge rate must be determined to estimate the amount of injected water that may be lost prior to extraction. Will this amount this is will adversely affect efforts to retard saltwater intrusion?

Items 3 and 4 are important because a storage facility for excess effluent and solar energy powering desalination are environmentally-friendly alternatives to GWR for the EIR to evaluate. The cost of the storage facility, which would allow farmers to use excess winter effluent in the summer, or the cost of solar energy for desalination may be considerably less than the cost of GWR.

Item 7 is important for the reason just given: Alternatives to GWR that are equally environmentally friendly, while affording lower risk to public health, may cost less than GWR.

**3. George Riley, Citizens for Public Water**

- Will the EIR explore or include any of the positive impacts (benefits) in addition to the negative impacts?
- Will other alternatives to the project (besides those already included)be addressed in the EIR?

**4. Helen Rucker, City of Salinas**

- Concerned about the outreach that was done for this meeting and the project in general, as she was surprised that more residents were not in attendance.
- It is important that "non-experts" are included in the scoping and made aware of project issues.

**5. Bill Carrothers (a second time)**

- Suggested that the EIR include information about industrial and environmental hygiene.
- Suggested that the EIR address the potential for operational failures at the Water Treatment Plant.
- Asked about the quality of water that would be sent to the outfall location as opposed to that of the water sent to Seaside for injection.

**6. Ron Weitzman (a second time)**

- Is it possible that a larger scale version of the GWR project can solve the entire water supply issue, therefore eliminating the need for a desalination plant?

**7. Helen Rucker (a second time)**

- Is the cost of the GWR project greater or less than the cost of a typical desalination plant?
- Who will bear the cost of this project; will local residents with lower incomes be able to afford to live in this area?

# APPENDIX D

## NOP COMMENT LETTERS

SORTED BY DATE RECEIVED AND BRACKETED BY SUB-COMMENT

MAY 30, 2013 THROUGH JULY 2, 2013

# Letter A

From: Bob Holden [mailto:bobh@mrwpca.com]
Sent: Mon 6/17/2013 4:42 PM
To: GWR; Alison Imamura; Valerie J. Young; Denise Duffy
Cc: Mike McCullough; Karen Harris
Subject: Eleanor Citen

All,
Ms. Eleanor Citen, PO Box 2428, Carmel, CA 93921, came to 5 Harris Court, Bldg. D this afternoon about 3:40 PM. She wanted to talk about GWR. She indicated that she will not attend the scoping meeting tomorrow. She doesn't want to drink recycled water. She gave me materials she purchased from Aquafornia (Water Education Foundation) for my education (Bay-Delta Tours, 2013 Water Tours, Western Water magazines, and Viewer's Guide: Drinking Water-Quenching the Public Thirst) . She knew about OCWD and how they are expanding. I told her that I drank water at Orange County. She said she has heard of others drinking it and that it tastes ok. However, she did not think it was safe as it had chemicals from the fields in it. I told her that the California Department of Public Health believes it is safe and that they are looking into direct potable reuse. I explained how direct potable took the advanced treated water and either put it into the drinking water treatment plant or directly into a pipe to the consumers. She wants a project to be built to provide water. She does not want it to include water of wastewater origin. She would like me to go to meetings and get some of the water that Southern California will no longer need for us locally. A-1

She thanked me for listening to her and gave me her card.
Thanks,
Bob

**From:** Ron Weitzman [mailto:ronweitzman@redshift.com]
**Sent:** Tuesday, June 18, 2013 4:40 PM
**To:** GWR
**Subject:** Items Suggested by WaterPlus for Inclusion in the EIR for GWR

ATTN: Bob Holden, Principal Engineer, MRWPCA

WaterPlus suggests that the EIR for GWR address the following items:

1. **Toxins in each potential water source**
2. **Discharge rate and natural capacity of Seaside aquifer**
3. **Cost of storage facility for excess effluent**
4. **Cost of solar energy for a desal-only project**
5. **Amount of required diluent**
6. **Flow rate between injection & extraction wells**
7. **Cost comparison with desal-only project**

Justification:

Items 1, 5, and 6 are important because the currently proposed GWR project includes sources of supply water in addition to sewer water, the principal source in previous versions of the project proposal. These additional sources, as well as sub-surface injection for potable use (rather than to retard saltwater intrusion), go beyond the precedent of Orange County and include pollutants not addressed there. Public B-1

Health concerns are a major issue of the project as currently proposed. B-1 cont.

Item 2 is important because GWR involves storage of water over time in the Seaside aquifer , which is considered to be quite porous. The size of the aquifer and its discharge rate must be determined to estimate the amount of injected water that may be lost prior to its extraction. Whatever amount this is will adversely affect efforts to retard saltwater intrusion. B-2

Items 3 and 4 are important because a storage facility for excess effluent or solar energy powering desalination are environmentally-friendly alternatives to GWR for the EIR to evaluate. The cost of the storage facility, which would allow farmers to use excess winter effluent in the summer, or the cost of solar energy for desalination may be considerably less than the cost of GWR. B-3

Item 7 is important for the reason just given: Alternatives to GWR that are equally environmentally friendly, while affording lower risk to public health, may cost less than GWR. B-4

--Ron Weitzman, for WaterPlus

Letter C

California Water Boards

Edmund G. Brown Jr., Governor
Matthew Rodriquez, Secretary for Environmental Protection

State Water Resources Control Board

JUN 18 2013

Bob Holden
Monterey Regional Water Pollution Control Agency
5 Harris Court, Building D
Monterey, CA 93940

Dear Mr. Holden:

NOTICE OF PREPARATION (NOP) FOR MONTEREY REGIONAL WATER POLLUTION CONTROL AGENCY (AGENCY); MONTEREY PENINSULA GROUNDWATER REPLENISHMENT PROJECT (PROJECT); MONTEREY COUNTY; STATE CLEARINGHOUSE NO. 2013051094

We understand that the Agency may be pursuing Clean Water State Revolving Fund (CWSRF) financing for this Project. As a funding agency and a state agency with jurisdiction by law to preserve, enhance, and restore the quality of California's water resources, the State Water Resources Control Board (State Water Board) is providing the following information on the preparation of the California Environmental Quality Act (CEQA) for the Project. C-1

The State Water Board, Division of Financial Assistance, is responsible for administering the CWSRF Program. The primary purpose for the CWSRF Program is to implement the Clean Water Act and various state laws by providing financial assistance for wastewater treatment facilities necessary to prevent water pollution, recycle water, correct nonpoint source and storm drainage pollution problems, provide for estuary enhancement, and thereby protect and promote health, safety and welfare of the inhabitants of the state. The CWSRF Program provides low-interest funding equal to one-half of the most recent State General Obligation Bond Rates with a 20-year term. Applications are accepted and processed continuously. Please refer to the State Water Board's CWSRF website at: www.waterboards.ca.gov/water_issues/programs/grants_loans/srf/index.shtml. C-2

The CWSRF Program is partially funded by the United States Environmental Protection Agency and requires additional "CEQA-Plus" environmental documentation and review. Four enclosures are included that further explain the CWSRF Program environmental review process and the additional federal requirements. The State Water Board is required to consult directly with agencies responsible for implementing federal environmental laws and regulations. Any environmental issues raised by federal agencies or their representatives will need to be resolved prior to State Water Board approval of a CWSRF financing commitment for the proposed Project. For further information on the CWSRF Program, please contact Mr. Ahmad Kashkoli, at (916) 341-5855. C-3

It is important to note that prior to a CWSRF financing commitment, projects are subject to provisions of the Federal Endangered Species Act (ESA), and must obtain Section 7 clearance from the United States Department of the Interior, Fish and Wildlife Service (USFWS), and/or the United States Department of Commerce National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) for any potential effects to special-status species. C-4

Please be advised that the State Water Board will consult with USFWS, and/or NMFS regarding all federal special-status species that the Project has the potential to impact if the Project is to be funded under the CWSRF Program. The Agency will need to identify whether the Project will involve any direct effects from construction activities, or indirect effects such as growth inducement, that may affect federally listed threatened, endangered, or candidate species that are known, or have a potential to occur on-site, in the surrounding areas, or in the service area, and to identify applicable conservation measures to reduce such effects. C-5

In addition, CWSRF projects must comply with federal laws pertaining to cultural resources, specifically Section 106 of the National Historic Preservation Act (Section 106). The State Water Board has responsibility for ensuring compliance with Section 106, and must consult directly with the California State Historic Preservation Officer (SHPO). SHPO consultation is initiated when sufficient information is provided by the CWSRF applicant. If the Agency decides to pursue CWSRF financing, please retain a consultant that meets the Secretary of the Interior's Professional Qualifications Standards (www.cr.nps.gov/local-law/arch_stnds_9.htm) to prepare a Section 106 compliance report. C-6

Note that the Agency will need to identify the Area of Potential Effects (APE), including construction and staging areas, and the depth of any excavation. The APE is three-dimensional and includes all areas that may be affected by the Project. The APE includes the surface area and extends below ground to the depth of any Project excavations. The records search request should be made for an area larger than the APE. The appropriate area varies for different projects but should be drawn large enough to provide information on what types of sites may exist in the vicinity. C-7

Other federal requirements pertinent to the Project under the CWSRF Program include the following:

A. Compliance with the Federal Clean Air Act: (a) Provide air quality studies that may have been done for the Project; and (b) if the Project is in a nonattainment area or attainment area subject to a maintenance plan; (i) provide a summary of the estimated emissions (in tons per year) that are expected from both the construction and operation of the Project for each federal criteria pollutant in a nonattainment or maintenance area, and indicate if the nonattainment designation is moderate, serious, or severe (if applicable); (ii) if emissions are above the federal de minimis levels, but the Project is sized to meet only the needs of current population projections that are used in the approved State Implementation Plan for air quality, quantitatively indicate how the proposed capacity increase was calculated using population projections. C-8

B. Compliance with the Coastal Zone Management Act: Identify whether the Project is within a coastal zone and the status of any coordination with the California Coastal Commission. C-9

C. Protection of Wetlands: Identify any portion of the proposed Project area that should be evaluated for wetlands or United States waters delineation by the United States Army Corps of Engineers (USACE), or requires a permit from the USACE, and identify the status of coordination with the USACE. C-10

D. Compliance with the Farmland Protection Policy Act: Identify whether the Project will result in the conversion of farmland. State the status of farmland (Prime, Unique, or Local and Statewide Importance) in the Project area and determine if this area is under a Williamson Act Contract. C-11

E. Compliance with the Migratory Bird Treaty Act: List any birds protected under this act that may be impacted by the Project and identify conservation measures to minimize impacts. C-12

F. Compliance with the Flood Plain Management Act: Identify whether or not the Project is in a Flood Management Zone and include a copy of the Federal Emergency Management Agency flood zone maps for the area. C-13

G. Compliance with the Wild and Scenic Rivers Act: Identify whether or not any Wild and Scenic Rivers would be potentially impacted by the Project and include conservation measures to minimize such impacts. C-14

Following the preparation of the draft CEQA document for the Project, please provide us a copy of the document to review if the Agency is considering CWSRF financing. In addition, we would appreciate notices of any hearings or meetings held regarding environmental review for the Project. C-15

Thank you for the providing us a copy of your NOP, and the consideration of the CWSRF for the financing of the Agency's Project. If you have any questions or concerns, please feel free to contact me at (916) 341-5855, or by email at AKashkoli@waterboards.ca.gov, or contact Christopher Bruni at (916) 341-5799, or by email at CBruni@waterboards.ca.gov.

Sincerely,

Madeline Harlan for

Ahmad Kashkoli
Senior Environmental Scientist

Enclosures (4)

1. SRF & CEQA-Plus
2. Quick Reference Guide to CEQA Requirements for State Revolving Fund Loans
3. Instructions and Guidance for "Environmental Compliance Information"
4. Basic Criteria for Cultural Resources Reports

Letter C (cont)

cc: State Clearinghouse
(Re: SCH# 2013051094)
P.O. Box 3044
Sacramento, CA 95812-3044

Letter C (cont)

If project emissions are **below the "de minimis" levels** and less than 10% of the emissions inventory for the non-attainment or maintenance area, then:

- **Further general conformity analysis is not required.**

If project emissions are **above the "de minimis" levels**:

- **A conformity determination for the area must be made.**

A conformity determination can be made if facilities are sized to meet the needs of current population projections used in an **approved** State Implementation Plan (SIP) for air quality. Using population projections, applicants must **quantify** their description of how the proposed capacity increase was calculated.

## NATIONAL HISTORIC PRESERVATION ACT

Section 106 of the NHPA requires federal agencies to take into account effects on historic properties caused by federal actions (such as funding SRF projects) and to provide the Advisory Council on Historic Preservation (ACHP) a reasonable opportunity to comment on such undertakings through consultation with the State Historic Preservation Officer (SHPO) and with interested Indian Tribes and individuals.

***USEPA has delegated to the State Water Board the responsibility for carrying out the requirements of Section 106 of the NHPA.**

**Historic properties include:**

- Archaeological sites.
- Historic era buildings.
- Traditional cultural properties.

**Starting point for the 106 process:**
Applicant's record search and cultural resource documents prepared for CEQA.

**State Water Board's Cultural Resource Officer (CRO) requires:**

- Copies of all original maps and studies for consultation with SHPO.

If your project has the potential to affect historic properties the consultation process can be quite lengthy. **Please contact the CRO early in your planning process to discuss what additional information may be needed for your specific project.**

***Environmental Review Process Guidelines for State Revolving Fund Loan Applicants*** document provides additional information on the review process and can be found on the State Water Board's web site located at:

http://www.waterboards.ca.gov/funding/srf.html

Water Boards

# SRF & CEQA-PLUS

**Environmental Review for State Revolving Fund (SRF) Loan Applicants**

**- WHAT - WHY - HOW -**

State Water Resources Control Board
Division of Financial Assistance
November 2005

## WHAT IS CEQA-PLUS?

The SRF Loan Program is partially funded by the U.S. Environmental Protection Agency (USEPA) and subject to federal environmental regulations, including the Endangered Species Act (ESA), the National Historic Preservation Act (NHPA), and the General Conformity Rule for the Clean Air Act (CAA), among others. Federal agencies have their own policies on how they comply with federal environmental laws. Instead of the National Environmental Policy Act (NEPA), USEPA has chosen to use the California Environmental Quality Act (CEQA) as the compliance base for California's SRF Loan Program, in addition to compliance with ESA, NHPA and CAA. Collectively, the State Water Board calls these requirements **CEQA-Plus.** Additional federal regulations also may apply.

**Lead Agency:** The Applicant

**Duties:**

- Prepare, circulate and consider the environmental documents prior to approving the project.
- Provide the State Water Board with eight (8) copies of the applicant's CEQA documents.

**Responsible Agency:** State Water Board, Division of Financial Assistance

**Duties:**

- Acting on behalf of USEPA, review and consider the CEQA documents before approving the project's funding.
- Make findings as to the adequacy of the documents and require additional studies or documentation, as needed.
- Distribute the applicant's CEQA documents to selected federal agencies for review and comment before making a determination on adequacy. (This distribution is in addition to the standard State Clearinghouse distribution under CEQA.)

***The applicant must address all comments by federal agencies before funding is approved.**

## ENDANGERED SPECIES ACT

**Non-federal Representative** (for all wastewater and water reclamation projects in California that involve an SRF loan): State Water Board

State Water Board - Environmental Services Staff (ES) reviews SRF projects to determine potential effects on federally listed species.

**Applicant Duties:**

- At the earliest possible date, provide ES with:
  - **Species lists.**
  - **Biological assessments.**
  - **Other documents related to project effects on sensitive species.**
- Notify ES **early** during the planning process of any issues regarding sensitive species.

**ES Duties:**

- Confer informally with the U.S. Fish and Wildlife Service (USFWS) and/or National Marine Fisheries Service (NMFS), as necessary.
- Evaluate and inform USFWS/NMFS of project impacts to federally listed species.
- Ask USEPA to request formal consultation if ES, in conjunction with USFWS/NMFS, determines that a project will adversely affect a federally listed species.

***USEPA will act as the lead agency in the formal consultation process. In response to a formal request from USEPA, USFWS/NMFS may have up to 90 days to prepare a biological opinion. The process can last 135 days or longer.**

## CLEAN AIR ACT

**CAA general conformity analysis applies only to projects in areas:**

- Not meeting National Ambient Air Quality Standards (NAAQS).
- Subject to a maintenance plan.

An analysis is necessary for each **criteria pollutant below** for which an area is considered as being in nonattainment or maintenance:

- **ozone**
- **carbon monoxide**
- **nitrogen dioxide**
- **sulfur dioxide**
- **lead**
- **inhalable particulate matter**

Letter C (cont)

## Cultural Resources

*Compliance with*
*Federal Section 106 of the*
*National Historic Preservation Act*

**Information Needed from the Applicant:**

- Current records search with maps showing all sites and surveys drawn in relation to the project area.
- Native American consultation.
- Instructions as to how to get started are found in the CEQA Guidelines, since these two items are basic to any cultural resources review.

## Migratory Bird Treaty Act

**Information Needed From the Applicant:**

- Identification of whether or not the project is within jurisdiction of the Migratory Bird Treaty Act.

## Wild and Scenic Rivers Act

**Information Needed from the Applicant:**

- Identification of whether or not the project will impact any Wild and Scenic Rivers.

## Other Requirements

**Information Needed from the Applicant:**

- Eight (8) copies of the final CEQA document.
- A date-stamped copy of the Notice of Determination or the Notice of Exemption filed with the Governor's Office of Planning and Research and a receipt of the filling fees paid to the California Department of Fish and Game for Negative Declarations (ND) or Environmental Impact Reports (EIR).
- A copy of the Resolution from the lead agency, approving or certifying the CEQA document and their project. *Note: The CEQA Guidelines uses "approve" or "adopt" for ND and "certify" for EIR.*

# Quick Reference Guide to the California Environmental Quality Act (CEQA)-Plus Requirements for State Revolving Fund Loans

*Guide to Federal Requirements*

State Water Resources Control Board
Division of Financial Assistance
January 2008

## Endangered Species

*Compliance with Section 7 of the Endangered Species Act*

Information Needed from the Applicant:

- List of special status species (both animal and plant) likely or possibly to occur at project site. *Note: If none will possibly occur, provide supporting information.*
- Any biological assessments or special biological studies that may have been done for the project.
- Other documents that disclose information about the project's effect on sensitive species.

## Protection of Wetlands

Information Needed from the Applicant:

- Identification of whether or not the project or construction activities will impact streams, flood control channels, or wetlands.

## Air Quality

*Compliance with the Federal Air Quality Act*

Information Needed from the Applicant:

- Air quality studies that may have been done for the project.
- For those projects in non-attainment areas or attainment areas subject to maintenance plans:
  - → Emission data for each criteria pollutant for which the area has been designated non-attainment or maintenance; and
  - → Summary of the emissions that are expected from both the construction and operation of the project for each criteria pollutant in a non-attainment or maintenance area.
- If emissions are above the federal de minimis levels, but the project is sized to meet only the needs of current population projections that are used in the approved State Implementation Plan for air quality:
  - → Quantitatively indicate how the proposed capacity increase was calculated using population projections.

## Floodplain Management

Information Needed from the Applicant:

- Identification of whether or not the project is in a Flood Management Zone and a copy of the Federal Emergency Management Agency flood zone maps for the project area.

## Farmland Protection Policy Act

Information Needed from the Applicant:

- Identification of whether or not the proposed project will impact any important farmland or land under Williamson Act control.

## Coastal Zone Management Act

Information Needed from the Applicant:

- Identification of whether or not the proposed project is in the Coastal Zone.

# BASIC CRITERIA FOR CULTURAL RESOURCES REPORTS

## FOR SECTION 106 CONSULTATION WITH THE STATE HISTORIC PRESERVATION OFFICER (SHPO) UNDER THE NATIONAL HISTORIC PRESERVATION ACT (NHPA)

CULTURAL RESOURCES REPORTS
The Section 106 compliance efforts and reports must be prepared by a qualified researcher that meets the Secretary of the Interior's Professional Qualifications Standards (www.cr.nps.gov/local-law/arch_stnds_9.htm).

REPORT TERMINOLOGY
A cultural resources report used for Section 106 consultation should use terminology consistent with 36 CFR, Section 800.16 of the NHPA. This doesn't mean that the report needs to "filled" with passages and interpretations of the regulations, the SHPO reviewer already knows the law.

- If "findings" are made they must be one of the four "findings" listed in Section 106. These include:

  "No historic properties affected" (no properties are within the APE, including the below ground APE).

  "No effect to historic properties" (properties may be near the APE but the project will not impact them).

  "No adverse effect to historic properties" (the project may affect historic properties but the impacts will not be adverse)

  "Adverse effect to historic properties". *Note: the SHPO must be consulted at this point. If your consultant proceeds on his own, his efforts may be wasted.*

CURRENT RECORDS SEARCH INFORMATION
- A current (less than a year old) records search from the appropriate Information Center is necessary. The records search should include maps that show all recorded sites and surveys in relation to the area of potential effects (APE) for the project.

- The APE is three-dimensional and includes all areas that may be affected by the project. It includes the surface area and extends below ground to the depth of any project excavations.

- The records search request should be made for an area larger than the APE. The appropriate area varies for different projects but should be drawn large enough to provide information on what types of sites may exist in the vicinity.

NATIVE AMERICAN AND INTERESTED PARTY CONSULTATION

- Native American and interested party consultation should be initiated at the beginning of any cultural resource investigations. The purpose is to gather information from people with local knowledge that may be used to guide research.

- A project description and map should be sent to the Native American Heritage Commission (NAHC) requesting a check of their Sacred Lands Files. The Sacred Lands Files include religious and cultural places that are not recorded at the information centers.

- The NAHC will include a list of Native American groups and individuals with their response. A project description and maps should be sent to everyone on the list asking for information on the project area.

- Similar letters should be sent to local historical organizations.

- Follow-up contact should be made by phone if possible and a phone log should be included in the report.

WARNING PHRASES IN ALREADY PREPARED CEQA REPORTS

- A finding of **"no known resources"**, this doesn't mean anything. The consultant's job is to find out if there are resources within the APE or to explain why they are not present.

- **"The area is sensitive for buried archaeological resources",** followed by a statement that **"monitoring is recommended as mitigation".** Monitoring is not an acceptable mitigation. A reasonable effort should be made to find out if buried resources are present in the APE.

- **"The area is already disturbed by previous construction",** this may be true, but documentation is still needed to show that the new project will not affect cultural resources. As an example, an existing road can be protecting a buried archaeological site. Or, previous construction may have impacted an archaeological site that was never documented.

- No mention of **"Section 106"**, a report that gives adequate information for CEQA may not be sufficient to comply with Section 106.

SHPO CONSULTATION LETTER

- A Section 106 consultation letter should be prepared by a qualified researcher, and submitted along with the Section 106 Report to the State Water Board to use to consultant with the State Historic Preservation Officer.

STATE WATER BOARD CONTACT INFORAMTION

Please contact Mr. Ahmad Kashkoli 916-341-5855 or akashkoli@waterboards.ca.gov if you have any questions related to CWSRF Program cultural resources compliance.

**Letter C (cont)**

Introduction:

The State Water Resources Control Board (State Water Board) uses the California Environmental Quality Act (CEQA) review process and compliance with federal environmental laws and regulations to satisfy the environmental requirements of the Clean Water State Revolving Fund (CWSRF) Program Operating Agreement between the United States Environmental Protection Agency (USEPA) and the State Water Board. The CWSRF Program is partially funded by a capitalization grant from the USEPA. The issuance of funds from the CWSRF Program is equivalent to a federal action, and thus, compliance with federal environmental laws and regulations is required for projects being funded under the CWSRF Program.

All CWSRF Program applicants must submit adequate and complete environmental documentation to the State Water Board. Following submittal of an applicant's environmental documents, the State Water Board will review the documents to determine if the information is sufficient to document compliance with the CWSRF Program environmental requirements, including making a determination if consultation with federal authorities is required, and may request additional environmental information, when needed. The State Water Board encourages all applicants to initiate early consultation, so that the State Water Board can better streamline the environmental review process.

CEQA Information:

All projects coming to the State Water Board for funding are considered "projects" under CEQA because of the State Water Board's discretionary decision to approve funding.

Detailed information, including CEQA statutes and guidelines can be found online at the California Natural Resources Agency website at http://ceres.ca.gov/ceqa. A CEQA Process Flowchart that shows interaction points between lead and responsible agencies can be found at http://ceres.ca.gov/topic/env_law/ceqa/flowchart/index.html. In addition, State Water Board environmental staff is available to answer questions about the CEQA process, as well as the CWSRF Program environmental requirements. Please contact your assigned Project Manager at the State Water Board, regarding contact information for the appropriate environmental staff.

CEQA requires full disclosure of all aspects of the project, including impacts and mitigation measures that are not only regulated by state agencies, but also by federal agencies. Early consultation with state and federal agencies in the CEQA process will assist in minimizing changes to the project when funding is being requested from the State Water Board.

The types of CEQA documents that may apply to an applicant's project include one or a combination of the following: 1) Notice of Exemption (NOE); 2) Initial Study and Negative Declaration (ND); 3) Initial Study and Mitigated Negative Declaration (MND) with a Mitigation Monitoring and Reporting Program (MMRP); 4) Environmental Impact Report (EIR) with an MMRP; and/or 5) Addendum, Supplemental and Subsequent ND, MND or EIR. The applicant must determine the appropriate document for its project and submit the supporting information listed under the applicable section of the Environmental Package Checklist for Applicant (Attachment 1), along with a completed copy of the Evaluation Form for Environmental Review and Federal Coordination (Attachment 2). Please submit two copies of all CEQA documents.

**Letter C (cont)**

The applicant must ensure the CEQA document is specific to the project for which funding is being requested. Program or Master Plan EIRs may not be suitable for satisfying the State Water Board environmental requirements if these documents are not project-specific. When an applicant uses an Addendum, Supplemental or Subsequent CEQA document for a project, the associated Program or Master Plan EIR must also be submitted, especially if the Addendum, Supplemental or Subsequent CEQA document includes references to pertinent environmental and mitigation information contained in the Program or Master Plan EIR.

If the applicant is using a CEQA document that is older than five years, the applicant must re-evaluate environmental and project conditions, and develop and submit an updated environmental document (such as an Addendum, Supplemental or Subsequent CEQA document) based on the results of that re-evaluation. The updated environmental document must be circulated through the State Clearinghouse for public review. The applicant must adopt the final updated environmental document, including any new identified measures, make CEQA findings, and file a Notice of Determination (NOD) with the local county clerk(s) and the Governor's Office of Planning and Research, State Clearinghouse (State Clearinghouse).

Each applicant, if it is a public agency, is responsible for approving the CEQA documents it uses regardless of whether or not it is a lead agency under CEQA. Non-profit organizations shall only be responsible for approving and ensuring implementation of the applicable project mitigation measures identified in the MMRP. All public agencies applying for CWSRF Program funding shall file either an NOE or an NOD with the State Clearinghouse and the local county clerk(s). Date stamped copies of those notices must be submitted with all the applicable environmental documents.

If the CEQA document was jointly prepared by a federal public governmental agency to satisfy the National Environmental Policy Act (NEPA) requirements, then the applicant must submit the corresponding NEPA documents, including a Finding of No Significant Impact, or a Record of Decision completed by the federal NEPA lead agency.

Federal Information:

In addition to CEQA compliance, the State Water Board is required to document environmental compliance with federal environmental laws and regulations, including:

1. Federal Endangered Species Act (ESA), Section 7:

The United States Department of the Interior, Fish and Wildlife Service (USFWS) and the United States Department of Commerce National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) must be consulted for any project that will have the potential to adversely impact a federal special-status species. The USEPA delegated the State Water Board to act as the non-federal lead for initiating informal Section 7 ESA consultation with the USFWS. The State Water Board will coordinate with the USEPA for projects requiring formal Section 7 ESA consultation with the USFWS and projects that will impact federal special-status fish species under the NMFS jurisdiction. The USFWS and NMFS must provide written concurrence prior to a CWSRF financing agreement. USFWS and NMFS comments may include conservation measures, for which the applicant's CWSRF financing agreement will be conditioned to ensure compliance.

For further information on the federal ESA law, regulation, policy, and notices, go to http://www.fws.gov/endangered/laws-policies/index.html and http://www.nmfs.noaa.gov/pr/laws/esa/. Note that compliance with both the state and federal ESAs is required of projects having the potential to impact state and federal special-status species. Although overlap exists between the state and federal ESAs, there might be additional or more restrictive state requirements. For further information on the state ESA, refer to the California Department of Fish and Game website at http://www.dfg.ca.gov/habcon/cesa/.

**Letter C (cont)**

2. Magnuson-Stevens Fishery Conservation and Management Act, Essential Fish Habitat (EFH):

The Magnuson-Stevens Fishery Conservation and Management Act, as amended, is designed to manage and conserve national fishery resources. EFH consultations are only required for actions that may adversely effect EFH. The applicant needs to determine whether the proposed project may adversely affect EFH. NMFS is responsible for publishing maps and other information on the locations of designated EFH, and can provide information on ways to promote conservation of EFHs to facilitate this assessment. If a project may adversely affect a designated EFH, the applicant must complete an EFH consultation.

The State Water Board will coordinate with the USEPA to request an EFH consultation from the NMFS. NMFS is required to respond informally or in writing. NMFS comments may include conservation measures, for which the applicant's CWSRF financing agreement will be conditioned to ensure compliance. For more information, see the brochure at http://www.nmfs.noaa.gov/sfa/reg_svcs/Council%20stuff/council%20orientation/2007/2007TrainingCD/TabT-EFH/EFH_CH_Handout_Final_3107.pdf.

3. National Historic Preservation Act (NHPA), Section 106:

The NHPA focuses on federal compliance. Section 106 requires Federal agencies to take into account the effects of their undertakings on historic properties. The Section 106 process seeks to accommodate historic preservation concerns with the needs of Federal undertakings through consultation among the agency official and other parties with an interest in the effects of the undertaking on historic properties. The goal of consultation is to identify historic properties potentially affected by the undertaking, assess its effects and seek ways to avoid, minimize or mitigate any adverse effects on historic properties. The Section 106 compliance efforts and reports must be prepared by a qualified researcher that meets the Secretary of the Interior's Professional Qualifications Standards (www.cr.nps.gov/local-law/arch_stnds_9.htm).

In addition, CEQA requires that impacts to cultural and historic resources be analyzed. The "CEQA and Archeological Resources" section from the Governor's Office of Planning and Research CEQA Technical Advice Series states that the lead agency obtains a current records search from the appropriate California Historical Resources Information System Center. Also, to contact the Native American tribes that are culturally affiliated with a project area from the list obtained from the Native American Heritage Commission (NAHC).

The NAHC can be contacted at:

915 Capitol Mall, Room 364
Sacramento, CA 95814
Tele: (916) 653-4082

4. Clean Air Act:

For CWSRF financed projects, we recommend including a general conformity section in the CEQA documents so that another public review process will not be needed, should a conformity determination be required. The applicant should check with its local air quality management district and review the Air Resources Board California air emissions map for information on the State Implementation Plan. For information on the analysis steps involved in evaluating conformity, please contact the State Water Board environmental staff through the assigned Project Manager.

**Letter C (cont)**

5. Coastal Zone Management Act:

Projects proposing construction in the Coastal Zone will require consultation with either the California Coastal Commission (or the designated local agency with a Local Coastal Program), or the San Francisco Bay Conservation and Development Commission (for projects located in the San Francisco Bay area). The applicant must submit a copy of the approved Coastal Development permit to the State Water Board to satisfy this requirement.

For more information on Coastal Zone Management Act requirements refer to the following agencies websites:

- United States Coastal Zone Boundaries through the NMFS website at http://coastalmanagement.noaa.gov/mystate/docs/StateCZBoundaries.pdf;
- California Coastal Commission website at http://www.coastal.ca.gov/ccatc.html; and/or
- San Francisco Bay Conservation and Development Commission website at http://www.bcdc.ca.gov/.

6. Coastal Barriers Resources Act:

The Coastal Barriers Resources Act is intended to discourage development in the Coastal Barrier Resources System and adjacent wetlands, marshes, estuaries, inlets, and near-shore waters. Since there is no designated Coastal Barrier Resources System in California, no impacts from California projects are expected. However, should the applicant believe there may be impacts to the Coastal Barrier Resources System due to special circumstances, please use the following information as a guide.

During the planning process, the applicant should consult with the appropriate Coastal Zone management agency (e.g., City or County with an approved Local Coastal Program, the California Coastal Commission, or the San Francisco Bay Conservation and Development Commission) to determine if the project will have an effect on the Coastal Barrier Resources System. If the project will have an effect on the Coastal Barrier Resources System, the State Water Board must consult with the appropriate Coastal Zone management agency and the USFWS. Any recommendations from the Coastal Zone management agency and USFWS will be incorporated into the project's design prior to approval of CWSRF financing.

For more information and to ensure that no modifications to Coastal Barrier Resources System have occurred, please visit: http://www.fws.gov/CBRA/.

7. Farmland Protection Policy Act:

Projects involving impacts to farmland designated as prime and unique, local and statewide importance, or under a Williamson Act Contract, will require consultation with the United States Department of Agriculture, Natural Resources Conservation Service and/or California Department of Conservation. For more information on the Farmland Protection Policy Act go to http://www.nrcs.usda.gov/programs/fppa, and regarding the Williamson Act Contact go to http://www.consrv.ca.gov/dlrp/lca.

**Letter C (cont)**

8. Floodplain Management – Executive Order 11988:

Each agency shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities. Before taking an action, each agency shall determine whether the proposed action will occur in a designated floodplain. The generally established standard for risk is the flooding level that is expected to occur every 100 years. If an agency determines or proposes to, conduct, support, or allow an action to be located in a floodplain, the agency shall consider alternatives to avoid adverse effects and incompatible development in the floodplains.

For further information regarding Floodplain Management requirements, please consult the United States Department of Homeland Security, Federal Emergency Management Agency website at http://www.fema.gov, as well as the USEPA floodplain management Executive Order 11988 at http://www.epa.gov/owow/wetlands/regs/eo11988.html.

9. Migratory Bird Treaty Act (MBTA):

The MBTA restricts the killing, taking, collecting and selling or purchasing of native bird species or their parts, nests, or eggs. The MBTA, along with subsequent amendments to this act, provides legal protection for almost all breeding bird species occurring in the United States and must be addressed under CEQA. In the CEQA document, each agency must make a finding that a project will comply with the MBTA. For further information, please consult the Migratory Bird Program through the USFWS website at http://www.fws.gov/laws/lawsdigest/migtrea.html.

10. Protection of Wetlands – Executive Order 11990:

Projects, regardless of funding, must get approval for any temporary or permanent disturbance to federal and state waters, wetlands, and vernal pools. The permitting process through the United States Army Corps of Engineers (USACE) can be lengthy, and may ultimately require project alterations to avoid wetlands and waters of the United States. Applicants must consult with the USACE early in the planning process if any portion of the project site contains wetlands, or other federal waters. The USACE Wetland Delineation Manual is available at http://www.wetlands.com/regs/tlpge02e.htm. Also note that the California State Water Boards are involved in providing approvals through the Clean Water Act Section 401 Water Quality Certification Program and/or Waste Discharge Requirements. For more information, please go to http://www.waterboards.ca.gov/water_issues/programs/cwa401/index.shtml.

11. Wild and Scenic Rivers Act:

There are construction restrictions or prohibitions for projects near or in a designated "wild and scenic river." A listing of designated "wild and scenic rivers" can be obtained at http://www.rivers.gov/rivers/california.php. Watershed information can be obtained through the "Watershed Browser" at http://cwp.resources.ca.gov/map_tools.php.

12. Safe Drinking Water Act, Source Water Protection:

Projects must comply with the Safe Drinking Water Act and document whether or not a project has the potential to contaminate a sole source aquifer. For projects impacting a listed sole source aquifer, the applicant must identify an alternative project location, or develop adequate mitigating measures in consultation with the USEPA. For more information, please go to the Sole Source Aquifer Program website at http://epa.gov/region09/water/groundwater/ssa.html.

13. Environmental Justice – Executive Order No. 12898:

Identify and address any disproportionately high and adverse human health or environmental effects of the project's activities on minority and low-income populations. USEPA has defined environmental justice as "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."

*Fair Treatment* means that no group of people should bear a disproportionate burden of environmental harms and risks, including those resulting from the negative consequences of industrial, governmental, and commercial operations or programs and policies.

*Meaningful Involvement* means that: 1) potentially affected community members have an appropriate opportunity to participate in decisions about a proposed activity that will affect their environment and/or health; 2) the public's contribution can influence the agency's decision; 3) the concerns of all participants involved will be considered in the decision-making process; and 4) the decision-makers seek out and facilitate the involvement of those potentially affected.

The term "environmental justice concern" is used to indicate the actual or potential lack of fair treatment or meaningful involvement of minority, low-income, or indigenous populations, or tribes in the development, implementation, and enforcement of environmental laws, regulations, and policies.

Your project may involve an "environmental justice concern" if the project could:

a) Create new disproportionate impacts on minority, low-income, or indigenous populations;
b) Exacerbate existing disproportionate impacts on minority, low-income, or indigenous populations; or
c) Present opportunities to address existing disproportionate impacts on minority, low-income, or indigenous populations that are addressable through the project.

# ENVIRONMENTAL[1] PACKAGE CHECKLIST
# FOR APPLICANT
## (What to Submit to Project Manager)

**Required for all CWSRF Projects:**

- ❑ **Evaluation Form for Environmental Review and Federal Coordination with the substantiating information** (i.e. USFWS species list/biological assessment, cultural resources documentation, air quality data, flood map etc.)
- ❑ **Project Report, Scope of Work and Map(s)**

**Based on the type of CEQA documents prepared for the project, provide additional information as identified in the following boxes.**

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If project is covered under a **CEQA Categorical or Statutory Exemption**, submit a copy of the following:

- ❑ **Notice of Exemption** (filed and date stamped by the county clerk and the Governor's Office of Planning and Research)

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If project is covered under a **Negative Declaration**, submit a copy of the following:

- ❑ **Draft and Final Initial Study/Negative Declaration (IS/ND)**
  - ❑ Comments and Responses to the Draft IS/ND
- ❑ **Resolution approving the CEQA documents**
  - ❑ Adopting the Negative Declaration
  - ❑ Making CEQA Findings
- ❑ **Notice of Determination** (filed and date stamped by the county clerk and the Governor's Office of Planning and Research)

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If project is covered under a **Mitigated Negative Declaration**, submit a copy of the following:

- ❑ **Draft and Final Initial Study/Mitigated Negative Declaration (IS/MND)**
  - ❑ Comments and Responses to the Draft IS/MND
  - ❑ Mitigation Monitoring and Reporting Plan/Program (MMRP)
- ❑ **Resolution approving the CEQA documents**
  - ❑ Adopting the Mitigated Negative Declaration and the MMRP
  - ❑ Making CEQA Findings
- ❑ **Notice of Determination** (filed and date stamped by the county clerk and the Governor's Office of Planning and Research)

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If project is covered under an **Environmental Impact Report (EIR)**, submit a copy of the following:

- ❑ **Draft and Final EIR**
  - ❑ Comments and Responses to the Draft EIR
  - ❑ Mitigation Monitoring and Reporting Plan/Program (MMRP)
- ❑ **Resolution approving the CEQA documents**
  - ❑ Certifying the EIR and adopting the MMRP
  - ❑ Making CEQA Findings
  - ❑ Adopting a Statement of Overriding Considerations for any adverse environmental impact(s), if applicable
- ❑ **Notice of Determination** (filed and date stamped by the county clerk and the Governor's Office of Planning and Research)

If EIR is a joint CEQA/National Environmental Policy Act document (EIR/Environmental Impact Statement or EIR/Environmental Assessment), submit the applicable Record of Decision and/or the Finding of No Significant Impact.

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[1] If the CEQA document is more than five years old applicant shall provide an updated CEQA document (eg. subsequent, supplemental, or addendum CEQA documents) or a letter that describes the current status of the environmental condition for the project's location.

**Letter C (cont)**

State Water Resources Control Board (State Water Board)
Clean Water State Revolving Fund Program

Evaluation Form for Environmental Review and Federal Coordination

**CWSRF No.:** ______________________________
**Applicant Name:** ______________________________
**Date:** ______________________________
**Project Title:** ______________________________

**1.** **<u>Federal Endangered Species Act (ESA), Section 7</u>:**
**Does the project involve any direct effects from construction activities, or indirect effects such as growth inducement that may affect federally listed threatened or endangered species or their critical habitat that are known, or have a potential, to occur on-site, in the surrounding area, or in the service area?**

a. **Required documents: Attach project-level biological surveys, evaluations analyzing the project's direct and indirect effects on special-status species, and an up-to-date species list (from the United States Fish and Wildlife Service and the California Natural Diversity Database) for the project area.**

☐ No. Discuss why the project will not impact any federally listed special status species:

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☐ Yes. Provide information on federally listed species that could potentially be affected by this project and any proposed avoidance and compensation measures so that the State Water Board can initiate informal/formal consultation with the applicable federally designated agency. Document any previous ESA consultations that may have occurred for the project. Include any comments below:

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**Letter C (cont)**

2. **<u>Magnuson-Stevens Fishery Conservation and Management Act, Essential Fish Habitat</u>: Does the project involve any direct effects from construction activities, or indirect effects such as growth inducement that may adversely affect essential fish habitat?**

☐ No. Discuss why the project will not impact essential fish habitat:

☐ Yes. Provide information on essential fish habitat that could potentially be affected by this project and any proposed avoidance and compensation measures. Document any consultations with the National Marine Fisheries Service that may have occurred for the project. Include any comments below:

3. **<u>National Historic Preservation Act, Section 106</u>: Identify the area of potential effects (APE), including construction, staging areas, and depth of any excavation. (Note: the APE is three dimensional and includes all areas that may be affected by the project, including the surface area and extending below ground to the depth of any project excavations).**

- **Required documents: Cultural Resources Assessment** prepared by a prepared by a qualified researcher that meets the Secretary of the Interior's Professional Qualifications Standards (www.cr.nps.gov/local-law/arch_stnds_9.htm). **Current records search** with maps showing all sites and surveys drawn in relation to the project area, and records of **Native American consultation.** Include any comments below:

4. **Federal Clean Air Act:**

**Identify Air Basin Name** ______________________

**Name of the Local Air District for Project Area:** ______________________

**Is the project subject to a State Implementation Plan (SIP) conformity determination?**

☐ No. The project is in an attainment or unclassified area for all federal criteria pollutants.

☐ Yes. The project is in a nonattainment area or attainment area subject to maintenance plans for a federal criteria pollutant. Include information to indicate the nonattainment designation (e.g. moderate, serious, severe, or extreme), if applicable. If estimated emissions (below) are above the federal de minimis levels, but the project is sized to meet only the needs of current population projections that are used in the approved SIP for air quality, then quantitatively indicate how the proposed capacity increase was calculated using population projections.

- **If you checked "Yes" above, provide the estimated project construction and operational air emissions (in tons per year) in the chart below, and attach supporting calculations.**
- **Also, attach any air quality studies that may have been done for the project.**

| Pollutant | Federal Status (Attainment, Nonattainment, Maintenance, or Unclassified) | Nonattainment Rates (i.e., moderate, serious, severe, or extreme) | Threshold of Significance for Project Air Basin (if applicable) | Construction Emissions (Tons/Year) | Operation Emissions (Tons/Year) |
|---|---|---|---|---|---|
| Ozone ($O_3$) | | | | | |
| Carbon Monoxide (CO) | | | | | |
| Oxides of Nitrogen ($NO_x$) | | | | | |
| Reactive Organic Gases (ROG) | | | | | |
| Volatile Organic Compounds (VOC) | | | | | |
| Lead (Pb) | | | | | |
| Particulate Matter less than 2.5 microns in diameter ($PM_{2.5}$) | | | | | |
| Particulate Matter less than 10 microns in diameter ($PM_{10}$) | | | | | |
| Sulfur Dioxide ($SO_2$) | | | | | |

5. **Coastal Zone Management Act:**

**Is any portion of the project site located within the coastal zone?**

☐ No. The project is not within the coastal zone.

☐ Yes. Describe the project location with respect to coastal areas and the status of the coastal zone permit, and provide a copy of the coastal zone permit or coastal exemption:

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**Letter C (cont)**

6. **<u>Coastal Barriers Resources Act</u>:**
**Will the project impact or be located within or near the Coastal Barrier Resources System or its adjacent wetlands, marshes, estuaries, inlets, and near-shore waters? Note that since there is currently no Coastal Barrier Resources System in California, projects located in California are not expected to impact the Coastal Barrier Resources System in other states. If there is a special circumstance in which the project may impact a Coastal Barrier Resource System, indicate your reasoning below.**

☐ No. The project will not impact or be located within or near the Coastal Barrier Resources System or its adjacent wetlands, marshes, estuaries, inlets, and near-shore waters.

☐ Yes. Describe the project location with respect to the Coastal Barrier Resources System, and the status of any consultation with the appropriate Coastal Zone management agency and the United States Fish and Wildlife Service:

7. **<u>Farmland Protection Policy Act</u>:**
**Is any portion of the project located on important farmland?**

☐ No. The project will not impact farmland.

☐ Yes. Include information on the acreage that would be converted from important farmland to other uses. Indicate if any portion of the project boundaries is under a Williamson Act Contract and specify the amount of acreage affected:

8. **<u>Flood Plain Management</u>:**
**Is any portion of the project located within a 100-year floodplain as depicted on a floodplain map or otherwise designated by the Federal Emergency Management Agency?**

- **Required documents: Attach a floodplain map.**

☐ No. Provide a description of the project location with respect to streams and potential floodplains:

☐ Yes. Describe the floodplain, and include a floodplains/wetlands assessment. Describe any measures and/or project design modifications that would be implemented to minimize or avoid project impacts:

**Letter C (cont)**

9. **Migratory Bird Treaty Act:**
**Will the project affect protected migratory birds that are known, or have a potential, to occur on-site, in the surrounding area, or in the service area?**

☐ No. Provide an explanation below.

☐ Yes. Discuss the impacts (such as noise and vibration impacts, modification of habitat) to migratory birds that may be directly or indirectly affected by the project and mitigation measures to reduce or eliminate these impacts. Include a list of all migratory birds that could occur where the project is located:

10. **Protection of Wetlands:**
**Does any portion of the project boundaries contain areas that should be evaluated for wetland delineation or require a permit from the United States Army Corps of Engineers?**

☐ No. Provide the basis for such a determination:

☐ Yes. Describe the impacts to wetlands, potential wetland areas, and other surface waters, and the avoidance, minimization, and mitigation measures to reduce such impacts. Provide the status of the permit and information on permit requirements:

11. **Wild and Scenic Rivers Act:**
**Identify watershed where the project is located:** ______

**Is any portion of the project located within a wild and scenic river?**

☐ No. The project is not located near a wild and scenic river.

☐ Yes. Identify the wild and scenic river watershed and project location relative to the affected wild and scenic river:

**Letter C (cont)**

12. **Safe Drinking Water Act, Sole Source Aquifer Protection:**
**Is the project located in an area designated by the United States Environmental Protection Agency, Region 9, as a Sole Source Aquifer?**

☐ No. The project is not within the boundaries of a sole source aquifer.

☐ Yes. Contact USEPA, Region 9 staff to consult, and identify the sole source aquifer (e.g., Santa Margarita Aquifer, Scott's Valley, the Fresno County Aquifer, the Campo/Cottonwood Creek Aquifer or the Ocotillo-Coyote Wells Aquifer) that will be impacted:

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13. **Environmental Justice:**
**Does the project involve an activity that is likely to be of particular interest to or have particular impact upon minority, low-income, or indigenous populations, or tribes?**

☐No. Selecting "No" means that this action is not likely to be of any particular interest to or have an impact on these populations or tribes. Explain.

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☐Yes. If you answer yes, please check at least one of the boxes and provide a brief explanation below:

☐ The project is likely to impact the health of these populations.

☐ The project is likely to impact the environmental conditions of these populations.

☐ The project is likely to present an opportunity to address an existing disproportionate impact of these populations.

☐ The project is likely to result in the collection of information or data that could be used to assess potential impacts on the health or environmental conditions of these populations.

☐ The project is likely to affect the availability of information to these populations.

☐ Other reasons, describe: ______________________________

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Letter D

**From:** Guidi, Robert G CIV (US) [mailto:robert.g.guidi.civ@mail.mil]
**Sent:** Wednesday, June 19, 2013 12:05 PM
**To:** GWR
**Cc:** Elliott, John H CIV (US); Grover-Bullington, Lenore R CIV (US); Preciado, Rogelio E CIV (US)
**Subject:** GWR EIR Scoping

Dear Bob,

Thank you for the opportunity to provide input on the Monterey Peninsula GWR EIR. Undoubtedly this proposed project and associated environmental analysis will receive a substantial amount of scrutiny.

Having listened to the various presentations and read the NOP for the EIR here are a few initial comments for consideration during the CEQA public scoping process as follows:

1. Water Quality – MRWPCA and DDA are planning to address the potential environmental impacts thereof. The depth or extent of that analysis is critical because of the safety concerns associated with the proposed technology. People must be highly assured the groundwater pumped out the aquifer is safe for consumption. The effluent from the six sources of recovered water is an initial concern. These sources vary significantly in concentrations and types of contaminates. Once these source waters are pumped and treated at the regional wastewater treatment facility the quality of the product water injected into the Seaside Basin Groundwater Aquifer comes into question (e.g. potential to contaminate the existing groundwater aquifer). Likewise, there are concerns about the quality of the "mixed" groundwater being provided for reuse. Bottom line – this environmental analysis must be thorough and flawless leaving no unanswered questions about safe drinking water. D-1

2. Socio-economic – This proposed project will probably add another water user fee to overburdened business and property owners. The costs of not only this project bit also the cumulative socio-economic impacts of multiple regional water projects need to be analyzed in detail. Various financial impacts, both adverse and beneficial must be explained clearly. The economic ripple effects throughout the communities from water rate increases such as higher costs for goods/services and gains/losses in jobs must be fully analyzed. The estimated range of the per unit costs in AF/yr for this proposed "new" source of water should be assessed against other proven supplemental water supplies and clearly explained to the water rate payers . D-2

3. Biological impacts – Three "barriers" have been identified for the treatment of the groundwater. Other types of barriers such as exposure to high intensity ultra-violet light combined with H2O2 should be addressed. Explaining the environmental reasons for selecting and eliminating alternative technologies provides a better analysis. D-3

Hopefully these initial comments are helpful in the scoping the EIR. Please keep POM DPW informed of any upcoming meetings and the availability of the Draft EIR.

Robert Guidi
USAG POM DPW
Master Planning
831-242-7928

State of California • Natural Resources Agency
Edmund G. Brown Jr., *Governor*
DEPARTMENT OF PARKS AND RECREATION
Major General Anthony L. Jackson, USMC (Ret), *Director*
2211 GARDEN Road
Monterey, CA 93940

June 19, 2013

Monterey Regional Water Pollution Control Agency
ATTN: Bob Holden
5 Harris Court, Bldg. D
Monterey, CA 93940

RE: Notice of Preparation: Monterey Peninsula Groundwater Replenishment Project EIR.

Dear Mr. Holden,

Thank you for the opportunity to comment on the Notice of Preparation for the Monterey Peninsula Groundwater Replenishment Project EIR. The California Department of Parks and Recreation owns and operates Fort Ord Dunes State Park (FODSP). In reviewing the NOP, State Parks has concern over the project's product water conveyance facilities that are proposed to be installed within the TAMC Right-Of-Way (ROW). Conveyance facilities within the TAMC ROW may require that construction related activities have access through FODSP. Any such access would require close coordination and approval from State Parks in advance. State Parks requests that staff be included in any conceptual design and or pre-construction meetings that involve the use of FODSP. Should the project require access through FODSP there will need to be close coordination with district and real property staff for the issuance of any needed temporary construction easements. Such easements can take up to 18 months to process. E-1

Other concerns include placing construction equipment on existing park roads and trails that are being used by the public, any associated traffic control needs, and avoiding impacts to park natural resources. E-2

Again, thank you for the opportunity to comment on the Notice of Preparation for the Monterey Peninsula Groundwater Replenishment Project EIR.

Sincerely,

Stephen Bachman
Senior Planner
(831) 649-2862

**Coalition of Peninsula Businesses**

*A coalition of the Monterey County Hospitality Association, Monterey Commercial Property Owners' Association, Monterey Peninsula Chamber of Commerce, Carmel Chamber of Commerce, Pacific Grove Chamber of Commerce, Monterey County Association of Realtors, Community Hospital of the Monterey Peninsula, Associated General Contractors – Monterey District*

*to resolve the Peninsula water challenge to comply with the CDO at a reasonable cost*

June 27, 2013

Bob Holden
Monterey Regional Water Pollution Control Agency
#5 Harris Court, Building D
Monterey, California 93940

Transmitted by e-mail to GWR@mrwpca.org

Dear Mr. Holden:

The Coalition of Peninsula Businesses (CPB) submits these comments on the Notice of Preparation (NOP) for the Monterey Groundwater Replenishment Project Environmental Impact Report.

**Purpose of project**

The project description should be more specific as to the purpose of the project; it is variously described as intended to help resist Seaside Basin seawater intrusion, as a source of replenishment water to help Cal Am meet its water needs with other than its illegal pumping of Carmel River Basin water and Seaside Basin water in excess of the water master-determined safe yield limits, and as a means to reduce the desal plant size of Cal Am's Monterey Peninsula Water Supply Project.

The project description needs to be amended to establish a clearer project purpose, explain the project's relationship or inter-relationship with the regional water project pending before the PUC, and to provide a clearer definition of its intended goal. Whether the Groundwater Replenishment Project is intended to be a stand-alone project or as a supplement to Cal Am's project should be spelled out clearly. The NOP seems to be geared to Peninsula water supply replacement only but it is not clear how or when or why that decision was made, if in fact a decision had been made. F-1

**Inter-relationship with the CSIP project**

MRWPCA apparently intends to use or build upon the facilities built for and financed by the landowners in the CSIP area. The rights of those landowners for use of reclaimed water up to the first 19,500 AFY and MRWPCA's right to divert any portion of that reclaimed water to another use must be explained. F-2

**Source water**

Sources of water to be reclaimed clearly must be spelled out, the status of agreements for acquisition and transportation of source water must be disclosed and legal rights to the use the source water and then to distribute recycled water need to be clearly established. The legal dispute between MRWPCA and ag interests as to rights to recycled water and the quantity of recycled water assured to ag interests must be resolved. If necessary, the sources of water to be recycled must be sufficient to meet the assurances to ag interests and provide water for sale to Cal Am for drinking water. F-3

OCEAN & MISSION• SUITE 201• P.O. BOX 223542 • CARMEL, CA • 93922
PHONE: 831-626-8636 • FAX: 831-626-4269 • EMAIL: jrbobmck@gmail.com or badams@adcomm4.com

**Quality of source water**

Rec ditch and other ag sources of water to be recycled are mentioned as possibilities. The Monterey County Water Resources Agency has conducted several studies of the quality of rec ditch and other ag runoff waters and found those waters to be highly polluted and contaminated. The instant EIR should reflect those prior studies and explain in some detail how the pollution and contamination will be dealt with to elevate the recycled water to California Department of Public Health standards. Specific examples of where source water of this quality has been successfully reclaimed to drinking water standards and at what cost should be provided. F-4

**Reliability of the continuing quantity of source water**

Due to highly increased water conservation measures throughout MRWPCA's service area, the amount of inflow has decreased over the last several years. This trend should be projected and the effect on MRWPCA's ability to produce reclaimed wastewater assessed. F-5

The same question should be answered in light of the proposed source water given the increased emphasis on water conservation, recycling and reduction in ag and urban runoff. F-6

**Growth and growth-inducing impacts**

The cities and county areas served by Cal Am already have adopted and EIR-certified General Plans that address growth issues and mitigation measures. The instant EIR should review and reflect those documents. F-7

**Alternatives**

If it is clearly established that the GWR project is intended as a supplement to Cal Am's project or as a Peninsula water supply replenishment-only project, study of a GWR project as an independent source of additional Peninsula water supply must be studied. F-8

Thank you for your attention to our concerns.

Sincerely,

Coalition of Peninsula Businesses

John Narigi, Co-chair

Bob McKenzie, Consultant

Letter G

FARM BUREAU MONTEREY

June 28, 2013

Mr. Bob Holden
Monterey Regional Water Pollution Control Agency
5 Harris Court, Building D
Monterey, CA 93940

**RE: Scoping for draft EIR on Groundwater Replenishment Project**

Dear Mr. Holden:

Monterey County Farm Bureau represents family farmers and ranchers in the interest of protecting and promoting agriculture throughout our County. We strive to improve the ability of those engaged in production agriculture to provide a reliable supply of food and fiber through responsible stewardship of our local resources.

Our primary concern with the proposed groundwater replenishment program is that of sufficient source water to supply the project in a reliable and effective manner throughout the life of the project. As you are well aware, there is a dispute over how much reclaimed water is available for this project, and it remains the Agricultural community's assertion that additional sources of water must be obtained to satisfy the desired annual acre feet of reclaimed water for this project. Our contention is that all the water that is currently committed to the Castroville Seawater Intrusion Project and Marina Coast Water District is not available for use within the scope of this project. G-1

Until this issue is settled to the satisfactory understanding of the Agricultural community, which we hope will happen through a process that involves all stakeholders and included in the CEQA process, we reserve our support for this project.

While we understand that groundwater replenishment is an important part of managing a groundwater basin intruded by saltwater, there must be a clear understanding of what water rights are used for the project. Successful groundwater replenishment programs, such as in Orange County, prove that the technology and science support the benefits of this type of program. G-2

Monterey County Farm Bureau hopes the CEQA process will identify additional water sources that can be used, and potentially be contracted for, to supply reclaimed water for this program. G-3

Thank you for the opportunity to comment on the scope of this CEQA process.

Sincerely,

Norman C. Groot
Executive Director

MONTEREY COUNTY
RESOURCE MANAGEMENT AGENCY
Benny J. Young, Director
Carl P. Holm, AICP, Deputy Director
Michael A. Rodriguez, C.B.O., Chief Building Official
Michael Novo, AICP, Director of Planning
Robert K. Murdoch, P.E., Director of Public Works

168 W. Alisal Street, 2nd Floor
Salinas, CA 93901
http://www.co.monterey.ca.us/rma

June 28, 2013

Monterey Regional Water Pollution Control Agency
ATTN: Bob Holden
5 Harris Court, Bldg. D
Monterey, CA 93940

Subject: NOP for Monterey Peninsula Groundwater Replenishment Project EIR (REF130047)

Dear Mr. Holden;

Thank you for the opportunity to review the NOP for the subject project. The Monterey County land use departments have reviewed the NOP and have the following comments:

Land Use. The EIR should include a consistency analysis with the Monterey County 2010 General Plan, applicable Land Use Plans as well as Titles 20 (Coastal Zoning) and Title 21 (Inland Zoning). The analysis should include a map showing the Coastal Zone boundary as well as the boundaries of the applicable Area Plans and Land Use Plans. The project will require Use Permits and Coastal Development Permits and Monterey County will be a Responsible Agency under CEQA. H-1

Construction Impacts. The project description should identify the location and size of all proposed construction staging areas. The traffic analysis should evaluate any temporary construction impacts due to installation of infrastructure in the public right-of-way. H-2

Biology. If any protected trees are proposed for removal, a Forest Management Plan will be required. Protected trees are identified in the corresponding Area Plans and Land Use Plans. The Forest Management Plan should be prepared by one of the consultants on the County's list (available on the County website). H-3

Alternatives. The alternatives should include alternate locations of the proposed facilities to minimize environmental impacts. In particular, if protected trees are proposed for removal and/or improvements are proposed on 25% slopes (Inland) or 30% (Coastal), alternatives should be considered to minimize tree removals and/or development on steep slopes. H-4

Since Monterey County will be a Responsible Agency, we request that the Administrative Draft EIR be submitted for our review. This would help ensure that the EIR meets the County's requirements when decisions are made on the Use Permits and Coastal Development Permits. H-5

Mr. Holden
June 28, 2013
Page 2

Finally, it is strongly recommended that a Pre-Application meeting on this project be scheduled as soon as possible. This would help to identify any land use issues early in the review process and to allow for the project to adjusted prior to submitting a formal application. Including all of the County land use agencies in the Pre-Application meeting would also help to achieve a more complete application upon formal submittal. If you are interested in a Pre-Application meeting, let me know and I will send you an application form. H-6

Feel free to call me if you have any questions.

Sincerely,

Bob Schubert

Bob Schubert, AICP
Senior Planner

Letter I

STATE OF CALIFORNIA

EDMUND G. BROWN JR., *Governor*

**CALIFORNIA STATE LANDS COMMISSION**
100 Howe Avenue, Suite 100-South
Sacramento, CA 95825-8202

*Our 75th Year*

*1938 - 2013*

JENNIFER LUCCHESI, *Executive Officer*
(916) 574-1800 *Fax* (916) 574-1810
*California Relay Service TDD Phone* 1-800-735-2929
*from Voice Phone* 1-800-735-2922

***Contact Phone:*** **(916) 574-1900**
***Contact Fax:*** **(916) 574-1885**

received July 1, 2013

June 27, 2013

File Ref: SCH # 2013051094

Bob Holden
Principal Engineer
Monterey Regional Water Pollution Control Agency
5 Harris Court, Building D
Monterey, CA 93940

**Subject: Notice of Preparation (NOP) for an Environmental Impact Report (EIR) for the Monterey Peninsula Groundwater Replenishment Project, Monterey County**

Dear Mr. Holden:

The California State Lands Commission (CSLC) staff has reviewed the subject NOP for the Monterey Peninsula Groundwater Replenishment Project (Project), which is being prepared by the Monterey Regional Water Pollution Control Agency (MRWPCA). MRWPCA, as a public agency proposing to carry out a project, is the lead agency under the California Environmental Quality Act (CEQA) (Pub. Resources Code, § 21000 et seq.). The CSLC is a trustee agency because of its trust responsibility for projects that could directly or indirectly affect sovereign lands, their accompanying Public Trust resources or uses, and the public easement in navigable waters. Additionally, if the Project involves work on sovereign lands, the CSLC will act as a responsible agency. I-1

**CSLC Jurisdiction and Public Trust Lands**

The CSLC has jurisdiction and management authority over all ungranted tidelands, submerged lands, and the beds of navigable lakes and waterways. The CSLC also has certain residual and review authority for tidelands and submerged lands legislatively granted in trust to local jurisdictions (Pub. Resources Code, §§ 6301, 6306). All tidelands and submerged lands, granted or ungranted, as well as navigable lakes and waterways, are subject to the protections of the Common Law Public Trust.

I-2

As general background, the State of California acquired sovereign ownership of all tidelands and submerged lands and beds of navigable lakes and waterways upon its admission to the United States in 1850. The State holds these lands for the benefit of all people of the State for statewide Public Trust purposes, which include but are not limited to waterborne commerce, navigation, fisheries, water-related recreation, habitat preservation, and open space. On navigable non-tidal waterways, including lakes, the State holds fee ownership of the bed of the waterway landward to the ordinary low water mark and a Public Trust easement landward to the ordinary high water mark, except where the boundary has been fixed by agreement or a court. Such boundaries may not be readily apparent from present day site inspections. I-2 cont

In order to determine the CSLC's leasing interest, if any, in the proposed Project, please provide more detailed maps showing the exact locations of all pipelines or other proposed improvements crossing the Salinas River. In addition, should any deep injection or shallow wells be located within the Salinas River or Monterey Bay, please provide CSLC staff with the exact locations as soon as they are known. I-3

**Project Description**

The MRWPCA proposes to produce and deliver high quality treated water for replenishment of the Seaside Basin to meet the Agency's and California American Water Company's (Cal-Am's) objectives and needs as follows:

- Reduce Water Diversions. Cal-Am has been ordered by the State Water Resources Control Board to reduce its diversions from the Carmel River to 3,376 AFY by 2017. The proposed Project will supply 3,500 AFY of replacement water to Cal-Am and reduce diversions from the Carmel River by the same amount;
- Provide a Cost-Effective Water Source. The Project should be capable of supplying reasonably-priced water;
- Regulatory Compliance. The Project should be capable of complying with water quality regulations intended to protect public health; and
- Additional Objectives. The Project should also assist in preventing seawater intrusion into the Seaside Basin, diversifying Monterey County's water supply portfolio, and provide additional water that could be used for crop irrigation. I-4

From the Project Description, CSLC staff understands that the Project would include the following components:

- Source Water Conveyance Facilities. Diversion and collection facilities, including pipelines and pump stations to convey source water to the new treatment facilities;
- Treatment Facilities. Pretreatment facilities, a new Advanced Water Treatment Plant, and associated facilities at the Regional Treatment Plant site to filter and treat the source water;
- Product Water Conveyance Facilities. Pipelines, pump stations, appurtenant facilities along one of two optional alignments to convey the treated water to the Seaside Basin; and
- Replenishment and Recharge Facilities. Pipelines, deep injection and shallow (vadose zone) wells, and backflush facilities to be located at one or both of two optional recharge site (coastal and inland) within the Seaside Basin Boundaries.

**Environmental Review**

CSLC staff requests that the following potential impacts be analyzed in the EIR.

General Comments

1. Project Description: A thorough and complete Project Description should be included in the EIR in order to facilitate meaningful environmental review of potential impacts, mitigation measures, and alternatives. The Project Description should be as precise as possible in describing the details of all allowable activities (e.g., types of equipment or methods that may be used, maximum area of impact or volume of sediment removed or disturbed, seasonal work windows, locations for material disposal, etc.), as well as the details of the timing and length of activities. Thorough descriptions will facilitate CSLC staff's determination of the extent and locations of its leasing jurisdiction, make for a more robust analysis of the work that may be performed, and minimize the potential for subsequent environmental analysis to be required. I-5

Biological Resources

2. Sensitive Species: The EIR should disclose and analyze all potentially significant effects on sensitive species and habitats in and around the Project area, including special-status wildlife, fish, and plants, and if appropriate, identify feasible mitigation measures to reduce those impacts. The MRWPCA should conduct queries of the California Department of Fish and Wildlife's (CDFW) California Natural Diversity Database (CNDDB) and U.S. Fish and Wildlife Service's (USFWS) Special Status Species Database to identify any special-status plant or wildlife species that may occur in the Project area. The EIR should also include a discussion of the MRWPCA's consultation with CDFW and USFWS, including any recommended mitigation measures and potentially required permits identified by these agencies. I-6

3. Invasive Species: One of the major stressors in California waterways is introduced species. In light of the recent decline of native pelagic organisms and in order to protect at-risk fish species, the EIR should examine if any elements of the Project (e.g., changes in amount and timing of freshwater flow) would favor non-native fisheries within the Salinas River. The CDFW's Invasive Species Program could assist with this analysis as well as with the development of appropriate mitigation (information at http://www.dfg.ca.gov/invasives/) I-7

4. Construction Noise: The EIR should also evaluate noise and vibration impacts on fish and birds from directional drilling of the pipelines and for associated land-side activity. Mitigation measures could include species-specific work windows as defined by CDFW, USFWS, and the National Oceanic and Atmospheric Administration's Fisheries Service (NOAA Fisheries). Again, staff recommends early consultation with these agencies to minimize the impacts of the Project on sensitive species. I-8

5. Frac-Out: If directional drilling will occur under the Salinas River to lay a pipeline, the EIR should evaluate the potential for frac-out to occur during drilling and analyze the potential impacts of frac-out to biological resources, including sensitive species and habitats. If impacts are found to be significant, the EIR should identify feasible mitigation measures to reduce the impacts of frac-out. CSLC staff may request documentation of mitigation for frac-out before issuing a lease. An example of a frac-out contingency plan that generally meets the CSLC's leasing requirements is the Contingency and Resource Protection Plan developed for the Construction of the AT&T Fiber Optic Cable Installation Project, Las Vegas to Victorville FTB Clark County, Nevada, and San Bernardino Counties, which is available at http://www.slc.ca.gov/division_pages/DEPM/DEPM_Programs_and_Reports/ATT_Fiber_Optic/PDF/Appendices/Ap-I_HDD_Plan.pdf. I-9

Climate Change

6. Greenhouse Gases: A greenhouse gas (GHG) emissions analysis consistent with the California Global Warming Solutions Act (AB 32) and required by the State CEQA Guidelines[1] should be included in the EIR. This analysis should identify a threshold for significance for GHG emissions, calculate the level of GHGs that will be emitted as a result of construction and ultimate build-out of the Project, determine the significance of the impacts of those emissions, and, if impacts are significant, identify mitigation measures that would reduce them to less than significant. I-10

7. Sea Level Rise: The EIR should also consider the effects of sea level rise on all resource categories potentially affected by the proposed Project. One of the Project's objectives is to prevent saltwater intrusion into groundwater basins. Since the EIR's impacts analysis will be used to develop a range of alternatives to the Project, please consider how sea level rise may increase or accelerate saltwater intrusion into the Project's groundwater basins and determine the Project's resiliency to sea level rise. If sea level rise is found to reduce the Project's effectiveness and impact CEQA resource categories, consider creating an alternative to the Project that would be more resilient to sea level rise. I-11

   At its meeting on December 17, 2009, the CSLC approved the recommendations made in a previously requested staff report, "A Report on Sea Level Rise Preparedness" (Report), which assessed the degree to which the CSLC's grantees and lessees have considered the eventual effects of sea level rise on facilities located within the CSLC's jurisdiction. (The Report can be found on the CSLC's website, www.slc.ca.gov.) One of the Report's recommendations directs CSLC staff to consider the effects of sea level rise on hydrology, soils, geology, transportation, recreation, and other resource categories in all environmental determinations associated with CSLC leases.

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[1] The State "CEQA Guidelines" are found in Title 14 of the California Code of Regulations, commencing with section 15000.

Please note that, when considering lease applications, CSLC staff is directed to (1) request information from applicants concerning the potential effects of sea level rise on their proposed projects, (2) if applicable, require applicants to indicate how they plan to address sea level rise and what adaptation strategies are planned during the projected life of their projects, and (3) where appropriate, recommend project modifications that would eliminate or reduce potentially adverse impacts from sea level rise, including adverse impacts on public access. I-11 cont

Cultural Resources

8. Submerged Resources: The EIR should evaluate potential impacts to submerged cultural resources in the Project area, including the Salinas River. The CSLC maintains a shipwrecks database that can assist with this analysis. CSLC staff requests that the MRWPCA contact Senior Staff Counsel Pam Griggs (see contact information below) to obtain shipwrecks data from the database and CSLC records for the Project site. The database includes known and potential vessels located on the State's tide and submerged lands; however, the locations of many shipwrecks remain unknown. Please note that any submerged archaeological site or submerged historic resource that has remained in State waters for more than 50 years is presumed to be significant. I-12

9. Title to Resources: The EIR should also mention that the title to all abandoned shipwrecks, archaeological sites, and historic or cultural resources on or in the tide and submerged lands of California is vested in the State and under the jurisdiction of the CSLC. CSLC staff requests that the MRWPCA consult with Senior Staff Counsel Pam Griggs (see contact information below), should any cultural resources on state lands be discovered during construction of the proposed Project. I-13

Additional Review

10. Deferred Mitigation: In order to avoid the improper deferral of mitigation, mitigation measures should either be presented as specific, feasible, enforceable obligations, or should be presented as formulas containing "performance standards which would mitigate the significant effect of the project and which may be accomplished in more than one specified way" (State CEQA Guidelines, §15126.4, subd. (b)). I-14

Thank you for the opportunity to comment on the NOP for the Project. As a responsible agency, the CSLC will need to rely on the Final EIR for the issuance of any amended or new lease as specified above and, therefore, we request that you consider our comments during development of the EIR. Please send additional information on the Project to the CSLC as plans become finalized.

Please send copies of future Project-related documents, including electronic copies of the Draft and Final EIR, Mitigation Monitoring and Reporting Program (MMRP), Notice of Determination (NOD), CEQA Findings and, if applicable, Statement of Overriding Considerations when they become available, and refer questions concerning environmental review to Holly Wyer, Environmental Scientist, at (916) 574-2399 or via e-mail at Holly.Wyer@slc.ca.gov. For questions concerning archaeological or historic resources under CSLC jurisdiction, please contact Senior Staff Counsel Pam Griggs at (916) 574-1854 or via email at Pamela.Griggs@slc.ca.gov. For questions concerning CSLC leasing jurisdiction, please contact Drew Simpkin, Public Land Management Specialist, at (916) 574-2275, or via email at Drew.Simpkin@slc.ca.gov.

Sincerely,

Cy R. Oggins, Chief
Division of Environmental Planning
and Management

cc: Office of Planning and Research
Drew Simpkin, LMD, CSLC
Holly Wyer, DEPM, CSLC
Shelli Haaf, Legal, CSLC

# MONTEREY REGIONAL WASTE MANAGEMENT DISTRICT

*Home of the Last Chance Mercantile*



July 1, 2013

***Via Electronic Mail (GWR@mrwpca.com)***

Monterey Regional Water Pollution Control Agency
5 Harris Court, Bldg D
Monterey, CA 93940

ATTN: Bob Holden

**RE: Comments to Notice of Preparation (NOP) for Monterey Peninsula Groundwater Replenishment Project Environmental Impact Report**

Dear Mr. Holden:

The Monterey Regional Waste Management District staff has reviewed the NOP document and found the document to be very well prepared.

We offer one comment adding to the existing language on Page 20, Table 1 as follows: J-1

| Agency/Entity | Permitting Regulation/Approval Requirement |
|---|---|
| Monterey Reg. Waste Management District | Electric Power Purchase Agreement, **Construction, Access, and Right of Way Easements** |

Thank you for the opportunity to review and comment on the NOP.

Very truly yours,

William M. Merry, P.E.
General Manager

cc: MRWMD Board of Directors

o:\rds\groundwater monit\nop for gwr letter7.1.13.docx

Letter K

## Michael Gonzales

**From:** Mike McCullough [MikeM@mrwpca.com]
**Sent:** Tuesday, July 02, 2013 3:51 PM
**To:** Michael Gonzales; Alison Imamura; Denise Duffy; valerieyoung@rcn.com
**Cc:** Brad Hagemann; Keith Israel
**Subject:** Comments from an individual - Peter Le

July 1, 2013

I have the following comments on the scope and contents of the GWR EIR prepared by MRWPCA:

The EIR needs to analyze thoroughly how the proposed project affects the agreed recycled water capacity of the MCWD in the approximate amount of 2.1 MGD. If MCWD utilizes it full 2.1 MGD recycled water, how much treated water the proposed project can provide.
Similarly, if the farmers insist on their share of 19,500 AFY of recycled water, how does this affect the proposed project? K-1

How does the 3,500 AFY arrive at? The EIR needs to show calculations on this proposed quantity for the existing and future conditions. K-2

The MRWPCA claimed that it has spent about 3 million dollars on modifying the regional treatment plant to provide recycled water to MCWD under the 2009 RUWAP agreement. Will this project utilize the MCWD designs or modified regional treatment that will be paid by MCWD for this project? What additional work on the regional treatment plant that will be done on this project? How does MRWPCA identify and separate all costs for two different projects, MCWD and GWR? K-3

K-4 [What impacts does this proposed project affect the MCWD recycled water project?][What is the required separation between MRWPCA recycled pipes and MCWD recycled pipes?] K-5 K-4/K-5

The EIR needs to consider the alternative of pumping excess winter flow from the Salinas River, treat it, and recharge the Seaside Aquifer.

How do the discharges of the proposed advanced water treatment plant and secondary source water affect the MCWD brine disposal capacity and the total capacity of the existing outfalls? K-6

How does the cooperation between MRWPCA and MCWD involve as described in page 11 of the NOP? K-7

MRWPCA proposes to use the partially MCWD completed recycled water system for this GWR project as described on page 15. Has MRWPCA discussed with any Director or staff on this proposal?
How does this project affect MCWD access to the acquired Armstrong Ranch property?
What is the current residence time of the recharged water as specified by the State? K-8

I would like to ask MRWPCA to make a presentation to the MCWD Board on their expectations of the MCWD roles on this proposed project. K-9

The above comments are mine and they do not represent the official comments from MCWD. Let me know if you have any questions.

Sincerely,

Peter Le

Letter L

State of California—Health and Human Services Agency

# California Department of Public Health

CDPH

Ron Chapman, MD, MPH
*Director*

EDMUND G. BROWN JR.
*Governor*

NOP
7/1/13
c

RECEIVED
JUL 01 2013
STATE CLEARING HOUSE

July 1, 2013

Bob Holden, Senior Planner
Monterey Regional Water Pollution Control Agency
5 Harris Court, Building D
Monterey, CA 93940

**RE:** Comment Letter for Monterey Regional Water Pollution Control Agency, Monterey Peninsula Groundwater Replenishment Project, Environmental Impact Report, SCH# 2013051094

Dear Mr. Medina:

Thank you for the opportunity to review the Environmental Impact Report, titled Monterey Peninsula Groundwater Replenishment Project. The California Department of Public Health (CDPH), Division of Drinking Water and Environmental Management is responsible for issuing water supply permits administered under the Safe Drinking Water Program. A project triggers a permit if it includes changes to the water supply, storage, treatment of drinking water, or consolidation of one or more public water systems. CDPH will need to issue a new or amended Water Supply Permit for the above referenced project should the project proceed under the alternatives described. CDPH will be a "responsible agency" pursuant to the California Environmental Quality Act (CEQA). L-1

The proposed project would provide a replacement water supply for the California American Water Company's - Monterey District service area and would assist with prevention of seawater intrusion into a coastal aquifer. CDPH would like to provide the following comment in regards to the proposed project: L-2

> The proposed project must comply with any draft or adopted regulations, frequent communication with CDPH is highly recommended to ensure there are no compliance issues.

Please contact Jan Sweigert, CDPH Monterey District Office, at (831) 655-6939 or e-mail Jan.Sweigert@cdph.ca.gov if you have any questions regarding the comments provided. If you have any questions regarding CDPH CEQA permit requirements, please call Jeffery Werth at (916) 449-5285 or e-mail to jeffery.werth@cdph.ca.gov.

Sincerely,

Jeffery Werth
CDPH Drinking Water Program, Environmental Review Unit

Cc: CDPH Monterey Office
Bridget Binning, Environmental Review Unit
State Clearinghouse

Seaside Basin Watermaster
2600 Garden Road
Suite 228
Monterey, CA 93940

July 1, 2013

Mr. Bob Holden
Monterey Regional Water Pollution Control Agency
5 Harris Court, Building D
Monterey, CA 93940

**Subject: Notice of Preparation of Environmental Impact Report for the Monterey Peninsula Groundwater Replenishment Project, May 30, 2013**

Dear Mr. Holden:

The Seaside Basin Watermaster submits the following comments on the Subject document:

1. There are numerous statements in the NOP that the GWR Project will "replenish" the Seaside Groundwater Basin (SGWB). These occur on pages 2, 9, 10, 16, and 17. As noted on page 10, since all of the GWR Project water currently being contemplated for injection into the SGWB will be pumped back out by existing municipal supply extraction wells not long after it has been injected, the GWR Project water will not provide long-term replenishment of the SGWB. The SGWB, as described in the NOP, will simply serve as an interim storage basin for this water. This should be clarified in the EIR. M-1

2. There have been recent discussions with MRWPCA staff regarding the potential for the GWR Project to provide additional water that could truly be beneficial to the SGWB by injecting it and leaving it in the aquifers, rather than pumping it back out. A quantity of 1,000 AFY had been proposed by MRWPCA as recently as May 2013. Apparently the project proponents decided not to include this additional water in the scope of the project for which the NOP was prepared. The Watermaster strongly urges that, if at all possible, the GWR Project be designed and configured such that it could provide additional water to replenish the SGWB. While the Watermaster does not currently have funds that could be used to purchase such additional water, if additional water could be made available once the GWR Project is operational, and if funds to purchase additional water became available, the additional water could be used to help raise groundwater levels to protective elevations to protect the SGWB from seawater intrusion. Accordingly, this potential to provide additional water via future expansion of the GWR Project should be addressed in the EIR. M-2

3. The map in Figure 1 does not clearly show where the GWR Project facilities are located. The "Monterey Peninsula Groundwater Replenishment Area" balloon is so large that it is really not helpful in understanding where the facilities described in the NOP will be located. M-3

4. It is very difficult to see exactly where the proposed Recharge Facilities are located in the map in Figure 2. Two detailed maps with a larger scale, one for each site, would be preferable. M-3 cont

5. On page 7 it states that Cal Am owns 12 wells in the SGWB. It would be more accurate to indicate that Cal-Am *currently operates* 12 production wells in the SGWB. M-4

6. On page 7 the sentence in the third paragraph pertaining to the makeup of the Watermaster should be corrected to read "The Watermaster Board of Directors consists of nine entities, one representative from each:…" The next-to-last sentence in this paragraph should be revised to read "Water levels were found to be below sea level in portions of both…". M-5

7. On page 10 the statement is made that one of the secondary objectives of the project will be to "Assist in preventing seawater intrusion in the Seaside Basin." As noted in Comment No. 1, since all of the GWR Project water will be pumped out after it is injected into the SGWB, it does not appear that the GWR Project, as described in the NOP, will assist in preventing seawater intrusion in the SGWB. This statement should be removed or clarified. M-6

8. A number of water sources for the GWR Project are listed on pages 12-14. Two of the source waters proposed for the GWR Project on pages 12 and 14 are the Blanco Drain and the Reclamation Ditch. Both of these sources have historically shown high levels of contamination, such as a broad spectrum of pesticides, as well as metals and bacterial organisms. The design of the GWR Project Treatment Facilities should address this in order to ensure that the plant is able to reliably produce water of suitable quality for direct injection into the SGWB, which serves as a potable water supply to the public. M-7

9. The first sentence on page 17 should be revised to read "With groundwater levels currently below sea level in portions of both…" M-8

10. Table 1 on page 20 lists a "Permit for Injection/Extraction" that will be needed from the Watermaster. The Watermaster's term for this permit is "Agreement for Storage and Recovery of Non-Native Water from the Seaside Groundwater Basin." The Watermaster adopted a formal process for applicants wishing to obtain such a permit to use, as well as specific requirements the Watermaster will impose if such an agreement were to be prepared for the GWR Project. Details on this can be obtained by contacting the Watermaster's office. M-9

Thank you for the opportunity to submit these comments so they can be addressed in the EIR.

Sincerely,

Robert Jaques

Robert Jaques
Technical Program Manager
(831) 375-0517
bobj83@comcast.net

Letter N

MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

received July 2, 2013
hand delivered

July 1, 2013

Monterey Regional Water Pollution Control Agency
Administration Office
ATTN: Mr. Bob Holden, Principal Engineer
5 Harris Court, Building D
Monterey, CA 93940

**SUBJECT: Notice of Preparation of Environmental Impact Report for the Monterey Peninsula Groundwater Replenishment Project, May 30, 2013**

Dear Mr. Holden:

At its June 17, 2013 meeting, the Monterey Peninsula Water Management District (MPWMD) Board of Directors reviewed the Notice of Preparation (NOP) for the Monterey Peninsula Groundwater Replenishment (GWR) Project Environmental Impact Report. In addition, MPWMD staff have worked with you during the development of the NOP. As you know, MPWMD is strongly in favor of moving ahead with this EIR and a project that allows 3,500 acre-feet per year (AFY) to be extracted from the Seaside Groundwater Basin (SGB) for municipal use. We have the following comment on the NOP and recommendation for the EIR:

**Water injection and subsequent extraction in the Seaside Groundwater Basin**

Page 17 of the NOP states:

> "It is anticipated that recharge amounts allocated to each well type and target aquifer could readily be adjusted based on basin conditions that will be determined through ongoing monitoring."

MPWMD monitoring of the Santa Margarita aquifer suggests that not all water injected by the GWR Project would be expected to be extracted at existing municipal supply wells completed in the aquifer. While a bypassed portion of injected water may not be "lost" to the aquifer and could eventually help stabilize water levels, it is important that this effect should be better understood with respect to the GWR Project. N-1

MPWMD recommends that the EIR contain an evaluation of both the travel time and volume of water moved between injection and extraction sites in order to determine what portion of injected water can be safely extracted and when. It is possible that in the initial stages of the GWR Project more than 3,500 AFY will need to be injected into the basin in order to provide a net of 3,500 AFY without temporarily or permanently exacerbating the potential for seawater intrusion at extraction sites. An alternative approach could be to develop an operating rule for the basin that would define what period of time must pass between the initiation of injection operations and the N-2

5 Harris Court, Building G, Monterey, CA 93940 • P.O. Box 85, Monterey, CA 93942-0085
831-658-5600 • Fax 831-644-9560 • http://www.mpwmd.dst.ca.us

initiation of extraction operations. In other words, there could be a "buffer" amount of water that is injected into the basin that would increase water levels at extraction sites to a condition that is determined to be "safe" for initiating extraction. N-2 (cont)

I appreciate the work done over the past several years by the Monterey Regional Water Pollution Control Agency to develop this project and look forward to working with you in the future. If you have questions or comments about this letter, please contact me at (831) 658-5650.

Sincerely,

David J. Stoldt, General Manager

cc: MPWMD Board of Directors

CITY OF PACIFIC GROVE
300 Forest Avenue ▫ Pacific Grove, California

July 2, 2013

Monterey Regional Water Pollution Control Agency
ATTN: Bob Holden
5 Harris Court, Bldg D
Monterey, CA 93940

RE: **Comments on Notice of Preparation – Monterey Peninsula Groundwater Replenishment Project Environmental Impact Report (EIR)**

Dear Mr. Holden:

The City of Pacific Grove appreciates the opportunity to comment on the Notice of Preparation for the Groundwater Replenishment Project (GWR) EIR. As a founding member of the Monterey Regional Water Pollution Control Agency (MRWPCA), we are supportive of the Agency's goals to expand recycled water uses to the GWR and reduce or eliminate winter discharges to the Monterey Bay. Pacific Grove has similar goals to maximize recycled water opportunities and eliminate wastewater discharges to the Monterey Bay. O-1

Because of the City's distance from the regional treatment plant, the urban areas between, the nature of the local topography, and the resulting poor cost effectiveness for extending recycled water delivery, MRWPCA has not previously considered opportunity sites within Pacific Grove as feasible to serve recycled water. Therefore, Pacific Grove is independently developing a non-potable recycled water supply project for irrigation of the Pacific Grove Golf Links, El Carmelo Cemetery, and other potential opportunities for recycled water use nearby on the Monterey Peninsula. The Pacific Grove Local Water Project (LWP) includes construction of a new satellite recycled water treatment facility at the existing Point Pinos wastewater treatment plant site to produce an initial 125 acre feet per year. The City plans to reclaim its wastewater from the City's sewage collection system, over which the City has sole control and ownership. O-2

In addition, Pacific Grove faces significant challenges in meeting the State Water Resources Control Board's requirements for discharges to the Pacific Grove Area of Special Biological Significance (ASBS). As previously permitted by MRWPCA and noted in the NOP, the City of Pacific Grove has already constructed portions of a dry weather storm water diversion system in order to meet the ASBS discharge regulations, which prohibit dry weather discharges. The LWP is evaluating the redirection of dry weather storm water flows from its current pumping to the MRWPCA regional treatment plant. O-3

Phone (831) 648-5722 ▫ www.ci.pg.ca.us

We support the NOP statement that MRWPCA member entities could send storm water to the Regional Treatment Plant for use in the GWR Project. In collaboration with the City of Monterey, the City is refining its investigation of alternative means of diverting and potentially treating wet weather storm water flows as part of a compliance project for the ASBS. The ASBS/Stormwater Reuse Project is included within the Monterey Bay Integrated Regional Water Management Plan ("IRWMP") project and has obtained funding through the IRWMP program. These investigations are analyzing the feasibility of options for localized storage at the California American Water-owned David Avenue Reservoir and conveyance of stormwater to the regional treatment plant operated by MRWPCA. Initial modeling of wet weather discharges has identified total flows ranging from 2,500 gallons per minute ("gpm") in an 85th percentile storm event to 12,000 gpm in a 1-year storm event. These flows may be partially diverted to the PGLWP and related facilities, or to MRWPCA as an additional supply source to the GWR. Average annual volumes that could be diverted are still being determined. O-3 (cont)

As MRWPCA moves forward with the GWR, we hope to continue to coordinate our respective efforts and projects. We anticipate the need to further discuss the capacity of the MRWPCA conveyance and treatment systems to be able to accept wet weather storm flows and the total flows from Pacific Grove to serve the GWR Project. The GWR facilities required to convey and inject the additional storm water volume available from the Cities should be addressed in the GWR EIR. These issues are more project-design related yet are likely to also produce environmental effects requiring additional review. The City believes that the GWR Project EIR should also consider the locally proposed projects, particularly in its analysis of cumulative effects. O-4

The GWR Project, particularly if augmented by storm water flows and elimination of discharges to the Monterey Bay, has potential benefits to local MS4 dischargers that should be acknowledged in the Project Objectives. The Seaside Groundwater Basin has adequate storage capacity and need for replenishment that the opportunity to cost effectively incorporate wet weather storm flows should be fully explored and maximized. O-5

Sincerely,

Thomas Frutchey, City Manager
City of Pacific Grove

cc: Sarah Hardgrave, Environmental Programs Manager
James Brezack, Brezack and Associates Planning

**CITY OF SEASIDE**
440 Harcourt Avenue
Seaside, CA 93955
Telephone (831) 899-6736
FAX (831) 899-6211

July 2, 2013

Mr. Bob Holden
Monterey Regional Water Pollution Control Agency
5 Harris Court, Building D
Monterey, CA 93940
Via email gwr@mrwpca.com

**Subject: Notice of Preparation of Environmental Impact Report for the Monterey Peninsula Groundwater Replenishment Project, May 30, 2013**

The City of Seaside submits the following comments on the subject document:

1. The project proposes to recharge the Seaside Groundwater Basin with treated water. Could the project scope be expanded to also consider recharging the Carmel River as either as an alternative or as an option? P-1

2. The project proposes to use storm water as a potential water source. On page 13, the NOP states, "Other MRWPCA member entities could also send storm water to the Regional Treatment Plant for use by the GWR Project by adding storm water into existing pipelines, manholes, or pump stations within the MRWPCA wastewater collection system." Does this project propose to revise the MRWPCA NPDES permit to allow storm water to be conveyed and treated by the existing sewer facilities? P-2

3. The Product Water Conveyance Alignment Option 2 (see page 15) would more or less follow Cal-Am's proposed pipeline alignment. Since available space is limited and the installation of two large pipes within the public right of way in the City of Seaside, especially in La Salle Avenue, would be very disruptive, the installation of MRWPCA and Cal-Am facilities should be coordinated to minimize potential impacts. P-3

4. There are numerous statements in the NOP that are very specific as to project design details that may adversely constrain the final project design. For example, on page 16 the NOP states "The GWR Project would include subsurface groundwater recharge facilities, including shallow (or vadose zone) and deep injection wells located at inland and, if feasible, coastal locations within the Seaside Basin." Could this statement be revised to allow some flexibility in the final project design and implementation?

   > "The GWR Project could include subsurface groundwater recharge facilities, including shallow (or vadose zone) and deep injection wells located within the Seaside Basin."

   Another example of modifying the project description to facilitate project implementation is incorporating the following changes on page 17:

   > "*Coastal Recharge Facilities.* The coastal recharge facilities would include up to three deep injection wells and up to four vadose zone wells located east of Highway 1 and west of the Bayonet and Black Horse Golf Course, as shown in Figure 2."

P-4

5. Please clarify which areas and how much land in the City of Seaside are being referred to as the 'Coastal Recharge Facilities' and the 'Inland Recharge Facilities' as shown in Figure 2. P-5

6. The inland recharge facilities location is described on page 17 as "…an acceptable location for the proposed inland recharge facilities, and the location that currently appears to be feasible is a City-planned utility corridor as shown in Figure 2." There is no City-planned utility corridor in the area shown in Figure 2. Please clarify. P-6

7. Please clarify where the 4 deep injection wells noted under the description of Inland Recharge Facilities on Page 17 would be constructed (e.g. area of well containment, back flush pit, fencing, treatment facility, etc.). P-7

8. Provide information related to coordination with the City of Seaside regarding traffic control and construction for the implementation of the underground pipeline within the City of Seaside. P-8

9. On page 17, the following statement under 'Coastal Recharge Facilities' is unclear and should either be removed or clarified. That is, the paragraph is describing the proposed facilities but this statement seems to be trying to discount their value: P-9

   "Due to the shallower water table at the coast, vadose zone wells would be shallower, and the long□term ability of the coastal wells to replenish both the Santa Margarita and Paso Robles aquifers would likely be less than the replenishment ability of the inland wells." P-10

10. On page 17, the following statement about 'available land' within the City of Seaside under 'Coastal Recharge Facilities' is unclear and should clarified. For example, P-11

    "The locations for the proposed coastal recharge facilities were determined based on an analysis of potentially available land and known aquifer characteristics."

11. Table 1, "Potential Permits and Approvals Required" on page 20 should include Seaside Highlands Homeowners Association if some of the land being considered for Coastal Injection Wells is within their jurisdiction. P-12

The City of Seaside appreciates the opportunity to comment on the NOP and looks forward to working with the MRWPCA on the subject project. Please contact the undersigned to discuss any questions or comments.

Sincerely,

Tim O'Halloran
City Engineer / Public Works Services Manager

Copy Diana Ingersoll, Deputy City Manager – Resource Management Services
Rick Riedl, Associate Civil Engineer
Rick Medina, Senior Planner

CITY OF MONTEREY

DEPARTMENT OF PLANS & PUBLIC WORKS

July 2, 2013

Monterey Regional Water Pollution Control Agency
Administration Office
Attn: Bob Holden, Principal Engineer
5 Harris Court, Building D
Monterey, CA 93940

Subject: Comments Regarding the Notice of Preparation – Monterey Peninsula Groundwater Replenishment Project Environmental Impact Report

Dear Mr. Holden:

We have reviewed the subject Notice of Preparation (NOP) and don't have any specific concerns about the NOP but we do have concerns about the process and rationale behind how the Project was defined. Potentially the scope of the Project, should it come to light, needs to be revised. The cornerstone to any adequate environmental review is a clear definition and understanding of the Project. Q-1

Specifically, we have the following questions and concerns. These comments are based upon a general lack of clarity behind the background as to how the Project scope was defined. If the Project scope needs to be revised or clarified, now would be the opportune time to do that before the EIR is prepared:

1. Has MRWPCA considered and quantified all of the potential sources of water flowing into its plant including, but not limited to, dry weather and certain wet weather flows from storm drains? On page 12 of the NOP, storm water collection is mentioned as one of the sources. However, in the subsequent sections of the NOP, the only quantification of flows is related to the City of Salinas Treatment Plant, Blanco drain, the reclamation ditch and storm water flows from the City of Salinas. As for the other member entities non-storm and storm water flows, there is only a passing reference at the bottom of page 13 of the NOP. Q-2

2. If the limitation of 3500 acre-feet per year (AFY) is a function of the source water availability or the capacity of the treatment system, why wasn't a greater capacity considered so that all of the member entities could convey all non-storm/dry weather flows as well as some portion of storm water flows? Q-3

3. How will the ability of member entities to convey non-storm water and storm water flows going to be apportioned? Will enlargements of the conveyance systems need to be made in order to achieve an equitable distribution of the apportionment? Q-4

4. Will there be any consideration for member entities receiving credits for flows that go into the groundwater recharge (GWR) and if so, will there be any quantification of what those credits will be to each entity? Q-5

5. There are certain existing and pending future regulatory reasons to divert both dry and certain wet weather storm drain flows to the MRWPCA Sewage Treatment Plant (STP) and these reasons are based upon removing pollutants from the receiving water (the Monterey Bay). Therefore, have there been any discussions with the State Water Resource Control Board with regard to the potential for discharging filter reject concentrate as described on page 15 of the NOP into the same receiving water that the diversions are intended to protect? Q-6

Please call me at (831) 646-3448 if you require any additional information or clarification on any issues pertaining to these comments.

Sincerely,

Tom Reeves
City Engineer

e: James Cullem, Executive Director, MPRWA
Chip Rerig, Chief of Planning, Engineering, and Environmental Compliance

MARINA COAST WATER DISTRICT

11 RESERVATION ROAD, MARINA, CA 93933-2099
Home Page: www.mcwd.org
TEL: (831) 384-6131 FAX: (831) 883-5995



July 2, 2013

Mr. Robert Holden
Monterey Regional Water Pollution Control Agency
5 Harris Court, Building D
Monterey, CA 93949

RE: Comments on the Groundwater Replenishment Project's Notice of Preparation of an Environmental Impact Report

Dear Mr. Holden,

Marina Coast Water District (MCWD, District) is pleased to provide Monterey Regional Water Pollution Control Agency (MRWPCA) with comments to the Notice of Preparation (NOP) for the planned Environmental Impact Report (EIR) associated with the proposed Groundwater Replenishment Project (GWR Project).

In general, MCWD supports the GWR Project. MCWD provides these comments within the NOP's described framework of alternatives, mitigation measures and statutory responsibilities.

The District's comments are:

1) The District encourages incorporating the GWR project into both the Greater Monterey County Integrated Regional Water Management Plan (IRWMP) and the Monterey Peninsula IRWMP. R-1

2) The District encourages MRWPCA to explore alternative source water volumes above the 3,500-acre-feet total specified in the NOP. R-2

3) The District's senior rights to return water from MRWPCA's treatment plant need to be recognized when discussing available plant output. The District is willing to consider leasing a portion of those senior rights for a predetermined period. R-3

Mr. Holden
July 2, 2013
Page 2

4) The District is willing to discuss with MRWPCA potential access to District recycled water (RW) facilities for conveyance of GWR water from the Advanced Water Treatment (AWT) facility to the Seaside Groundwater Basin, with appropriate compensation to the District for that right of access. The District requests the inclusion of this option in the EIR. R-4

5) The District suggests exploring the long term plan (beyond 15-years) for the GWR Project. Will the GWR project continue injecting water into the Seaside Groundwater Basin once the Seaside Groundwater Basin is recharged and is operating within protective groundwater elevations and sustainable yield? Are there other potential uses for Advanced Water Treatment (AWT) water? One future possibility would be to send AWT water northward to combat seawater intrusion in the Salinas Valley Groundwater Basin. R-5

6) The District encourages MRWPCA to evaluate project alternatives that include variable seasonal flow rates of the source waters without the need for including secondary or tertiary effluent water sources. Part of the rationale expressed in the NOP appears to be to obtain and treat enough impaired water to allow the AWT facility to run at a single, predictable flow rate; therefore the seasonality of the water sources appears to be an operational consideration and leads MRWPCA to include effluent water sources in the project. The District would recommend that a project alternative be prepared that uses a treatment facility flow rate model that fluctuates and does not use effluent water sources. R-6

7) The District requests that MRWPCA confirm with the California Department of Public Health (DPH) the required residence time (between injection and extraction) for all the proposed water sources prior to publication of the Draft EIR. R-7

8) MCWD requests confirming that the capacity of the Seaside Groundwater Basin is sufficient, within that pre-determined residence time, for the injection of additional GWR Project water. R-8

9) MCWD requests confirming with DPH, prior to Draft EIR publication, the horizontal distance that will be required between points of injection and points of extraction in the event that those two modes of operation are simultaneously occurring. Will the well spacing requirement and the limited horizontal distance between the proposed coastal recharge facility and the Bay preclude the use of the coastal recharge facility for the GWR? R-9

The District hopes these comments are beneficial and we look forward to working with MRWPCA in advancing regional goals through implementation of the GWR Project.

Sincerely,

Dr. Thomas P. Moore
President, MCWD Board of Directors

Brian C. Lee, P.E.
Interim General Manager / District Engineer

Fort Ord Community Advisory Group (FOCAG)
P.O. Box 969
Seaside, CA 93955
Phone: 831-484-6659
Email: focagemail@yahoo.com

The "Fort Ord Community Advisory Group is a public interest group formed to review, comment and advise on the remediation (cleanup) of the Fort Ord Army Base, Superfund Site, to ensure that human health, safety and the environment are protected to the greatest extent possible." - Mission Statement.

Monterey Regional Water Pollution Control Agency (MRWPCA)
ATTN: Bob Holden
5 Harris Court, Bldg D
Monterey, CA 93940
Via E-mail: GWR@mrwcpa.com, hard copy to follow via U.S. Mail

Re: Notice of Preparation, Scoping Comments
Monterey Peninsula Groundwater Replenishment Project Environmental Impact Report

July 2, 2013

Dear Bob Holden,

The Fort Ord Community Advisory Group (FOCAG) offers the following comments on the scope of environmental issues. The scope should include existing hazards to drinking water and potential increasing hazards to the drinking water supply due to the migration and leaching of toxic chemicals from former Army training ranges. These would include proposed ground disturbing activities including a horse park. The Seaside Aquifer lies directly beneath the Army Training Ranges, known as Site #39 of former Fort Ord. This area includes the area known as Parker Flats that had, among other uses, Army tank training areas. S-1

Fort Ord is a National Superfund Site, first put on the National Superfund Priority List because of discovered contamination of area groundwater. S-2

Page 2

There have been multiple issues with the Upper 180, the Lower 180, and the 400-foot aquifers beneath areas of former Fort Ord. Site #39, perhaps the largest munitions impact/training area in the country, sits over the Seaside Groundwater Basin. This should be of concern to MRWPCA and others for the possibility of leaching and migration of chemicals into underground aquifers. S-2 cont

It is understood residual munitions chemicals from 77-years of munitions use, remain in Fort Ord training areas, including Site 39. The cleanup thus far, has concentrated on remaining unexploded munitions, but failed to identify many munitions constituents even though numerous munitions chemistry books were and are readily available. How can the extent of contamination be known unless all known munitions constituents are looked for? The cleanup has used a sampling rationale of looking for a few constituents but only reporting levels above a certain threshold. There potentially are hundreds of chemicals below threshold levels. For example, hypothetically, if there are two hundred chemicals each at 2 ppm, well below the reporting level, there potentially could be a toxic chemical brew of 200-400 ppm. Could the cumulative, low levels of chemicals potentially be a health hazard? Are the human health risks known for this level of exposure? What are the synergistic effects of munitions chemicals and pesticides on organisms? Are there studies available on the effects of low-level exposure to these chemicals?

Hundreds of munitions chemicals and pesticides at very low levels may be a potential toxic brew creating a health and safety hazard in the underground water aquifers. The cleanup has failed to make the public aware of the actual levels of munitions and pesticide contaminates throughout training areas.
a) What might be the justification for the cleanup failing to identify all the munitions and pesticide chemicals in Tables 3,4,5, and 6? (See Attachment 2, Tables 1-7). The Army BRAC has been asked the following questions:
b) Because the Army kept abysmal records of training ranges, training areas and specific activities, what is the justification for failing to look for all munitions chemicals and pesticides in all training areas, including Site #39? S-3
c) What is the justification for the cleanup failing to include all the munitions and pesticide chemicals identified in Attachment 2, Tables 3,4,5, and 6?
d) What is the extent of out-gassing from munitions and pesticide chemicals

in former training areas?
e) What is the justification for failing to report the actual levels of munitions and pesticide chemicals in all training areas? S-3 cont

On 3-24-10 (fortordcleanup.com, Document BW-2532), and 2-7-11 (fortordcleanup.com, Document BW-2557), the FOCAG raised questions regarding pesticide use at Fort Ord and in training areas. The 2-7-11 FOCAG letter specifically addresses Army's failure to thoroughly investigate pesticides in training areas. Despite Army's claim that it has thoroughly investigated pesticides in training areas, our review of the cited cleanup documents did not support the Army's claim. The only sampling we have found for pesticides in the Parker Flats and Site 39 training areas was for a total of 4 sample locations that only looked for 8 organochlorine pesticides.

It is our understanding Army BRAC remains responsible for identifying and sampling for chemicals potentially used in training areas, including Site 39. However, the chemicals being looked for in former Army training sites is woefully inadequate. The FOCAG includes, with this letter, 7 Tables of munitions chemicals and pesticides potentially found in former Fort Ord including a list of Training Areas and the chemicals actually being looked for in. (See attachment 2, Tables 1-7) S-4

There are several hundred chemicals potentially leaching out of ordnance into the ground as well as residual chemicals from decades of weapons/ordnance training and pyrotechnics. Herbicides were used to keep vegetation down and minimize threats of wildfires from munitions training exercises. Attached are 6 Tables identifying munitions chemicals and pesticides used in training areas include Table 1, is the Fort Ord Cleanup 1994 list of potential Training Range chemicals. Table 2 is the Fort Ord Cleanup 2003 Sampling and Analysis list of potential Training Range chemicals. Tables 3, and 4 are lists of munitions constituents found in munitions chemistry books, many of which the cleanup has not included in its list(s). Tables 5, and 6 are lists of pesticides; known and suspected as being used at Fort Ord. Particularly alarming is Table 5 that identifies 23 munitions chemicals also known to be pesticides. This may explain why some training areas are virtually devoid of insects and birds. Not only has the cleanup thus far failed to identify all munitions chemicals and pesticides; it has also failed to extensively look for all munitions chemical and pesticides in all training areas. S-4 cont

The FOCAG is not aware of any Basewide training maps pre-1940. We do know the entire pre-1940 Fort Ord footprint was the Gigling Artillery Range 1917-1940. It is understood this artillery range primarily trained with 37mm, 75mm, 105mm, and 155mm projectiles. These projectiles are found throughout most of the pre-1940 footprint. One of the known impact areas for the pre-1940's 37mm and 75mm projectiles is "Artillery Hill". This area, OE-50 and OE-53 (Veterans Cemetery and Endowment Parcels), when sampled and cleared to a depth of 4' discovered significant amounts of 37mm and 75mm fragments and unexploded projectiles. According to the Archives Search Report and interviews with range control personnel, these Sites were target areas for rifle grenades and shoulder launched projectiles in the 1940's, 1950's and 1960's. Other projectiles found include 60mm, 81mm, 3 inch stokes, and 4.2 inch mortars, and Levin's projectors. The latter ground tube launched munitions range(s) was not known prior to the sampling and removal actions. The FOCAG is unaware of historical training maps showing the firing points, range fans, or target areas of any of the ranges within or firing out of Sites OE-50 and OE-53 yet these areas were obviously extensively used for munitions training. S-5

The proposed Veteran's Cemetery site among other uses was a former 1920-30's; 37mm and 75mm artillery target range known as "Artillery Hill". The Veteran's site also includes a Chemical, Biological, Radiological, (CBR) site. Training devices and munitions discovered nearby include non-metallic landmines and Chemical Agent Identification Sets (CAIS) in glass vials. The detection equipment used to clear this site is incapable of detecting non-metallic, and deeply buried munitions. Although the munitions cleanup was to a depth of 4.0', the 37mm has a maximum detection depth of 0.9' and the 75mm has a maximum detection depth of 2.5'. There are other munitions found onsite that cannot be reliably detected within 4' of the surface.

Again, there have been multiple issues with the Upper-180, the Lower-180, and the 400-foot aquifers beneath areas of former Fort Ord. Site 39, perhaps the largest munitions impact/training area in the country, sits over the Seaside Groundwater Basin. This should be of concern to MRWPCA and S-6 others for the possibility of leaching chemicals into underground aquifers. Project Scoping should include:

a) What is the migration and fate of munitions and pesticide chemicals into this drinking water supply?

b) Where did all the chemicals go?

c) What Fort Ord document fully investigated the potential munitions and pesticide contamination?

d) Is there ongoing monitoring and reporting of the potential munitions and pesticide contamination of the Seaside Groundwater Basin? Where is it?

e) What might construction, development, and irrigating in the area above the Seaside Groundwater Basin do for migrating chemicals?

S-6 cont

Thank you for the opportunity to comment on this NOP/Scoping for the EIR for the proposed Monterey Peninsula Groundwater Replenishment Supply.

Respectfully,

Mike Weaver
Co-Chair, FOCAG

Attachment #1
Reference the following link:

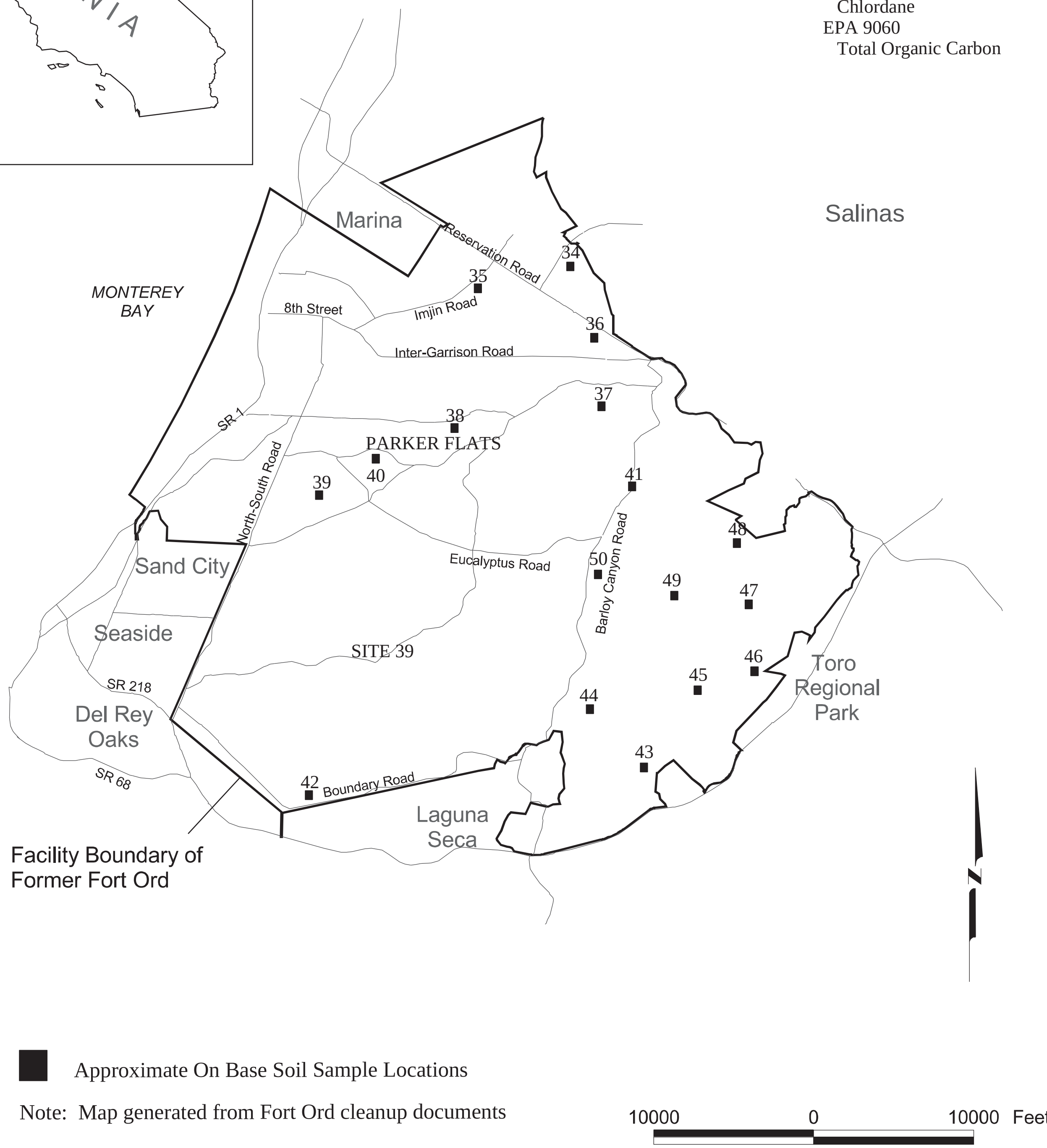
http://fortordcleanup.com/adminrec/ar_pdfs/AR-ESCA-0100/ESCA-0100.PDF

This link is regarding Site 39. August 12, 2008, Fort Ord Community Advisory Group Position Paper
80-pages of research, statistics, commentary, analysis, and questions.

Attachment #2
(Reference the attachment to this letter sent via email. Hard copy to follow.)
Tables 1-7 (34 pages total)
Fort Ord known and suspected Munitions and Pesticide Chemicals used in Training Areas


Test Method/Analyte Name

EPA 8080
Gamma - BHC
Heptachalor epoxide
Dieldrin
4,4' -DDE
Endrin
4,4' -DDD
4,4' -DDT
Chlordane
EPA 9060
Total Organic Carbon



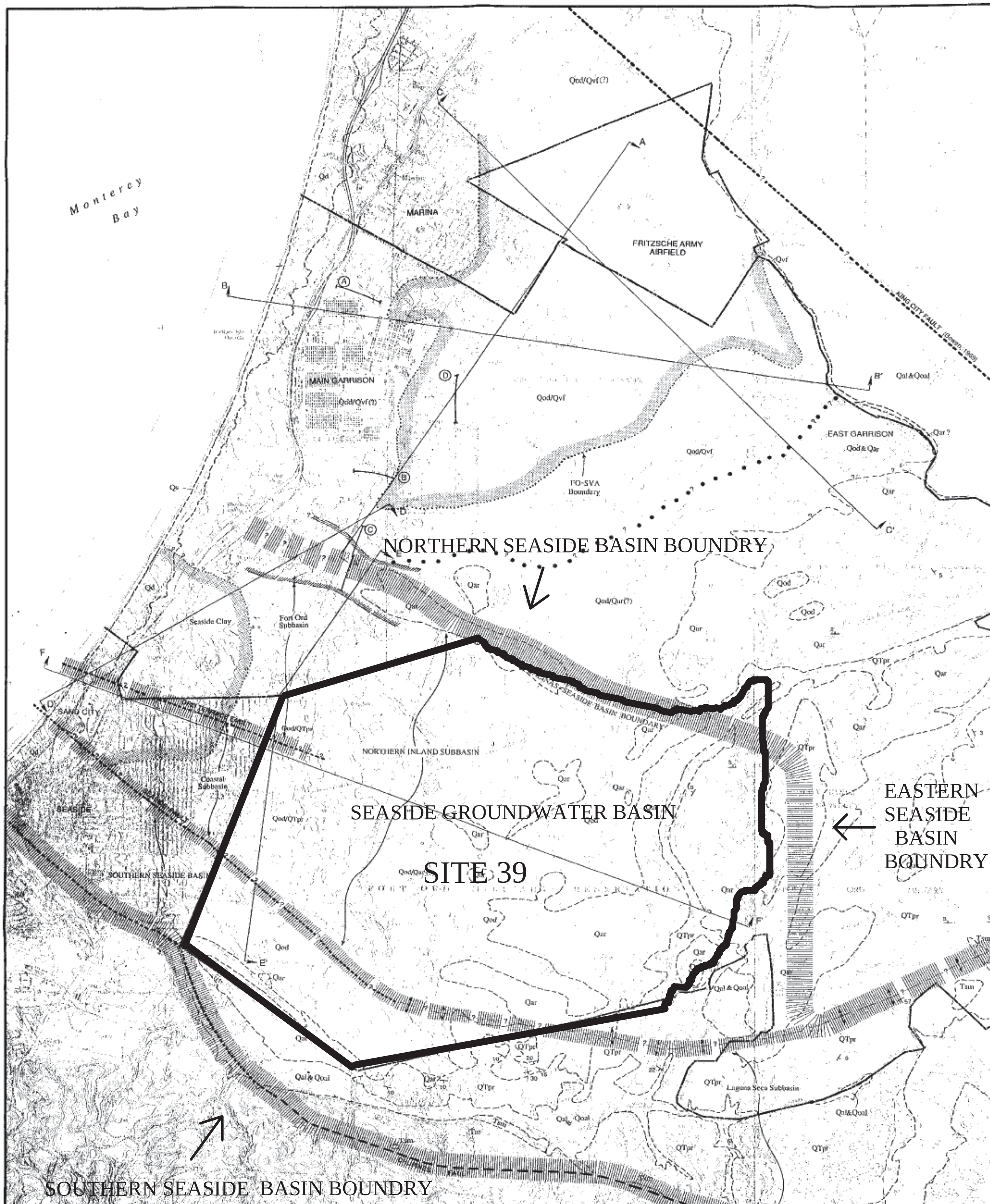

Pesticide Sampling
Fort Ord RI/FS 1995, Vol II - Remedial Investigation
Basewide Background Soil Investigation
BW-1283E

SEASIDE GROUNDWATER BASIN / SITE 39 IMPACT AREA

**Letter S (cont)**

Basewide Hydrogeologic Characterization

BW-0608 PLATE 3




SITE 39 BOUNDRY (8000 Acres, one of the countries largest munitions training areas.)

SEASIDE GROUNDWATER BASIN BOUNDRY (Supplies City of Seaside drinking water.)

Where did all the munitions chemicals go? What chemicals where looked for? What where the actual chemical detection levels?

# Fort Ord known and suspected Munitions and Pesticide Chemicals used in Training Areas

Table 1: List of munitions chemicals compiled from 1994 Site 39 Remedial Investigation
**Note:** very few are being looked for in training areas.

Table 2: List of munitions chemicals compiled from 2003 Sampling and Analysis Plan
**Note:** very few are being looked for in training areas.

Table 3: List of munitions chemicals Military Explosives (Chemistry) 30 September 1984
**Note:** many of these munitions chemicals are not included in Tables 1 & 2

Table 4: List of munitions chemicals found in practice and pyrotechnic
**Note:** many of these munitions chemicals are not included in Tables 1 & 2

Table 5: List of 23 pyrotechnic chemicals also used as Pesticides
**Note:** may explain why some training areas appear to be devoid of life (very few bugs, birds, ground squirrels, etc.)

Table 6: List of 48 pesticides used at Fort Ord
**Note:** none of these chemicals have been looked for in training areas.

Table 7: Munitions Chemicals looked for in transferred training areas FORA ESCA RP parcels
**Note:** in training areas, very few and in some sites **no** munitions chemicals have been looked for. **No** Training areas have been tested for pesticide chemicals.

**Table 1: Munitions Chemicals identified by the Fort Ord Superfund cleanup; 1994 RI/FS BW-1283K Tables**

Phenol
Bis(2-chloroethyl) ether
2-Chlorophenol
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Benzyl alcohol
1,2-Dichlorobenzene
2-Methylphenol
4-Methylphenol
n-Nitrosodipropylamine
Hexachloroethane
Nitrobenzene
Isophorone
2-Nitrophenol
2,4-Dimethylphenol
Benzoic acid
Bis(2-chloroethox)methane
2,4-Dichlorophenol
1,2,4-Trichlorobenzene
Naphthalene
4-Chloroaniline
Hexachlorobutadiene
4-Chloro-3-methylphenol
2-Methlnaphthalene
Hexachorocyclopentadiene
2,4,6-Trichlorophenol
2,4,5-Trichlorophenol
2-Chloronaphthalene
2-Nitroaniline
Dimethl phthalate
Acenaphthylene
2,6-Dinitrotoluene
3-Nitroaniline
Acenaphthene
2,4-Dinitrophenol
4-Nitrophenol
Dibenzofuran
2,4-Dinitrotoluene
Diethyl phthalate
4-Chlorophenyl phenylether
Fluorene
4-Nitroaniline
4,6-Dinitro-2-methyl phenol
n-Nitrosodiphenylamine
4-Bromophenylphenylether
Hexachlorobenzene

Pentachlorophenol
Phenanthrene
Anthracene
Di-n-butlphthalate
Fluoranthene
Pyrene
Butylbenzylphthalate
3,3-Dichlorobenzidine
Benzo(a)anthracene
Chrysene
Bis(2-ethlhexyl)phthalate
Di-n-octyIphthalate
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(a)pyrene
Indeno(l,2,3-cd)pyrene
Dibenzo(a,h)antkracene
Benzo(ghi)perylene
Bis(2-chloroisopropyl)ether
TPH-Diesel
TPH-Extractable Unknown Hydrocarbon
TPH-Gasoline
TPH-Purgeable Unknown Hydrocarbon
Benzene
Ethylbenzene
Toluene
Xylenes
HMX
RDX
1,3,5-Trinitrobenzene
1,3-Dinitrobenzene
Tetryl
Nitrobenzene
2,4,6-Trinitrotoluene
2,4-Dinitrotoluene
2,6-Dinitrotoluene
o-NitroToluene
m-NitroToluene
p-ilitrotoluene
2-Amino-dinitrotoluene
4-Amino-dinitrotoluene
Nitroalvcerin
Picri;-hcid
Nitroguanidine
PETN

**Table 2: Munitions Chemicals identified by the Superfund cleanup: 2003 Sampling and Analysis Plan, Revision 0; Fort Ord, California; BW-2214D**

| | |
|---|---|
| Gasoline (C -C ) | 8006-61-9 |
| 4-Bromofluorobenzene | 460-00-4 |
| Diesel (C -C ) | 68334-30-5 |
| Motor Oil (C -C ) | ADR-02-001 |
| ortho-terphenyl | 84-15-1 |
| Acetone | 67-64-1 |
| Benzene | 71-43-2 |
| Bromobenzene | 108-86-1 |
| Bromochloromethane | 74-97-5 |
| Bromodichloromethane | 75-27-4 |
| Bromoform | 75-25-2 |
| Bromomethane | 74-83-9 |
| 2-Butanone | 78-93-3 |
| n-Butylbenzene | 104-51-8 |
| sec-Butylbenzene | 135-98-8 |
| tert-Butylbenzene | 98-06-6 |
| Carbon disulfide | 75-15-0 |
| Carbon tetrachloride | 56-23-5 |
| Chlorobenzene | 108-90-7 |
| Chloroethane | 75-00-3 |
| 2-Chloroethyl vinyl ether | 110-75-8 |
| Chloroform | 67-66-3 |
| Chloromethane | 74-87-3 |
| 2-Chlorotoluene | 95-49-8 |
| 4-Chlorotoluene | 106-43-4 |
| Dibromochloromethane | 124-48-1 |
| 1,2-Dibromo-3-chloropropane | 96-12-8 |
| 1,2-Dibromoethane | 106-93-4 |
| Dibromomethane | 74-95-3 |
| 1,2-Dichlorobenzene | 95-50-1 |
| 1,3-Dichlorobenzene | 541-73-1 |
| 1,4-Dichlorobenzene | 106-46-7 |
| Dichlorodifluoromethane | 75-71-8 |
| 1,1-Dichloroethane | 75-34-3 |
| 1,2-Dichloroethane | 107-06-2 |
| 1,1-Dichloroethene | 75-35-4 |
| cis-1,2-Dichloroethene | 156-59-2 |
| trans-1,2-Dichloroethene | 156-60-5 |
| 1,2-Dichloropropane | 78-87-5 |
| 1,3-Dichloropropane | 142-28-9 |
| 2,2-Dichloropropane | 594-20-7 |
| 1,1-Dichloropropene | 563-58-6 |
| cis-1,3-Dichloropropene | 10061-01-5 |
| trans-1,3-Dichloropropene | 10061-02-6 |
| Ethylbenzene | 100-41-4 |

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|---|---|
| Hexachlorobutadiene | 87-68-3 |
| 2-Hexanone | 591-78-6 |
| Isopropylbenzene | 98-82-8 |
| p-Isopropyltoluene | 99-87-6 |
| Methyl tert-butyl ether | 1634-04-4 |
| Methylene chloride | 75-09-2 |
| 4-Methyl-2-pentanone | 108-10-1 |
| n-Propylbenzene | 103-65-1 |
| Styrene | 100-42-5 |
| 1,1,1,2-Tetrachloroethane | 630-20-6 |
| 1,1,2,2-Tetrachloroethane | 79-34-5 |
| Tetrachloroethene | 127-18-4 |
| Toluene | 108-88-3 75-125 |
| 1,2,3-Trichlorobenzene | 87-61-6 |
| 1,2,4-Trichlorobenzene | 120-82-1 |
| 1,1,1-Trichloroethane | 71-55-6 |
| 1,1,2-Trichloroethane | 79-00-5 |
| Trichloroethene | 79-01-6 |
| Trichlorofluoromethane | 75-69-4 |
| 1,2,3-Trichloropropane | 96-18-4 |
| 1,1,2-Trichloro-1,2,2-trifluoroethane | 76-13-1 |
| 1,2,4-Trimethylbenzene | 95-63-6 |
| 1,3,5-Trimethylbenzene | 08-67-8 |
| Vinyl acetate | 108-05-4 |
| Vinyl chloride | 75-01-4 |
| m,p-Xylene | 1330-20-7 |
| o-Xylene | 95-47-6 |
| 4-Bromofluorobenzene | 1868-53-7 |
| Dibromofluoromethane | 460-00-4 |
| 1,2-Dichloroethane-d4 | 17060-07-0 |
| Toluene-d8 | 2037-26-5 |
| Acenaphthene | 83-32-9 |
| Acenaphthylene | 208-96-8 |
| Anthracene | 120-12-7 |
| Benzoic acid | 65-85-0 |
| Benzo[a]anthracene | 56-55-3 |
| Benzo[b]fluoranthene | 205-99-2 |
| Benzo[k]fluoranthene | 207-08-9 |
| Benzo[g,h,i]perylene | 191-24-2 |
| Benzo[a]pyrene | 50-32-8 |
| Benzyl alcohol | 100-51-6 |
| Bis(2-chloroethoxy)methane | 111-91-1 |
| Bis(2-chloroethyl)ether | 111-44-4 |
| Bis(2-chloroisopropyl)ether | 108-60-1 |
| Bis(2-ethylhexyl)phthalate | 117-81-7 |
| 4-Bromophenyl phenyl ether | 101-55-3 |
| Butylbenzylphthalate | 85-68-7 |
| Carbazole | 86-74-8 |

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| 4-Chloroaniline | 106-47-8 |
| 4-Chloro-3-methylphenol | 35421-08-0 |
| 2-Chloronaphthalene | 91-58-7 |
| 2-Chlorophenol | 95-57-8 |
| 4-Chlorophenyl phenyl ether | 7005-72-3 |
| Chrysene | 218-01-9 |
| Dibenzo(a,h)anthracene | 53-70-3 |
| 3,3'-Dichlorobenzidine | 91-94-1 |
| Dibenzofuran | 132-64-9 |
| 1,2-Dichlorobenzene | 95-50-1 |
| 1,3-Dichlorobenzene | 541-73-1 |
| 1,4-Dichlorobenzene | 106-46-7 |
| 2,4-Dichlorophenol | 120-83-2 |
| Diethylphthalate | 84-66-2 |
| 2,4-Dimethylphenol | 105-67-9 |
| Dimethyl phthalate | 131-11-3 |
| Di-n-butylphthalate | 84-74-3 |
| 4,6-Dinitro-2-methylphenol | 534-52-1 |
| 2,4-Dinitrophenol | 51-28-5 |
| 2,4-Dinitrotoluene | 121-14-2 |
| 2,6-Dinitrotoluene | 606-20-2 |
| Di-n-octyl phthalate | 117-84-0 |
| Fluoroanthene | 206-44-0 |
| Fluorene | 86-73-7 |
| Hexachlorobenzene | 118-74-1 |
| Hexachlorobutadiene | 87-68-3 |
| Hexachlorocyclopentadiene | 77-47-4 |
| Hexachloroethane | 67-72-1 |
| Indeno(1,2,3-cd)pyrene | 193-39-5 |
| Isophorone | 78-59-1 |
| 2-Methylnaphthalene | 91-57-6 |
| 2-Methylphenol | 95-48-7 |
| 3-Methylphenol | 108-39-4 |
| 4-Methylphenol | 106-44-5 |
| Naphthalene | 91-20-3 |
| 2-Nitroaniline | 88-74-4 |
| 3-Nitroaniline | 99-09-2 |
| 4-Nitroaniline | 100-01-6 |
| Nitrobenzene | 98-95-3 |
| 2-Nitrophenol | 88-75-5 |
| 4-Nitrophenol | 100-02-7 |
| N-Nitroso-di-n-butylamine | 924-16-3 |
| N-Nitrosodiethenolamine | 1116-54-7 |
| N-Nitrosodiphenylamine | 86-30-6 |
| N-Nitroso-di-n-propylamine | 621-64-7 |
| Pentachlorophenol | 87-86-5 |
| Phenanthrene | 85-01-8 |
| Phenol | 108-95-2 |

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|---|---|
| Pyrene | 129-00-0 |
| Pyridine | 110-86-1 |
| 1,2,4-Trichlorobenzene | 120-82-1 |
| 2,4,5-Trichlorophenol | 95-95-4 |
| 2,4,6-Trichlorophenol | 88-06-2 |
| 2,4,6-Tribromophenol | 118-79-6 |
| 2-Fluorobiphenyl | 321-60-8 |
| 2-Fluorophenol | 367-12-4 |
| Nitrobenzene-d5 | 20810-28-0 |
| Phenol-d6 | 4165-62-2 |
| Terphenyl-d14 | 98904-43-9 |
| HMX | 2691-41-0 |
| sym-Trinitrobenzene | 99-35-4 |
| RDX | 121-82-4 |
| 1,3-Dinitrobenzene | 99-65-0 |
| Nitrobenzene | 98-95-3 |
| 2,4,6-Trinitrotoluene | 118-96-7 |
| Tetryl | 479-45-8 |
| 2,4-Dinitrotoluene | 121-14-2 |
| 2,6-Dinitrotoluene | 606-20-2 |
| 2-Am-DNT | 35572-78-2 |
| 4-Am-DNT | 1946-51-0 |
| 2-Nitrotoluene | 88-72-2 |
| 3-Nitrotoluene | 99-08-1 |
| 4-Nitrotoluene | 99-99-0 |
| Nitroglycerin | 55-63-0 |
| 1,4-Dinitrobenzene | 100-25-4 |
| Aluminum | 7429-90-5 |
| Antimony | 7440-36-0 |
| Arsenic | 7440-38-2 |
| Barium | 7440-39-3 |
| Beryllium | 7440-41-7 |
| Cadmium | 7440-43-9 |
| Calcium | 7440-70-2 |
| Chromium | 7440-47-3 |
| Cobalt | 7440-48-4 |
| Copper | 7440-50-8 |
| Iron | 7439-89-6 |
| Lead | 7439-92-1 |
| Magnesium | 7439-95-4 |
| Manganese | 7439-96-5 |
| Molybdenum | 7439-98-7 |
| Nickel | 7440-02-0 |
| Potassium | 7440-09-7 |
| Selenium | 7782-49-2 |
| Silver | 7440-22-4 |
| Sodium | 7440-23-5 |
| Strontium | 7440-24-6 |

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|---|---|
| Thallium | 1314-32-5 |
| Titanium | 7440-32-6 |
| Vanadium | 7440-62-2 |
| Zinc | 7440-66-6 |
| Mercury | 7439-97-6 |
| Perchlorate | 14797-73-0 |

# Table 3. Munitions Chemical Compositions

## Explosives, Propellants, Pyrotechnics
### Military Explosives (Chemistry) 30 September 1984

# Explosives

## Chapters 7 & 8

**Lead Azide:** $Pb(N_3)_2$, is a salt of hydrazoic acid, $HN_3$. The compound is white, has a nitrogen content of 28.86 percent and a molecular weight of 291.26. At the melting point, 245°C to 250°C, decomposition into lead and nitrogen gas occurs. The pure compound has two crystal modifications: an orthorhombic form and a monoclinic form. The orthorhombic form, which is also called the alpha form, has a density of 4.68 grams per cubic centimeter and unit cell dimensions of a = 11.31 Angstroms, b = 16.25 Angstroms, and c = 6.63 Angstroms. The monoclinic form, which is also called the beta form, has a density of 4.87 grams per cubic centimeter and unit cell dimensions of a = 18.49 Angstroms, b = 8.84 Angstroms, and c =5.12 Angstroms. The compound is usually prepared as colorless, needlelike crystals.

**Other Lead Azide Types:**

- Dextrinated Lead Azide (DLA)
- Service Lead Azide (SLA)
- Colloidal Lead Azide (CLA)
- Polyvinylalcohol Lead Azide (PVA-LA)
- RD-1333 lead azide
- Dextrinated Colloidal Lead Azide (DCLA)

**Mercury Fulminate** $Hg(ONC)_2$, is a salt of fulminic or paracyanic acid. The acid undergoes polymerization very rapidly in both aqueous and ethereal solutions, and so cannot be isolated. The structure of fulminic acid, and thus the salts of this acid, is undetermined. Mercury fulminate has an oxygen balance to $CO_2$ of-17 percent, an oxygen balance to CO of -5.5 percent, a nitrogen content of 9.85 percent, and a molecular weight of 284.65. When mercury fulminate is crystallized from water, a hydrate, Hg(ON: C).1/2 H20, is formed that has a nitrogen content of 9.55 percent and a molecular weight of 293.64. The anhydrous form, which is crystallized from alcohol, is white when pure but normal manufacturing yields a gray product of only 98 to 99 percent purity. The crystals formed are octahedral but are usually truncated. Only the smaller crystals are fully developed. The crystal density is 4.43 grams per cubic centimeter.

**Diazodinitrophenol (DDNP)** This explosive is also known as 4,5-dinitrobenzene-2-diazo-1-oxide, dinol, diazol and may be referred to as DADNP. The compound is a greenish yellow to brown solid with tabular crystals. DDNP has a crystal density of 1.63 to 1.65 grams per cubic centimeter at 25°C and a molecular weight of 210.108. DDNP is not dead pressed even at a pressure of 896,350 kilopascals (130,000 pounds per square inch).

**Lead Styphnate** Two forms of lead styphnate are used as primary explosives: basic and normal. Basic lead styphnate has a nitrogen content of six percent and a molecular weight of 705.53.

The compound has two crystal forms: yellow needles with a density of 3.878 grams per cubic centimeter and red prisms with a density of 4.059 grams per cubic centimeter. The apparent density is 1.4 to 1.6 grams per cubic centimeter. Normal lead styphnate has a nitrogen content of nine percent and the monohydrate has a molecular weight of 468.38.

**Tetracene** is also known as guanyldiazoguanyl tetrazene and 4-guanyl-1 -(nitrosoaminoguanyl)-1tetrazene. The compound is a colorless to pale yellow, fluffy material with needle crystals, an oxygen balance to $CO_2$ of-57.6 percent, an oxygen balance to CO of-43 percent, a nitrogen content of 74.4 percent, and a molecular weight of 188.15. Tetracene forms a hydrate with three molecules of water. The melting point of the pure compound is between 140°C and 160°C accompanied by decomposition and explosion. The apparent density is only 0.45 grams per cubic centimeter. When compressed at 20,685 kilopascals (3,000 pounds per square inch), the density is 1.05 grams per cubic centimeter. The crystal density is 1.7 grams per cubic centimeter. The compound can be easily dead pressed. Tetracene is practically insoluble in water and ethanol and so can be stored wet with water or a mixture of water and ethanol. The compound is also insoluble in ether, benzene, acetone, carbon tetrachloride, and ethylene dichloride. Tetracene is soluble in dilute nitric acid or strong hydrochloric acid. In a solution with hydrochloric acid, the hydrochloride is precipitated by the addition of ether. Tetracene may then be recovered by treatment with sodium acetate or ammonium hydroxide. The heat of formation is 270 calories per gram and the heat of detonation is 658

**Potassium Dinitrobenzofuroxane (KDNBF)** is a red crystalline solid with a nitrogen content of 21.21 percent and molecular weight of 264.20. The oxygen balance of the compound to $CO_2$, $H_2O$, and $K_2O$ is -42.4 percent. The anhydrous salt has a density of 2.21 grams per cubic centimeter and a melting point, with explosive decomposition, of 210°C. KDNBF is soluble to the extent of 0.245 grams per 100 grams of water at 30°C. Between the temperatures of 50C to 50°C the specific heat is 0.217 calories per gram per degree centigrade. KDNBF is used in primary compositions.

**Lead Mononitroresorcinate (LMNR)** has a nitrogen content of 3.89 percent, an $NO_2$ content of 12.77 percent, a lead content of 57.51 percent, and a molecular weight of 360.30. The compound forms microscopic reddish brown crystals. LMNR has slow burning properties and a low combustion temperature. The compound is used in electric detonators with DLA as the spot charge to initiate a PETN base charge, as an upper charge, and as an ingredient in primary compositions.

**Primary Compositions** are mixtures of primary explosives, fuels, oxidizers, and other ingredients used to initiate detonation in high explosive charges or ignite propellants and pyrotechnics. The ingredients and the portions of the ingredients for individual priming compositions are determined empirically from the use the composition is intended for. Fuels commonly used in priming compositions are lead thiocynate, antimony sulfide, and calcium silicide. The last two also serve to sensitize the composition to friction or percussion. Oxidizing agents include potassium chlorate and barium nitrate. Other ingredients include primary explosives and binders. The major determining factor in ingredient selection is the impetus which is to detonate the priming composition. The types of impetus commonly used are percussion and electrical.

**Percussion Priming Compositions FA959, FA982, FA956, Compounds:**

Normal lead styphnate
Tetracene
Barium nitrate
Antimony sulfide
Powdered zirconium
Lead dioxide
PETN
Aluminum
Gum Arabic

**Stab Detonator Priming Compositions NOL130, PA101, NOL 60, Compounds:**

Lead azide
Basic lead styphnate
Tetracene
Barium nitrate
Antimony sulfide
Powdered aluminum

**Electric Priming Compositions I, II, III, IV, V, VI, Compounds:**

Potassium chlorate
Lead mononitroresorcinate
Nitrocellulose
Lead thiocynate
DDNP
Charcoal
Nitrostarch
Titanium
Aluminum

**Aliphatic Nitrate Esters** compounds in this class are prepared by O-type nitration in which a nitro group is attached to an oxygen atom of the compound being nitrated.

**1,2,4-Butanetriol Trinitrate (BTN)** This explosive is also known as a, b, g-trihydroxybutane trinitrate and is sometimes referred to as BTTN. The compound is a light yellow liquid with a density of 1.520 at 20°C, a molecular weight of 241, a melting point of -27°C, an oxygen balance to CO2 of 17 percent, and a refractive index of 1.4738 at 20°C. The liquid has a viscosity of 62 centipoises at 20°C. 1,2,4- Butanetriol trinitrate is slightly soluble in water, miscible with alcohol, ether, acetone, and a solution of 2 parts ether and 1 part alcohol. BTN has a heat of formation of 368 calories per gram, a heat of combustion of 2,167 calories per gram, and a heat of detonation of 1,458 calories per gram. This compound is a good gelatinizer for nitrocellulose and can be used as a substitute for nitroglycerin in double-base propellants. Heat, vacuum stability, and volatility tests indicate more stability than nitroglycerin. Impact sensitivity is about the same as for nitroglycerin. Brisance, as measured by the sand test, is about the same: 49 grams crushed versus 51.5 grams for nitroglycerin or 47 grams for TNT. The five second explosion temperature is 230°C versus 220°C for nitroglycerin. BTN can be manufactured by the nitration of 1,2,4-butanetriol with a mixture of nitric and sulfuric acids.

**Diethyleneglycol Dinitrate (DEGN)** This explosive is also known as dinitrodiglycol or 2,2'-oxybisethanol dinitrate and is sometimes referred to as DEGDN. The compound is a clear, colorless, odorless liquid with a nitrogen content of 14.29 percent, a theoretical maximum density of 1.39 grams per cubic centimeter, an oxygen balance to C02 of-41 percent, and a molecular weight of 196. DEGN boils between 160° and 161°C and can, upon cooling, form a stable solid with a melting point of 2°C or remain liquid to a freezing point of -11.2° to 11.40°C. Other characteristics of the liquid are: refractive index at 20°C with sodium light, 1.450; viscosity at 20°C, 8.1 centipoises; vapor pressure at 20°C, 0.0036 torr; vapor pressure at 25°C, 0.00593 torr; vapor pressure at 600C, 0.130 torr; specific gravity, 1.385. At 60°C DEGN has a volatility of 0.19 milligrams per square centimeter per hour. At constant pressure, the heat of combustion is 2,792 calories per gram. The heat of formation is-99.4 kilogram calories per mole. The heat of detonation is 1,161 calories per gram. DEGN is readily soluble in ether, acetone, chloroform, benzene, nitrobenzene, toluene, nitroglycerin, and glacial acetic acid but is insoluble in ethanol, carbon tetrachloride, and carbon disulfide. Solubility in water at 25°C and 60°C is 0.40 and 0.46 gram per 100 grams, respectively. DEGN's chemical reactivity is similar to nitroglycerin's, but is less subject to hydrolysis and is not readily saponified by alcoholic sodium hydroxide. DEGN can be used as an explosive and can be used in propellants as a colloiding agent for nitrocellulose. Propellants based on DEGN and nitrocellulose develop relatively low temperatures and cause relatively little erosion of guns, but are unduly volatile.

**Nitrocellulose (NC)** or cellulose nitrate is a mixture of nitrates obtained by nitrating cellulose. Cellulose is a long chain polymer of anhydroglucose units (C5H10O5). The number of anhydroglucose units or degree of polymerization (DP) is variable. Cellulose used for preparation of military grades of nitrocellulose have a DP of approximately 1,000 to 1,500. Cellulose threads possess micellar structure and consist of numerous rod-like crystallites oriented with their long axis parallel to the thread axis, thus forming a fiber. Almost pure cellulose is found in the pith of certain plants, in absorbent cotton, and in some filter papers. Pure cellulose is most readily obtained from cotton by treating with a dilute acid or base solution then thoroughly washing with water. At the present time most of the cellulose for nitrocellulose preparation is obtained from coniferous wood, which is 50 to 60 percent cellulose. Another source is straw, which is 30 to 40 percent cellulose. The nitration of cellulose involves replacement of the hydrogen in the three hydroxyl (OH) groups in the anhydroglucose units with NO2 groups. A representative formula for the nitrated cellulose may be written as C6H7(OH)*x* (ONO2) *y* where *x*+ *y*=3. The mononitrate, *x* =2 and *y* =1, has a nitrogen content of 6.76 percent; the dinitrate, *x*=1 and *y* =2, has a nitrogen content of 11.11 percent; the trinitrate, *x* =0 and *y* =3, has a nitrogen content of 14.14 percent. As a practical matter, however, any desired degree of nitration up to 14.14 percent may be obtained by adjusting the composition of the mixed acid used for nitration, the acid to cellulose ratio, the time of nitration, or the temperature of nitration. In nitrocellulose with less than 14.14 percent nitrogen, the NO2 groups are distributed randomly along the entire length of the cellulose polymer, so *x* and *y* should be regarded as average values over the entire length of the chain. The nitrogen content determines the chemical and physical properties of any particular nitrocellulose. The five grades of nitrocellulose listed below are recognized and used.

**Other Nitrocellulose Types:**

- Pyroxylin or collodion,
- Pyrocellulose
- Guncotton
- High nitrogen nitrocellulose
- Blended nitrocellulose

**Nitroglycerin (NG),** glycerol trinitrate, or 1,2,3-propanetriol trinitrate, is a clear, colorless, odorless, oily liquid with a theoretical maximum density of 1.596 grams per cubic centimeter. Nitroglycerin has a sweet, burning taste and a molecular weight of 227.1. Nitroglycerin is soluble in one liter of water to the extent of only 0.173, 0.191, 0.228, and 0.246 gram at 20°, 30°, 50° and 60°C, respectively and is essentially nonhygroscopic when exposed to atmospheric humidity.

**Nitrostarch (NS)** is a mixture of nitrates obtained by nitrating starch. The general formula for starch is C6H10O5. The structure of starch is the same as for nitrocellulose, with the exception that the polymer chains are spiral rather than straight. The starch molecule consists of approximately 1,000 anhydroglucose units. The nitration of starch involves replacement of the hydrogen in the three hydroxyl (OH) groups in the anhydroglucose units with NO2 groups. A representative formula for the nitrated starch may be written as C6H7(OH) *x* (ONO2)*y* where *x* +*y* =3. The NO2 groups are distributed randomly along the entire length of the starch molecule, so *x* and *y* should be regarded as averages over the entire length of the chain. The following empirical formula can be employed to obtain *y* as a function of the nitrogen content *N*: *y*=162N/(1400-45*N*)

**Pentaerythritol Tetranitrate (PETN)** is also known as 2,2-bis [(nitrooxy) methyl]-1,3-propanediol dinitrate; penthrite; or nitropenta and may be referred to as TEN. The compound is a white solid with a molecular weight of 316.2. PETN has two polymorphs: one with a tetragonal crystalline structure and the other with an orthorhombic crystalline structure. The phase change between the two polymorphs occurs at 130°C. The tetragonal crystals have a density of 1.778 grams per cubic centimeter and the orthorhombic crystals have a density of 1.716 grams per cubic centimeter. Normal manufacturing yields tetragonal crystals. The unit cell dimensions of the tetragonal crystals are a=9.38 Angstroms, b=9.38 Angstroms, and c =6.71 Angstroms. The dimensions for the orthorhombic crystals are a=13.29 Angstroms, b = 13.49 Angstroms, c = 6.83 Angstroms. There are two molecules per cell in the tetragonal form and four molecules per cell in the orthorhombic form. The interatomic distances have been determined as 1.50 Angstroms for the C-C bonds, 1.37 Angstroms for the C-O bonds, 1.36 Angstroms for O-N bonds, and 1.27 Angstroms for N-O bonds. PETN melts at 141.3°C. The boiling point is 160°C under a pressure of 2 torr; 180°C under a pressure of 50 torr. Under atmospheric pressure at temperatures above 21 0°C, PETN decomposes rapidly and in some cases detonates. The vapor pressure of solid PETN can be found by the empirical equation: $\log p = 16.73 - 7750/T$. PETN is more sensitive to initiation than nitrocellulose, RDX, or tetryl, as judged by the sand test. This is shown, also, by the fact that PETN with 35 percent of water present can be detonated by a No. 6 electric blasting cap, whereas RDX fails to explode if more than 14 percent of water is present. PETN is one of the most sensitive of the standardized military explosives.

**Triethylene Glycoldinitrate (TEGN)** This explosive is also referred to as TEGDN. The compound is a light yellow, oily liquid with a nitrogen content of 11.67 percent, a molecular weight of 240.20, and an oxygen balance to $CO_2$ of -66.6 percent. The melting point of the solid is - 19°C. Other characteristics of the liquid are: refractive index, 1.4540; viscosity at 20°C, 13.2 centipoises; vapor pressure at 25°C, less than 0.001 torr; volatility at 60°C, 40 milligrams per square centimeter per hour; and density, 1.335 grams per cubic centimeter. At constant pressure, TEGN's heat of combustion is 3428 calories per gram, heat of explosion is 725 kilocalories per kilogram, and heat of formation is -603.7 kilocalories per kilogram. TEGN is very soluble in acetone, ether, and a solution of 2 parts ether and 1 part ethanol. TEGN is soluble in carbon disulfide and slowly soluble in water. The primary use of TEGN is as a gelatinizing agent for nitrocellulose in propellants, but TEGN can also be used as a component in a liquid explosive, a plasticizer in the fabrication of flexible explosive sheets, and as a plasticizer in pytrotechnic flares.

**1,1,1 Trimethylolethane Trinitrate (TMETN)** This explosive is also known as metriol trinitrate and is sometimes referred to as MTN. The compound is a slightly turbid, viscous oil with a nitrogen content of 16.41 percent and a molecular weight of 255.15. TMETN has a melting point of -3°C and an apparent boiling point of 182°C, but this is merely the temperature at which decomposition becomes vigorous enough to resemble boiling. Other properties of the liquid are a density of 1.47 grams per cubic centimeter at 22°C and a refractive index of 1.4752 at 25°C. TMETN is practically insoluble in water. Less than 0.015 grams dissolved per 100 grams of water at up to 60°C. TMETN is soluble in alcohol and many other organic solvents. At 60°C TMETN's volatility is 24 milligrams per square centimeter. The heat of formation is 422 calories per gram at constant volume and 446 calories per gram at constant pressure. The heat of combustion is 2,642 calories per gram at constant volume with the water being liquid. In an acid bath, TMETN is hydrolyzed to the extent of 0.018 percent in 10 days at 220°C and 0.115 percent in 5 days at 60°C. TMETN can be used as a flash and erosion reducing additive in propellants and an ingredient of commercial explosives. TMETN alone does not gelatinize nitrocellulose unless the temperature is raised to 100°C, which would be dangerous. But if mixed with only 8 percent of metriol triacetate, gelatinization takes place at 80°C. When TMETN is mixed with nitroglycerin, the mechanical properties of double-base cast propellants are improved. Combinations with triethylene glycol dinitrate are used as plasticizers for nitrocellulose.

**Cyclotetramethylenetetranitramine (HMX)** is also known as: octahydro-1,3,5,7-tetranitro-1 ,3,5,7-tetrazocine; 1,3,5,7-tetranitro-1 ,3,5,7-tetrazacyclooctane; cyclotetramethylene tetranitramine; or octogen. HMX is a white, crystalline solid with a nitrogen content of 37.84 percent, a theoretical maximum density of 1.905 grams per cubic centimeter, a nominal density of 1.89 grams per cubic centimeter, a melting point of 285°C, and a molecular weight of 296.17. There are four polymorphs of HMX: an alpha, beta, gamma, and delta form. Each polymorph has a range of stability and there are differences among them in physical properties such as density, solubility, and refractive index. The most common polymorph is the beta form. The term HMX without an alpha, gamma or delta qualifier refers to the beta form throughout the rest of this text. The crystalline structure of beta HMX is monoclinic with a density of 1.903 grams per cubic centimeter. The unit cell dimensions are a=6.54 Angstroms, b=11.05 Angstroms, and c=8.70 Angstroms. Beta HMX is stable to about 102°C to 104.5°C, when the crystalline structure is converted to the alpha form. The crystals of the alpha form are orthorhombic with a density of 1.82 grams per cubic centimeter. The unit cell dimensions are a=15.14 Angstroms, b =23.89 Angstroms, c = 5.91 Angstroms. At approximately 160°C to 164°C the meta stable gamma form exists. The crystals of the gamma form are monoclinic with a density of 1.76 grams per cubic centimeter. The unit cell dimensions are a=10.95 Angstroms, b =7.93 Angstroms, and c = 14.61 Angstroms. Above the 160°C to 164°C range to the melting point, the delta form exists. The crystals of the delta form are hexagonal with a density of 1.80 grams per cubic centimeter. The unit cell dimensions are a=7.71 Angstroms and b=32.55 Angstroms. The polymorphs may also be prepared by precipitation from solution under various conditions. The beta form is precipitated from a solution of HMX in acetic acid, acetone, nitric acid, or nitrometrane with very slow cooling. The alpha form is precipitated from the same solution with more rapid cooling and the gamma form is precipitated with even more rapid cooling. The delta form is crystallized from solution such as acetic acid orbetachloroethyl phosphate, in which HMX is only slightly soluble. Very rapid chilling of the solution is required.

**Cyclotrimethylenetrinitramine (RDX)** This explosive is also known as: hexahydro-1,3,5-trinitro-1,3,5-triazine; 1,3,5-trinitro1,3,5-triazacyclohexane; cyclotrimethylene trinitramine; hexogen; cyclonite; or 1,3,5-trinitrotrimethylene-triamine.The compound is a white solid with a density of 1.806 grams per cubic centimeter, a nitrogen content of 37.84 percent, and a molecular weight of 222.13. RDX has orthorhombic crystals with a wide variety of habits; from needles when precipitated from HNO3, to plates when precipitated from acetic acid, to a massive form when precipitated from nitroethane or acetone. The unit cell dimensions are a=13.18 Angstroms, b = 1 1.57 Angstroms, and c = 10.71 Angstroms, and there are eight molecules per cell unit. On the Moh's scale RDX has a scratch hardness of 2.5. Other properties of pure RDX include a specific heat as shown in table 8-15 and a heat of combustion at constant pressure of 2,307.2 calories per gram. The heat of formation value is + 14.71 kilocalories per mole. RDX has an extremely low volatility. Pure RDX is used in press loaded projectiles but not in cast loaded projectiles because of extensive decomposition at the melting point. Cast loading is accomplished by blending RDX with a relatively low melting point substance. Compositions in which the RDX particles are coated with wax are called Composition A, in mixtures with TNT, Composition B, and blends with a nonexplosive plasticizer, Composition C. Straight RDX is used as a base charge in detonators and in some blasting caps, and as an oxidizer in specialized gun propellant.

**Ethylenediamine Dinitrate (EDDN)** This explosive is also designated EDD or EDAD. The compound is composed of white crystals with a specific gravity of 1.595 at 25/40, a nitrogen content of 30.10 percent, an oxygen balance to C02 of-25.8 percent, a melting point of 185° to 187°C, and a molecular weight of 186.13. The compound is soluble in water, but insoluble in alcohol or ether. EDDN has a heat of combustion of 374.7 kilocalories per mole at constant pressure, a heat of formation of 156.1 kilocalories per mole, and a heat of explosion of 127.9 to 159.3 kilocalories per mole. Eutectics are formed with ammonium nitrate, but EDDN is immiscible with molten TNT. An aqueous solution of EDDN is distinctly acidic. EDDN has been used to a limited extent as a bursting charge pressed in shells and as a cast charge in eutectic mixtures with ammonium nitrate. Mixtures with wax were used in boosters during World War II by the Germans.

**Ethylenedinitramine (Haleite)** This compound is also known as N’ N'-dinitroethylene diamine; ethylene dinitramine; or 1,2-dinitrodiaminoethane, and is sometimes designated EDNA. The name Haleite is in recognition of the development of this compound as a military explosive by the late Dr. G. C. Hale of Picatinny Arsenal. The compound is white with an orthorhombic crystal structure, a nitrogen content of 37.33 percent, anoxygen balance to CO2 of-32 percent, an oxygen balance to CO of-10.5 percent, and a molecular weight of 150.10. The density of the crystals vary from 1.66 to 1.77 depending on the solvent from which the crystallization took place.

**Nitroguanidine (NQ)** This explosive is also known as picrite or guanylnitramine. The compound has a nitrogen content of 53.84 percent, an oxygen balance to CO2 of -30.8 percent, a theoretical maximum density of 1.81 grams per cubic centimeter, a nominal density of 1.55 to 1.75 grams per cubic centimeter, and a molecular weight of 104.1. The melting point of nitroguanidine varies somewhat with the rate of heating. The pure material melts with decomposition at 232°C, but values from 220°C to 250°C are obtainable with various heating rates. At least two crystalline forms exist for nitroguanidine; alpha and beta.

**2, 4,6Trinitrophenylmethylnitramine (Tetryl)** This explosive is also known as: 2,4,6tetranitro-N-methyl aniline; N-methyl-N,2,4,6tetranitro-benzenamine; 2,4,6-trinitrophenylmethylnitramine; tetranitromethylamulene; or picrylmethylnitramine and is sometimes referred to as pyronite, tetrylit, tetralite, tetralita, or CE. The compound is colorless when freshly prepared and highly purified, but rapidly acquires a yellow color when exposed to light. Tetryl has a nitrogen content of 24.4 percent, an oxygen balance to CO2 of-47 percent, a nominal density of 1.71 grams per cubic centimeter with a theoretical maximum density of 1.73 grams per cubic centimeter, and a molecular weight of 287.15. The melting point of the pure substance is 129.45°C and of the technical grade, 129°C.

**Nitroaromatics.** Compounds in this class are prepared by C-type nitration in which a nitrogroup is attached to a carbon atom of the compound being nitrated.

**Ammonium Picrate** This explosive is also known as ammonium 2,4,6-trinitrophenolate, explosive D, and Dunnite. The compound has a nitrogen content of 22.77 percent, an oxygen balance to C02 of- 52 percent, a maximum crystal density of 1.717 grams per cubic centimeter, a nominal density of 1.63 grams per cubic centimeter, a melting point with decomposition
of about 280°C and a molecular weight of 246. Ammonium picrate exists in a stable form as yellow,
monoclinic crystals and a meta stable form as red, orthorhombic crystals. The unit cell dimensions are a =13.45 Angstroms, b

**1,3-Diamino-2,4,6-Trinitrobenzene (DA TB)** This explosive is also known as 2,4,6trinitro-1,3-diaminobenzene; 2,4,6-trinitro-7,3benzenediamine trinitro-m-phenylenediamine; or 2,4,6-trinitro-1 ,3-diaminobenzol and may be referred to as DATNB. The compound is a yellow, crystalline solid with a nitrogen content of 28.81 percent, a melting point of 2860C to 301°C with decomposition, and a molecular weight of 243.14.

**1,3,5Triamino-2, 4,6Trinitrobenzene (TA TB)** This explosive is also known as 2,4,6trinitro-1,3,5-benzenetriamine and may be referred to as TATNB. TATB has a nitrogen content of 32.56 percent, an oxygen balance to C02 of -55.78 percent, and a molecular weight of 258.18. TATB is yellow but exposure to sunlight or ultraviolet light causes a green coloration which, with prolonged exposure, turns brown. The compound has a theoretical maximum density of 1.937 grams per cubic centimeter and a nominal density of 1.88 grams per cubic centimeter. An instantaneous hot bar decomposition temperature of 450°C to 451 °C was reported with rapid thermal decomposition above 320°C. The structure of the crystalline lattice of TATB contains many unusual features. Some of these are the extremely long C-C bonds in the benzene ring, the very short C-N bonds, amino bonds, and the six furcated hydrogen bonds. Evidence of a strong intermolecular interaction, hydrogen bonds, in TATB is indicated by the lack of an observable melting point and very low solubility. The intermolecular network results in a graphite-like lattice structure with the resulting properties of lubricity and intercalaction.

**2,4,6-Trinitrotoluene (TNT)** This explosive is also known as trotyl, tolit, triton, tritol, trilite, and 1-methyl-2,4,6-trinitrobenzene. TNT has been the most widely used military explosive from World War I to the present time. The advantages of TNT include low cost, safety in handling, fairly high explosive power, good chemical and thermal stability, favorable physical properties, compatibility with other explosives, a low melting point favorable for melt casting operations, and moderate toxicity. There are six possible ring nitrated TNT isomers. The alpha isomer, which is the one of military interest  is symmetrical and will be referred to as TNT. The other five meta isomers will be identified by the Greek letters beta through eta excluding zeta. TNT is a yellow, crystalline compound with a nitrogen content of 18.5 percent, an oxygen balance to CO2 of-73.9 percent, a molecular weight of 227.13, and a melting point of 80°C to 81°C. TNT shows no deterioration after 20 years storage in a magazine.

**Impurities Present in TNT**

2,4,5-Trinitrotoluene
2,3,4-Trinitrotoluene
2,3,6-Trinitrotoluene
2,3,5-Trinitrotoluene
3,4,5-Trinitrotoluene
2,6-Dinitrotoluene
2,4-Dinitrotoluene
2,3-Dinitrotoluene
2,5-Dinitrotoluene
3,4-Dinitrotoluene
3,5-Dinitrotoluene
1,3-Dinitrobenzene
1,3,5-Trinitrobenzene
2,4,6-Trinitrobenzyl alcohol
2,4,6-Trinitrobenzaldehyde
2,4,6-Trinitrobenzoic acid
Alpha-nitrato-2,4,6-trinitrotoluene
Tetranitromethane
2,2'-Dicarboxy-3,3',5,5'-tetranitroazoxybenzene (white compound)
2,2',4,4',6,6'-Hexanitrobibenzyl (HNBB)
3-Methyl-2',4,4',6,6'-pentanitrodiphenylmethane(MPDM)
3,3',5,5'-Tetranitroazoxybenzene

**Compositions** are explosives in which two or more explosive compounds are mixed to produce an explosive with more suitable characteristics for a particular application. Generally, the characteristics of the composition are intermediate between the characteristics of the individual explosive ingredients. For example, the addition of TNT to RDX reduces brisance somewhat but considerably improves sensitivity. The composition explosives are categorized by the number of ingredients contained in the mixture.

**Binary Mixtures**

**Amatols** are binary mixtures of ammonium nitrate and TNT. The percentages of ammonium nitrate and TNT are reflected in the nomenclature for each mixture, for example, 80/20 amatol consists of 80 percent ammonium nitrate and 20 percent TNT. Ammonium nitrate is insoluble in TNT. The chemical and physical properties of the constituents determine the properties of the amatol. The mixture begins to melt at TNT's melting point but the ammonium nitrate, which has a higher melting point, remains solid.

**Composition A** explosives consist of a series of formulations of RDX and a desensitizer. Compositions A and A2 contain the same percentages of materials as composition A3 but the type of wax used and the granulation requirements for the RDX are different. Composition A contains beeswax, while composition A2 contains a synthetic wax. Compositions A and A2 are no longer used. All of the composition A explosives are press loaded. The density of composition A3 is 1.47 and 1.65 grams per cubic centimeter when pressed to 20,685 kilopascals (3,000 pounds per square inch) and 82,740 kilopascals (12,000pounds per square inch), respectively.

**Composition B** type explosives are mixtures of RDX and TNT. Composition B refers to mixtures of approximately 60 percent RDX and 40 percent TNT. Other portions of RDX and TNT are called cyclotols.

**Composition C** During World War II, the British used a plastic demolition explosive that could be shaped by hand and had great shattering power. As standardized by the United States, this explosive was designated as composition C and contained 88.3 percent RDX and 11.7 percent of a nonexplosive oily plasticizer. Included in the plasticizer was 0.6 percent lecithin, which helped to prevent the formation of large crystals of RDX which would increase the sensitivity of the composition.

**Ednatols** are mixtures of halite (ethylene dinitramine) and TNT. The most used haleite/TNT portions are 60/40, 55/45, and 50/50. Ednatols are yellowish, uniform blends with a melting point of 80°C. The eutectic temperature is about 80°C. In an extrudation test at 65°C there was no extrudate. Ednatols are considered satisfactory for bursting charges in ammunition. All of the following data in the discussion of the properties of ednatol refer to the 55/45 mixture. 55/45 Ednatol has an oxygen balance to carbon dioxide of -51 percent and to carbon monoxide of - 17 percent. The density of the cast explosive is 1.62 grams per cubic centimeter, which is four percent greater than that of cast TNT or haleite pressed under 206,850 kilopascals (30,000 pounds per square inch).

**LX-14** is an explosive which consists of 95.5 percent HMX and 4.5 percent estane 5702-F1. The mixture is a white solid with violet spots. LX-14 has a theoretical maximum density of 1.849 grams per cubic centimeter, a nominal density of 1.83 grams per cubic centimeter, and a melting point of greater than 270°C, with decomposition. The heat of formation is 1.50 kilocalories per mole. The calculated heats of detonation are 1.58 kilocalories per gram with liquid water and 1.43 kilocalories per gram with gaseous water. At a density of 1.835 grams per cubic centimeter the detonation velocity is 8,830 meters per second.

**Octols** are mixtures of HMX and TNT. Octol is used as an oil well formation agent and in fragmentation and shaped charges. In fragmentation tests using a 105 millimeter M1 shell, 15 percent more fragments are produced and the average velocity of the fragments is 100 meters per second faster than with a similar shell loaded with composition B. This improvement is attributed to both the higher rate of detonation of octol and the greater density of octol which permits a greater weight of explosive in the same volume.

**Pentolite** are castable explosive mixtures containing PETN and TNT. The most commonly used blend consists of 50/50 PETN/TNT. Other blends such as 75/25, 40/60, 30/70, and 10/90 have been occasionally employed but the 50/50 blend is superior in the characteristics of sensitivity to initiation, brisance, and suitability for melt loading. 87 percent TNT and 13 percent PETN form a eutectic with a freezing point of 76.7°C. Cast 50/50 pentolite, therefore, consists of 42.2 percent PETN, and 57.8 percent of the eutectic mixture.

**Picratol** is a mixture of 52 percent ammonium picrate and 48 percent TNT. Molten TNT has little or no solvent action on ammonium picrate, and consequently, cast picratol consists essentially of a physical mixture of crystals of the two explosives. The density of cast picratol is 1.61 to 1.63. This permit’s a weight of charge almost equal to that

**Tetrytols** are light yellow to buff mixtures of TNT and tetryl. As is the case for tetryl, tetrytols are no longer used by the United States but are still being used by other nations including various NATO allies. Tetrytols resemble tetryl more closely than they resemble TNT. They are more powerful but less sensitive than TNT. Tetrytols can be cast into munitions, which is an advantage over press loading. Table 8-73 compares the physical characteristics of various detritus compositions.

**Ternary Mixtures**

**Amatex 20** The mixture has a nominal density of 1.61 grams per cubic centimeter and is used as a filler in ammunition items.

**Amatex 20** consists of:

| | |
|---|---|
| RDX | 40 percent |
| TNT | 40 percent |
| Ammonium nitrate | 20 percent |

**Ammonal**

**Ammonals** are mixtures containing, as principle ingredients, ammonium nitrate and powdered aluminum incorporated with high explosives such as TNT, DNT, and RDX. Powdered carbon was also used in earlier ammonals. In the ammonals that do not contain carbon, the mixture of ammonium nitrate and high explosive detonates developing a very high temperature which causes volatilization of the aluminum powder. In general, ammonals are fairly insensitive and stable mixtures but are hygroscopic due to the presence of ammonium nitrate. In the presence of moisture, ammonals react with the same metals as amatols: copper, bronze, lead, and copper plated steel.

**(HTA-3)** are mixtures of HMX, TNT, and aluminum

**Minol-2** are mixtures of TNT, ammonium nitrate, and aluminum.

**Torpex** is a silvery white solid when cast. The composition of torpex is 41.6 percent RDX, 39.7 percent TNT, 18.0 percent aluminum powder, and 0.7 percent wax.

**Quanternary Mixtures**

**Depth bomb explosive (DBX)** is the only explosive covered under quanternary mixtures. DBX consists of:

| | |
|---|---|
| TNT | 40 percent |
| RDX | 21 percent |
| Ammonium nitrate | 21 percent |
| Aluminum | 18 percent |

**Industrial Explosives**

**Dynamites** Military operations frequently necessitate excavation, demolition, and cratering operations for which the standard high explosives are unsuited. Recourse is made to commercial and special compositions. Commercial blasting explosives, with the exception of black powder, are referred to as dynamites although in some cases they contain no nitroglycerin.

**Ammonium nitrate fuel oil explosives (ANFO)** When ammonium nitrate is mixed with approximately 5.6 percent of a combustible material such as fuel oil, the heat liberated on detonation is increased by almost three-fold.

# Propellants

## CHAPTER 9
## UNITED STATES PROPELLANTS

**Introduction** Selection of a propellant for an application is made on the basis of the requirements of that specific application. In general, guns are designed to meet specified performance standards and withstand a specific pressure in the barrel. With a knowledge of the properties of the constituents normally used for propellants, the propellant designer creates a formulation to satisfy the performance standards and limitations of the gun. When ignited, the propellant produces large quantities of hot, gaseous products. Complete combustion or deflagration of the propellant occurs in milliseconds in guns and the pressure produced accelerates the projectile down the barrel.

**Single-base propellants** M1, M6, M10, and IMR.

**Double-base gun propellants** M2, M5, M8 and M18.

**Triple-base gun propellants** contain nitroguanidine as additional energizer which increases the energy content of the formulation without raising the flame temperature.

**Composite propellants**, used in solid fuel rockets, contain a polymer binder, a fuel, and an oxidizer.

**Ball Propellants**

**Propellants Compounds: M1, M2, M5, M6, M8, M10, M31, M30, IMR, M18**

- Nitrocellulose (NC)
- Nitrogen
- Nitroglycerin
- Barium nitrate
- Potassium nitrate
- Potassium sulfate
- Lead carbonate
- Nitroguanidine
- Dinitrotoluene
- Dibutylphthalate
- Diethylphthalate
- Diphenylamine
- Ethyl centralite
- Graphite
- Cryolite
- Ethyl alcohol (residual)

**Diphenylamine**, (C6H5)2NH, is an ammonia derivative in which two of the hydrogens have been replaced by phenyl groups. Each phenyl ring has three hydrogens which can be replaced with nitro groups. Therefore, DPA can be

nitrated to the hexanitrate by absorbing the nitrogen oxides produced during the decomposition of nitrocellulose. DPA is nitrated relatively easily and the reaction is not exothermic. During the decomposition of nitrocellulose, DPA nitrates to the following compounds in succession.

N-nitrosodiphenylamine
2-nitrodiphenylamine
4-nitrodiphenylamine
N-nitroso-2-nitrodiphenylamine
N-nitroso-4-nitrodiphenylamine
4,4', 2,4', 2,2', and 2,4-dinitrodiphenylamines
N-nitroso-4, 4'-dinitrodiphenylamine
N-nitroso-2, 4'-dinitrodiphenylamine
2, 4, 4' and 2, 2', 4-trinitrodiphenylamines
2,2', 4,4'-tetranitrodiphenylamine
2,2', 4,4', 6-pentanitrodiphenylamine
Hexanitrodiphenylamine

The propellant does not start to become unstable until most of the diphenylamine has been converted to hexanitrodiphenylamines. A very accurate test to measure the remaining safe storage life in a propellant lot is to analyze the distribution profile of the nitro DPAs. Only about one percent DPA can be added to a propellant because its nitrated products change the ballistic properties.

**Centralite I** (which is also called ethyl centralite or symmetrical diethyldiphenylurea), OC [N-(C2H5) (C6H5)]2, was developed in Germany for use in double base propellants. The compound acts as a stabilizer, gelatinizer, and waterproofing agent. Unlike diphenylamine, centralite can be used in relatively large proportions and some propellant compositions contain as much as eight percent of this material. Like diphenylamine, centralite is nitrated by the products of nitrocellulose decomposition. The following compounds are formed successively, as many as four being present simultaneously, as deterioration of the powder proceeds.

4-nitrocentralite
4,4' dinitrocentralite
N-nitroso-N-ethylaniline
N-nitroso-N-ethyl-4-nitraniline
2,4, dinitro-N-ethyl-aniline

**Centralite II** (which is also called methyl centralite or symmetrical dimethyl diphenylurea), OC[N(CH3) (C6H5)]2, also has been used as a stabilizer but is not considered to be as effective as the ethyl analogue

**Three akardites**, or acardites, are used to stabilize propellants. Akardite II is often used in DEGN containing propellants.

# Pyrotechnic Devices

## Military Explosives (Chemistry) 30 September 1984

### CHAPTER 10
### UNITED STATES PYROTECHNICS

Pyrotechnics are used to send signals, to illuminate areas of interest, to simulate other weapons during training, and as ignition elements for certain weapons.(1)

All pyrotechnic compositions contain oxidizers and fuels. Additional ingredients present in most compositions include binding agents, retardants, and waterproofing agents. Ingredients such as smoke dyes and color intensifiers are present in the appropriate types of compositions.

**Oxidizers:** are substances in which anoxidizing agent is liberated at the high temperatures of the chemical reaction involved.

**Fuels:** include finely powdered aluminum, magnesium, metal hydrides, red phosphorus, sulfur, charcoal, boron, silicon, and suicides. The most frequently used are powdered aluminum and magnesium.

**Binding agents:** include resins, waxes, plastics, and oils. These materials make the finely divided particles adhere to each other when compressed into pyrotechnic items.

**Retardants** are materials that are used to reduce the burning rate of the fuel-oxidizing agent mixture, with a minimum effect on the color intensity of the composition.

**Waterproofing agents** are necessary in many pyrotechnic compositions because of the susceptibility of metallic magnesium to reaction with moisture, the reactivity of metallic aluminum with certain compounds in the presence of moisture, and the hygroscopicity of nitrates and peroxides.

**Color intensifiers:**

hexachloroethane (C2CI6)
hexachlorobenzene (C6CI6)
polyvinyl chloride
dechlorane (C1oCI12).

**Smoke dyes** are azo and anthraquinone dyes. These dyes provide the color in smokes used for signaling, marking, and spotting.

**Flares and Signals** The illumination provided by a flare is produced by both the thermal radiation from the product oxide particles and the spectral emission from excited metals.

**Infrared Flare Formulas:**

Silicon
KNO3
CsNO3
RbNO3
Hexamethylene
tetramine
Epoxy resin

**Red-Green Flare System:**

Barium nitrate
Strontium nitrate 13
Potassium perchlorate
Magnesium
Dechlorane
Polyvinyl acetate resin

**Signal flares** are smaller and faster burning than illuminating flares. Various metals are added these compositions to control the color of the flame.

**Colored and White Smoke** The pyrotechnic generation of smoke is almost exclusively a military device for screening and signaling. Screening smokes are generally white because black smokes are rarely sufficiently dense. Signal smokes, on the other hand, are colored so as to assure contrast and be distinct in the presence of clouds and ordinary smoke.

**Venturi thermal generator type.** The smoke producing material and the pyrotechnic fuel block required to volatilize the smoke material are in separate compartments. The smoke producing material is atomized and vaporized in the venturi nozzle by the hot gases formed by the burning of the fuel block.

**Burning type.** Burning type smoke compositions are intimate mixtures of chemicals. Smoke is produced from these mixtures by either of two methods. In the first method, a product of combustion forms the smoke or the product reacts with constituents of the atmosphere to form a smoke. In the second method, the heat of combustion of the pyrotechnic serves to volatilize a component of the mixture which then condenses to form the smoke. White phosphorus, either in bulk or in solution, is one example of the burning type of smoke generator.

**Explosive dissemination type.** The smoke producing material is pulverized or atomized and then vaporized, or a preground solid is dispersed by the explosion of a bursting charge. The explosive dissemination smoke generator may contain metallic chlorides which upon dispersal, hydrolyze in air. Examples are titanium, silicon, and stannic tetrachloride.

**Smoke Agent Mixtures:**

White phosphorus
Sulfur trioxide

FS agent
HC mixture
FM agent
Crude oil

**The preferred method of dispersing colored smokes** involves the vaporization and condensation of a colored organic volatile dye. These dyes are mixed to the extent of about 50 percent with a fuel such as lactose (20 percent) and an oxidizer (30 percent) for which potassium chlorate is preferred.

**Tracers and Fumers** The principal small arms application of military pyrotechnics is in tracer munitions where they serve as incendiaries, spotters, and as fire control. Two types of tracers are used. The difference between the two types is the method of tracking. The more frequently used tracer uses the light produced by the burning tracer composition for tracking. Smoke tracers leave a trail of colored smoke for tracking. Red is the flame color most often employed in tracers.

**Igniter and Tracer Compositions**

Strontium peroxide
Magnesium
1-136 Igniter
Calcium resinate
Barium peroxide
Zinc stearate
Toluidine red (identifier)
Strontium nitrate
Strontium oxalate
Potassium perchlorate
Polyvinyl chloride

**Incendiaries** Two types of incendiaries are commonly used. The traditional type is a bomb containing a flammable material. These materials include thermite (a mixture of aluminum and rust), phosphorus, and napalm. In addition, the case of the bomb may be constructed of a material such as magnesium that will burn at a high temperature once ignited.Depleted uranium is used extensively in pyrotechnics which have armor piercing capabilities.

Depleted uranium deficient in the more radioactive isotope U235, is the waste product of the uranium enrichment process. The depleted uranium is formed into projectiles that can penetrate armor because of their high density and mechanical properties. The impact of the projectile causes the uranium to form many pyrophoric fragments which can ignite fuel and munition items.

**Pyrophoric Metals**

| | |
|---|---|
| U | Uranium |
| Th | Thorium |
| Zr | Zirconium |
| Hf | Hafnium |

| | |
|---|---|
| Ce | Cerium |
| La | Lanthanum |
| Pr | Praseodymium |
| Nd | Neodymium |
| Sm | Samarium |
| Y | Yttrium |
| Ti | Titanium |

**Delays and Fuses** Delay compositions are mixtures of oxidants and powdered metals which produce very little gas during combustion.

**Photoflash Compositions** Photoflash compositions are the single most hazardous class of pyrotechnic mixtures. The particle size of the ingredients is so small that burning resembles an explosion. The various photoflash devices are similar, differing principally in size and the amount of delay.

**Colored smokes:**

Yellow: Auramine hydrochloride
Green: 1,4-Di-p-toluidinoanthraquinone with auramine hydrochloride
Red: 1-Methylanthraquinone
Blue: Not suitable for signaling because of excessive light scatter.

**Currently used dyes:**

Orange: 1-(4-Phenylazo)-2-naphthol
Yellow: N, N-Dimethyl-p-phenylazoaniline
Blue: 1,4-Diamylaminoanthraqdinone

**Black Powders Used in Pyrotechnics**

Potassium nitrate
Sodium nitrate
Charcoal
Coal (semibituminous)
Sulfur

**Ignition Mixtures Components**

Aluminum (powdered)
Ammonium dichromate
Asphaltum
Barium chromate
Barium peroxide
Boron (amorphous)
Calcium resinate
Charcoal
Diatomaceous earth (See also superfloss)
Fe203 (Red)
Fe304 (Black)
Potassium nitrate
Potassium perchlorate

Laminac
Magnesium (powdered)
Sodium nitrate
Nitrocellulose
Parlon (chlorinated rubber)
Pb02 -
Pb304
Sr peroxide
Sugar
Superfloss
Titanium
Toluidine red toner
Vegetable oil
Vistanex (polyisobutylene)
Zinc Stearate
Zirconium

# Table 4. Pyrotechnic Munitions Chemicals

**Chemicals found in practice and pyrotechnic munitions** [1 2]

| | | |
|---|---|---|
| Aluminum | Copper powder | Potassium chromate |
| Ammonium chloride | Chlorinated rubber (Parlon) | Potassium chlorate |
| Ammonium perchlorate | Cupric oxide | Polyvinyl acetate |
| Amorphous boron | Cuprous chloride | Polyvinylchloride (PVC) |
| Antimony sulfide | Calcium silicide | Perchlorate |
| Antimony metal powder | Cellulose-nitrate-plastic | Potassium dichromate |
| Anthracene | Dichloromethane | Potassium perchlorate |
| Asphaltum | Gilsonite | Resin (laminac) |
| Barium nitrate | Graphite | Red phosphorous |
| Barium chromate | Hexachlorobenzene | Selenium |
| Barium chlorate | Hexachloroethane (HC) | Sodium oxalate |
| Barium peroxide | Iron oxide | Sodium bicarbonate |
| Barium sulfate | Infusorial earth | Stearic acid |
| Bismuth tetroxide | Lead dioxide | Strontium nitrate |
| Butyl rubber | Lithium peroxide | Strontium carbonate |
| Calcium resinate | Lithium perchlorate | Strontium nitrate |
| Calcium fluoride | Magnesium | Strontium peroxide |
| Carbon tetrachloride | Magnese dioxide | Shellac |
| Calcium metal | Mercurous chloride | Tellurium |
| Cobalt naphthenate | Polyisobutylene (vistanex) | Titanium |
| Copper carbonate | Potassium iodate | Tungsten |
| Zirconium hydride | Zinc stearate | White phosphorous |
| Polychlorotrifluoroethylene | Manganese | Magnesium aluminum |
| Lead monoxide | Lead chromate | Diatomaceous Earth |
| Saltpeter | Cupric Oxide | Charcoal |
| Calcium Resinate | Sulphur | Calcium Phosphide |
| Red Gum | Barium Oxalate | Adhesive, Dextrin |
| Dextrin | Ammonium Nitrate | Orange Shellac |
| Auramine Hydrochloride | Stearin | Arsenic Disulphide |

**Dyes**

| | |
|---|---|
| 1-(2-Methoxyphenylazo)-2-Napthol Sudan Red G | 4-Dimethylamino Azobenzene |
| 1, 4 Dimethylamino Anthraquinone Fast Blue B | 1, 4 Diphenyl Toluidino Anthraquinone |
| 2-(4-Dimethylamino Phenylazo) Napthalene | 1-Amino Anthraquinone Fast Red A1 |
| Indanthrene Dye Golden Yellow GKAC | 4-Methylamino Anthraquinone |

[1] Book: Military Pyrotechnics, 1919; Henry B. Faber; Dean of Pyrotechnic Schools Ordnance Department U.S. Army
[2] Book: Military and Civilian Pyrotechnics, 1968; Dr. Herbert Ellern

# Table 5. 23 Pyrotechnic munitions chemicals also used as Pesticides

| Chemical | | CAS | Pesticide/Biocide/Repellant |
|---|---|---|---|
| Arsenic sulfide | 12344-68-2 | 12612-21-4 | Herbicide, Insecticide, Rodenticide |
| Ammonium Nitrate | | 6484-52-2 | Microbiocide, Rodenticide |
| Ammonium Chloride | | 12125-02-9 | Algaecide, Microbiocide |
| Anthracene | | 120-12-7 | Herbicide, Insecticide, Rodenticide |
| Barium nitrate | | 10022-31-8 | Repellant |
| Calcium phosphide | | 1305-99-3 | Rodenticide |
| Carbon tetrachloride | | 56-23-5 | Fumigant, |
| Cobalt naphthenate | | 61789-51-3 | Fungicide, Insecticide |
| Copper powder | | 7440-50-8 | Fungicide, |
| Copper carbonate | | 12069-69-1 | Algaecide, Fungicide, Insecticide |
| Cupric oxide | | 1317-38-0 | Fungicide, Insecticide |
| Cuprous chloride | | 7758-89-6 | Fungicide |
| Dichloromethane | | 75-09-2 | Dog and Cat Repellant |
| Diatomaceous Earth | | 61790-53-2 | Insecticide, Molluscicide |
| Iron oxide | | 1309-37-1 | Herbicide |
| Potassium chlorate | | 3811-04-9 | Defoliant, Herbicide, Microbiocide |
| Saltpeter | | 7757-79-1 | Microbiocide, Rodenticide |
| Sodium bicarbonate | | 144-55-8 | Fungicide |
| Sodium oxalate | | 62-76-0 | Microbiocide |
| Sulphur | | 7704-34-9 | Fungicide, Insecticide |
| Stearic acid | | 57-11-4 | Adjuvant |
| Naphthalene (smoke dye) | | 91-20-3 | Insecticide, insect repellant |
| Anthraquinone (smoke dye) (found in 4 smoke dye formulas) | | 84-65-1 | Bird Repellant |

**Note:** May explain why training areas are devoid of a robust insect and bird population.

**Pesticide Use Information Source:**
Pesticide Action Network North America: www.pesticideinfo.org/Search_Chemicals.jsp

# Table 6 Pesticides used at Fort Ord

**48 Pesticides known as used at Fort Ord**

| | | |
|---|---|---|
| **Calcium Cyanide Gas** | **Mercury** | **DDT** |
| **DDD** | **DDE** | **2,4-D** |
| **Malathion** | **Chlordane** | **Dieldrin** |
| **Warfarin** | **Diazinon** | **Baygon** |
| **Altosid SR-10** | **Tordon 101** | **Hyvar X** |
| **Sevin (Carbyrl Dust)** | **1080** | **Diphacinone** |
| **Chlorophacinone** | **Zinc Phosphide** | **Endrin** |
| **Heptachlor Epoxide** | **Gamma-BHC** | **Derzan-T** |
| **Derzvan** | **Methyl Bromide** | **Cyntroid 3-EC** |
| **Pyrethrum** | **Permaguard** | **Ficam W** |
| **Gophercide** | **Diphacin** | **Weed-Rhap LY-4P** |
| **Monuron** | **Ded-Weed Silvex LV** | **Simazine** |
| **Aertex** | **Paraquat CL, Banvel** | **Betasan** |
| **Trexsan** | **Amino Triazole** | **Amitrol-T** |
| **Diquat** | **Tok-E-25** | **Surflan** |
| **Enide** | **Metalde HTDE** | **Arochlor 1254** |

**Note: Pesticides where applied to training areas for decades. Pesticides where applied by air and ground to manage pests (rodents, insects, fungi, and vegetation) the extent of which is not known.**

**Former Fort Ord Pesticide Use; Research Documents:**
Available at Fort Ord Administrative Record ; http://fortordcleanup.com/adminrec/arsearch.asp
enter record number, example: BW-0013

1) Fort Ord Installation Assessment 1983; BW-0013, pesticide types and uses
2) Fort Ord Base Closure Preliminary Assessment1990; BW-2427, pesticide types and uses
3) Fort Ord Literature review and Base Inventory Report Vol I, 1991; RI/FS BW-0136
4) Fort Ord Basewide Background Soil Investigation draft 1992; BW-0289
5) Fort Ord Basewide Background Soil Investigation draft final 1993; BW-0352
6) Fort Ord Basewide Background Soil Investigation final 1995; BW-1283E Basewide RI/FS
7) Fort Ord 2003 Burn ATSDR Health Consultation; OE-0522

**Table 7. Munitions Chemicals looked for in training areas transferred to the Fort Ord Reuse Authority (FORA) for development**

**All these development parcels are known training areas**

**Historical Area (HA) Training Areas and total chemicals looked for:**

**HA-161,CSUMB** Booby Traps, Mines, Projectiles, Pyrotechnics - Development

| | | |
|---|---|---|
| TPH-Diesel | TPH-Motor Oil | Bis(2-ethylhexyl)phthalate |
| TPH-Gasoline | Di-n-butyl phthalate | Di-n-octylphthalate |
| Antimony | Copper | Lead |
| Cadmium | | |

**HA-175, OE-45** Tactical Training Area - Development

**No Sampling Required**

**HA-103, OE-13B** Mortar Range / Parker Flats portion - MST/Horse Park Development

**No Sampling Required:** based on off-site sampling results

**HA-110, DRO.1** Site 39 Multi-use Training/Impact Area - Del Rey Oaks Development

**No Sampling Required:** based on off-site sampling results

**HA-111, DRO.2** Site 39 Multi-use Training/Impact Area - Del Rey Oaks Development

**No Sampling Required:** based on off-site sampling results

**HA-112, SEA.1** Site 39 Multi-use Training/Impact Area - Seaside Development

**No Sampling Required:** based on “no stressed vegetation or impacts to soil”

**HA-112, SEA.2** Site 39 Multi-use Training/Impact Area - Seaside Development

**No Sampling Required:** based on “no stressed vegetation or impacts to soil”

**HA-112, SEA.3** Site 39 Multi-use Training/Impact Area - Seaside Development

**No Sampling Required:** based on “no stressed vegetation or impacts to soil”

**<u>HA-112, SEA.4</u>** Site 39 Multi-use Training/Impact Area - Seaside Development

**No Sampling Required:** based on "no stressed vegetation or impacts to soil"

**<u>HA-116, MOCO1</u>** Site 39 Multi-use Training/Impact Area - Monterey Co Development

**No Sampling Required:** based on "no MEC was identified during sampling"

**<u>HA-117, MOCO2</u>** Site 39 Multi-use Training/Impact Area - Monterey Co Development

| | | |
|---|---|---|
| Antimony | Copper | Lead |

**<u>HA-118, Site 39</u>** Site 39 Impact Area - Habitat Management Area

| | | |
|---|---|---|
| 2,4,6-Trinitrotoluene | 2-Amino-trinitrotoluene | 4-Amino-dinitrotoluene |
| HMX | RDX | 1,3,5-Trinitrobenzene |
| Tetryl | | |

**Note:** Pyrotechnics were used day and night, over a 77 year period. Pyrotechnics were used for all types of troops training including non-live fire, live-fire, bivouac, and maneuvers activities.

Compiled from Fort Ord documents AR BW-2300J, Basewide Range Assessment Reports Final 2009

CITY OF SALINAS
Public Works Department • 200 Lincoln Avenue • Salinas, California 93901 • (831) 758-7241

July 2, 2013

Monterey Regional Water Pollution Control Agency
ATTN: Bob Holden
5 Harris Court, Building D
Monterey, CA 93940

***Re: City of Salinas Response to Notice of Preparation, Monterey Peninsula Ground Water Replenishment Project Environmental Impact Report***

Mr. Holden,

The City of Salinas, via this letter, is providing general and specific comments that we believe should be addressed as part of the Environmental Impact Study Process, or considered in the context of the Ground Water Replenishment Project as it moves forward.

**General Comments:**

1. **National Environmental Policy Act (NEPA):** Varied and significant streams of funding will be required to complete implementation of the GWR project. We offer the observation that several aspects of this project could be and should be eligible for federal funding. (In fact the City of Salinas Industrial Waste Water Improvement Project that will link to this project is partially funded by a federal Economic Development Grant and will also include funding from loans secured by federal Community Development Block Grant funding). Given this possibility we believe it is prudent and wise to develop CEQA information in that could be used to satisfy compliance with the National Environmental Policy Act (NEPA). Meeting NEPA requirements sooner rather than later could serve to open other sources of funding. T-1

2. **California Regional Water Quality Control Board (Water Board):** Numerous permits issue by the regional and state California Water Boards will be required to implement this project.. We recommend that serious consideration be given, as soon as possible to secure these permits. Our expectation is that it would take the Water Board upwards of two years to issue new, or change existing permits previously issued. Given the aggressive timeline of this project, we believe a process that runs parallel with the environmental study processes be developed. We would also recommend that the Water Board be consulted early on to help define the process that would be required to obtain these permits. In other jurisdictions, similar projects have been issued "Master Permits" for water recycling and reuse projects. We recommend that this possibility also be explored. T-2

3. **Funding for Public Outreach:** After reviewing recent budget decisions made by the MRWPCA Board to fund Public Outreach for the GWR project, we believe funding is inadequate for the scale of project being proposed. MRWPCA needs to accept its role as a leader in water reuse and T-3

recycling and begin the effort required to gain approvals or agreements from two major economic engines (Agricultural and Hospitality), multiple local jurisdictions, agencies and citizen committees, as well as State and Federal organizations. We are concerned that MRWPCA has not in the past operated as an agency subject to high visibility in a heavily controversial environment. The recent history of major water projects in the County are a testament to how disagreement and lack of communication can cause essential projects to fail. MRWPCA must take the lead to ensure that all information associated with this project be broadly disseminated across multiple media platforms with honesty and transparency. This project will require the highest level of communication skills and effort to build community consensus if it is to succeed. This effort needs to begin immediately and with adequate funding. We believe that the environment in which this project will be developed is such that MRWPCA will need to "rethink" its communication strategies for this project, and that this effort will require far more funding than is currently provided. T-3 cont

4. **Independent Utility:** We encourage the MRWPCA to clarify and emphasize that the GWR Project stands on its own and has independent justification, purpose and utility separate from other water resource projects, including the desalination efforts. There is too much discussion about the extent to which the two are integrated and/or dependent on each other when it is not the case. T-4

5. **Options:** The NOP identifies and discusses Options A and B for potential routing of the pipelines to move the water from Salinas to the MRWPCA treatment facility in Marina. Both of these options start at the City of Salinas, agricultural wash-water settling ponds. There is also a pipeline that goes from the City of Salinas pump station at TP1 to the treatment facilities; Shouldn't this pipeline also be addressed as well? T-5

**Specific Comments:**

1. On page 8 the NOP states "*The GWR Project could not produce all of the needed replacement water, but the primary goal of the project is to produce 3,500 AFY to be used by Cal-Am in order to reduce its Carmel River diversions by that same amount*." Recent presentations to the CPUC made by MRWPCA representatives indicate a potential of 9,500 AFY to 12,500 AFY of available source water that could be used for GWR purposes. With the understanding that it takes approximately 4,200 AFY to produce 3,500 AFY of potable water via the GWR, we are concerned that the advanced treatment plan as proposed is inadequately sized to process the source water. We understand that the source water could also be recycled and used to satisfy irrigation needs (this of course would be supported by the City of Salinas) however there is only limited discussion of the actual amount of available source water and how it would ultimately be processed and distributed. This concern is also extended to the tertiary treatment with questions about the ability to process high amounts of source water. At the very minimum designing the advanced treatment facility so that it could be rapidly expanded is an important consideration T-6

2. On page 12, the NOP refers to the source water being provided from a combination of sources listed. We recommend that the MRWPCA clarify that the water may come from one of the options listed, or some combination of the potential sources listed. How will the MRWPCA determine which source or sources are used or drawn from and when? T-7

3. On page 12 (and a number of other places), there is a fair amount of detail specific to pipe sizes, capacity, pump location and pump sizes. We recommend that the MRWPCA remain flexible, where possible. We recommend that the CEQA study focus on routing and those issues of potential environmental significance and defer being too specific on some of the system details until the design is further along. If more than 3,500 AFY can be sourced from City of Salinas storm and agricultural wash water, and the MRWPCA can use that water for the greater good, would increasing the system capacity require new environmental processing? If so, is it possible to avoid his? T-8

4. On page 13 the NOP states "*A new 9,000-foot long, 30-inch diameter pipeline would transport water from the proposed new Blanco Drain pump station to the new GWR Project treatment facilities at the Regional Treatment Plant. Directional drilling would be used to cross under the Salinas River, and then the pipeline would be placed along the boundary of the Monterey Regional Waste Management District property to the MRWPCA's existing Regional Treatment Plant site.*" In terms of water conveyance systems, for both source and recycled water, it is important to extend our thinking into the future in terms of MRWPCA becoming a regional source of recycled water. Given this thinking, we recommend that two pipelines be placed simultaneously under the river while this work project is taking place. The cost saving and future benefits we believe would prove to be invaluable as MRWPCA began to provide recycle water back into the Salinas Valley for irrigation, or to increase volume of source water intake. The second pipeline would not necessarily be required to come into immediate use but could be capped at both ends until needed. However, the economies of scale realized by locating two pipelines with one permit under one contract should prove in the long term very cost effective and provide the kind of flexibility needed for this project. T-9

The City of Salinas appreciates the opportunity to comment on this important document. Should you have questions or wish clarification on our comments please contact me at 831-758-7390.

Regards,

Gary E. Petersen
Public Works Director

cc: Ray Corpuz, City Manager
Frank Aguayo, Senior Civil Engineer
Kevin Flynn, Kimley-Horn and Associates

Letter U

Bill Carrothers Comment - my only comment on the GWR Project is the same as George Riley's. He and I are both interested in the costs associated with scaling up the proposal, and what it would cost to design the project to have the potential for future capacity increases. U-1

# APPENDIX E

# SUPPLEMENT TO MAY 2013 NOP

**SUPPLEMENT TO THE MAY 2013 NOTICE OF PREPARATION FOR THE MONTEREY PENINSULA GROUNDWATER REPLENISHMENT (PURE WATER MONTEREY) PROJECT ENVIRONMENTAL IMPACT REPORT**

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**TO:** Agencies, Interested Parties, and Members of the Public
**DATE:** December 8, 2014
**SUBJECT:** Supplement to May 2013 Notice of Preparation of an EIR
**PROJECT TITLE:** Pure Water Monterey Groundwater Replenishment Project
**PROJECT LOCATION:** Northern Monterey County, California
**LEAD AGENCY:** Monterey Regional Water Pollution Control Agency
5 Harris Court, Building D
Monterey, CA 93940

Staff contact: Mr. Bob Holden, Principal Engineer
Phone: (831) 372-3367 Fax: (831) 372-6178
Email: gwr@mrwpca.com

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The Monterey Regional Water Pollution Control Agency (MRWPCA) is the Lead Agency for preparation of an Environmental Impact Report (EIR) under the California Environmental Quality Act (CEQA) for the Monterey Peninsula Groundwater Replenishment Project (now called the Pure Water Monterey GWR Project). MRWPCA commenced the CEQA process for the proposed project on May 31, 2013 when a Notice of Preparation (NOP) of an EIR was circulated for a 30-day public review period (SCH# 2013051094). MRWPCA considered and incorporated comments on the May 2013 NOP, and the Draft EIR for the project is well underway. On a parallel track, as a result of ongoing engineering and technical evaluations and regional coordination efforts, MRWPCA has updated the project description.

To provide public agencies, interested parties and members of the public with an opportunity to comment on the scope of the EIR related to updates to the project description, MRWPCA has decided to supplement the May 2013 NOP.

**Comment Period for Supplement to NOP**
MRWPCA invites public agencies, organizations and members of the public to submit written comments providing specific details about the scope and content of the environmental information in the EIR related to the updates to the project description. If commenting on behalf of a responsible or trustee agency, please also identify your specific areas of statutory responsibility. The public comment period on the Supplement to the NOP begins on December 10, 2014 and ends on January 8, 2014. Please send your written comments to Mr. Bob Holden at the address identified above, including your name, address, and contact information. If a response is not received from you within 30 days, the Lead

Agency will assume, in accordance with CEQA Guidelines section 15082(b)(2) that you have no comments on the Supplement to the NOP.

**Project Location and Background**

The Pure Water Monterey GWR Project would be located within northern Monterey County, and would include new facilities located within the unincorporated areas of the Salinas Valley and the cities of Salinas, Marina, Seaside, Monterey, and Pacific Grove. Figure 1 shows the proposed location of project facilities; locations that have been updated since publication of the May 2013 NOP are indicated by red dashed-line circles.

The Pure Water Monterey Groundwater Replenishment Project would create a reliable source of water supply for northern Monterey County. The project would provide purified water for recharge of the Seaside Groundwater Basin, and recycled water to augment the existing Castroville Seawater Intrusion Project's (CSIP) agricultural irrigation supply. The project is jointly sponsored by the MRWPCA and the Monterey Peninsula Water Management District (Water Management District).

The sources of water proposed to be recycled, treated and reused by the project are the same as those presented in the May 2013 NOP: municipal wastewater, industrial wastewater, urban stormwater runoff, and surface water diversions from the Blanco Drain and Reclamation Ditch. The source waters would be conveyed to the Regional Treatment Plant, which is located two miles north of the City of Marina and operated by MRWPCA.

The project objectives also have not changed. The primary objective of the project is to produce 3,500 acre-feet per year (AFY) of high quality replacement water to California American Water Company (CalAm) for delivery to its customers in the Monterey District Service area; thereby enabling CalAm to reduce its diversions from the Carmel River system by this same amount. CalAm is under a state order to secure replacement water supplies to reduce its Carmel River diversions by December 2016. CalAm also is required to reduce its pumping in the Seaside Groundwater Basin in accordance with the Watermaster's pumping mandates. Under the proposed project, highly treated water would be injected into the Seaside Basin. This highly-treated water would be produced from a new advanced water treatment facility that would be constructed at the Regional Treatment Plant and would treat the source waters identified above. The product water from the advanced treatment plant would be conveyed to and injected into the Seaside Basin via a new pipeline and new well facilities. The highly-treated water would then mix with the existing groundwater and be stored for future urban use by CalAm.

Another purpose of the project is to provide additional recycled water for crop irrigation in the CSIP area. Currently, the only sources of supply for the existing water recycling facility at the Salinas Valley Reclamation Plant (located at the Regional Treatment Plant site) are municipal wastewater and small amounts of urban dry weather runoff. Municipal wastewater flows have declined in recent years due to aggressive water conservation efforts by the MRWPCA member entities. By increasing the amount and type of source waters entering the wastewater collection system, additional recycled water can be provided for use in the CSIP area.

**Updates to the Pure Water Monterey GWR Project Description**

As noted above, ongoing engineering and technical evaluations and regional coordination efforts have resulted in some updates to the project description since the May 2013 NOP was issued. The full original project description is included in the *"Monterey Peninsula Groundwater Replenishment Project*

*Environmental Impact Report Notice of Preparation"* (May 2013), and is available for review at the MRWPCA Administrative Offices (5 Harris Court, Building D, Monterey, CA 93940) and on the project website: www. purewatermonterey.org. Following is a description of the project description updates.

- **Source waters:** All of the source waters identified in the May 2013 NOP are still being evaluated in the EIR as potential sources for the project. Ongoing engineering studies have now identified the volume of additional recycled water that could be provided to the CSIP area from the project. As source flows for the proposed project were studied and the seasonal variability of each was understood, the stakeholder agencies entered into a Memorandum of Understanding Regarding Source Waters and Water Recycling (MOU). The Parties to the MOU are the MRWPCA, the Monterey County Water Resources Agency, the City of Salinas, the Marina Coast Water District (MCWD), and the Monterey Peninsula Water Management District. The MOU is an agreement to "negotiate a Definitive Agreement to establish contractual rights and obligations of all Parties," that would include (1) protection of MCWD's recycled water right entitlement, (2) provision of up to 5,292 AFY of recycled water to Monterey County Water Resources Agency for the CSIP, and (3) provision of 3,500 AFY of highly treated water for injection into the Seaside Groundwater Basin and extraction by CalAm. The MOU also includes provisions for creation of a drought reserve, as discussed below. The MOU reflects the stakeholder agencies' positions regarding the combined benefits and conditions that would be required to secure the necessary rights and agreements to use the source waters needed for the proposed project.
- **Drought reserve storage and recovery:** The proposed project now includes a drought reserve component to support crop irrigation during dry years. Under this component, an extra 200 AFY of advanced treated water would be injected in the Seaside Basin during normal and wet years, up to a total of 1,000 AF, to create a "banked reserve." During drought years, MRWPCA would reduce the amount of water that it provides to the Seaside Groundwater Basin in order to increase production of recycled water for crop irrigation. CalAm would be able to extract the banked water in the Seaside Groundwater Basin to make up the difference to its supplies, such that its extractions and deliveries would not fall below 3,500 acre-feet per year.
- **Project facilities:** Ongoing technical and engineering evaluations have resulted in some new proposed project facilities and updates to other proposed facilities, as noted below.
  - *Optimization of recycled water production at the Salinas Valley Reclamation Project*: New improvements at the existing reclamation plant would enable it to produce more continuous flows in the winter and enhanced delivery to the CSIP area. Proposed improvements would include new sluice gates, a new pipeline between the existing inlet and outlet structures within the storage pond, chlorination basin upgrades, and a new storage pond platform. All of the modifications would occur within the existing Salinas Valley Reclamation Plant footprint. (Item #1 on Figure 1)
  - *Diversion location at Tembladero Slough.* The proposed project now includes a proposed diversion from Tembladero Slough, which is part of the Reclamation Ditch drainage system. This diversion would consist of a new intake structure on the channel bottom, which would connect to a new lift station on the channel bank via a new gravity pipeline. The new intake would be screened to prevent fish and trash from entering the new pump station. The new pump station would discharge through a new force main to the existing wet well at the MRWPCA Castroville Pump Station. The channel banks and invert near the pump station intake would be lined with concrete to prevent scouring. (Item #2 on Figure 1)

- *Removal of coastal recharge facilities as an injection location option in the Seaside Basin*: Groundwater modeling indicates that the coastal location is not feasible for injection. The proposed project now includes only the inland location for the injection facilities. Product water pipelines to that site have also been eliminated as a component of the proposed project. (Item #3 on Figure 1)
- *Inclusion of CalAm's proposed new distribution system pipelines as part of the GWR project*: Because the CalAm water supply system was initially built to deliver water from Carmel Valley to Monterey Peninsula cities, a hydraulic trough currently exists in the peninsula distribution system that prevents water delivery at adequate quantities from the Seaside Groundwater Basin to most of Monterey, and all of Pacific Grove, Pebble Beach, Carmel Valley, and City of Carmel areas. CalAm is proposing to construct two new pipelines, the Transfer and Monterey pipelines (located in Monterey), to bridge this trough. These pipelines are being studied in the EIR for the Monterey Peninsula Water Supply Project proposed by CalAm. Because the pipelines are also needed to deliver the full amount of GWR water injected into the Seaside Basin to CalAm customers, they are now also included as part of the GWR project. (Item #4 on Figure 1)
- *Method of collecting and conveying agricultural wash water from the Salinas Treatment Facility:* The May 2013 NOP envisioned that agricultural washwater would be conveyed by a new pump station and pipeline to a proposed new Blanco Drain pump station, and from there to the Regional Treatment Plant. This water is now proposed to be diverted from the existing Salinas collection and treatment facilities to the existing Salinas Pump Station. The wash water would then mix with the municipal wastewater and be conveyed through the existing 36-inch diameter Salinas interceptor to the Regional Treatment Plant. (Item #5 on Figure 1)

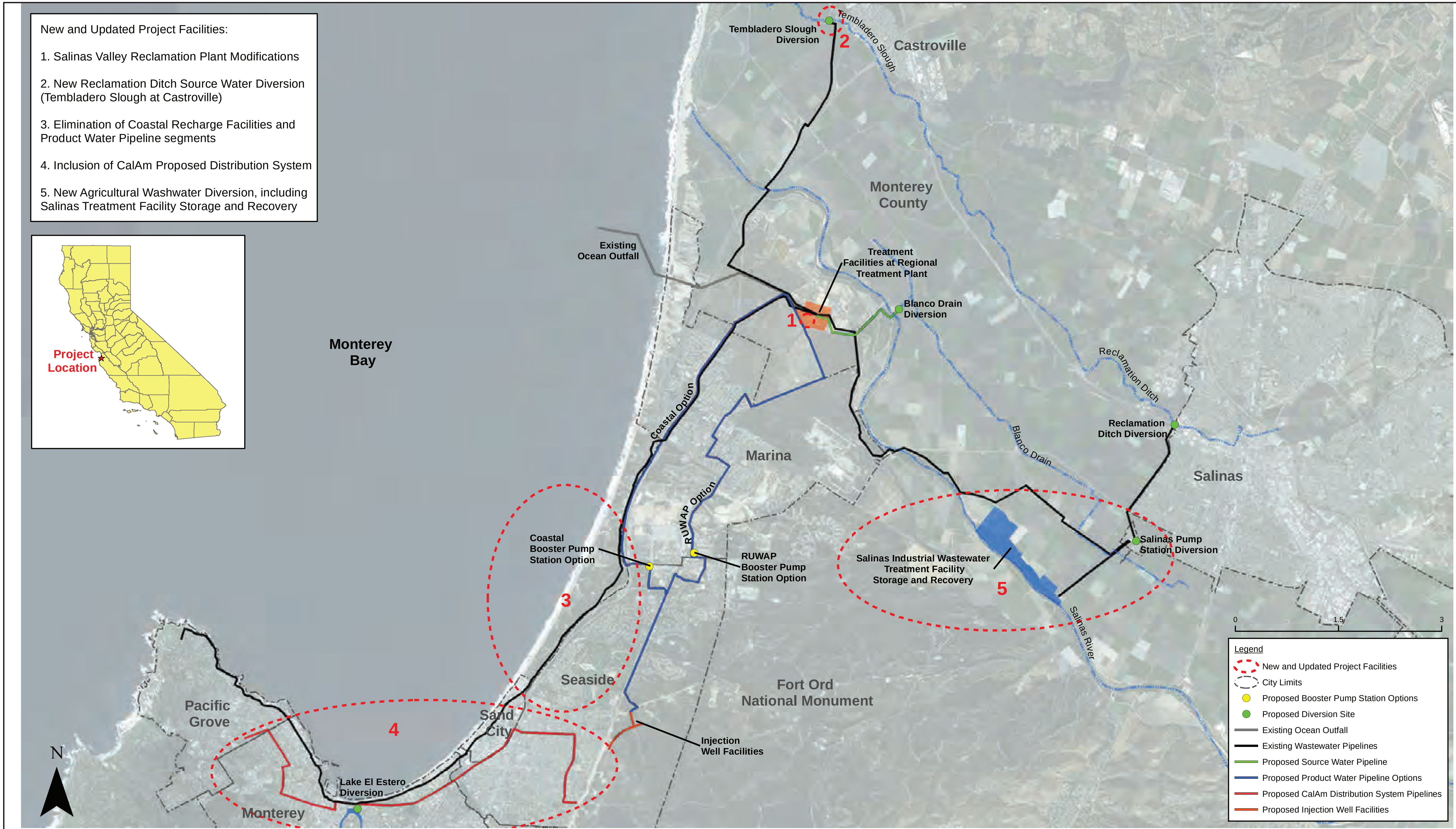
**Environmental Analysis**

As described within the May 2013 NOP, the EIR will assess the following issues of potential environmental effect: aesthetic resources, air quality and greenhouse gas emissions, biological resources, cultural resources, geology and soils, hazards and hazardous materials, hydrogeology and groundwater quality, hydrology and surface water quality, land use and planning, noise and vibration, population and housing, transportation and traffic, other environmental issues (e.g., public services and utilities; energy delivery systems; agricultural, mineral and forest resources). The EIR will also evaluate growth-inducing effects that could result from implementation of the project, as well as cumulative impacts and alternatives to the project.

**Availability of Supplement to the NOP**

The Supplement to the NOP is available for a 30-day public review period beginning December 10, 2014 and ending January 8, 2015. Copies of the document are available for review at MRWPCA, 5 Harris Court, Building D, Monterey CA 93940 and on the MRWPCA website at: www.purewatermonterey.org. Additionally, copies of this document are available for review at the following libraries:

Seaside Public Library
Marina Public Library
Salinas Public Libraries
Castroville Public Library
Monterey Public Library
Carmel Valley Public Library
Harrison Memorial Library (Carmel)




DD&A

# New and Updated Project Facilities

December 2014

Pure Water Monterey GWR Project
Supplemental Notice of Preparation

Figure 1

# APPENDIX F

## SUPPLEMENT TO NOP COMMENT LETTERS

REC'D DEC 12 2014

STATE OF CALIFORNIA

Governor's Office of Planning and Research

State Clearinghouse and Planning Unit

Edmund G. Brown Jr.
Governor

Ken Alex
Director

**Notice of Preparation**

December 9, 2014

To: Reviewing Agencies

Re: Monterey Peninsula Groundwater Replenishment (Pure Water Monterey) Project
SCH# 2013051094

Attached for your review and comment is the Notice of Preparation (NOP) for the Monterey Peninsula Groundwater Replenishment (Pure Water Monterey) Project draft Environmental Impact Report (EIR).

Responsible agencies must transmit their comments on the scope and content of the NOP, focusing on specific information related to their own statutory responsibility, within 30 days of receipt of the NOP from the Lead Agency. This is a courtesy notice provided by the State Clearinghouse with a reminder for you to comment in a timely manner. We encourage other agencies to also respond to this notice and express their concerns early in the environmental review process.

Please direct your comments to:

**Bob Holden**
**Monterey Regional Water Pollution Control Agency**
**5 Harris Court, Building D**
**Monterey, CA 93940**

with a copy to the State Clearinghouse in the Office of Planning and Research. Please refer to the SCH number noted above in all correspondence concerning this project.

If you have any questions about the environmental document review process, please call the State Clearinghouse at (916) 445-0613.

Sincerely,

Scott Morgan
Director, State Clearinghouse

Attachments
cc: Lead Agency

1400 TENTH STREET P.O. BOX 3044 SACRAMENTO, CALIFORNIA 95812-3044
TEL (916) 445-0613 FAX (916) 323-3018 www.opr.ca.gov

# Document Details Report
# State Clearinghouse Data Base

***SCH#*** **2013051094**
***Project Title*** Monterey Peninsula Groundwater Replenishment (Pure Water Monterey) Project
***Lead Agency*** Monterey Regional Water Pollution Control Agency

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***Type*** **NOP** Notice of Preparation

***Description*** The Pure Water Monterey Groundwater Replenishment Project would create a reliable source of water supply for northern Monterey County. The project would provide purified water for recharge of the Seaside Groundwater Basin, and recycled water to augment the existing Castroville Seawater Intrusion Project's agricultural irrigation supply. The project would be located within northern Monterey County, and would include new facilities located within the unincorporated areas of the Salinas Valley and the cities of Salinas, Marina, Monterey and Pacific Grove.

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## Lead Agency Contact

***Name*** Bob Holden
***Agency*** Monterey Regional Water Pollution Control Agency
***Phone*** 831 372 3367 ***Fax***
***email***
***Address*** 5 Harris Court, Building D
***City*** Monterey ***State*** CA ***Zip*** 93940

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## Project Location

***County*** Monterey
***City*** Seaside, Marina
***Region***
***Cross Streets***
***Lat / Long***
***Parcel No.*** numerous
***Township*** ***Range*** ***Section*** ***Base***

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## Proximity to:

***Highways*** Hwy 1, 156, 68
***Airports*** Monterey Peninsula, Marina
***Railways***
***Waterways*** Salinas and Carmel Rivers, other creeks/ditches, sloughs
***Schools*** numerous
***Land Use*** Various

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***Project Issues*** Agricultural Land; Archaeologic-Historic; Air Quality; Biological Resources; Coastal Zone; Drainage/Absorption; Economics/Jobs; Flood Plain/Flooding; Geologic/Seismic; Minerals; Noise; Population/Housing Balance; Public Services; Recreation/Parks; Schools/Universities; Sewer Capacity; Soil Erosion/Compaction/Grading; Solid Waste; Toxic/Hazardous; Traffic/Circulation; Vegetation; Water Quality; Water Supply; Wetland/Riparian; Growth Inducing; Landuse; Cumulative Effects; Aesthetic/Visual; Forest Land/Fire Hazard

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***Reviewing Agencies*** Resources Agency; California Coastal Commission; Department of Parks and Recreation; Department of Water Resources; Department of Fish and Wildlife, Region 4; Office of Emergency Services, California; Native American Heritage Commission; State Lands Commission; Caltrans, District 5; Air Resources Board; State Water Resources Control Board, Divison of Financial Assistance; State Water Resources Control Board, Division of Drinking Water; State Water Resources Control Board, Division of Water Quality; State Water Resources Control Board, Division of Water Rights; Department of Toxic Substances Control; Regional Water Quality Control Board, Region 3

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***Date Received*** 12/09/2014 ***Start of Review*** 12/09/2014 ***End of Review*** 01/07/2015

Print Form

*Appendix C*

## Notice of Completion & Environmental Document Transmittal

*Mail to:* State Clearinghouse, P.O. Box 3044, Sacramento, CA 95812-3044 (916) 445-0613
*For Hand Delivery/Street Address:* 1400 Tenth Street, Sacramento, CA 95814

**SCH #2013051094**

**Project Title:** Monterey Peninsula Groundwater Replenishment (Pure Water Monterey) Project

Lead Agency: Monterey Regional Water Pollution Control Agency
Contact Person: Bob Holden, Principal Engineer
Mailing Address: 5 Harris Court, Building D
Phone: (831)372-3367
City: Monterey  Zip: 93940  County: Monterey

**Project Location:** County: Monterey  City/Nearest Community: Seaside, Marina, Unincorporated County
Cross Streets: not applicable  Zip Code:
Longitude/Latitude (degrees, minutes and seconds): ____° ____′ ____″ N / ____° ____′ ____″ W  Total Acres:
Assessor's Parcel No.: numerous  Section:  Twp.:  Range:  Base:
Within 2 Miles: State Hwy #: 1, 156, 68  Waterways: Salinas and Carmel Rivers, other creeks/ditches/sloughs
Airports: Monterey Peninsula  Railways:  Schools: numerous

**Document Type:**

CEQA: ☒ NOP ☐ Early Cons ☐ Neg Dec ☐ Mit Neg Dec ☐ Draft EIR ☐ Supplement/Subsequent EIR (Prior SCH No.) ____ Other: Supplement to NOP

NEPA: ☐ NOI ☐ EA ☐ Draft EIS ☐ FONSI

Other: ☐ Joint Document ☐ Final Document ☐ Other:

RECEIVED
STATE CLEARINGHOUSE

**Local Action Type:**

☐ General Plan Update ☐ General Plan Amendment ☐ General Plan Element ☐ Community Plan
☐ Specific Plan ☐ Master Plan ☐ Planned Unit Development ☐ Site Plan
☐ Rezone ☐ Prezone ☐ Use Permit ☐ Land Division (Subdivision, etc.)
☐ Annexation ☐ Redevelopment ☐ Coastal Permit ☒ Other: Project approval

**Development Type:**

☐ Residential: Units ____ Acres ____
☐ Office: Sq.ft. ____ Acres ____ Employees ____
☐ Commercial: Sq.ft. ____ Acres ____ Employees ____
☐ Industrial: Sq.ft. ____ Acres ____ Employees ____
☐ Educational:
☐ Recreational:
☒ Water Facilities: Type water supply  MGD 6
☐ Transportation: Type
☐ Mining: Mineral
☐ Power: Type ____ MW ____
☐ Waste Treatment: Type ____ MGD ____
☐ Hazardous Waste: Type
☐ Other:

**Project Issues Discussed in Document:**

☒ Aesthetic/Visual
☒ Agricultural Land
☒ Air Quality
☒ Archeological/Historical
☒ Biological Resources
☒ Coastal Zone
☒ Drainage/Absorption
☒ Economic/Jobs
☐ Fiscal
☒ Flood Plain/Flooding
☒ Forest Land/Fire Hazard
☒ Geologic/Seismic
☒ Minerals
☒ Noise
☒ Population/Housing Balance
☒ Public Services/Facilities
☒ Recreation/Parks
☒ Schools/Universities
☐ Septic Systems
☒ Sewer Capacity
☒ Soil Erosion/Compaction/Grading
☒ Solid Waste
☒ Toxic/Hazardous
☒ Traffic/Circulation
☒ Vegetation
☒ Water Quality
☒ Water Supply/Groundwater
☒ Wetland/Riparian
☒ Growth Inducement
☒ Land Use
☒ Cumulative Effects
☐ Other:

**Present Land Use/Zoning/General Plan Designation:**
Various

**Project Description:** *(please use a separate page if necessary)*
The Pure Water Monterey Groundwater Replenishment Project would create a reliable source of water supply for northern Monterey County. The project would provide purified water for recharge of the Seaside Groundwater Basin, and recycled water to augment the existing Castroville Seawater Intrusion Project's agricultural irrigation supply. The project would be located within northern Monterey County, and would include new facilities located within the unincorporated areas of the Salinas Valley and the cities of Salinas, Marina, Seaside, Monterey and Pacific Grove.

*Note: The State Clearinghouse will assign identification numbers for all new projects. If a SCH number already exists for a project (e.g. Notice of Preparation or previous draft document) please fill in.*

# NOP Distribution List

**County:** Monterey **SCH#** 2013051094

## Resources Agency

- [x] **Resources Agency**
  Nadell Gayou
- [ ] **Dept. of Boating & Waterways**
  Nicole Wong
- [x] **California Coastal Commission**
  Elizabeth A. Fuchs
- [ ] **Colorado River Board**
  Lisa Johansen
- [ ] **Dept. of Conservation**
  Elizabeth Carpenter
- [ ] **California Energy Commission**
  Eric Knight
- [ ] **Cal Fire**
  Dan Foster
- [ ] **Central Valley Flood Protection Board**
  James Herota
- [ ] **Office of Historic Preservation**
  Ron Parsons
- [x] **Dept of Parks & Recreation**
  Environmental Stewardship Section
- [ ] **California Department of Resources, Recycling & Recovery**
  Sue O'Leary
- [ ] **S.F. Bay Conservation & Dev't. Comm.**
  Steve McAdam
- [x] **Dept. of Water Resources**
  Resources Agency
  Nadell Gayou

## Fish and Game

- [ ] **Depart. of Fish & Wildlife**
  Scott Flint
  Environmental Services Division
- [ ] **Fish & Wildlife Region 1**
  Donald Koch
- [ ] **Fish & Wildlife Region 1E**
  Laurie Harnsberger
- [ ] **Fish & Wildlife Region 2**
  Jeff Drongesen
- [ ] **Fish & Wildlife Region 3**
  Charles Armor
- [x] **Fish & Wildlife Region 4**
  Julie Vance
- [ ] **Fish & Wildlife Region 5**
  Leslie Newton-Reed
  Habitat Conservation Program
- [ ] **Fish & Wildlife Region 6**
  Tiffany Ellis
  Habitat Conservation Program
- [ ] **Fish & Wildlife Region 6 I/M**
  Heidi Sickler
  Inyo/Mono, Habitat Conservation Program
- [ ] **Dept. of Fish & Wildlife M**
  George Isaac
  Marine Region

## Other Departments

- [ ] **Food & Agriculture**
  Sandra Schubert
  Dept. of Food and Agriculture
- [ ] **Depart. of General Services**
  Public School Construction
- [ ] **Dept. of General Services**
  Anna Garbeff
  Environmental Services Section
- [ ] **Delta Stewardship Council**
  Kevan Samsam
- [ ] **Housing & Comm. Dev.**
  CEQA Coordinator
  Housing Policy Division

## Independent Commissions, Boards

- [ ] **Delta Protection Commission**
  Michael Machado
- [x] **OES (Office of Emergency Services)**
  Dennis Castrillo
- [x] **Native American Heritage Comm.**
  Debbie Treadway
- [ ] **Public Utilities Commission**
  Leo Wong
- [ ] **Santa Monica Bay Restoration**
  Guangyu Wang
- [x] **State Lands Commission**
  Jennifer Deleong
- [ ] **Tahoe Regional Planning Agency (TRPA)**
  Cherry Jacques

## Cal State Transportation Agency CalSTA

- [ ] **Caltrans - Division of Aeronautics**
  Philip Crimmins
- [ ] **Caltrans – Planning**
  HQ LD-IGR
  Terri Pencovic
- [ ] **California Highway Patrol**
  Suzann Ikeuchi
  Office of Special Projects

## Dept. of Transportation

- [ ] **Caltrans, District 1**
  Rex Jackman
- [ ] **Caltrans, District 2**
  Marcelino Gonzalez
- [ ] **Caltrans, District 3**
  Eric Federicks – South
  Susan Zanchi - North
- [ ] **Caltrans, District 4**
  Erik Alm
- [x] **Caltrans, District 5**
  Larry Newland
- [ ] **Caltrans, District 6**
  Michael Navarro
- [ ] **Caltrans, District 7**
  Dianna Watson
- [ ] **Caltrans, District 8**
  Mark Roberts
- [ ] **Caltrans, District 9**
  Gayle Rosander
- [ ] **Caltrans, District 10**
  Tom Dumas
- [ ] **Caltrans, District 11**
  Jacob Armstrong
- [ ] **Caltrans, District 12**
  Maureen El Harake

## Cal EPA

**Air Resources Board**

- [x] All Other Projects
  Cathi Slaminski
  - [ ] Transportation Projects
    Nesamani Kalandiyur
  - [ ] Industrial/Energy Projects
    Mike Tollstrup
- [x] **State Water Resources Control Board**
  Regional Programs Unit
  Division of Financial Assistance
- [x] **State Water Resources Control Board**
  Jeffery Werth
  Division of Drinking Water
- [x] **State Water Resources Control Board**
  Student Intern, 401 Water Quality Certification Unit
  Division of Water Quality
- [x] **State Water Resouces Control Board**
  Phil Crader
  Division of Water Rights
- [x] **Dept. of Toxic Substances Control**
  CEQA Tracking Center
- [ ] **Department of Pesticide Regulation**
  CEQA Coordinator

## Regional Water Quality Control Board (RWQCB)

- [ ] **RWQCB 1**
  Cathleen Hudson
  North Coast Region (1)
- [ ] **RWQCB 2**
  Environmental Document Coordinator
  San Francisco Bay Region (2)
- [x] **RWQCB 3**
  Central Coast Region (3)
- [ ] **RWQCB 4**
  Teresa Rodgers
  Los Angeles Region (4)
- [ ] **RWQCB 5S**
  Central Valley Region (5)
  - [ ] **RWQCB 5F**
    Central Valley Region (5)
    Fresno Branch Office
  - [ ] **RWQCB 5R**
    Central Valley Region (5)
    Redding Branch Office
- [ ] **RWQCB 6**
  Lahontan Region (6)
  - [ ] **RWQCB 6V**
    Lahontan Region (6)
    Victorville Branch Office
- [ ] **RWQCB 7**
  Colorado River Basin Region (7)
- [ ] **RWQCB 8**
  Santa Ana Region (8)
- [ ] **RWQCB 9**
  San Diego Region (9)

- [ ] Other ____________________
- [ ] ____________________
  Conservancy

Last Updated 10/13/2014

18 December 2014

Mr. Bob Holden, Principal Engineer
Monterey Regional Water Pollution Control Agency
Email: gwr@mrwpca.com

Re: SUPPLEMENT TO THE MAY 2013 NOTICE OF PREPARATION FOR THE MONTEREY PENINSULA GROUNDWATER REPLENISHMENT (PURE WATER MONTEREY) PROJECT ENVIRONMENTAL IMPACT REPORT

Dear Mr. Holden:

Following are comments by WaterPlus on the 8 December 2014 supplement to the NOP for the Pure Water Monterey Project.

❖ **Claimed project benefits.** An overview of the project claimed the project would meet these goals:

- Create a reliable, publicly owned, safe water supply for Monterey Peninsula.
- Allow other, more energy-intensive, options such as seawater desalination to be smart-sized, thus enhancing the overall environmental benefits.
- Diversify the community's water supply portfolio for a more secure water supply.
- Be online sooner and use far less energy than most other water supply alternatives

To assure a safe water supply from advanced-level purification of municipal sewer water, you would need, in addition to the processes described, either an amount of fresh water equal to the amount of treated water for combined injection into the Seaside Aquifer or the filtration of the treated water in settlement ponds prior to aquifer injection, as in Santa Ana. The report makes no mention of these state Health Department requirements or of how the project intends to meet them. Does the project still intend to process municipal sewer water for injection into the Seaside Aquifer? If not, the supplement should say as much.

What does the overview mean by "smart-sized"? Reduced energy use? That in itself may be smart but still has to be demonstrated with comparable numbers describing this and alternative projects. The cost of this alternative must also be compared with the cost of others. The report claims $3,000 an acre-foot but needs to break down that figure into components and update it if necessary (for example, if it now includes the cost of DDT and other pesticide purification from agricultural run-off sources). The cost of desal per unit decreases with increasing plant size, and so down-sizing a desal plant only increases its cost. That is not smart. The large desal plant at Carlsbad is about $1,000 less costly per acre-foot than the proposed GWR project, and so the implication for smart-sizing would be to increase rather than decrease the desal-plant size. This conflict requires discussion and resolution.

Dependence on diversified water-supply sources can make a community vulnerable to the failure of the least reliable of the sources, which in this case would be GWR along with aquifer storage and recovery because both are vulnerable to drought while the first is also vulnerable to conservation efforts for whatever reason, as the supplement itself acknowledges. Diversification is not a given as a good thing. It needs objective discussion and substantiation.

Every water-supply option requires an energy audit, and this one is no exception. A desal plant at Moss Landing may be powered by solar and wind energy, for example, and the cost effect of that may still keep desal more than competitive with GWR. These comparisons need to be made objectively in an EIR if it is not to be merely a Public Relations document in disguise.

- **The MOU underlying the NOP supplement.** The supplement is at least partly the product of an MOU described as "an agreement to negotiate a Definitive Agreement to establish contractual rights and obligations of all Parties, that would include (1) protection of MCWD's recycled water right entitlement, (2) provision of up to 5,292 AFY of recycled water to Monterey County Water Resources Agency for the CSIP, and (3) provision of 3,500 AFY of highly treated water for injection into the Seaside Groundwater Basin and extraction by Cal Am."

This MOU does not indicate specifically how the parties to the agreement would deal with the 19,500 acre-feet of treated sewer water that Salinas Valley growers claim the right to use. Will the growers continue to have this right or will it be reduced? If any reduced amount is to be treated for injection into the Seaside Aquifer, as originally planned, has this option been presented to the public for approval by Cal Am customers and, particularly, by authorized representatives of the local hospitality industry? The NOP supplement must specify how much untreated water is needed to meet the treated-water requirement and indicate both (a) the sources of this water, together with the amount of water available annually from each, and (b) where the treatment residuals will go--important information for inclusion in an EIR .

In summary, the NOP document needs transformation from what in too many portions appears to be a Public Relations endorsement of the project to an objective and reliably documented project report.

Very respectfully,

Ron Weitzman
President, WaterPlus

STATE OF CALIFORNIA
NATIVE AMERICAN HERITAGE COMMISSION
1550 Harbor Blvd., ROOM 100
West SACRAMENTO, CA 95691
(916) 373-3710
Fax (916) 373-5471

Edmond G. Brown, Jr., *Governor*

December 24, 2014

Bob Holden
Monterey Regional Water Pollution Control Agency
5 Harris Court, Building D
Monterey, CA 93940

RE: SCH # 2013051094 Monterey Peninsula Groundwater Replenishment (Pure Water Monterey) Project, Monterey County.

Dear Mr. Holden,

The Native American Heritage Commission (NAHC) has reviewed the Notice of Preparation (NOP) referenced above. The California Environmental Quality Act (CEQA) states that any project that causes a substantial adverse change in the significance of an historical resource, which includes archeological resources, is a significant effect requiring the preparation of an EIR (CEQA Guidelines 15064(b)). To comply with this provision the lead agency is required to assess whether the project will have an adverse impact on historical resources within the area of project effect (APE), and if so to mitigate that effect. To adequately assess and mitigate project-related impacts to archaeological resources, the NAHC recommends the following actions:

- ✓ Contact the appropriate regional archaeological Information Center for a record search. The record search will determine:
  - If a part or all of the area of project effect (APE) has been previously surveyed for cultural resources.
  - If any known cultural resources have already been recorded on or adjacent to the APE.
  - If the probability is low, moderate, or high that cultural resources are located in the APE.
  - If a survey is required to determine whether previously unrecorded cultural resources are present.
- ✓ If an archaeological inventory survey is required, the final stage is the preparation of a professional report detailing the findings and recommendations of the records search and field survey.
  - The final report containing site forms, site significance, and mitigation measurers should be submitted immediately to the planning department. All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum, and not be made available for pubic disclosure.
  - The final written report should be submitted within 3 months after work has been completed to the appropriate regional archaeological Information Center.
- ✓ Contact the Native American Heritage Commission for:
  - A Sacred Lands File Check. **USGS 7.5-minute quadrangle name, township, range, and section required**
  - A list of appropriate Native American contacts for consultation concerning the project site and to assist in the mitigation measures. **Native American Contacts List attached.**
- ✓ Lack of surface evidence of archeological resources does not preclude their subsurface existence.
  - Lead agencies should include in their mitigation plan provisions for the identification and evaluation of accidentally discovered archeological resources, per California Environmental Quality Act (CEQA) Guidelines §15064.5(f). In areas of identified archaeological sensitivity, a certified archaeologist and a culturally affiliated Native American, with knowledge in cultural resources, should monitor all ground-disturbing activities.
  - Lead agencies should include in their mitigation plan provisions for the disposition of recovered cultural items that are not burial associated, which are addressed in Public Resources Code (PRC) §5097.98, in consultation with culturally affiliated Native Americans.
  - Lead agencies should include provisions for discovery of Native American human remains in their mitigation plan. Health and Safety Code §7050.5, PRC §5097.98, and CEQA Guidelines §15064.5(e), address the process to be followed in the event of an accidental discovery of any human remains and associated grave goods in a location other than a dedicated cemetery.

Sincerely,

Katy Sanchez

Katy Sanchez
Associate Government Program Analyst

CC: State Clearinghouse

**Native American Contacts**
**Monterey County**
**December 16, 2014**

Jakki Kehl
720 North 2nd Street
Patterson , CA 95363
jakkikehl@gmail.com
510-701-3975
Ohlone/Costanoan

Amah MutsunTribal Band
Valentin Lopez, Chairperson
P.O. Box 5272
Galt , CA 95632
vlopez@amahmutsun.org
(916) 743-5833
Ohlone/Costanoan
Northern Valley Yokuts

Coastanoan Rumsen Carmel Tribe
Tony Cerda, Chairperson
240 E. 1st Street
Pomona , CA 91766
rumsen@aol.com
(909) 524-8041 Cell
(909) 629-6081
Ohlone/Costanoan

Amah MutsunTribal Band of Mission San Juan Bautista
Irenne Zwierlein, Chairperson
789 Canada Road
Woodside , CA 94062
amahmutsuntribal@gmail.
(650) 400-4806 Cell
(650) 332-1526 Fax
Ohlone/Costanoan

Ohlone/Coastanoan-Esselen Nation
Louise Miranda-Ramirez, Chairperson
P.O. Box 1301
Monterey , CA 93942
ramirez.louise@yahoo.com
(408) 629-5189
(408) 205-7579 Cell
Esselen
Ohlone/Costanoan

Ohlone/Coastanoan-Esselen Nation
Christianne Arias, Vice Chairperson
P.O. Box 552
Soledad , CA 93960
(831) 235-4590
Esselen
Ohlone/Costanoan

Trina Marine Ruano Family
Ramona Garibay, Representative
30940 Watkins Street
Union City , CA 94587
soaprootmo@comcast.net
(510) 972-0645
Ohlone/Costanoan
Bay Miwok
Plains Miwok
Patwin

Amah MutsunTribal Band
Edward Ketchum
35867 Yosemite Ave
Davis , CA 95616
aerieways@aol.com
Ohlone/Costanoan
Northern Valley Yokuts

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of the statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.

This list is only applicable for contacting locative Americans with regard to cultural resources for the proposed SCH # 2013051094 Monterey Peninsula Groundwater Replenishment (Pure Water Monterey) Project, Monterey County.

**Native American Contacts**
**Monterey County**
**December 16, 2014**

Ohlone/Coastanoan-Esselen Nation
Pauline Martinez-Arias, Tribal Council woman
1116 Merlot Way — Esselen
Gonzales , CA 93926 — Ohlone/Costanoan
maklici0-us@gmail
(831) 596-9897

Indian Canyon Mutsun Band of Costanoan
Ann Marie Sayers, Chairperson
P.O. Box 28 — Ohlone/Costanoan
Hollister , CA 95024
ams@indiancanyon.org
(831) 637-4238

Amah MutsunTribal Band of Mission San Juan Bautista
Michelle Zimmer
789 Canada Road — Ohlone/Costanoan
Woodside , CA 94062
amahmutsuntribal@gmail.com
(650) 851-7747 Home
(650) 332-1526 Fax

**This list is current only as of the date of this document.**

**Distribution of this list does not relieve any person of the statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.**

**This list is only applicable for contacting locative Americans with regard to cultural resources for the proposed SCH # 2013051094 Monterey Peninsula Groundwater Replenishment (Pure Water Monterey) Project, Monterey County.**

From: PETER LE [mailto:peter381@sbcglobal.net]
Sent: Sunday, January 04, 2015 8:30 PM
To: GWR
Subject: Comments on the Supplement to May 2013 NOP dated December 8, 2014

January 4, 2015

Mr. Bob Holden
Principal Engineer, MRWPCA
Phone: 372-3367 Fax: 372-6178
gwr@mrwpca.com

I have the following comments on the scope and contents of the GWR (Pure Water Monterey) EIR prepared by MRWPCA based on the Supplement to May 2013 NOP dated December 8, 2014:

1. The EIR needs to analyze thoroughly, calculate and show in table format how the proposed project affects the agreed recycled water capacity and rights of the MCWD in the approximate amount of 1.1 MGD. If MCWD utilizes it 300 AF per month during summer months and the full 1.1 MGD recycled water during remaining months (not including any unused recycled water), how much treated water the proposed project can provide from different water sources? The EIR cannot assume that MCWD will not utilize its senior water rights of the recycled water in any given month and/or any given year. The EIR cannot assume that MCWD gives up its senior water rights of the recycled water either.

2. The MRWPCA claimed that it has spent about 3 million dollars on planning, designing and modifying the regional treatment plant to provide recycled water to MCWD under the executed 2009 RUWAP agreement. Will this project utilize the MCWD designs or modified regional treatment that will be paid by MCWD for this project? What additional work on the regional treatment plant that will be done on this project? How does MRWPCA identify and separate all costs for two different projects, MCWD and Pure Water Project?

3. What impacts does this proposed project affect the MCWD recycled water or RUWAP project in terms of completed designs? What is the required separation between MRWPCA recycled pipes and MCWD recycled pipes?

4. The EIR needs to consider the alternative of pumping excess winter flow from the Salinas River, treat it, and recharge the Seaside Aquifer.

5. How do the discharges of the proposed advanced water treatment plant and secondary source water affect the MCWD brine disposal capacity as described in the executed agreement with MRWPCA and the total capacity of the existing outfalls? What is the status of the executed MCWD brine disposal agreement with MRWPCA?

6. How does this project affect access to the District's property at the Armstrong Ranch and adjacent to the MRWPCA property and impact the proposed use of the District's property?

7. Will this EIR utilize any part of the adopted and paid for by MCWD RUWAP EIR and/or any previously EIR's adopted and paid for by MCWD?

The above comments are mine and they do not represent the official comments from MCWD. Let me know if you have any questions.

Sincerely,

signed by Peter Le

SURFRIDER FOUNDATION MONTEREY CHAPTER

January 7, 2015

Monterey Regional Water Pollution Control Agency
Attn: Bob Holden, Principal Engineer
5 Harris Court, Building G
Monterey, CA 93940
gwr@mrwpca.com

Re: comments on Supplement to the Notice of Preparation for Monterey Peninsula Groundwater Replenishment Project - SCH#2013051094

*Via electronic mail*

Dear Mr. Holden,

Thank you for the opportunity to comment on the Supplement to the Notice of Preparation ("Supplement to the NOP") for the Monterey Peninsula Groundwater Replenishment Project. Surfrider Foundation is a non-profit environmental organization dedicated to the protection and enjoyment of oceans, waves, and beaches through a powerful activist network. In support of this mission, and specifically in support of protecting water quality and marine ecosystems, the Surfrider Foundation Monterey Chapter has been very engaged in the effort to identify water supply and demand offsetting solutions for peninsula cities, which would replace the deficit of water that was formerly supplied by the Carmel River and Seaside Groundwater Basin.

The Surfrider Foundation Monterey Chapter ("Surfrider") wishes to offer the following comments on the document:

On page three of the Supplement to the NOP, it ~~is mentioned~~ states that one of the project changes is the addition of a water diversion at Tembladero Slough, comprised of a new intake structure on the channel bottom screened to "prevent fish" from entering the pump system.

Although the Tembladero Slough is very impaired (--it is a Clean Water Act Section 303d-listed water body for impairments from pesticides, nutrients, fecal coliform, and ammonia), it serves an important role in delivering freshwater into the Elkhorn Slough and also supports aquatic life, including the federally listed tidewater goby. Surfrider is concerned that the proposed water diversion intake could adversely impact aquatic species through impingement and/or entrainment, and also that the loss of freshwater to this system could exacerbate the current impairments and further reduce the environmental services provided by the Tembladero Slough.

To ensure that the project is consistent with various environmental laws (including Endangered Species Act, Clean Water Act, Porter-Cologne Water Quality Control Act and the California Coastal Act, and others) and ~~therefore~~ also specifically to comply with the California Environmental Quality Act (“CEQA”) Surfrider believes it would be advisable to consider project alternatives that appropriately avoid or minimize impacts to aquatic life by a) using the Best Available Site, Design, and Technology to minimize impingement and entrainment to aquatic species at all life stages and b) minimizing the loss of freshwater from the Tembladero Slough to prevent further degradation of the water body. To achieve these objectives, it may be necessary to consider a project alternative that does not rely on water from the Tembladero Slough.

Thank you for consideration of these comments. Please continue to include the Surfrider Foundation Monterey Chapter in future notices related to this project.

Sincerely,

Antony Tersol
Vice Chair
Surfrider Foundation Monterey Chapter

319 Forest Ave.
Pacific Grove, CA 93950
atersol@gmail.com

FLY MONTEREY
Monterey Peninsula Airport District

200 Fred Kane Drive, Suite 200
Monterey, CA 93940
(831) 648-7000
(831) 648-7021 FAX

January 8, 2014

Monterey Regional Water Pollution Control Agency
Attn: Mr. Bob Holden
Principal Engineer
5 Harris Court
Building D
Monterey, CA 93940

**RE: MONTEREY PENINSULA AIRPORT DISTRICT COMMENTS FOR THE SUPPLEMENT TO MAY 2013 NOP OF AN EIR FOR THE MONTEREY PENINSULA GROUNDWATER REPLENISHMENT PROJECT**

Dear Mr. Holden:

Thank you for allowing the Monterey Peninsula Airport District (District) to comment on the project in subject. On behalf of the District, we are very interested in the outcome of this project and would like to be kept in the loop for future notifications.

We highly encourage you to inform the Monterey County Airport Land Use Commission (ALUC) of said project if you have not already done so. Currently, the proposed Lake El Estero Diversion Site is located within the Monterey Airport Influence Area (AIA) and therefore must be referred to the ALUC for a determination of consistency under the 1987 Comprehensive Land Use Plan (CLUP) for Monterey Peninsula Airport.

Additionally, the District is currently drafting a new Airport Land Use Compatibility Plan (ALUCP) that is estimated to be complete in 2016/2017. According to the Draft ALUCP, the Lake El Estero Diversion Site will not only be located within the AIA, but will also be located within the Outer Approach/Departure Safety Zone.

Please contact me if you have any questions.

Thank you,

Shelley Glennon
Planning Manager - Environmental
Planning & Development Department
Phone: (831) 648-7000 Ext. 209
Mobile: (831) 402-0731
sglennon@montereyairport.com

CITY OF MONTEREY

Colton Hall, California Constitution Hall 1849

DEPARTMENT OF PLANS & PUBLIC WORKS

January 8, 2015

Mr. Bob Holden, Principal Engineer
Monterey Regional Water Pollution Control Agency
5 Harris Court, Building D
Monterey, CA 93940

**Subject: Comment Letter - Supplement to May 2013 Notice of Preparation (NOP) of an Environmental Impact Report (EIR), Pure Water Monterey Groundwater Replenishment Project**

Dear Mr. Holden,

Thank you for the opportunity to comment on the Pure Water Monterey Groundwater Replenishment Project (Project) Supplement to the NOP and related to the scope of the Environmental Impact Report (EIR) as a result of the updates to the project description. The City appreciates the efforts of the Monterey Regional Water Pollution Control Agency (MRWPCA) staff and project partners to continue the engineering and technical evaluations and regional coordination and collaboration efforts.

The project as currently defined includes a proposed water diversion from Lake El Estero pump station into the sanitary sewer collection system for regional treatment and future water use(s). As an agency with the jurisdictional responsibility for this portion of the project and in carrying out and/or approving the project under review, the City submits the following comments for consideration related to the scope and content of the environmental information to be included and/or considered in the EIR:

- **Project Description**: City staff has recognized a need to work with the MRWPCA to further refine the project description and scope to define parameters for the proposed water diversion from Lake El Estero to support the EIR analyses. To do this, the City suggests follow-up meeting(s) to discuss those parameters and to reflect a volume, timing, duration, and any other proposed parameters necessary to adequately characterize this diversion portion of the Project Description for environmental review.
- **Potentially Significant Environmental Issues and/or Environmental Information**: Below are potentially significant environmental issues and/or environmental information for consideration/review related to the project and Lake El Estero diversion, and as pertinent to hydrology and water quality, geology and soils, biological resources, cultural resources, and coastal resources (land use/planning) in the City of Monterey:
    - **Hydrology and Water Quality, and Geology and Soil Resources**: The City is aware a relatively shallow, unconfined aquifer exists in the vicinity of Lake El Estero, though its extent, surface connectivity/recharge, water quality, and seasonal fluctuations are not documented nor well understood. However, recent and localized geologic, soil, and

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Website • www.monterey.org

groundwater level and quality data were collected and analyzed by Trinity Source Group Inc. The data were collected as a result of on-going soil and groundwater clean-up action related to legacy groundwater contamination at 951 Del Monte Avenue, a City property located across Del Monte Avenue from the proposed diversion facility. This information and these data are available for review.

- In the 1970s the City pumped groundwater for maintenance use/purposes from a City well along Aquajito Road near Washerwoman's Pond, which is a sediment basin with overflow connection to Lake El Estero. As described by City staff account, due to this groundwater withdrawal and use, an adjacent hotel structure began to experience land subsidence and associated structural impacts. Consequently, the City ceased pumping groundwater at this location. The exact date of the subsidence is unknown, and thus the climatic conditions that precipitated the event are also unknown, as are the volume and frequency of City well pumping at that time. As mentioned, the geologic and hydrologic setting in this watershed is largely undocumented or unknown, including the relationship between surface and groundwater resources. Although the subsidence account is based on institutional knowledge of this drainage area, this one occurrence may or may not be indicative of a local unconfined aquifer/groundwater table sensitive to changes in water table elevation due to withdrawals from its system.

- **Water Quality Resources:** Majors Creek is one tributary to Lake El Estero, and is listed with the Environmental Protection Agency (EPA) and State Water Resources Control Board (SWRCB) on the Clean Water Act Section 303(d) list for impaired water bodies. This relatively small urban creek with short open channel ephemeral drainage has a body of historic volunteer water quality data (Years 2000-2012) demonstrating total metals (copper, lead, zinc) and bacteria (E. coli) exceedances of water quality objectives of the Central Coast Basin Plan. And, recent water quality data collected as a part of a California State University Monterey Bay Majors Creek Existing Conditions study by A. Goodmansen (2014) confirmed similar results with continued metals and bacterial exceedances. The report highlights, among other possible factors, high traffic volumes in the upper watershed on State Highway 1 as a possible urban source for metals introduced to this ephemeral creek's flow. E. coli sources are unknown, and currently assumed to be natural as the City has no known issues with sewerage pipes in that location. If further DNA-typing of the E. coli is feasible in 2015, the City may gain greater clarity as to possible source(s). Also, Lake El Estero is signed by the Monterey County Health Department for "No Swimming. Contact with lake water may cause illness due to naturally occurring high bacteria levels". For these water quality reasons, the diversion of Lake El Estero discharges to the regional treatment facility instead of to the Monterey Bay may be a significant environmental benefit, depending on the defined diversion parameters to be analyzed.
- **Biological Resources**: Per City of Monterey General Plan EIR Figure 6 Major Habitat Types, the Lake El Estero vicinity is mapped with riparian/wetland habitat. Also tributary drainages are mapped to support Monterey Pine and Mixed Monterey Pine Forest habitat. More biological information is available in the technical supporting documentation titled *Biological Assessment for the City of Monterey* by Denise Duffy & Associates (2003). Further biological study may be necessary to determine or confirm the current day presence of biological resources that may exist since the 2003 biological assessment.

- **Cultural Resources**: Per City of Monterey General Plan EIR Figure 8, Archaeological Sensitivity Map, this diversion facility and proposed California American Distribution System Pipelines in the City of Monterey fall within an area of high probability of prehistoric artifacts, and will necessitate an Archaeological Report to conclude the likelihood of impact to cultural resources.
- **Coastal Resources (Land Use and Planning)**: It is unclear if portions of this project are proposed in the Coastal Zone within the City of Monterey. This aspect will need to be examined.
- **Regulatory Permitting**: As is assumed will be explored by the environmental team, the City wishes to note that various permits may be necessary from other agencies such as the U.S. Army Corps of Engineers, State Water Resources Control Board/Regional Water Quality Control Board, California Department of Fish and Wildlife, Coastal Commission, and possibly others as necessary, to implement the whole of this project.

As a critical natural and economic resource to the community and region, the City desires to ensure long-term coordinated water resources management and stewardship of Lake El Estero and its associated resources. Consequently and prior to City or regional consideration of a long-term sustainable water diversion effort from this watershed, a focused watershed study may be a necessary tool to understand existing, baseline geologic, hydrologic, and biological conditions. Such a study may include the extent and connectivity of surface and groundwater resources and associated environmental dynamics at work and resources present, including watershed recharge areas and rates, potential necessary minimum in-lake water levels and/or groundwater table elevations needed to healthfully maintain/sustain the lake and associated drainages and biological resources. Depending on any determined diversion parameters, such a study may behoove this environmental review effort and to support conclusions drawn as a part of the EIR analyses. Accordingly, the City would like to discuss this study potential further with the regional project team.

It's important to note that the City Council has yet to review any policy considerations related to this project. Accordingly, the comments herein are offered based on preliminary discussions and understanding of the collaborative and envisioned project, which is conceptually supported by City staff who are eager to assist in the refinement of the project description as it relates to those areas within the City's jurisdiction and looks forward to sharing information and data with the project team to further the study of this regional water project for environmental review.

Thank you for this opportunity to comment. Please feel free to contact me with questions.

Sincerely,

Dino Pick
Deputy City Manager Plans and Public Works

ec: Michael McCarthy, City Manager
Hans Uslar, Assistance City Manager
Chip Rerig, Chief of Planning, Engineering, and Environmental Compliance
Kimberly Cole, Principal Planner

| | |
|---|---|
| **From:** | Denise Duffy |
| **To:** | Diana Buhler; Alison Imamura |
| **Subject:** | FW: Supplement to NOP for MRWPCA GWR project (8028-110) |
| **Date:** | Friday, January 09, 2015 8:02:21 AM |
| **Attachments:** | CWSRF-FedralCrossCutterTrifoldBrochure(2-19-2014).pdf<br>CWSRF-CEQA Flyer(2-19-2014).pdf<br>CWSRF-BCBRR-Flyer(2-19-2014).pdf |

FYI on another NOP comment –see below - 3 brochures explaining the SRF program

**From:** Mike McCullough [mailto:MikeM@mrwpca.com]
**Sent:** Thursday, January 8, 2015 3:15 PM
**To:** Denise Duffy; bschussman@perkinscoie.com
**Subject:** FW: Supplement to NOP for MRWPCA GWR project (8028-110)

FYI

**From:** Kashkoli, Ahmad@Waterboards [mailto:Ahmad.Kashkoli@waterboards.ca.gov]
**Sent:** Thursday, January 08, 2015 3:11 PM
**To:** valerieyoung@rcn.com
**Cc:** Bob Holden; Mike McCullough; Brezack, Jim; Stewart, Susan@Waterboards; Alison Imamura; Hack, Jody@Waterboards
**Subject:** RE: Supplement to NOP for MRWPCA GWR project (8028-110)

Hello Valarie,

I just realized that we have not responded to your NOP, and the due date is today. Attached are three brochures that further explain the CWSRF Program environmental review process and the additional federal requirements. For the complete environmental application package please visit: http://www.waterboards.ca.gov/water_issues/programs/grants_loans/srf/srf_forms.shtml. The State Water Board is required to consult directly with agencies responsible for implementing federal environmental laws and regulations. Any environmental issues raised by federal agencies or their representatives will need to be resolved prior to State Water Board approval of a CWSRF financing commitment for the proposed Project.

Thank you for considering our requirements. Please let me or Susan Stewart know if any questions or need additional information.

Ahmad Kashkoli, Senior Environmental Scientist
Division of Financial Assistance
State Water Resources Control Board
1001 I Street, Sacramento, CA 95814
Telephone: (916) 341-5855
Fax: (916) 341-5707
akashkoli@waterboards.ca.gov

**From:** Stewart, Susan@Waterboards
**Sent:** Wednesday, December 10, 2014 2:30 PM
**To:** valerieyoung@rcn.com; Kashkoli, Ahmad@Waterboards; Hack, Jody@Waterboards

**Cc:** Bob Holden; Mike McCullough; Brezack, Jim; Alison Imamura
**Subject:** RE: Supplement to NOP for MRWPCA GWR project (8028-110)

Hello Valerie,

Thank you for sending us early notice, and a copy of the Supplement to the NOP for the Groundwater Replenishment Project. I will be sure Ahmad is aware of this document so we can review the changes to the Project and provide comment as needed.

***Susan Stewart***
***susan.stewart@waterboards.ca.gov***
***(916) 341-5879***

---

**From:** valerieyoung@rcn.com [mailto:valerieyoung@rcn.com]
**Sent:** Wednesday, December 10, 2014 10:18 AM
**To:** Kashkoli, Ahmad@Waterboards; Stewart, Susan@Waterboards
**Cc:** Bob Holden; Mike McCullough; Brezack, Jim; Alison Imamura
**Subject:** Supplement to NOP for MRWPCA GWR project

Hi Ahmad and Susan,
Attached please find Supplement to May 2013 Notice of Preparation (NOP) for the Monterey Regional Water Pollution Control Agency Groundwater Replenishment Project. You will recall we met with you back in January of this year to describe the project and discuss environmental review protocols. The project description has been updated since then, and we have issued this NOP Supplement to enable agency and public comment on the environmental review of the project updates. The NOP Supplement has been submitted to the State Clearinghouse and they will do their normal distribution, which includes the SWRCB. We wanted you to receive this directly from out team as well.

Please let us know if you have any questions, and wishing you both a happy holiday season.

Cheers,
Valerie Young
for MRWPCA

Valerie J. Young, AICP
Environmental Planning Consultant
550 Battery Street #1904
San Francisco, CA 94111
415.341.4671

## National Historic Preservation Act (NHPA)

Section 106 of the NHPA requires an analysis of the effects on "historic properties." The Section 106 process is designed to accommodate historic preservation concerns for federal actions with the potential to affect historic properties. Early consultation with appropriate government agencies, Indian tribes, and members of the public, will ensure that their views and concerns are addressed during the planning phase.

Historic properties (i.e., buildings, structures, objects, and archaeological sites 50 years or older) are properties that are included in the National Register of Historic Places or meet the criteria for the National Register.

### Required Documents:

✓ A draft State Historic Preservation Officer consultation request letter; and

✓ A cultural resources report on historic properties conducted according to the Secretary of the Interior's Standards, including:

- A clearly defined Area of Potential Effect (APE), specifying the length, width, and depth of excavation, with a map clearly illustrating the project APE;
- A records search, less than one year old, extending to a half-mile beyond the project APE;
- Written description of field methods;
- Identification and evaluation of historic properties within the project's APE; and
- Documentation of consultation with the Native American Heritage Commission and local Native American tribes.

# ADDITIONAL INFORMATION

If your project has the potential to affect biological resources or historic properties, the consultation process can be lengthy. Please contact the State Water Board staff early in your planning process to discuss what additional information may be needed for your specific project.

Please contact your State Water Board Project Manager or Mr. Ahmad Kashkoli at (916) 341-5855 or *Ahmad.Kashkoli@waterboards.ca.gov* for more information related to the CWSRF Program environmental review process and requirements.

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# Environmental Review Requirements

State Water Resources Control Board
Division of Financial Assistance

# ENVIRONMENTAL REVIEW REQUIREMENTS

The Clean Water State Revolving Fund (CWSRF) Program is partially funded by the United States Environmental Protection Agency (EPA), and is subject to federal environmental regulations as well as the California Environmental Quality Act (CEQA). All applicants seeking CWSRF financing must comply with both CEQA and the federal cross-cutting regulations. The "**Environmental Package**" provides the forms and instructions needed to complete the environmental review requirements for CWSRF financing. The forms and instructions are available at: *http://www.waterboards.ca.gov/water_issues/programs/grants_loans/srf/srf_forms.shtml.*

## Lead Agency/Applicant

The applicant will generally act as the "Lead Agency" for environmental review. It will prepare, circulate, and consider the environmental documents prior to approving the project. It also provides the State Water Board with copies of the CEQA documents, and a completed "**Environmental Evaluation Form for Environmental Review and Federal Coordination**" *(http://www.waterboards.ca.gov/water_issues/programs/grants_loans/srf/docs/forms/application_environmental_package.pdf)* with supporting documents as part of the "**Environmental Package**."

## Responsible Agency/State Water Board

The State Water Board acts on behalf of EPA to review and consider the environmental documents before approving financing. The State Water Board may require additional studies or documentation to make its own CEQA findings, as well as circulate CEQA documents and other environmental reports to relevant federal agencies for consultation before making a determination about the project financing.

The Applicant must address all relevant federal agencies' comments before project financing is approved.

# FEDERAL CROSS-CUTTING REGULATIONS

The CWSRF Program requires consultation with relevant federal agencies on the following federal environmental regulations, if applicable to the project:

- Clean Air Act
- Coastal Barriers Resources Act
- Coastal Zone Management Act
- Endangered Species Act
- Environmental Justice
- Farmland Protection Policy Act
- Floodplain Management
- Magnuson-Stevens Fishery Conservation and Management Act
- Migratory Bird Treaty Act
- National Historic Preservation Act
- Protection of Wetlands
- Safe Drinking Water Act, Sole Source Aquifer Protection
- Wild and Scenic Rivers Act

The following is a brief overview of requirements for some of the key regulations.

## Clean Air Act (CAA)

The CAA general conformity analysis only applies to projects in areas not meeting the National Ambient Air Quality Standards or subject to a maintenance plan.

If project emissions are below the federal "de minimis" levels then:

- A general conformity analysis is not required.

If project emissions are above the federal "de minimis" levels then:

- A general conformity determination for the project must be made. A general conformity determination can be made if facilities are sized to meet the needs of current population projections used in an approved State Implementation Plan for air quality.

- Using population projections, applicants must explain how the proposed capacity increase was calculated.

An air quality modeling analysis is necessary of all projects for the following criteria pollutants, regardless of attainment status:

- Carbon monoxide
- Lead
- Oxides of nitrogen
- Ozone
- Particulate matter (PM2.5 and PM10)
- Sulfur dioxide

## Endangered Species Act (ESA)

The ESA requires an analysis of the effects on federally listed species. The State Water Board will determine the project's potential effects on federally listed species, and will initiate informal/formal consultation with the United States Fish and Wildlife Service (USFWS) and/or the National Marine Fisheries Service, as necessary under Section 7 of the ESA.

### Required Documents:

✓ A species list, less than one year old, from the USFWS and the California Department of Fish and Wildlife's Natural Diversity Database;

✓ A biological survey conducted during the appropriate time of year;

✓ Maps or documents (biological reports or biological assessments, if necessary); and

✓ An assessment of the direct or indirect impacts to any federally listed species and/or critical habitat. If no effects are expected, explain why and provide the supporting evidence.

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# Basic Criteria for Cultural Resources Report Preparation

State Water Resources Control Board
Division of Financial Assistance

For Section 106 Consultation with the State Historic Preservation Officer (SHPO) under the National Historic Preservation Act

## CULTURAL RESOURCES REPORT

The Cultural Resources Report must be prepared by a qualified researcher that meets the Secretary of the Interior's Professional Qualifications Standards. Please see the Professional Qualifications Standards at the following website at: *http://www.cr.nps.gov/local-law/arch_stnds_9.htm*

The Cultural Resources Report should include one of the four "findings" listed in Section 106. These include:

***"No historic properties affected"***

(no properties are within the area of potential effect (APE; including below the ground).

***"No effect to historic properties"***

(properties may be near the APE, but the project will not have any adverse effects).

***"No adverse effect to historic properties"***

(the project may affect "historic properties", but the effects will not be adverse).

***"Adverse effect to historic properties"***

Note: Consultation with the SHPO will be required if a "no adverse effect to historic properties" or an "adverse effect to historic properties" determination is made, to develop and evaluate alternatives or modifications to the proposed project that could avoid, minimize or mitigate adverse effects on "historic properties."

## RECORDS SEARCH

- A records search (less than one year old) extending to a half-mile beyond the project APE from a geographically appropriate Information Center is required. The records search should include maps that show all recorded sites and surveys in relation to the APE for the proposed project, and copies of the confidential site records included as an appendix to the Cultural Resources Report.
- The APE is three-dimensional (depth, length and width) and all areas (e.g., new construction, easements, staging areas, and access roads) directly affected by the proposed project.

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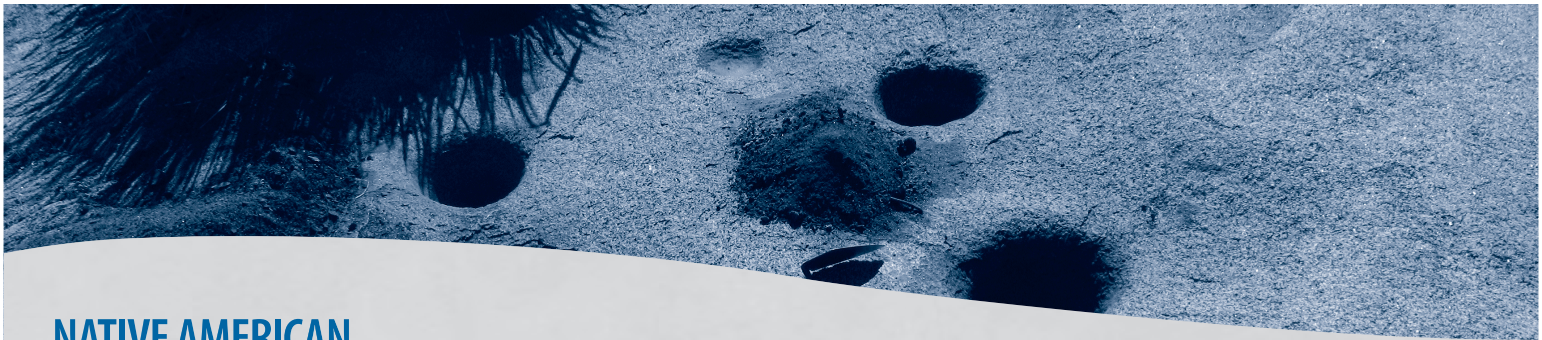

## NATIVE AMERICAN and INTERESTED PARTY CONSULTATION

- Native American and interested party consultation should be initiated at the planning phase of the proposed project to gather information to assist with the preparation of an adequate Cultural Resources Report.
- The Native American Heritage Commission (NAHC) must be contacted to obtain documentation of a search of the Sacred Lands Files for or near the project APE.
- All local Native American tribal organizations or individuals identified by the NAHC must be contacted by certified mail, and the letter should include a map and a description of the proposed project.
- Follow-up contact should be made by telephone and a phone log maintained to document the contacts and responses.
- Letters of inquiry seeking historical information on the project area and local vicinity should be sent to local historical societies, preservation organizations, or individual members of the public with a demonstrated interest in the proposed project.

Copies of all documents mentioned above (project description, map, phone log and letters sent to the NAHC and Native American tribal organizations or individuals and interested parties) must be included in the Cultural Resources Report.

## PRECAUTIONS

A finding of ***"no known resources"*** without supporting evidence is unacceptable. The Cultural Resources Report must identify resources within the APE or demonstrate with sufficient evidence that none are present.

***"The area is sensitive for buried archaeological resources,"*** followed by a statement that ***"monitoring is recommended."*** Monitoring is not an acceptable option without good-faith effort to demonstrate that no known resource is present.

If ***"the area is already disturbed by previous construction"*** documentation is still required to demonstrate that the proposed project will not affect "historic properties." An existing road can be protecting a buried archaeological deposit or may itself be a "historic property." Additionally, previous construction may have impacted an archaeological site that has not been previously documented.

## SHPO CONSULTATION LETTER

Submit a draft consultation letter prepared by the qualified researcher with the Cultural Resources Report to the State Water Resources Control Board. A draft consultation letter template is available for download on the State Water Board webpage at: *http://www.waterboards.ca.gov/water_issues/programs/grants_loans/cwsrf_requirements.shtml*

*Contact Information:* For more information related to the CWSRF Program Cultural Resources and Requirments, please contact Mr. Ahmad Kashkoli at 916-341-5855 or Ahmad.Kashkoli@waterboards.ca.gov

CALIFORNIA Water Boards
STATE WATER RESOURCES CONTROL BOARD
REGIONAL WATER QUALITY CONTROL BOARDS
waterboards.ca.gov

REVISED: JAN. 2014

CLEAN WATER STATE REVOLVING FUND

# California Environmental Quality Act Requirements

State Water Resources Control Board

Division of Financial Assistance

The State Water Resources Control Board (State Water Board), Division of Financial Assistance, administers the Clean Water State Revolving Fund (CWSRF) Program. The CWSRF Program is partially funded by grants from the United States Environmental Protection Agency. All applicants seeking CWSRF financing must comply with the California Environmental Quality Act (CEQA), and provide sufficient information so that the State Water Board can document compliance with federal environmental laws. The "Environmental Package" provides the forms and instructions needed to complete the environmental review requirements for CWSRF Program financing. It is available at: ***http://www.waterboards.ca.gov/water_issues/programs/grants_loans/srf/srf_forms.shtml***

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## LEAD AGENCY

The applicant is usually the "Lead Agency" and must prepare and circulate an environmental document before approving a project. Only a public agency, such as a local, regional or state government, may be the "Lead Agency" under CEQA. If a project will be completed by a non-governmental organization, "Lead Agency" responsibility goes to the first public agency providing discretionary approval for the project.

## RESPONSIBLE AGENCY

The State Water Board is generally a "Responsible Agency" under CEQA. As a "Responsible Agency," the State Water Board must make findings based on information provided by the "Lead Agency" before financing a project.

## ENVIRONMENTAL REVIEW

The State Water Board's environmental review of the project's compliance with both CEQA and federal cross-cutting regulations must be completed before a project can be financed by the CWSRF Program.

## DOCUMENT REVIEW

Applicants are encouraged to consult with State Water Board staff early during preparation of CEQA document if considering CWSRF financing. Applicants shall also send their environmental documents to the State Water Board, Environmental Review Unit during the CEQA public review period. This way, any environmental concerns can be addressed early in the process.

## REQUIRED DOCUMENTS

The Environmental Review Unit requires the documents listed below to make findings and complete its environmental review. Once the State Water Board receives all the required documents and makes its own findings, the environmental review for the project will be complete.

- ✓ Draft and Final Environmental Documents: Environmental Impact Report, Negative Declaration, and Mitigated Negative Declaration as appropriate to the project
- ✓ Resolution adopting/certifying the environmental document, making CEQA findings, and approving the project
- ✓ All comments received during the public review period and the "Lead Agency's" responses to those comments
- ✓ Adopted Mitigation Monitoring and Reporting Plan, if applicable
- ✓ Date-stamped copy of the Notice of Determination or Notice of Exemption filed with the County Clerk(s) and the Governor's Office of Planning and Research
- ✓ CWSRF Evaluation Form for Environmental Review and Federal Coordination with supporting documents

*Contact Information:* For more information related to the CWSRF Program environmental review process and requirements, please contact your State Water Board Project Manager or Mr. Ahmad Kashkoli at 916-341-5855 or Ahmad.Kashkoli@waterboards.ca.gov

CALIFORNIA Water Boards
STATE WATER RESOURCES CONTROL BOARD
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REVISED: FEB. 2014

**DEPARTMENT OF TRANSPORTATION**
50 HIGUERA STREET
SAN LUIS OBISPO, CA 93401-5415
PHONE (805) 549-3101
FAX (805) 549-3329
TTY 711
http://www.dot.ca.gov/dist05/

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January 8, 2015

MON-1-Var.
SCH# 2013051094

Bob Holden
Monterey Regional Water Pollution Control Agency
5 Harris Court, Building D
Monterey, CA 93940

Dear Mr. Nichols:

COMMENTS TO PURE WATER MONTEREY PROJECT

The California Department of Transportation (Caltrans), District 5, Development Review, has reviewed the above referenced project and offers the following comments in response to your summary of impacts.

- Any work within the State right-of-way will require an encroachment permit issued from Caltrans. Detailed information such as complete drawings, biological and cultural resource findings, hydraulic calculations, environmental reports, traffic study, etc., may need to be submitted as part of the encroachment permit process.

If you have any questions, or need further clarification on items discussed above, please don't hesitate to call me at (805) 542-4751.

Sincerely,

JOHN J. OLEJNIK
Associate Transportation Planner
District 5 Development Review Coordinator
john.olejnik@dot.ca.gov

STATE OF CALIFORNIA — EDMUND G. BROWN JR., *Governor*

**CALIFORNIA STATE LANDS COMMISSION**
100 Howe Avenue, Suite 100-South
Sacramento, CA 95825-8202

*Established in 1938*

**JENNIFER LUCCHESI,** *Executive Officer*
**(916) 574-1800** *Fax* **(916) 574-1810**
*California Relay Service TDD Phone* **1-800-735-2929**
*from Voice Phone* **1-800-735-2922**

***Contact Phone:*** **(916) 574-1890**
***Contact FAX:*** **(916) 574-1885**

January 8, 2015

File Ref: SCH # 2013051094

Bob Holden
Monterey Regional Water Pollution Control Agency
5 Harris Court, Building D
Monterey, CA 93940

**Subject: Supplemental Notice of Preparation (NOP) for an Environmental Impact Report (EIR) for the Pure Water Monterey Groundwater Replenishment (GWR) Project,[1] Monterey County**

Dear Mr. Holden:

The California State Lands Commission (CSLC) staff has reviewed the subject Supplemental NOP for an EIR for the Pure Water Monterey GWR Project (Project), which is being prepared by the Monterey Regional Water Pollution Control Agency (MRWPCA). The MRWPCA, as a public agency proposing to carry out a project, is the lead agency under the California Environmental Quality Act (CEQA) (Pub. Resources Code, § 21000 et seq.). The CSLC is a trustee agency for projects that could directly or indirectly affect sovereign lands and their accompanying Public Trust resources or uses. Additionally, if the Project involves work on sovereign lands, the CSLC will act as a responsible agency. CSLC staff requests that MRWPCA consult with us on preparation of the draft EIR as required by CEQA section 21153, subdivision (a), and the State CEQA Guidelines section 15086, subdivisions (a)(1) and (a)(2).

**<u>CSLC Jurisdiction and Public Trust Lands</u>**

The CSLC has jurisdiction and management authority over all ungranted tidelands, submerged lands, and the beds of navigable lakes and waterways. The CSLC also has certain residual and review authority for tidelands and submerged lands legislatively granted in trust to local jurisdictions (Pub. Resources Code, §§ 6301, 6306). All tidelands and submerged lands, granted or ungranted, as well as navigable lakes and waterways, are subject to the protections of the Common Law Public Trust.

[1] Previously called the Monterey Peninsula Groundwater Replenishment Project

As general background, the State of California acquired sovereign ownership of all tidelands and submerged lands and beds of navigable lakes and waterways upon its admission to the United States in 1850. The State holds these lands for the benefit of all people of the State for statewide Public Trust purposes, which include but are not limited to waterborne commerce, navigation, fisheries, water-related recreation, habitat preservation, and open space. On tidal waterways, the State's sovereign fee ownership extends landward to the mean high tide line, except for areas of fill or artificial accretion or where the boundary has been fixed by agreement or a court. On navigable non-tidal waterways, including lakes, the State holds fee ownership of the bed of the waterway landward to the ordinary low water mark and a Public Trust easement landward to the ordinary high water mark, except where the boundary has been fixed by agreement or a court. Such boundaries may not be readily apparent from present day site inspections.

In order to determine if any portions of the Project will encroach onto lands under the jurisdiction of the CSLC, which would require a lease, please provide more detailed maps depicting the location and extent of proposed facilities within any rivers, particularly the Salinas River, and sloughs. From review of the supplemental NOP, it appears that the coastal groundwater recharge facilities have been removed from the Project. If any remaining facilities or infrastructure associated with the Project are planned for construction in the Pacific Ocean, please also provide detailed maps of these facilities.

**Project Description**

The MRWPCA proposes to produce and deliver high quality treated water for replenishment of the Seaside Basin to meet its and California American Water Company's (CalAm's) objectives and needs to reduce water diversions from the Carmel River.

From the Supplemental NOP, CSLC staff understands that the river crossings and in-water equipment discussed in the original NOP remain part of the Project, but that the following additions and deletions have been made to the Project proposal:

- Addition of a water diversion intake and associated equipment at Tembladero Slough;
- Addition of CalAm's water distribution pipelines; and
- Removal of the proposed coastal injection wells and recharge facilities.

**Environmental Review**

CSLC staff reviewed the May 2013 NOP and provided comments in a letter dated June 27, 2013 (enclosed). Although the Supplemental NOP discusses the above-mentioned Project changes, the comments submitted by CSLC staff in June 2013 are still applicable to Project activities that may occur on sovereign land. Please refer to the June 2013 letter for specific comments on the NOP.

Thank you for the opportunity to comment on the Supplemental NOP for the Project. As a trustee and responsible agency, the CSLC staff requests that you consult with us on this Project and keep us advised of changes to the Project description and all other important developments. Please send additional information on the Project to the CSLC staff listed below as the EIR is being prepared.

Please refer questions concerning environmental review to Holly Wyer, Environmental Scientist, at (916) 574-2399 or via e-mail at Holly.Wyer@slc.ca.gov. For questions concerning CSLC leasing jurisdiction, please contact Drew Simpkin, Public Land Management Specialist, at (916) 574-2275, or via email at Drew.Simpkin@slc.ca.gov.

Sincerely,

Cy R. Oggins, Chief
Division of Environmental Planning
and Management

Enclosure (June 27, 2013 Comment Letter)

cc: Office of Planning and Research
H. Wyer, CSLC
D. Simpkin, CSLC
J. Rader, CSLC

STATE OF CALIFORNIA EDMUND G. BROWN JR., *Governor*

**CALIFORNIA STATE LANDS COMMISSION**
100 Howe Avenue, Suite 100-South
Sacramento, CA 95825-8202

*Our 75th Year*
*1938 - 2013*

**JENNIFER LUCCHESI**, *Executive Officer*
(916) 574-1800 *Fax* (916) 574-1810
*California Relay Service TDD Phone* 1-800-735-2929
*from Voice Phone* 1-800-735-2922

***Contact Phone:*** **(916) 574-1900**
***Contact Fax:*** **(916) 574-1885**

June 27, 2013

File Ref: SCH # 2013051094

Bob Holden
Principal Engineer
Monterey Regional Water Pollution Control Agency
5 Harris Court, Building D
Monterey, CA 93940

**Subject: Notice of Preparation (NOP) for an Environmental Impact Report (EIR) for the Monterey Peninsula Groundwater Replenishment Project, Monterey County**

Dear Mr. Holden:

The California State Lands Commission (CSLC) staff has reviewed the subject NOP for the Monterey Peninsula Groundwater Replenishment Project (Project), which is being prepared by the Monterey Regional Water Pollution Control Agency (MRWPCA). MRWPCA, as a public agency proposing to carry out a project, is the lead agency under the California Environmental Quality Act (CEQA) (Pub. Resources Code, § 21000 et seq.). The CSLC is a trustee agency because of its trust responsibility for projects that could directly or indirectly affect sovereign lands, their accompanying Public Trust resources or uses, and the public easement in navigable waters. Additionally, if the Project involves work on sovereign lands, the CSLC will act as a responsible agency.

**<u>CSLC Jurisdiction and Public Trust Lands</u>**

The CSLC has jurisdiction and management authority over all ungranted tidelands, submerged lands, and the beds of navigable lakes and waterways. The CSLC also has certain residual and review authority for tidelands and submerged lands legislatively granted in trust to local jurisdictions (Pub. Resources Code, §§ 6301, 6306). All tidelands and submerged lands, granted or ungranted, as well as navigable lakes and waterways, are subject to the protections of the Common Law Public Trust.

As general background, the State of California acquired sovereign ownership of all tidelands and submerged lands and beds of navigable lakes and waterways upon its admission to the United States in 1850. The State holds these lands for the benefit of all people of the State for statewide Public Trust purposes, which include but are not limited to waterborne commerce, navigation, fisheries, water-related recreation, habitat preservation, and open space. On navigable non-tidal waterways, including lakes, the State holds fee ownership of the bed of the waterway landward to the ordinary low water mark and a Public Trust easement landward to the ordinary high water mark, except where the boundary has been fixed by agreement or a court. Such boundaries may not be readily apparent from present day site inspections.

In order to determine the CSLC's leasing interest, if any, in the proposed Project, please provide more detailed maps showing the exact locations of all pipelines or other proposed improvements crossing the Salinas River. In addition, should any deep injection or shallow wells be located within the Salinas River or Monterey Bay, please provide CSLC staff with the exact locations as soon as they are known.

**Project Description**

The MRWPCA proposes to produce and deliver high quality treated water for replenishment of the Seaside Basin to meet the Agency's and California American Water Company's (Cal-Am's) objectives and needs as follows:

- Reduce Water Diversions. Cal-Am has been ordered by the State Water Resources Control Board to reduce its diversions from the Carmel River to 3,376 AFY by 2017. The proposed Project will supply 3,500 AFY of replacement water to Cal-Am and reduce diversions from the Carmel River by the same amount;
- Provide a Cost-Effective Water Source. The Project should be capable of supplying reasonably-priced water;
- Regulatory Compliance. The Project should be capable of complying with water quality regulations intended to protect public health; and
- Additional Objectives. The Project should also assist in preventing seawater intrusion into the Seaside Basin, diversifying Monterey County's water supply portfolio, and provide additional water that could be used for crop irrigation.

From the Project Description, CSLC staff understands that the Project would include the following components:

- Source Water Conveyance Facilities. Diversion and collection facilities, including pipelines and pump stations to convey source water to the new treatment facilities;
- Treatment Facilities. Pretreatment facilities, a new Advanced Water Treatment Plant, and associated facilities at the Regional Treatment Plant site to filter and treat the source water;
- Product Water Conveyance Facilities. Pipelines, pump stations, appurtenant facilities along one of two optional alignments to convey the treated water to the Seaside Basin; and
- Replenishment and Recharge Facilities. Pipelines, deep injection and shallow (vadose zone) wells, and backflush facilities to be located at one or both of two optional recharge site (coastal and inland) within the Seaside Basin Boundaries.

**Environmental Review**

CSLC staff requests that the following potential impacts be analyzed in the EIR.

General Comments

1. Project Description: A thorough and complete Project Description should be included in the EIR in order to facilitate meaningful environmental review of potential impacts, mitigation measures, and alternatives. The Project Description should be as precise as possible in describing the details of all allowable activities (e.g., types of equipment or methods that may be used, maximum area of impact or volume of sediment removed or disturbed, seasonal work windows, locations for material disposal, etc.), as well as the details of the timing and length of activities. Thorough descriptions will facilitate CSLC staff's determination of the extent and locations of its leasing jurisdiction, make for a more robust analysis of the work that may be performed, and minimize the potential for subsequent environmental analysis to be required.

Biological Resources

2. Sensitive Species: The EIR should disclose and analyze all potentially significant effects on sensitive species and habitats in and around the Project area, including special-status wildlife, fish, and plants, and if appropriate, identify feasible mitigation measures to reduce those impacts. The MRWPCA should conduct queries of the California Department of Fish and Wildlife's (CDFW) California Natural Diversity Database (CNDDB) and U.S. Fish and Wildlife Service's (USFWS) Special Status Species Database to identify any special-status plant or wildlife species that may occur in the Project area. The EIR should also include a discussion of the MRWPCA's consultation with CDFW and USFWS, including any recommended mitigation measures and potentially required permits identified by these agencies.

3. Invasive Species: One of the major stressors in California waterways is introduced species. In light of the recent decline of native pelagic organisms and in order to protect at-risk fish species, the EIR should examine if any elements of the Project (e.g., changes in amount and timing of freshwater flow) would favor non-native fisheries within the Salinas River. The CDFW's Invasive Species Program could assist with this analysis as well as with the development of appropriate mitigation (information at http://www.dfg.ca.gov/invasives/)

4. Construction Noise: The EIR should also evaluate noise and vibration impacts on fish and birds from directional drilling of the pipelines and for associated land-side activity. Mitigation measures could include species-specific work windows as defined by CDFW, USFWS, and the National Oceanic and Atmospheric Administration's Fisheries Service (NOAA Fisheries). Again, staff recommends early consultation with these agencies to minimize the impacts of the Project on sensitive species.

5. Frac-Out: If directional drilling will occur under the Salinas River to lay a pipeline, the EIR should evaluate the potential for frac-out to occur during drilling and analyze the potential impacts of frac-out to biological resources, including sensitive species and habitats. If impacts are found to be significant, the EIR should identify feasible mitigation measures to reduce the impacts of frac-out. CSLC staff may request documentation of mitigation for frac-out before issuing a lease. An example of a frac-out contingency plan that generally meets the CSLC's leasing requirements is the Contingency and Resource Protection Plan developed for the Construction of the AT&T Fiber Optic Cable Installation Project, Las Vegas to Victorville FTB Clark County, Nevada, and San Bernardino Counties, which is available at http://www.slc.ca.gov/division_pages/DEPM/DEPM_Programs_and_Reports/ATT_Fiber_Optic/PDF/Appendices/Ap-I_HDD_Plan.pdf.

Climate Change

6. Greenhouse Gases: A greenhouse gas (GHG) emissions analysis consistent with the California Global Warming Solutions Act (AB 32) and required by the State CEQA Guidelines[1] should be included in the EIR. This analysis should identify a threshold for significance for GHG emissions, calculate the level of GHGs that will be emitted as a result of construction and ultimate build-out of the Project, determine the significance of the impacts of those emissions, and, if impacts are significant, identify mitigation measures that would reduce them to less than significant.

7. Sea Level Rise: The EIR should also consider the effects of sea level rise on all resource categories potentially affected by the proposed Project. One of the Project's objectives is to prevent saltwater intrusion into groundwater basins. Since the EIR's impacts analysis will be used to develop a range of alternatives to the Project, please consider how sea level rise may increase or accelerate saltwater intrusion into the Project's groundwater basins and determine the Project's resiliency to sea level rise. If sea level rise is found to reduce the Project's effectiveness and impact CEQA resource categories, consider creating an alternative to the Project that would be more resilient to sea level rise.

   At its meeting on December 17, 2009, the CSLC approved the recommendations made in a previously requested staff report, "A Report on Sea Level Rise Preparedness" (Report), which assessed the degree to which the CSLC's grantees and lessees have considered the eventual effects of sea level rise on facilities located within the CSLC's jurisdiction. (The Report can be found on the CSLC's website, www.slc.ca.gov.) One of the Report's recommendations directs CSLC staff to consider the effects of sea level rise on hydrology, soils, geology, transportation, recreation, and other resource categories in all environmental determinations associated with CSLC leases.

[1] The State "CEQA Guidelines" are found in Title 14 of the California Code of Regulations, commencing with section 15000.

Please note that, when considering lease applications, CSLC staff is directed to (1) request information from applicants concerning the potential effects of sea level rise on their proposed projects, (2) if applicable, require applicants to indicate how they plan to address sea level rise and what adaptation strategies are planned during the projected life of their projects, and (3) where appropriate, recommend project modifications that would eliminate or reduce potentially adverse impacts from sea level rise, including adverse impacts on public access.

Cultural Resources

8. Submerged Resources: The EIR should evaluate potential impacts to submerged cultural resources in the Project area, including the Salinas River. The CSLC maintains a shipwrecks database that can assist with this analysis.. CSLC staff requests that the MRWPCA contact Senior Staff Counsel Pam Griggs (see contact information below) to obtain shipwrecks data from the database and CSLC records for the Project site. The database includes known and potential vessels located on the State's tide and submerged lands; however, the locations of many shipwrecks remain unknown. Please note that any submerged archaeological site or submerged historic resource that has remained in State waters for more than 50 years is presumed to be significant.

9. Title to Resources: The EIR should also mention that the title to all abandoned shipwrecks, archaeological sites, and historic or cultural resources on or in the tide and submerged lands of California is vested in the State and under the jurisdiction of the CSLC. CSLC staff requests that the MRWPCA consult with Senior Staff Counsel Pam Griggs (see contact information below), should any cultural resources on state lands be discovered during construction of the proposed Project.

Additional Review

10. Deferred Mitigation: In order to avoid the improper deferral of mitigation, mitigation measures should either be presented as specific, feasible, enforceable obligations, or should be presented as formulas containing "performance standards which would mitigate the significant effect of the project and which may be accomplished in more than one specified way" (State CEQA Guidelines, §15126.4, subd. (b)).

Thank you for the opportunity to comment on the NOP for the Project. As a responsible agency, the CSLC will need to rely on the Final EIR for the issuance of any amended or new lease as specified above and, therefore, we request that you consider our comments during development of the EIR. Please send additional information on the Project to the CSLC as plans become finalized.

Please send copies of future Project-related documents, including electronic copies of the Draft and Final EIR, Mitigation Monitoring and Reporting Program (MMRP), Notice of Determination (NOD), CEQA Findings and, if applicable, Statement of Overriding Considerations when they become available, and refer questions concerning environmental review to Holly Wyer, Environmental Scientist, at (916) 574-2399 or via e-mail at Holly.Wyer@slc.ca.gov. For questions concerning archaeological or historic resources under CSLC jurisdiction, please contact Senior Staff Counsel Pam Griggs at (916) 574-1854 or via email at Pamela.Griggs@slc.ca.gov. For questions concerning CSLC leasing jurisdiction, please contact Drew Simpkin, Public Land Management Specialist, at (916) 574-2275, or via email at Drew.Simpkin@slc.ca.gov.

Sincerely,

Cy R. Oggins, Chief
Division of Environmental Planning
and Management

cc: Office of Planning and Research
Drew Simpkin, LMD, CSLC
Holly Wyer, DEPM, CSLC
Shelli Haaf, Legal, CSLC

**CITY OF SEASIDE - RESOURCE MANAGEMENT SERVICES**
440 Harcourt Avenue
Seaside, CA 93955
Telephone (831) 899-6736
FAX (831) 899-6211

February 6, 2015

Bob Holden, Principal Engineer
Monterey Regional Water Pollution Control Agency
5 Harris Court, Bldg. D
Monterey, CA 93940
Via Email: gwr@mrwpca.com

**Subject: NOP for Supplement to May 2013 Notice of Preparation of an EIR for the Pure Water Monterey Groundwater Replenishment Project**

Dear Mr. Holden,

This letter transmits comments for the proposed subject project. The City of Seaside respectfully requests that the following comments be considered for incorporation into the environmental documents.

1) The proposed monitoring wells will be relocated, if necessary and at the owner's expense, as soon as the City has approved development plans for the area. The monitoring wells shall be relocated to be within a proposed future public right of way or an accessible public area.

2) The proposed monitoring wells should not include any above grade features.

3) Proposed above grade features, such as injection well appurtenances, shall be screened to minimize visual impacts.

4) The proposed backwash pits should be designed to minimize visual impacts.

5) In the event that new underground piping is required, the City requests that the same route be used as for the proposed Cal-Am Monterey Peninsula Water Supply Project.

6) MRWPCA shall coordinate with Cal-Am on work within the public right of way within the City of Seaside, such as pipeline installation, so that all work is performed concurrently with Cal-Am.

7) To the greatest extent possible, locate the facilities within the City of Seaside that cannot be located within a public right of way to areas classified as the Utility Corridor or Borderlands under the Habitat Management Plan.

We look forward to working with your staff to complete the proposed project in a timely manner. You may contact me or Rick Riedl of my staff at 831-899-6825 or RRiedl@ci.seaside.ca.us to discuss any questions or comments.

Sincerely,

Tim O'Halloran
City Engineer / Public Works Services Manager

Cc: Diana Ingersoll, Deputy City Manager – Resource Management Services
Lisa Brinton, Community and Economic Development Services Manager
Rick Riedl, Senior Civil Engineer
Rick Medina, Senior Planner

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# Appendix B rev

# Source Water Assumptions Memorandum

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Schaaf & Wheeler
CONSULTING CIVIL ENGINEERS

3 Quail Run Circle, Suite 101
Salinas, CA 93907-2348
831-883-4848
FAX 831-758-6328
asterbenz@swsv.com

# MEMORANDUM

| | | | |
|---|---|---|---|
| TO: | Bob Holden, MRWPCA<br>Larry Hampson, MPWMD | DATE: | March 26, 2015<br>Updated Sept. 23, 2015 |
| CC: | Alison Imamura, Denise Duffy & Assoc. | | |
| FROM: | Andrew Sterbenz, PE | JOB #: | MRWP.01.14 |
| SUBJECT: | Pure Water Monterey Groundwater Replenishment Project – Proposed Source Water Availability, Yield, and Use | | |

The purpose of this memorandum is to summarize the source water availability and yield estimates for the Pure Water Monterey Groundwater Replenishment Project (Proposed Project), to explain the seasonal storage yield estimates, and to provide the proposed maximum and typical (or normal) water use estimates for the Proposed Project. The Proposed Project will develop various source waters and convey them to the MRWPCA Regional Treatment Plant (RTP) where they will undergo primary and secondary treatment with the current municipal wastewater flows, and then undergo Advanced Water Treatment before being conveyed for injection in the Seaside Groundwater Basin. Source waters conveyed to the RTP which are not required for injection into the Seaside Basin will undergo tertiary treatment at the Salinas Valley Reclamation Plant (SVRP) and be used to increase the recycled water supply provided to the Castroville Seawater Intrusion Project (CSIP).

A number of technical documents were prepared to analyze and confirm available source supplies for the Proposed Project. Source waters for the Proposed Project include new surface water diversions, agricultural wash water, urban stormwater runoff and unused secondary-treated effluent from the RTP which would otherwise be discharged to the ocean as further described, below. The source water availability studies that have been used as the basis for estimating yield are cited throughout this report. These reports and studies include:

1. Schaaf & Wheeler, Reclamation Ditch Yield Study, March 2015
2. Schaaf & Wheeler, Blanco Drain Yield Study, December 2014
3. Data on Source Water Estimates provided by Bob Holden, MRWPCA, February 2014
4. Todd Groundwater, *Memorandum: Pure Water Monterey Groundwater Replenishment Project: Impacts of Changes in Percolation at the Salinas Industrial Wastewater Treatment Facility on Groundwater and the Salinas River,* February 2015
5. Schaaf & Wheeler, *Groundwater Replenishment Project, Salinas River Inflow Impacts,* February 2015
6. Schaaf & Wheeler, *Groundwater Replenishment Project, Urban Runoff Capture at Lake El Estero,* April 2014
7. Data from *Monterey County Water Recycling Projects/Salinas Valley Water Project/Salinas River Diversion Facility Update,* MCWRA Board Packet, February 24, 2014

Among the Proposed Project's objectives is to provide high quality replacement water to allow California American Water Company (CalAm) to extract 3,500 acre-feet per year (AFY) more water from the

Seaside Basin for delivery to its customers in the Monterey District service area and reduce Carmel River system water use by an equivalent amount. To meet this objective, the Proposed Project would include features that would create a reliable source of water supply by using source waters described below to produce purified recycled water using existing secondary treatment processes and a new Advanced Water Treatment (AWT) Facility at the MRWPCA Regional Treatment Plant. After treatment by the AWT Facility, the purified recycled water would be conveyed to the Seaside Groundwater Basin for subsurface injection using a series of shallow and deep wells. In the Seaside Groundwater Basin, the treated water would mix with the groundwater present in the aquifers and be stored for future urban use. CalAm would use existing wells and improved potable water supply distribution facilities to extract and distribute the water produced by the Proposed Project, enabling CalAm to reduce its diversions from the Carmel River system by this same amount.

Another purpose of the Proposed Project is to provide additional water to the Regional Treatment Plant that could be recycled at the existing tertiary treatment facility (the Salinas Valley Reclamation Plant) and used for crop irrigation using the CSIP system. The Salinas Valley Reclamation Plant produces tertiary-treated, disinfected recycled water for agricultural irrigation within the CSIP service area. Municipal wastewater and certain urban dry weather runoff diversions treated at the Regional Treatment Plant are currently the only sources of supply for the Salinas Valley Reclamation Plant. Municipal wastewater flows have declined in recent years due to aggressive water conservation efforts by the MRWPCA member entities. The new sources of water supply developed for the GWR Project would increase supply available at the Regional Treatment Plant for use by the Salinas Valley Reclamation Plant during the peak irrigation season (April to September). In addition, the Proposed Project would include Salinas Valley Reclamation Plant modifications to allow tertiary treatment at lower daily production rates, facilitating increased use of recycled water during the late fall, winter and early spring months when demand drops below 5 million gallons per day (MGD).

Source waters for the Proposed Project include new surface water diversions, agricultural wash water, urban stormwater runoff and unused secondary-treated effluent from the RTP which would otherwise be discharged to the ocean.

**Agricultural Wash Water**

The City of Salinas owns and operates an industrial wastewater collection and treatment system, which serves approximately 25 agricultural processing and related businesses located in the southeast corner of the City. This wastewater collection system is separate from the Salinas municipal sewage collection system. These flows, referred to as agricultural wash water, are conveyed in a network of gravity pipelines to the Salinas Industrial Wastewater Treatment Facility (SIWTF), where it is treated using aeration and disposed of using evaporation and percolation. These flows would be redirected into the municipal wastewater system for conveyance to the RTP as a source of supply for the GWR Project.

Annual inflows to the SIWTF were analyzed and a projection of year 2017 flows was prepared by the MRWPCA[1], as shown in the first row of Table 1, below. Recorded monthly inflows for calendar years 2007-2013 were tabulated and the annual averaged plotted (see Figure 1). A linear trend line was used to estimate future flows, and the projected annual average of 3.37 mgd in 2017 was used to scale the 2013 monthly inflow values. As expected, the recorded agricultural wash water flows in 2014 (included on Figure 1) fell on the trend line.

The SITWF consists of an aeration basin, three storage/percolation ponds covering 108 acres, drying beds coving 67 acres and three rapid infiltration basins covering 1.3 acres. To assess the effects of diverting

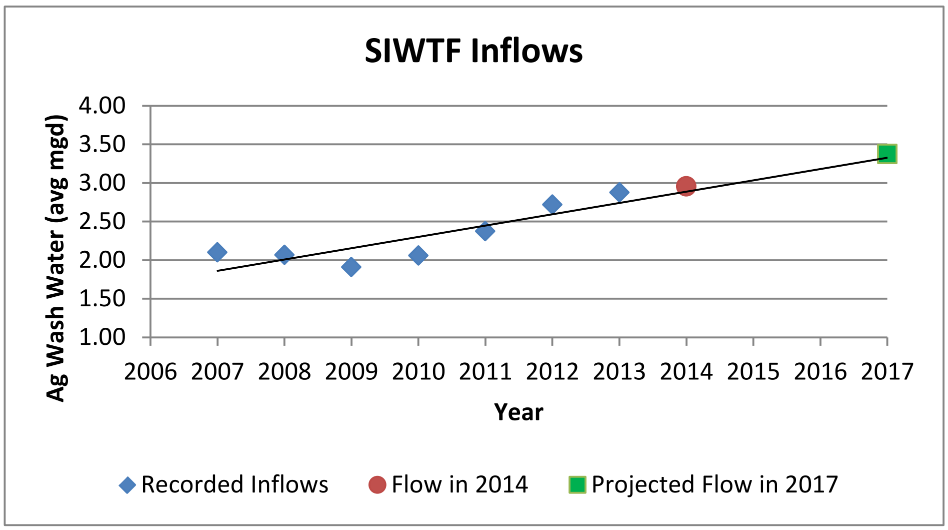
[1] Estimation by Bob Holden, MRWPCA, February 2014

flows treated at the SIWTF, Todd Groundwater[2] estimated the percentages of flows disposed as evaporation, percolation from the main ponds, and disposal through the drying beds and rapid infiltration basins (RIBs). These values are show in Table 1, below, and are used in the estimation of seasonal storage losses discussed later in this memorandum. The State Water Resources Control Board has clarified that this diversion will require a wastewater change petition for the SIWTF.

**Table 1: Agricultural Wash Water (acre-feet)**

| Source \ Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ag. Wash Water - 2017 | 156 | 158 | 201 | 307 | 311 | 391 | 435 | 444 | 367 | 410 | 329 | 223 | 3,732 |
| Rainfall | 26.4 | 23.7 | 21.3 | 11.1 | 3.0 | 0.8 | 0.2 | 0.4 | 1.7 | 5.7 | 14.2 | 23.7 | 132 |
| Evaporation | -12 | -16 | -29 | -41 | -46 | -52 | -45 | -43 | -32 | -28 | -15 | -12 | -372 |
| Percolation from ponds 1, 2, and 3 | -143 | -129 | -143 | -138 | -143 | -138 | -143 | -143 | -138 | -143 | -138 | -143 | -1,680 |
| RIBs/Drying Beds | -28 | -37 | -51 | -139 | -125 | -202 | -247 | -258 | -198 | -245 | -190 | -92 | -1,812 |

**Figure 1: Agricultural Wash Water Projection**




## Urban Stormwater Runoff

Urban stormwater runoff from two communities would be captured and used for the Proposed Project. Stormwater and urban runoff from the southern portion of the City of Salinas is pumped to the Salinas River (the rest of the City drains into the Reclamation Ditch system). Schaaf & Wheeler[3] estimated the amount of stormwater flow which could be diverted to the municipal wastewater system or the SIWTF for use in the Proposed Project. The estimated average annual yield is provided in Table 2, below.

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[2] Todd Groundwater, *Memorandum: Pure Water Monterey Groundwater Replenishment Project: Impacts of Changes in Percolation at the Salinas Industrial Wastewater Treatment Facility on Groundwater and the Salinas River*, February 2015

[3] Schaaf & Wheeler, *Groundwater Replenishment Project, Salinas River Inflow Impacts*, February 2015

Stormwater and urban runoff from 2,400 acres within the City of Monterey flow to Lake El Estero, which is maintained as part of El Estero Park. Excess stormwater is pumped to a discharge point on Del Monte State Beach. Schaaf & Wheeler[4] estimated the amount of stormwater flow which could be diverted to the municipal wastewater system for use in the Proposed Project. The estimated average annual yield is provided in Table 2. Diverting from Lake El Estero will require a water rights permit.

**Table 2: Urban Runoff Sources (acre-feet)**

| Source \ Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South Salinas | 52 | 41 | 34 | 16 | 2 | 0 | 0 | 0 | 2 | 8 | 23 | 47 | 225 |
| Lake El Estero | 24 | 15 | 14 | 5 | 1 | 0 | 0 | 0 | 1 | 4 | 10 | 13 | 87 |

## Surface Water Rights for Stream Flows

The Proposed Project would use three new surface water diversion sites to provide new source waters for recycling. The first two are from the Reclamation Ditch system, which has a drainage area of 157 square-miles. The Reclamation Ditch carries seasonal stormwater flows, urban runoff from the City of Salinas and agricultural tile drainage flows. Diversion points are proposed on the Reclamation Ditch at Davis Road, and on the Tembladero Slough at Castroville, based on the proximity of the channel to existing wastewater conveyance facilities. Schaaf & Wheeler[5] estimated the yield from this system, assuming a maximum 6 cfs diversion rate at Davis Road, maximum 3 cfs diversion rate at Castroville, and leaving an in-stream flow of 2 cfs at Davis Road in the winter, 0.7 cfs in the summer, and 1 cfs at Castroville year-round. The average annual yields from these diversions are shown in Table 3, below.

The third diversion is from the Blanco Drain, just above its confluence with the Salinas River. The Blanco Drain conveys seasonal stormwater flows and agricultural tile drainage from 6,400 acres. Schaaf & Wheeler[6] estimated the yield from this system, assuming a maximum diversion rate of 6 cfs, as shown in Table 3.

All of these diversions would require water rights permits from the State Water Resources Control Board (SWRCB), as would the Lake El Estero diversion discussed under Urban Stormwater Runoff.

**Table 3: Surface Water Sources (acre-feet)**

| Source \ Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Reclamation Ditch | 162 | 143 | 165 | 162 | 97 | 132 | 129 | 121 | 80 | 87 | 98 | 146 | 1,522 |
| Tembladero Slough | 131 | 117 | 142 | 154 | 145 | 67 | 66 | 62 | 41 | 45 | 50 | 115 | 1,135 |
| Blanco Drain | 209 | 223 | 246 | 252 | 225 | 274 | 277 | 244 | 184 | 168 | 133 | 185 | 2,620 |

## Secondary Treated Effluent

Secondary treated municipal wastewater from the MRWPCA Regional Treatment Plant (RTP) is used as influent to the Salinas Valley Reclamation Plant (SVRP), which produces recycled water for the CSIP. Average recycled water production for the period 2009-2013 was 12,955 AFY. Average wastewater inflow to the RTP during that period was 21,764 AFY. An average of 8,809 AFY of treated wastewater in excess of what was delivered to the CSIP was discharged to the Monterey Bay through the MRWPCA's ocean outfall. The average monthly inflows and outflows from the RTP are shown in Table 4, below.

[4] Schaaf & Wheeler, *Groundwater Replenishment Project, Urban Runoff Capture at Lake El Estero,* April 2014

[5] Schaaf & Wheeler, *Reclamation Ditch Yield Study*, March 2015

[6] Schaaf & Wheeler, *Blanco Drain Yield Study*, December 2014

**Table 4: Average RTP Inflows and Outflows, 2009-2013[7] (acre-feet)**

| Source/ Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **RTP Inflows** | 1,798 | 1,678 | 1,867 | 1,796 | 1,850 | 1,799 | 1,893 | 1,888 | 1,813 | 1,844 | 1,762 | 1,776 | 21,764 |
| **SVRP Deliveries** | 13 | 459 | 726 | 1,376 | 1,763 | 1,750 | 1,866 | 1,854 | 1,698 | 984 | 448 | 18 | 12,955 |
| **Ocean Outfall** | 1,785 | 1,219 | 1,141 | 420 | 88 | 49 | 27 | 34 | 114 | 859 | 1,314 | 1,759 | 8,809 |

The assumption that future CSIP recycled water demands would continue consistent with the recycled water use in this time period is considered conservative, given that this period included one drought year (2013) and that the Salinas River Diversion Facility (SRDF) operated for only four of the five years (the SRDF was not placed into operation until the year 2010).

CSIP use of all water sources are shown in Table 5, below. Under current conditions, CSIP wells are used to meet peak day demands that exceed the available recycled and river water supplies, and also to meet small demands below the lower production limit of the SVRP. The CSIP groundwater use conservatively includes one year when the SRDF didn't operate (similar to a multi-year drought condition such as occurred in 2014 and 2015).

**Table 5: Average CSIP Use by Source, 2009-2013[8] (acre-feet)**

| Source/ Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **CSIP-Wells** | 448 | 195 | 304 | 412 | 324 | 606 | 519 | 504 | 300 | 75 | 233 | 352 | 4,271 |
| **SRDF-River** | 0 | 0 | 0 | 100 | 561 | 819 | 886 | 739 | 266 | 56 | 0 | 0 | 3,427 |
| **SVRP-Recycled** | 5 | 483 | 733 | 1,383 | 1,738 | 1,748 | 1,843 | 1,853 | 1,698 | 984 | 452 | 18 | 12,939 |

Note: The SVRP numerical difference between Tables 4 and 5 is due to rounding differences in the source reports.

**Proposed Project and CSIP Demands**

The Proposed Project goal is to produce 3,500 AFY of highly treated (or purified recycled) water for injection in the Seaside Groundwater Basin to allow CalAm to extract the same amount for treatment and distribution to their customers in their Monterey District service area. To produce that volume, approximately 4,320 AFY of source water inflows are required at the AWT Facility. During wet or normal water years, an additional 200 AFY may be produced and injected in the winter months to develop a drought reserve. This would require an additional 248 AFY of source water. The monthly distribution of this demand is shown in Table 6, below.

Source flows not required for the Proposed Project would be made available to create additional recycled water for the CSIP. Table 6 includes an estimate of new source flows in excess of the AWT inflow needs, assuming seasonal storage of agricultural wash water (discussed below), year-round diversion of surface water, and AWT Facility demands for a normal year building a drought reserve.

[7] Data provided by Bob Holden, MRWPCA, February 2014.

[8] Data from MCWRA *Monterey County Water Recycling Projects/Salinas Valley Water Project/Salinas River Diversion Facility Update*, February, 2014

The CSIP system distributes recycled water, Salinas River water and well water from the Salinas Valley Groundwater Basin to agricultural irrigation demands in the northern Salinas Valley. Under existing conditions, well water is used to meet peak summer demands in excess of the supply available from the other sources, and also to meet low demands below the minimum production capacity of the SVRP (currently 5 MGD). As part of the Proposed Project, the SVRP would be modified to meet recycled water demands as low as 0.5 MGD. This modification would allow the MCWRA to reduce the use of the CSIP wells, particularly in the winter months when secondary treated effluent is available. The average CSIP well use for the period 2009-2013[9] is shown in Table 6. This provides a reasonable estimate of how much additional recycled water could be used by CSIP in average year conditions.

**Table 6: Monthly GWR and CSIP Use of New Supplies (acre-feet)**

| Use \ Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Proposed Project Demand | 367 | 331 | 367 | 355 | 367 | 355 | 367 | 367 | 355 | 367 | 355 | 367 | 4,320 |
| Drought Reserve | 42 | 38 | 42 | | | | | | | 42 | 41 | 42 | 248 |
| New Supplies in excess of AWT[10] | 117 | 129 | 158 | 541 | 514 | 709 | 540 | 504 | 320 | 0 | 0 | 50 | 3,582 |
| CSIP Wells Use | 448 | 195 | 304 | 440 | 324 | 606 | 476 | 504 | 300 | 76 | 233 | 354 | 4,260 |

## Seasonal Storage at the SIWTF

To maximize the available supply during the peak irrigation months, the main ponds at the SIWTF would be used for seasonal storage of agricultural wash water and Salinas' urban stormwater. The analysis of source water yield and proposed diversions assumes that during the months of October through March, these flows would be directed to the SIWTF. In addition, for the source water assumptions, the use of the drying beds and infiltration basins would be discontinued, so the only losses would be evaporation and percolation from the main ponds. During the months of April through September, these flows would be diverted to the municipal wastewater collection system for recycling and injection into the Seaside Basin and tertiary treatment for CSIP. Stored water would also be pumped from the SIWTF ponds to the municipal wastewater collection system.

## Results of Source Water Availability Analysis

In the attached Table 7: Source Water Analysis, the existing inflows to the RTP are entered in the top line under Sources. The monthly storage balance in the SIWTF ponds is calculated for a normal water year. The inflow, rainfall, evaporation and percolation from Table 1 are shown in rows 1, 3, 4 and 5, respectively. Urban Runoff from South Salinas is carried from Table 2 into line 2. Assuming the ponds are empty at the start of October, they would remain wet for nine months a year, maintaining the operational characteristics of the SIWTF and enabling continued contributions of seepage water to Salinas River flows and recharge to the Salinas Valley Groundwater Basin[11]. The net yield of agricultural wash water and Salinas stormwater for the Proposed Project is shown on line 8. Other source flows from Tables 2 and 3 are shown on lines 9 through 12, and the net new supply is shown on line 13. Under the Demands heading are included the average SVRP deliveries to the CSIP and the average groundwater use by the CSIP, as well as the AWT Facility feed-water demands. Line 21 shows the projected net supply to

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[9] Data from *Monterey County Water Recycling Projects/Salinas Valley Water Project/Salinas River Diversion Facility Update,* MCWRA Board Packet, February 24, 2014

[10] Excess supplies are calculated as the total of new water conveyed to the RTP (not including secondary treated effluent) minus the AWT Facility demand

[11] Full diversion of flows was analyzed in the report: *Groundwater Replenishment Project, Salinas River Inflow Impacts*

the CSIP (sum of existing and augmented flows), and Line 26 shows the supply for the Proposed Project while developing a drought reserve. Assuming the agencies divert all of the water shown on this table (i..e, under an assumption that the Proposed Project would divert the maximum available source waters), there would still be approximately 6,300 AFY of secondary-treated municipal wastewater discharged through the ocean outfall (line 28) during normal rainfall years.

**Diversion and Use Scenarios**

The MRWPCA has a goal of reusing 100% of the secondary treated municipal effluent at the RTP (i.e., having no discharge to the ocean), and operating the system as efficiently as possible to reduce the energy demand. Therefore, rather than divert all waters as described in the last section and in Table 7, the Proposed Project would prioritize the use of secondary treated effluent above the diversion of surface water sources, to the extent possible, which would minimize adverse environmental impacts and maximize system efficiency. The proposed priority of source usage would be:

1. Unused secondary treated effluent
2. Agricultural wash water
3. Salinas storm water
4. Reclamation Ditch
5. Blanco Drain
6. Tembladero Slough
7. Lake El Estero

In the attached scenario tables (Tables 8 through 10), the use of the various sources is reduced to just meet the demands of the AWT Facility and offset the current CSIP groundwater use in the wet season (OCT-MAR). During the dry season (APR-SEP), surface water diversions are shown meeting the monthly AWT Facility demands and providing extra flow for the CSIP, such that the annual use of new sources exceeds the annual AWT Facility demands. In practice, the surface water diversions could be reduced or increased based on the actual CSIP system demands, up to the total yields shown in Table 7. The demand scenarios considered are:

Table 8: A normal water year while developing a drought reserve (AWT Facility producing 3,700 AFY)
Table 9: A normal water year with a full drought reserve (AWT Facility producing 3,500 AFY)
Table 10: A drought year starting with a full reserve (AWT Facility producing 2,700 AFY)

In the normal year with a full reserve scenario, surface water diversions were only required from the Reclamation Ditch and the Blanco Drain. Surface water diversions were only required between April and October in both normal year scenarios.

In the drought year scenario, the stormwater and wastewater availability were reduced. Urban runoff from Salinas was assumed to be one-third of the historic average. Rainfall on the SIWTF ponds used the 2013 rainfall record (critically dry year). The unused secondary treated effluent values from 2013 were used, also the historic low. The CSIP groundwater well use from OCT 2013 to SEP 2014 was used as the CSIP augmentation target. Under this scenario, surface water diversions were required from the Reclamation Ditch, Blanco Drain and Tembladero Slough, and the diversions were needed from March through November.

References:

City of Salinas, Industrial Wastewater Treatment Facility, 2013 Annual Report, January 2014

Monterey County Water Resources Agency, *Monterey County Water Recycling Projects/Salinas Valley Water Project/Salinas River Diversion Facility Update*, MCWRA Board Packet, February 24, 2014

Monterey County Water Resources Agency, *Salinas Valley Water Project, Annual Flow Monitoring Reports for Water Years 2010 – 2013.*

Monterey County Water Resources Agency, Application to Appropriate Water, April 2014.

Monterey Peninsula Water Management District, *Source Water Spreadsheet Analysis, March, 2015.*

Monterey Peninsula Water Management District, *Industrial Ponds Percolation and Evaporation Technical Memorandum 2015-01,* July 2015.

Schaaf & Wheeler, *Groundwater Replenishment Project, Urban Runoff Capture at Lake El Estero*, April 2014

Schaaf & Wheeler, *Blanco Drain Yield Study*, December 2014

Schaaf & Wheeler, *Groundwater Replenishment Project, Salinas River Inflow Impacts*, February 2015

Schaaf & Wheeler, *Reclamation Ditch Yield Study*, March 2015

Todd Groundwater, *Memorandum: Pure Water Monterey Groundwater Replenishment Project: Impacts of Changes in Percolation at the Salinas Industrial Wastewater Treatment Facility on Groundwater and the Salinas River*, February 2015

## Table 7: Source Water Analysis for the Pure Water Monterey Groundwater Replenishment Project

**Full Surface Water Yields, Normal Water Year, Building a Drought Reserve**

**All facilities built [1] - average water year conditions - all flows in acre-feet** — **7/14/2015**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **SOURCES** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
| | **Existing RTP Inflows (Average 2009 to 2013)** | **1,798** | **1,678** | **1,867** | **1,796** | **1,850** | **1,799** | **1,893** | **1,888** | **1,813** | **1,844** | **1,762** | **1,776** | **21,764** |
| | **New Source Water** | | | | | | | | | | | | | |
| | *City of Salinas* | | | | | | | | | | | | | |
| 1 | Salinas Agricultural Wash Water [2] | 156 | 158 | 201 | 307 | 311 | 391 | 435 | 444 | 367 | 410 | 329 | 223 | 3,732 |
| | *Agricultural Wash Water (AWW) to Ponds [3]* | *156* | *158* | *201* | *0* | *0* | *0* | *0* | *0* | *0* | *410* | *329* | *223* | *1,477* |
| | *AWW directly to RTP* | *0* | *0* | *0* | *307* | *311* | *391* | *435* | *444* | *367* | *0* | *0* | *0* | *2,255* |
| 2 | Salinas Urban Storm Water Runoff [4] | 52 | 41 | 34 | 16 | 2 | 0 | 0 | 0 | 2 | 8 | 23 | 47 | 225 |
| | *Urban runoff to ponds* | *52* | *41* | *34* | *0* | *0* | *0* | *0* | *0* | *0* | *8* | *23* | *47* | *205* |
| | *Urban runoff to RTP* | *0* | *0* | *0* | *16* | *2* | *0* | *0* | *0* | *2* | *0* | *0* | *0* | *20* |
| 3 | Rainfall (on SIWTF, 121 acre pond area) [5] | 26 | 24 | 21 | 11 | 3 | 1 | 0 | 0 | 2 | 6 | 14 | 24 | 132 |
| 4 | Evaporation (from SIWTF, 121 acre pond area) [6] | (12) | (16) | (29) | (41) | (46) | (52) | | | | (28) | (15) | (12) | (251) |
| 5 | Percolation [7] | (143) | (129) | (143) | (138) | (143) | (138) | | | | (143) | (138) | (143) | (1,257) |
| 6 | SIWTF pond storage balance [8] | 684 | 763 | 847 | 647 | 362 | 0 | 0 | 0 | 0 | 253 | 466 | 605 | |
| 7 | Recovery of flow from SIWTF storage ponds to RTP | 0 | 0 | 0 | 32 | 100 | 172 | 0 | 0 | 0 | 0 | 0 | 0 | 304 |
| 8 | AWW and Salinas Runoff to RTP | 0 | 0 | 0 | 355 | 413 | 563 | 435 | 444 | 369 | 0 | 0 | 0 | 2,579 |
| | *Water Rights Applications to SWRCB* | | | | | | | | | | | | | |
| 9 | Blanco Drain [9] | 209 | 223 | 246 | 252 | 225 | 274 | 277 | 244 | 184 | 168 | 133 | 185 | 2,620 |
| 10 | Reclamation Ditch at Davis Road [10] | 162 | 143 | 165 | 162 | 97 | 132 | 129 | 121 | 80 | 87 | 98 | 146 | 1,522 |
| 11 | Tembladero Slough at Castroville [11] | 131 | 117 | 142 | 154 | 145 | 67 | 66 | 62 | 41 | 45 | 50 | 115 | 1,135 |
| 12 | City of Monterey - Diversion at Lake El Estero | 24 | 15 | 14 | 5 | 1 | 0 | 0 | 0 | 1 | 4 | 10 | 13 | 87 |
| 13 | **Subtotal New Waters Available** | **526** | **498** | **567** | **928** | **881** | **1,036** | **907** | **871** | **675** | **304** | **291** | **459** | **7,943** |
| | **Total Projected Water Supply** | **2,324** | **2,176** | **2,434** | **2,724** | **2,731** | **2,835** | **2,800** | **2,759** | **2,488** | **2,147** | **2,053** | **2,235** | **29,707** |
| | **DEMANDS** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
| | Average SVRP deliveries to CSIP (2009-2013) | 13 | 459 | 726 | 1,376 | 1,763 | 1,750 | 1,866 | 1,854 | 1,698 | 984 | 448 | 18 | 12,955 |
| 14 | FIVE YEAR AVERAGE CSIP AREA WELL WATER USE (2009-2013) | 448 | 195 | 304 | 412 | 324 | 606 | 519 | 504 | 300 | 75 | 233 | 352 | 4,272 |
| | **TOTAL CSIP Demand** | **461** | **654** | **1,030** | **1,788** | **2,087** | **2,356** | **2,385** | **2,358** | **1,998** | **1,059** | **681** | **370** | **17,227** |
| 16 | FEEDWATER AMOUNT AT RTP TO GWR PROJECT AWTF | 367 | 331 | 367 | 355 | 367 | 355 | 367 | 367 | 355 | 367 | 355 | 367 | 4,320 |
| 17 | FEEDWATER TO ESTABLISH CSIP AREA DROUGHT RESERVE (200 AFY AWTF PRODUCT WATER) [14] | 42 | 38 | 42 | | | | | | | 42 | 41 | 42 | 248 |
| 18 | **TOTAL TO GWR ADVANCED WATER TREATMENT FACILITY** | **409** | **369** | **409** | **355** | **367** | **355** | **367** | **367** | **355** | **409** | **396** | **409** | **4,568** |
| | **Total Projected Water Demand** | **870** | **1,024** | **1,439** | **2,143** | **2,454** | **2,711** | **2,752** | **2,725** | **2,353** | **1,468** | **1,077** | **779** | **21,795** |
| | **Use of Source Water** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
| 19 | Secondary effluent to SVRP for CSIP [12] | 461 | 654 | 1,030 | 1,788 | 1,850 | 1,799 | 1,893 | 1,888 | 1,813 | 1,059 | 681 | 370 | 15,287 |
| 20 | New sources available to CSIP [13] | 0 | 0 | 0 | 573 | 514 | 681 | 540 | 504 | 320 | 0 | 0 | 0 | 3,132 |
| 21 | **Total Supply to CSIP** | **461** | **654** | **1,030** | **2,361** | **2,364** | **2,480** | **2,433** | **2,392** | **2,133** | **1,059** | **681** | **370** | **18,419** |
| | **Net CSIP Increase** | | | | | | | | | | | | | **5,463** |
| 23 | Surface waters at RTP to AWT | 409 | 369 | 409 | 0 | 0 | 0 | 0 | 0 | 0 | 304 | 291 | 409 | 2,191 |
| 24 | Secondary effluent to AWT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 105 | 105 | 0 | 210 |
| 25 | AWW and Salinas urban runoff to AWT | 0 | 0 | 0 | 355 | 367 | 355 | 367 | 367 | 355 | 0 | 0 | 0 | 2,166 |
| 26 | **Feedwater to AWT** | **409** | **369** | **409** | **355** | **367** | **355** | **367** | **367** | **355** | **409** | **396** | **409** | **4,567** |
| | **Subtotal- all waters (including secondary effluent)** | **870** | **1,024** | **1,439** | **2,716** | **2,731** | **2,835** | **2,800** | **2,759** | **2,488** | **1,468** | **1,077** | **779** | **22,986** |
| 27 | FIVE YEAR AVERAGE WASTE WATER EFFLUENT TO OCEAN OUTFALL (2009-2013)[15] | 1,785 | 1,219 | 1,141 | 420 | 88 | 49 | 27 | 34 | 114 | 859 | 1,314 | 1,759 | 8,809 |
| 28 | WASTE WATER EFFLUENT TO OCEAN OUTFALL WITH PROPOSED DIVERSIONS TO CSIP/AWT/RUWAP [16] | 1,337 | 1,024 | 837 | 8 | 0 | 0 | 0 | 0 | 0 | 679 | 976 | 1,407 | 6,267 |
| 29 | NEW SUPPLIES IN EXCESS OF AWT DEMANDS [17] | 117 | 129 | 158 | 573 | 514 | 681 | 540 | 504 | 320 | (105) | (105) | 50 | 3,375 |
| 30 | AWT BRINE TO OCEAN OUTFALL | 78 | 70 | 78 | 67 | 70 | 67 | 70 | 70 | 67 | 78 | 75 | 78 | 868 |

**Notes**

1 Presumes all facilities associated with diversions are completed.

2 Table 2-1, p. 5, Schaaf & Wheeler Consulting Engineers. Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

3 Volume of effluent from City of Salinas agricultural wash water to be directed into ponds 1,2,3, and the aeration pond for storage.

4 Average monthly flow from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

5 Rainfall from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015. Pond area presumed to be Ponds 1,2, 3 + Aeration lagoon. No rainfall/evaporation or storage assigned to drying beds.

6 Table 3, Todd Groundwater, Draft Memorandum, Pure Water Monterey Groundwater Replenishment Project: Impacts of Changes in Percolation at the Salinas Industrial Wastewater Treatment Facility on Groundwater and the Salinas River, February 11, 2015.

7 Table 4, Ibid. Also confirmed in MPWMD Industrial Ponds Percolation and Evaporation Technical Memorandum 2015-01, July 2015.

8 Ponds 1,2,3 and aeration basin hold up to 1,065 acre-feet (one foot of freeboard). If flow to ponds would exceed the maximum volume, it is presumed that excess flow can be diverted to the RIBs or drying beds or flow can be diverted to the RTP. Presume that pond storage goes to zero sometime during the year (shown here starting in July).

9 Max diversion = 6 cfs diversion. See REVISED DRAFT BLANCO DRAIN YIELD STUDY, Schaaf and Wheeler, December 2014.

10 Max. diversion = 6 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Note that flow figures shown here are a combination of flow estimates in the S&W analysis made for the 2 cfs instream requirement Jan-May and 1 cfs instream requirement for June-Dec.

11 Max. diversion = 3 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Figures shown here are the difference between the combined Davis Road/TS diverison with Seasonal Bypass. This presumes the preference is to remove flow at Davis Road first, rather than bypass flow to Tembaldero Slough.

12 Unused secondary effluent waste water currently discharged to Monterey Bay would be used in conjunction with improvements at the RTP to provide additional flow to the Salinas Valley Reclamation Project (SVRP) during periods of low demand (i.e., < 5 mgd).

13 New source waters not used by AWT in the summer months will be available to SVRP for CSIP.

14 A drought reserve of up to 1,000 AF would be created over five years by producing 200 AFY additional product water from the GWR Project AWTF during winter months and storing the water in the Seaside Basin. This would establish a "water bank" that the CSIP can draw on in droughts. The drought reserve would allow flow at the RTP for the GWR Project to be temporarily reduced during critically dry periods, thus freeing up more of the newly available inflows to the RTP to be sent to the CSIP area. Extraction from the Seaside Basin would continue at the average rate to supply the Monterey Peninsula.

15 Average monthly RTP discharge, 2009-2013 (reported by MRWPCA).

16 Secondary treated municpal effluent not used for SVRP/CSIP or the AWT.

17 Excess is calculated as Line 13 minus Line 23

## Table 8: Source Water Analysis for the Pure Water Monterey Groundwater Replenishment Project

### Diversion Patterns for a Normal Water Year, Building a Drought Reserve

**All facilities built [1] - average water year conditions - all flows in acre-feet** 7/15/2015

| # | SOURCES | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Existing RTP Inflows (Average 2009 to 2013)** | **1,798** | **1,678** | **1,867** | **1,796** | **1,850** | **1,799** | **1,893** | **1,888** | **1,813** | **1,844** | **1,762** | **1,776** | **21,764** |
| | | | | | | | | | | | | | | |
| | **New Source Water** | | | | | | | | | | | | | |
| | *City of Salinas* | | | | | | | | | | | | | |
| 1 | Salinas Agricultural Wash Water [2] | 156 | 158 | 201 | 307 | 311 | 391 | 435 | 444 | 367 | 410 | 329 | 223 | 3,732 |
| | *Agricultural Wash Water (AWW) to Ponds [3]* | *156* | *158* | *201* | *0* | *0* | *0* | *0* | *0* | *0* | *410* | *329* | *223* | *1,477* |
| | *AWW directly to RTP* | *0* | *0* | *0* | *307* | *311* | *391* | *435* | *444* | *367* | *0* | *0* | *0* | *2,255* |
| 2 | Salinas Urban Storm Water Runoff [4] | 52 | 41 | 34 | 16 | 2 | 0 | 0 | 0 | 2 | 8 | 23 | 47 | 225 |
| | *Urban runoff to ponds* | *52* | *41* | *34* | *0* | *0* | *0* | *0* | *0* | *0* | *8* | *23* | *47* | *205* |
| | *Urban runoff to RTP* | *0* | *0* | *0* | *16* | *2* | *0* | *0* | *0* | *2* | *0* | *0* | *0* | *20* |
| 3 | Rainfall (on SIWTF, 121 acre pond area) [5] | 26 | 24 | 21 | 11 | 3 | 1 | 0 | 0 | 2 | 6 | 14 | 24 | 132 |
| 4 | Evaporation (from SIWTF, 121 acre pond area) [6] | (12) | (16) | (29) | (41) | (46) | (52) | | | | (28) | (15) | (12) | (251) |
| 5 | Percolation [7] | (143) | (129) | (143) | (138) | (143) | (138) | | | | (143) | (138) | (143) | (1,257) |
| 6 | SIWTF pond storage balance [8] | 684 | 763 | 847 | 647 | 362 | 0 | 0 | 0 | 0 | 253 | 466 | 605 | |
| 7 | Recovery of flow from SIWTF storage ponds to RTP | 0 | 0 | 0 | 32 | 100 | 172 | 0 | 0 | 0 | 0 | 0 | 0 | 304 |
| 8 | AWW and Salinas Runoff to RTP | 0 | 0 | 0 | 355 | 413 | 563 | 435 | 444 | 369 | 0 | 0 | 0 | 2,579 |
| | *Water Rights Applications to SWRCB* | | | | | | | | | | | | | |
| 9 | Blanco Drain [9] | 0 | 0 | 0 | 252 | 225 | 274 | 277 | 244 | 184 | 0 | 0 | 0 | 1,456 |
| 10 | Reclamation Ditch at Davis Road [10] | 0 | 0 | 0 | 162 | 97 | 132 | 129 | 121 | 80 | 0 | 0 | 0 | 721 |
| 11 | Tembladero Slough at Castroville [11] | 0 | 0 | 0 | 154 | 145 | 67 | 66 | 62 | 41 | 0 | 0 | 0 | 535 |
| 12 | City of Monterey - Diversion at Lake El Estero | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | **Subtotal New Waters Available** | **0** | **0** | **0** | **923** | **880** | **1,036** | **907** | **871** | **674** | **0** | **0** | **0** | **5,291** |
| | | | | | | | | | | | | | | |
| | **Total Projected Water Supply** | **1,798** | **1,678** | **1,867** | **2,719** | **2,730** | **2,835** | **2,800** | **2,759** | **2,487** | **1,844** | **1,762** | **1,776** | **27,055** |

| # | DEMANDS | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Average SVRP deliveries to CSIP (2009-2013) | 13 | 459 | 726 | 1,376 | 1,763 | 1,750 | 1,866 | 1,854 | 1,698 | 984 | 448 | 18 | 12,955 |
| 14 | FIVE YEAR AVERAGE CSIP AREA WELL WATER USE (2009-2013) | 448 | 195 | 304 | 412 | 324 | 606 | 519 | 504 | 300 | 75 | 233 | 352 | 4,272 |
| | **TOTAL CSIP Demand** | **461** | **654** | **1,030** | **1,788** | **2,087** | **2,356** | **2,385** | **2,358** | **1,998** | **1,059** | **681** | **370** | **17,227** |
| | | | | | | | | | | | | | | |
| 16 | FEEDWATER AMOUNT AT RTP TO GWR PROJECT AWTF | 367 | 331 | 367 | 355 | 367 | 355 | 367 | 367 | 355 | 367 | 355 | 367 | 4,320 |
| 17 | FEEDWATER TO ESTABLISH CSIP AREA DROUGHT RESERVE (200 AFY AWTF PRODUCT WATER) [14] | 42 | 38 | 42 | | | | | | | 42 | 41 | 42 | 248 |
| 18 | **TOTAL TO GWR ADVANCED WATER TREATMENT FACILITY** | **409** | **369** | **409** | **355** | **367** | **355** | **367** | **367** | **355** | **409** | **396** | **409** | **4,568** |
| | | | | | | | | | | | | | | |
| | **Total Projected Water Demand** | **870** | **1,024** | **1,439** | **2,143** | **2,454** | **2,711** | **2,752** | **2,725** | **2,353** | **1,468** | **1,077** | **779** | **21,795** |

| # | Use of Source Water | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 | Secondary effluent to SVRP for CSIP [12] | 461 | 654 | 1,030 | 1,788 | 1,850 | 1,799 | 1,893 | 1,888 | 1,813 | 1,059 | 681 | 370 | 15,287 |
| 20 | New sources available to CSIP [13] | 0 | 0 | 0 | 568 | 513 | 681 | 540 | 504 | 319 | 0 | 0 | 0 | 3,125 |
| 21 | **Total Supply to CSIP** | **461** | **654** | **1,030** | **2,356** | **2,363** | **2,480** | **2,433** | **2,392** | **2,132** | **1,059** | **681** | **370** | **18,412** |
| | **Net CSIP Increase** | | | | | | | | | | | | | **5,456** |
| | | | | | | | | | | | | | | |
| 23 | Surface waters at RTP to AWT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 | Secondary effluent to AWT | 409 | 369 | 409 | 0 | 0 | 0 | 0 | 0 | 0 | 409 | 396 | 409 | 2,401 |
| 25 | AWW and Salinas urban runoff to AWT | 0 | 0 | 0 | 355 | 367 | 355 | 367 | 367 | 355 | 0 | 0 | 0 | 2,166 |
| 26 | **Feedwater to AWT** | **409** | **369** | **409** | **355** | **367** | **355** | **367** | **367** | **355** | **409** | **396** | **409** | **4,567** |
| | **Subtotal- all waters (including secondary effluent)** | **870** | **1,024** | **1,439** | **2,711** | **2,730** | **2,835** | **2,800** | **2,759** | **2,487** | **1,468** | **1,077** | **779** | **22,979** |

| # | | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | FIVE YEAR AVERAGE WASTE WATER EFFLUENT TO OCEAN OUTFALL (2009-2013) [15] | 1,785 | 1,219 | 1,141 | 420 | 88 | 49 | 27 | 34 | 114 | 859 | 1,314 | 1,759 | 8,809 |
| 28 | WASTE WATER EFFLUENT TO OCEAN OUTFALL WITH PROPOSED DIVERSIONS TO CSIP/AWT/RUWAP [16] | 928 | 655 | 428 | 8 | 0 | 0 | 0 | 0 | 0 | 375 | 685 | 998 | 4,076 |
| 29 | NEW SUPPLIES IN EXCESS OF AWT DEMANDS [17] | (409) | (369) | (409) | 568 | 513 | 681 | 540 | 504 | 319 | (409) | (396) | (409) | 724 |
| 30 | AWT BRINE TO OCEAN OUTFALL | 78 | 70 | 78 | 67 | 70 | 67 | 70 | 70 | 67 | 78 | 75 | 78 | 868 |

**Notes**

1 Presumes all facilities associated with diversions are completed.

2 Table 2-1, p. 5, Schaaf & Wheeler Consulting Engineers. Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

3 Volume of effluent from City of Salinas agricultural wash water to be directed into ponds 1,2,3, and the aeration pond for storage.

4 Average monthly flow from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

5 Rainfall from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015. Pond area presumed to be Ponds 1,2, 3 + Aeration lagoon. No rainfall/evaporation or storage assigned to drying beds.

6 Table 3, Todd Groundwater, Draft Memorandum, Pure Water Monterey Groundwater Replenishment Project: Impacts of Changes in Percolation at the Salinas Industrial Wastewater Treatment Facility on Groundwater and the Salinas River, February 11, 2015.

7 Table 4, Ibid. Also confirmed in MPWMD Industrial Ponds Percolation and Evaporation Technical Memorandum 2015-01, July 2015.

8 Ponds 1,2,3 and aeration basin hold up to 1,065 acre-feet (one foot of freeboard). If flow to ponds would exceed the maximum volume, it is presumed that excess flow can be diverted to the RIBs or drying beds or flow can be diverted to the RTP. Presume that pond storage goes to zero sometime during the year (shown here starting in July).

9 Max diversion = 6 cfs diversion. See REVISED DRAFT BLANCO DRAIN YIELD STUDY, Schaaf and Wheeler, December 2014.

10 Max. diversion = 6 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Note that flow figures shown here are a combination of flow estimates in the S&W analysis made for the 2 cfs instream requirement Jan-May and 1 cfs instream requirement for June-Dec.

11 Max. diversion = 3 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Figures shown here are the difference between the combined Davis Road/TS diverison with Seasonal Bypass. This presumes the preference is to remove flow at Davis Road first, rather than bypass flow to Tembaldero Slough.

12 Unused secondary effluent waste water currently discharged to Monterey Bay would be used in conjunction with improvements at the RTP to provide additional flow to the Salinas Valley Reclamation Project (SVRP) during periods of low demand (i.e., < 5 mgd).

13 New source waters not used by AWT in the summer months will be available to SVRP for CSIP.

14 A drought reserve of up to 1,000 AF would be created over five years by producing 200 AFY additional product water from the GWR Project AWTF during winter months and storing the water in the Seaside Basin. This would establish a "water bank" that the CSIP can draw on in droughts. The drought reserve would allow flow at the RTP for the GWR Project to be temporarily reduced during critically dry periods, thus freeing up more of the newly available inflows to the RTP to be sent to the CSIP area. Extraction from the Seaside Basin would continue at the average rate to supply the Monterey Peninsula.

15 Average monthly RTP discharge, 2009-2013 (reported by MRWPCA).

16 Secondary treated municpal effluent not used for SVRP/CSIP or the AWT.

17 Excess is calculated as Line 13 minus Line 23

## Table 9: Source Water Analysis for the Pure Water Monterey Groundwater Replenishment Project

### Diversion Pattern for a Normal Water Year when the Drought Reserve is Full

| | All facilities built [1] - average water year conditions - all flows in acre-feet | | | | | | | | | | | | | 7/15/2015 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **SOURCES** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
| | **Existing RTP Inflows (Average 2009 to 2013)** | **1,798** | **1,678** | **1,867** | **1,796** | **1,850** | **1,799** | **1,893** | **1,888** | **1,813** | **1,844** | **1,762** | **1,776** | **21,764** |
| | | | | | | | | | | | | | | |
| | **New Source Water** | | | | | | | | | | | | | |
| | *City of Salinas* | | | | | | | | | | | | | |
| 1 | Salinas Agricultural Wash Water [2] | 156 | 158 | 201 | 307 | 311 | 391 | 435 | 444 | 367 | 410 | 329 | 223 | 3,732 |
| | *Agricultural Wash Water (AWW) to Ponds [3]* | *156* | *158* | *201* | *0* | *0* | *0* | *0* | *0* | *0* | *410* | *329* | *223* | *1,477* |
| | *AWW directly to RTP* | *0* | *0* | *0* | *307* | *311* | *391* | *435* | *444* | *367* | *0* | *0* | *0* | *2,255* |
| 2 | Salinas Urban Storm Water Runoff [4] | 52 | 41 | 34 | 16 | 2 | 0 | 0 | 0 | 2 | 8 | 23 | 47 | 225 |
| | *Urban runoff to ponds* | *52* | *41* | *34* | *0* | *0* | *0* | *0* | *0* | *0* | *8* | *23* | *47* | *205* |
| | *Urban runoff to RTP* | *0* | *0* | *0* | *16* | *2* | *0* | *0* | *0* | *2* | *0* | *0* | *0* | *20* |
| 3 | Rainfall (on SIWTF, 121 acre pond area) [5] | 26 | 24 | 21 | 11 | 3 | 1 | 0 | 0 | 2 | 6 | 14 | 24 | 132 |
| 4 | Evaporation (from SIWTF, 121 acre pond area) [6] | (12) | (16) | (29) | (41) | (46) | (52) | | | | (28) | (15) | (12) | (251) |
| 5 | Percolation [7] | (143) | (129) | (143) | (138) | (143) | (138) | | | | (143) | (138) | (143) | (1,257) |
| 6 | SIWTF pond storage balance [8] | 684 | 763 | 847 | 647 | 362 | 0 | 0 | 0 | 0 | 253 | 466 | 605 | |
| 7 | Recovery of flow from SIWTF storage ponds to RTP | 0 | 0 | 0 | 32 | 100 | 172 | 0 | 0 | 0 | 0 | 0 | 0 | 304 |
| 8 | AWW and Salinas Runoff to RTP | 0 | 0 | 0 | 355 | 413 | 563 | 435 | 444 | 369 | 0 | 0 | 0 | 2,579 |
| | *Water Rights Applications to SWRCB* | | | | | | | | | | | | | |
| 9 | Blanco Drain [9] | 0 | 0 | 0 | 252 | 225 | 274 | 277 | 244 | 184 | 0 | 0 | 0 | 1,456 |
| 10 | Reclamation Ditch at Davis Road [10] | 0 | 0 | 0 | 162 | 97 | 132 | 129 | 121 | 80 | 0 | 0 | 0 | 721 |
| 11 | Tembladero Slough at Castroville [11] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | City of Monterey - Diversion at Lake El Estero | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | **Subtotal New Waters Available** | **0** | **0** | **0** | **769** | **735** | **969** | **841** | **809** | **633** | **0** | **0** | **0** | **4,756** |
| | | | | | | | | | | | | | | |
| | **Total Projected Water Supply** | **1,798** | **1,678** | **1,867** | **2,565** | **2,585** | **2,768** | **2,734** | **2,697** | **2,446** | **1,844** | **1,762** | **1,776** | **26,520** |
| | | | | | | | | | | | | | | |
| | **DEMANDS** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
| | Average SVRP deliveries to CSIP (2009-2013) | 13 | 459 | 726 | 1,376 | 1,763 | 1,750 | 1,866 | 1,854 | 1,698 | 984 | 448 | 18 | 12,955 |
| 14 | FIVE YEAR AVERAGE CSIP AREA WELL WATER USE (2009-2013) | 448 | 195 | 304 | 412 | 324 | 606 | 519 | 504 | 300 | 75 | 233 | 352 | 4,272 |
| | **TOTAL CSIP Demand** | **461** | **654** | **1,030** | **1,788** | **2,087** | **2,356** | **2,385** | **2,358** | **1,998** | **1,059** | **681** | **370** | **17,227** |
| | | | | | | | | | | | | | | |
| 16 | FEEDWATER AMOUNT AT RTP TO GWR PROJECT AWTF | 367 | 331 | 367 | 355 | 367 | 355 | 367 | 367 | 355 | 367 | 355 | 367 | 4,320 |
| 17 | FEEDWATER TO ESTABLISH CSIP AREA DROUGHT RESERVE (200 AFY AWTF PRODUCT WATER) [14] | 0 | 0 | 0 | | | | | | | 0 | 0 | 0 | 0 |
| 18 | **TOTAL TO GWR ADVANCED WATER TREATMENT FACILITY** | **367** | **331** | **367** | **355** | **367** | **355** | **367** | **367** | **355** | **367** | **355** | **367** | **4,320** |
| | | | | | | | | | | | | | | |
| | **Total Projected Water Demand** | **828** | **985** | **1,397** | **2,143** | **2,454** | **2,711** | **2,752** | **2,725** | **2,353** | **1,426** | **1,036** | **737** | **21,547** |
| | | | | | | | | | | | | | | |
| | **Use of Source Water** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
| 19 | Secondary effluent to SVRP for CSIP [12] | 461 | 654 | 1,030 | 1,788 | 1,850 | 1,799 | 1,893 | 1,888 | 1,813 | 1,059 | 681 | 370 | 15,287 |
| 20 | New sources available to CSIP [13] | 0 | 0 | 0 | 414 | 368 | 614 | 474 | 442 | 278 | 0 | 0 | 0 | 2,590 |
| 21 | **Total Supply to CSIP** | **461** | **654** | **1,030** | **2,202** | **2,218** | **2,413** | **2,367** | **2,330** | **2,091** | **1,059** | **681** | **370** | **17,877** |
| | **Net CSIP Increase** | | | | | | | | | | | | | **4,921** |
| | | | | | | | | | | | | | | |
| 23 | Surface waters at RTP to AWT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 | Secondary effluent to AWT | 367 | 331 | 367 | 0 | 0 | 0 | 0 | 0 | 0 | 367 | 355 | 367 | 2,154 |
| 25 | AWW and Salinas urban runoff to AWT | 0 | 0 | 0 | 355 | 367 | 355 | 367 | 367 | 355 | 0 | 0 | 0 | 2,166 |
| 26 | **Feedwater to AWT** | **367** | **331** | **367** | **355** | **367** | **355** | **367** | **367** | **355** | **367** | **355** | **367** | **4,320** |
| | **Subtotal- all waters (including secondary effluent)** | **828** | **985** | **1,397** | **2,557** | **2,585** | **2,768** | **2,734** | **2,697** | **2,446** | **1,426** | **1,036** | **737** | **22,197** |
| | | | | | | | | | | | | | | |
| 27 | FIVE YEAR AVERAGE WASTE WATER EFFLUENT TO OCEAN OUTFALL (2009-2013)[15] | 1,785 | 1,219 | 1,141 | 420 | 88 | 49 | 27 | 34 | 114 | 859 | 1,314 | 1,759 | 8,809 |
| 28 | WASTE WATER EFFLUENT TO OCEAN OUTFALL WITH PROPOSED DIVERSIONS TO CSIP/AWT/RUWAP [16] | 970 | 693 | 470 | 8 | 0 | 0 | 0 | 0 | 0 | 417 | 726 | 1,040 | 4,323 |
| 29 | NEW SUPPLIES IN EXCESS OF AWT DEMANDS [17] | (367) | (331) | (367) | 414 | 368 | 614 | 474 | 442 | 278 | (367) | (355) | (367) | 436 |
| 30 | AWT BRINE TO OCEAN OUTFALL | 70 | 63 | 70 | 67 | 70 | 67 | 70 | 70 | 67 | 70 | 67 | 70 | 821 |

**Notes**

1 Presumes all facilities associated with diversions are completed.

2 Table 2-1, p. 5, Schaaf & Wheeler Consulting Engineers. Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

3 Volume of effluent from City of Salinas agricultural wash water to be directed into ponds 1,2,3, and the aeration pond for storage.

4 Average monthly flow from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

5 Rainfall from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015. Pond area presumed to be Ponds 1,2, 3 + Aeration lagoon. No rainfall/evaporation or storage assigned to drying beds.

6 Table 3, Todd Groundwater, Draft Memorandum, Pure Water Monterey Groundwater Replenishment Project: Impacts of Changes in Percolation at the Salinas Industrial Wastewater Treatment Facility on Groundwater and the Salinas River, February 11, 2015.

7 Table 4, Ibid. Also confirmed in MPWMD Industrial Ponds Percolation and Evaporation Technical Memorandum 2015-01, July 2015.

8 Ponds 1,2,3 and aeration basin hold up to 1,065 acre-feet (one foot of freeboard). If flow to ponds would exceed the maximum volume, it is presumed that excess flow can be diverted to the RIBs or drying beds or flow can be diverted to the RTP. Presume that pond storage goes to zero sometime during the year (shown here starting in July).

9 Max diversion = 6 cfs diversion. See REVISED DRAFT BLANCO DRAIN YIELD STUDY, Schaaf and Wheeler, December 2014.

10 Max. diversion = 6 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Note that flow figures shown here are a combination of flow estimates in the S&W analysis made for the 2 cfs instream requirement Jan-May and 1 cfs instream requirement for June-Dec.

11 Max. diversion = 3 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Figures shown here are the difference between the combined Davis Road/TS diverison with Seasonal Bypass. This presumes the preference is to remove flow at Davis Road first, rather than bypass flow to Tembaldero Slough.

12 Unused secondary effluent waste water currently discharged to Monterey Bay would be used in conjunction with improvements at the RTP to provide additional flow to the Salinas Valley Reclamation Project (SVRP) during periods of low demand (i.e., < 5 mgd).

13 New source waters not used by AWT in the summer months will be available to SVRP for CSIP.

14 A drought reserve of up to 1,000 AF would be created over five years by producing 200 AFY additional product water from the GWR Project AWTF during winter months and storing the water in the Seaside Basin. This would establish a "water bank" that the CSIP can draw on in droughts. The drought reserve would allow flow at the RTP for the GWR Project to be temporarily reduced during critically dry periods, thus freeing up more of the newly available inflows to the RTP to be sent to the CSIP area. Extraction from the Seaside Basin would continue at the average rate to supply the Monterey Peninsula.

15 Average monthly RTP discharge, 2009-2013 (reported by MRWPCA).

16 Secondary treated municpal effluent not used for SVRP/CSIP or the AWT.

17 Excess is calculated as Line 13 minus Line 23

## Table 10: Source Water Analysis for the Pure Water Monterey Groundwater Replenishment Project

**Diversion Pattern for a Drought Year Starting with a Full Reserve**

**All facilities built [1] - average water year conditions - all flows in acre-feet** **7/15/2015**

| No. | SOURCES | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Minimum Year RTP Inflows (2013)** | *1,725* | *1,494* | *1,645* | *1,657* | *1,722* | *1,675* | *1,748* | *1,773* | *1,715* | *1,690* | *1,634* | *1,612* | **20,090** |
| | **New Source Water** | | | | | | | | | | | | | |
| | *City of Salinas* | | | | | | | | | | | | | |
| 1 | Salinas Agricultural Wash Water [2] | 156 | 158 | 201 | 307 | 311 | 391 | 435 | 444 | 367 | 410 | 329 | 223 | 3,732 |
| | *Agricultural Wash Water (AWW) to Ponds [3]* | *156* | *158* | *201* | *0* | *0* | *0* | *0* | *0* | *0* | *410* | *329* | *223* | *1,477* |
| | *AWW directly to RTP* | *0* | *0* | *0* | *307* | *311* | *391* | *435* | *444* | *367* | *0* | *0* | *0* | *2,255* |
| 2 | Salinas Urban Storm Water Runoff [4] | 17 | 14 | 11 | 5 | 1 | 0 | 0 | 0 | 1 | 3 | 8 | 16 | 76 |
| | *Urban runoff to ponds* | *17* | *14* | *11* | *0* | *0* | *0* | *0* | *0* | *0* | *3* | *8* | *16* | *69* |
| | *Urban runoff to RTP* | *0* | *0* | *0* | *5* | *1* | *0* | *0* | *0* | *1* | *0* | *0* | *0* | *7* |
| 3 | Rainfall (on SIWTF, 121 acre pond area) [5] | 11 | 6 | 4 | 3 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 4 | 36 |
| 4 | Evaporation (from SIWTF, 121 acre pond area) [6] | (12) | (16) | (29) | (41) | (46) | (52) | | | | (28) | (15) | (12) | (251) |
| 5 | Percolation [7] | (143) | (129) | (143) | (138) | (143) | (138) | | | | (143) | (138) | (143) | (1,257) |
| 6 | SIWTF pond storage balance [8] | 550 | 584 | 628 | 452 | 163 | (27) | 0 | 0 | 0 | 245 | 433 | 521 | |
| 7 | Recovery of flow from SIWTF storage ponds to RTP | 0 | 0 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| 8 | AWW and Salinas Runoff to RTP | 0 | 0 | 0 | 312 | 412 | 391 | 435 | 444 | 368 | 0 | 0 | 0 | 2,362 |
| | *Water Rights Applications to SWRCB* | | | | | | | | | | | | | |
| 9 | Blanco Drain [9] | 0 | 0 | 246 | 252 | 225 | 274 | 277 | 244 | 184 | 168 | 133 | 0 | 2,003 |
| 10 | Reclamation Ditch at Davis Road [10] | 0 | 0 | 165 | 162 | 97 | 132 | 129 | 121 | 80 | 87 | 98 | 0 | 1,071 |
| 11 | Tembladero Slough at Castroville [11] | 0 | 0 | 142 | 154 | 145 | 67 | 66 | 62 | 41 | 45 | 50 | 0 | 772 |
| 12 | City of Monterey - Diversion at Lake El Estero | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | **Subtotal New Waters Available** | **0** | **0** | **553** | **880** | **879** | **864** | **907** | **871** | **673** | **300** | **281** | **0** | **6,208** |
| | **Total Projected Water Supply** | **1,725** | **1,494** | **2,198** | **2,537** | **2,601** | **2,539** | **2,655** | **2,644** | **2,388** | **1,990** | **1,915** | **1,612** | **26,297** |

| No. | DEMANDS | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Max Year SVRP deliveries to CSIP (2013) | *0* | *692* | *1,558* | *1,669* | *1,799* | *1,675* | *1,786* | *1,803* | *1,725* | *1,548* | *1,127* | *88* | 15,469 |
| 14 | PEAK CSIP AREA WELL WATER USE (10/2013-09/2014) | *509* | *9* | *221* | *242* | *1,197* | *1,261* | *1,303* | *1,025* | *453* | *165* | *35* | *730* | 7,150 |
| | **TOTAL CSIP Demand** | **509** | **701** | **1,779** | **1,911** | **2,996** | **2,936** | **3,089** | **2,828** | **2,178** | **1,713** | **1,162** | **818** | **22,619** |
| 16 | FEEDWATER AMOUNT AT RTP TO GWR PROJECT AWTF | 367 | 331 | 367 | **133** | **137** | **133** | **137** | **137** | **133** | 367 | 355 | 367 | 2,963 |
| 17 | FEEDWATER TO ESTABLISH CSIP AREA DROUGHT RESERVE (200 AFY AWTF PRODUCT WATER) [14] | 0 | 0 | 0 | | | | | | | 0 | 0 | 0 | 0 |
| 18 | **TOTAL TO GWR ADVANCED WATER TREATMENT FACILITY** | **367** | **331** | **367** | **133** | **137** | **133** | **137** | **137** | **133** | **367** | **355** | **367** | **2,963** |
| | **Total Projected Water Demand** | **876** | **1,032** | **2,146** | **2,044** | **3,133** | **3,069** | **3,226** | **2,965** | **2,311** | **2,080** | **1,517** | **1,185** | **25,583** |

| No. | Use of Source Water | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 | Secondary effluent to SVRP for CSIP [12] | 509 | 701 | 1,645 | 1,657 | 1,722 | 1,675 | 1,748 | 1,773 | 1,715 | 1,623 | 1,162 | 818 | 16,747 |
| 20 | New sources available to CSIP [13] | 0 | 0 | 186 | 747 | 742 | 731 | 770 | 734 | 540 | 0 | 0 | 0 | 4,451 |
| 21 | **Total Supply to CSIP** | **509** | **701** | **1,831** | **2,404** | **2,464** | **2,406** | **2,518** | **2,507** | **2,256** | **1,623** | **1,162** | **818** | **21,197** |
| | **Net CSIP Increase** | | | | | | | | | | | | | **5,728** |
| 23 | Surface waters at RTP to AWT | 0 | 0 | 367 | 0 | 0 | 0 | 0 | 0 | 0 | 300 | 281 | 0 | 948 |
| 24 | Secondary effluent to AWT | 367 | 331 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 67 | 74 | 367 | 1,206 |
| 25 | AWW and Salinas urban runoff to AWT | 0 | 0 | 0 | 133 | 137 | 133 | 137 | 137 | 133 | 0 | 0 | 0 | 809 |
| 26 | **Feedwater to AWT** | **367** | **331** | **367** | **133** | **137** | **133** | **137** | **137** | **133** | **367** | **355** | **367** | **2,963** |
| | **Subtotal- all waters (including secondary effluent)** | **876** | **1,032** | **2,198** | **2,537** | **2,601** | **2,539** | **2,655** | **2,644** | **2,388** | **1,990** | **1,517** | **1,185** | **24,161** |

| No. | | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | *DRY YEAR WASTEWATER EFFLUENT TO OCEAN OUTFALL (2013) [15]* | *1,725* | *802* | *87* | *0* | *0* | *0* | *0* | *0* | *0* | *142* | *507* | *1,607* | 4,870 |
| 28 | WASTE WATER EFFLUENT TO OCEAN OUTFALL WITH PROPOSED DIVERSIONS TO CSIP/AWT/RUWAP [16] | 849 | 462 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 398 | 427 | 2,137 |
| 29 | NEW SUPPLIES IN EXCESS OF AWT DEMANDS [17] | (367) | (331) | 186 | 747 | 742 | 731 | 770 | 734 | 540 | (67) | (74) | (367) | 3,244 |
| 30 | AWT BRINE TO OCEAN OUTFALL | 70 | 63 | 70 | 25 | 26 | 25 | 26 | 26 | 25 | 70 | 67 | 70 | 563 |

**Notes**

1 Presumes all facilities associated with diversions are completed.

2 Table 2-1, p. 5, Schaaf & Wheeler Consulting Engineers. Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

3 Volume of effluent from City of Salinas agricultural wash water to be directed into ponds 1,2,3, and the aeration pond for storage.

4 Assume dry year at 1/3 the average monthly values from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

5 Rainfall from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015. Pond area presumed to be Ponds 1,2, 3 + Aeration lagoon. No rainfall/evaporation or storage assigned to drying beds.

6 Table 3, Todd Groundwater, Draft Memorandum, Pure Water Monterey Groundwater Replenishment Project: Impacts of Changes in Percolation at the Salinas Industrial Wastewater Treatment Facility on Groundwater and the Salinas River, February 11, 2015.

7 Table 4, Ibid. Also confirmed in MPWMD Industrial Ponds Percolation and Evaporation Technical Memorandum 2015-01, July 2015.

8 Ponds 1,2,3 and aeration basin hold up to 1,065 acre-feet (one foot of freeboard). If flow to ponds would exceed the maximum volume, it is presumed that excess flow can be diverted to the RIBs or drying beds or flow can be diverted to the RTP. Presume that pond storage goes to zero sometime during the year (shown here starting in July).

9 Max diversion = 6 cfs diversion. See REVISED DRAFT BLANCO DRAIN YIELD STUDY, Schaaf and Wheeler, December 2014.

10 Max. diversion = 6 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Note that flow figures shown here are a combination of flow estimates in the S&W analysis made for the 2 cfs instream requirement Jan-May and 1 cfs instream requirement for June-Dec.

11 Max. diversion = 3 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Figures shown here are the difference between the combined Davis Road/TS diversion with Seasonal Bypass. This presumes the preference is to remove flow at Davis Road first, rather than bypass flow to Tembaldero Slough.

12 Unused secondary effluent waste water currently discharged to Monterey Bay would be used in conjunction with improvements at the RTP to provide additional flow to the Salinas Valley Reclamation Project (SVRP) during periods of low demand (i.e., < 5 mgd).

13 New source waters not used by AWT in the summer months will be available to SVRP for CSIP.

14 A drought reserve of up to 1,000 AF would be created over five years by producing 200 AFY additional product water from the GWR Project AWTF during winter months and storing the water in the Seaside Basin. This would establish a "water bank" that the CSIP can draw on in droughts. The drought reserve would allow flow at the RTP for the GWR Project to be temporarily reduced during critically dry periods, thus freeing up more of the newly available inflows to the RTP to be sent to the CSIP area. Extraction from the Seaside Basin would continue at the average rate to supply the Monterey Peninsula.

15 Monthly RTP discharge during critically dry year (2013), reported by MRWPCA

16 Secondary treated municpal effluent not used for SVRP/CSIP or the AWT.

17 Excess is calculated as Line 13 minus Line 23

# Appendix C <u>rev</u>

# Source Water Rights White Paper

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PERKINSCOIE

August 10, 2015

TO: Bob Holden, MRWPCA

FROM: Barbara Schussman, Laura Zagar and Anne Beaumont

RE: ***Pure Water Monterey Groundwater Replenishment Project: Amended Water Rights Analysis***

## Introduction

The Proposed Groundwater Replenishment Project (the Proposed Project) consists of two components: the Pure Water Monterey Groundwater Replenishment improvements and operations that will develop high-quality replacement water for existing urban supplies, and an enhanced agricultural irrigation component.

The Proposed Project would recycle and reuse water from a number of sources, including:

A. Municipal wastewater,
B. Industrial wastewater (agricultural wash water),
C. Urban stormwater runoff, and
D. Surface water diversions.

Below is an analysis of each water source, including the legal framework and current status of water rights for each source. A summary chart is included at the end.

## A. Municipal Wastewater Collection and Treatment System

### 1. Brief Description of Project Use

The Monterey Regional Water Pollution Control Agency (MRWPCA) collects municipal wastewater from communities in northern Monterey County and treats it at its Regional Wastewater Treatment Plant (Regional Treatment Plant). Most of the wastewater is recycled for crop irrigation at an onsite tertiary treatment plant called the Salinas Valley Reclamation Plant. The tertiary-treated wastewater is delivered to growers through a conveyance and irrigation system called the Castroville Seawater Intrusion Project. The treated wastewater that is not recycled for crop irrigation is discharged to the ocean through MRWPCA's existing ocean outfall. The Proposed Project would include improvements that would enable more of the municipal wastewater to be recycled than is possible today; thus, less municipal wastewater would be discharged through the ocean outfall.

### 2. *Legal Framework*

Unless otherwise provided by agreement, the owner of a wastewater treatment plant has the exclusive right to the treated wastewater it produces as against anyone who has supplied the water discharged into the wastewater collection and treatment system, including a person using water under a service contract.[1] MRWPCA therefore has the exclusive right to use municipal wastewater that is discharged into its collection system, except as that right has been varied by contractual arrangements.[2]

Here, MRWPCA has entered into a number of relevant contracts, including contracts that assigned rights to Marina Coast Water District and Monterey County Water Resources Agency (Water Resources Agency). We understand MRWPCA has entered into the following:

- The 1989 Annexation Agreement between MRWPCA and the Marina Coast Water District provides the Marina Coast Water District with the right to obtain treated wastewater from MRWPCA. The Marina Coast Water District has not exercised its recycled water rights, but may do so in the future.

- The 1992 agreement between MRWPCA and Water Resources Agency (including amendments) (1992 Agreement) provides for the construction and operation of the Salinas Valley Reclamation Plant by MRWPCA to provide water treated to a level adequate for agricultural irrigation for use by the Castroville Seawater Intrusion Project. In particular, Section 3.03 of the 1992 Agreement (Amendment 3) provides that MRWPCA commits all of its incoming wastewater flows to the treatment plant from sources within the 2001 MRWPCA service area, up to 29.6 million gallons per day, except for flows taken by the Marina Coast Water District under the Annexation Agreements, losses, flows not needed to meet the Water Resource Agency's authorized demand, and flows to which MRWPCA is otherwise entitled under the agreement.

- In 1996, pursuant to another Annexation Agreement, the Marina Coast Water District received the right to tertiary-treated water from the Salinas Valley Reclamation Plant, in satisfaction of the 1989 agreement rights.

- In 2009, the Marina Coast Water District and MRWPCA entered into a Memorandum of Understanding relating to the Regional Urban Water Augmentation Agreement (RUWAP MOU). In the RUWAP MOU, the MRWPCA assigned a portion of its allotment from the Amendment 3 of the 1992 Agreement between MRWPCA and Monterey County Water Resources Agency. MRWPCA agreed to, among other things, provide 650 AFY of

[1] Cal. Water Code § 1210.
[2] California Water Code § 1211 requires the owner of a wastewater treatment plant to obtain approval of the State Board for a change in the point of discharge of treated wastewater when the proposed change would result in decreased flow in any portion of a watercourse. The proposed diversion of municipal wastewater from the Regional Treatment Plant from communities in northern Monterey County would not impact the flows in a watercourse; thus, approval from the State Board for this proposed diversion would not be needed.

recycled waters during the months of May through August each year from MRWPCA entitlements.[3] Marina Coast Water District agreed to commit 300 AFY of recycled water during the months of April through September from Marina Coast Water District's entitlements. Currently, Marina Coast Water District does not have approved funding, water purchase/user agreements, or adequate physical distribution facilities to use the recycled water; thus Marina Coast Water District's water right to recycled water from the RUWAP MOU have not been triggered.

To address certain water rights, the stakeholder agencies entered into a Memorandum of Understanding (Source Waters MOU). The Source Waters MOU reaffirmed the Marina Coast Water District's and Water Resources Agency's recycled water entitlements, and presented a proposal for collection of additional source waters to meet the Proposed Project objectives.

Importantly, the Source Waters MOU is intended to provide a framework for negotiation of a Definitive Agreement and does not create a binding contractual obligation. The Definitive Agreement would establish the contractual rights and obligations of the parties. To date, the Definitive Agreement has not yet been completed. If a Definitive Agreement is reached, it would be approved after the EIR is certified.

### 3. *Status of Water Rights*

Because the Source Waters MOU is not binding, it is not sufficient to secure the water rights at this time. Any outstanding water rights would need to be addressed and resolved in the forthcoming Definitive Agreement. Until then, the existing agreements with the Marina Coast Water District could impact the source water for the Proposed Project. Although the Definitive Agreement is needed to secure certain water rights, the Source Waters MOU demonstrates a reasonable likelihood that rights to that this source of water can be obtained from stakeholders that send wastewater at the Regional Treatment Facility.

## B. Salinas Agricultural Wash Water System

### 1. *Brief Description of Project Use*

Water from the City of Salinas agricultural industries, 80% to 90% of which is water used for washing produce, is currently conveyed to ponds at the Salinas Industrial Wastewater Treatment Facility for treatment (aeration) and disposal by evaporation and percolation. The Proposed Project would include improvements that would enable the agricultural wash water to be conveyed to the Regional Treatment Plant to be recycled. The Proposed Project also includes improvements at the Salinas Industrial Wastewater Treatment Facility to allow storage of

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[3] Certain parties have disputed the validity of Amendment 3. If Amendment 3 were to be found invalid, the assignment of MRWPCA's recycled waters to Marina Coast Water District in the RUWAP MOU may also be found to be invalid. For purposes of this analysis, however, it is assumed that Amendment 3 is valid and enforceable and that Marina Coast Water District has an existing right to 650 AFY during the summer months.

agricultural wash water and south Salinas stormwater in the winter and recovery of that water for recycling and reuse in the spring, summer and fall.

### 2. *Legal Framework*

The City of Salinas has the exclusive right to the treated wastewater it collects in its system and treats at the Salinas Treatment Facility, unless modified in a contractual agreement.[4] Prior to making a change in the point of discharge of treated wastewater, the owner of a wastewater treatment plant shall obtain approval from the State Board for that change if the proposed change would result in decreased flow of any portion of a watercourse.[5] In reviewing a petition, the State Board must find that the proposed change will not injure any other legal users of water and that the change complies with the requirements of the California Fish and Game Code and the federal Endangered Species Act. The petition would also require the issuance of the EIR.

The City of Salinas thus has an exclusive right to the agricultural wash water discharged to its system, except (1) as that right has been varied by contractual arrangements or (2) to the extent the diversion of that wastewater would decrease the flow of a watercourse.

### 3. *Status of Water Rights*

Since the City of Salinas currently has the exclusive right to its treated wastewater, a contract would be needed between MRWPCA and the City of Salinas for the diversion and use of agricultural wash water. Although no agreement for the use of agricultural wash water is yet in effect, we understand that the City of Salinas has been working cooperatively with MRWPCA, demonstrating a reasonable likelihood that this source of water can be obtained.

In addition, the State Board clarified in its comments on the Draft EIR that State Board approval would be needed for diversion of wastewater that is currently discharged into percolation ponds adjacent to the Salinas River, because such diversion would reduce the flow of the Salinas River. We understand that such approval will be pursued for the diversions from the percolation ponds.

## C. Salinas Stormwater Collection System

### 1. *Brief Description of Project Use*

Stormwater from urban areas in southern portions of the City of Salinas is currently collected and released to the Salinas River through an outfall near Davis Road. The Proposed Project would include improvements that would enable Salinas Stormwater to be conveyed to the Regional Treatment Plant to be recycled.

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[4] Cal. Water Code § 1210.
[5] Cal. Water Code § 1211(a), (b).

### 2. *Legal Framework*

To divert stormwater and dry weather flow from urban areas, agreements are needed between MRWPCA and the local agencies that currently collect and convey the flows in man-made facilities for discharge to surface waters. These local agencies include the City of Salinas for urban runoff/stormwater source water from the Salinas River. Stormwater runoff from urban areas through storm drain infrastructure (i.e., in the City of Salinas) does not become water of the state until it is discharged into a river or channel.

### 3. *Status of Water Rights*

MRWPCA would need to obtain water rights from the applicable local agencies, including the City of Salinas. We understand that there are currently no contractual arrangements or permits for diversion of stormwater or urban/agricultural runoff to the MRWPCA wastewater collection and conveyance system. However, such agreements are being pursued by MRWPCA. MRWPCA is also in the process of adjusting its connection fees and rates for discharges of stormwater and urban runoff to the wastewater collection system. We understand that the City of Salinas has been working cooperatively with MRWPCA, and agreement is reasonably likely. This demonstrates a reasonable likelihood that this source of water can be obtained.

## D. Reclamation Ditch / Tembladero Slough, Blanco Drain, and Lake El Estero Diversions

### 1. *Brief Description of Project Use*

The Reclamation Ditch is a network of excavated earthen channels used to drain natural, urban, and agricultural runoff and agricultural tile drainage. The Proposed Project would include improvements that would enable water from the Reclamation Ditch watershed to be diverted in two locations—from the Reclamation Ditch at Davis Road and from Tembladero Slough (to which the Reclamation Ditch is a tributary) near Castroville—to be conveyed to the Regional Treatment Plant to be recycled.

The Blanco Drain collects water from approximately 6,400 acres of agricultural lands near Salinas. The Proposed Project would include improvements that would enable water in the Blanco Drain to be diverted and conveyed to the Regional Treatment Plant to be recycled.

The City of Monterey actively manages the water level in Lake El Estero so that there is storage capacity for large storm events. Prior to a storm event, the lake level is lowered by pumping or gravity flow for discharge to Del Monte Beach. The Proposed Project would include improvements that would enable water that would otherwise be discharged to the beach to instead be conveyed to the Regional Treatment Plant to be recycled.

### 2. *Legal Framework*

Water that enters surface streams and rivers is considered water of the state. A water rights permit is required to impound or divert waters of the state, except for certain riparian uses. Transfer of surface water flows out of known and defined channels for recycling would be a consumptive use that may come under the jurisdiction and regulation of the State Board.

Water rights permits from the State Board would be required for surface water diversions from the Reclamation Ditch, Blanco Drain, and Tembladero Slough. In its comments on the Draft EIR, the State Board clarified that the proposed diversion from Lake El Estero would also require an appropriative right from the State Board. These source waters include agricultural return flow (overland flow and tile drainage), stormwater flow, and urban runoff. The State Board will require a completed CEQA document before issuing a permit.

In considering an application to appropriate water, the State Board considers a number of factors.[6] Specifically, the State Board considers "the relative benefit to be derived from (1) all beneficial uses of the water concerned including, but not limited to, use for domestic, irrigation, municipal, industrial, preservation and enhancement of fish and wildlife, recreational, mining and power purposes, and any uses specified to be protected in any relevant water quality control plan, and (2) the reuse or reclamation of the water sought to be appropriated, as proposed by the applicant. The State Board may subject such appropriations to such terms and conditions as in its judgment will best develop, conserve, and utilize in the public interest, the water sought to be appropriated."[7] The State Board is guided by the policy that domestic use is the highest use and irrigation is the next highest use of water.[8] The Proposed Project is consistent with these factors and it does not appear that any of the factors considered would reduce the likelihood of obtaining the necessary permits.

The Water Resources Agency submitted an application in April 2014 to the State Board to appropriate waters of the Blanco Drain, the Reclamation Ditch, and Tembladero Slough. Specifically, it applied to divert up to 25,000 acre-feet per year from each of the two water bodies at a combined rate of diversion of up to 100 cfs. On November 10, 2014, the State Water Resources Control Board sent a letter stating that staff had found the application was incomplete in several respects. In response, the Water Resources Agency submitted five separate applications on July 29, 2015, three of which are related to the Proposed Project (Application Nos. 32263A, 32263B, 32263C).[9] At the request of the State Board, the Water Resources

[6] Cal. Water Code §§ 1250 et seq.
[7] Cal. Water Code § 1257.
[8] Cal. Water Code § 1254.
[9] The remaining two applications, Application Nos. 32263D and 32263E, relate to potential future diversions by the Water Resources Agency. The Proposed Project is separate and has independent utility from these potential future diversions. Such additional waters are not needed for the Proposed Project to proceed. While these additional waters may receive tertiary treatment at the Salinas Valley Reclamation Plant, and may be distributed through the Castroville Seawater Intrusion Project (CSIP) conveyance system that would be used by the Proposed Project, these potential future diversions likely would require additional facilities for which the Water Resources Authority has not

Agency submitted amended applications with minor changes on July 29, 2015. The applications remain pending before the State Board.

The Source Waters MOU specifies that these water rights would be retained exclusively by the Water Resources Agency under the permits, but that all parties would pay pro rata costs associated with the procurement and retention of these water rights. The parties also agreed to work jointly on obtaining the needed water rights through amendments to the permit application.

In comments on the Draft EIR, the State Board clarified that an application would need to be filed to divert water from Lake El Estero in advance of a storm event. In addition, MRWPCA would need to obtain any needed agreements with the owners of the infrastructure that would be used for this diversion, such as the City of Monterey.

### 3. *Status of Water Rights*

Several steps need to be taken to secure these water rights. As a preliminary matter, the State Board would need to grant the water rights requested in Application Nos. 32263A, 32263B, 32263C. Second, the Source Waters MOU indicates that the Water Resources Agency would hold all of the rights to these waters under the Definitive Agreement associated with Application Nos. 32263A, 32263B, and 32263C, once issued. A separate agreement would therefore be necessary between the Water Resources Agency and MRWPCA to ensure that the Proposed Project has sufficient water rights associated with these applications. Therefore, these water rights are not secured yet. However, because the Water Resources Agency has submitted an application for water rights, and given the terms of the Source Waters MOU, there is a reasonable likelihood that this source of water can be obtained.

An application would also need to be filed for the diversion of the Lake El Estero diversion, should such waters be used for the Proposed Project. MRWPCA would need to obtain rights to use the infrastructure that would be used by this diversion owned by local agencies, such as the City of Monterey. It is our understanding that such rights would be pursued in due course if Lake El Estero waters would be used by the Proposed Project.

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yet performed engineering or feasibility studies. The environmental impacts of these potential future diversions would be analyzed in a separate CEQA process.

## E. Summary Chart

| Source of Water | Status of Water Rights |
|---|---|
| Municipal Wastewater Collection and Treatment System | The MOU is not binding; the forthcoming Definitive Agreement would address and resolve competing water rights of Marina Coast Water District and Monterey County Water Resources Agency. |
| Salinas Agricultural Wash Water System | A contract is needed between MRWPCA and the City of Salinas for diversion and use of the agricultural wash water. In addition, State Board approval is needed for the diversion of the agricultural wash water away from the percolation ponds. |
| Salinas Stormwater Collection System and Lake El Estero water | Contracts are needed between MRWPCA and the applicable local agencies, including the City of Salinas. |
| Reclamation Ditch / Tembladero Slough, Blanco Drain, and Lake El Estero Diversions | State Board approval of the pending applications is needed. An additional application for the Lake El Estero diversion would need to be filed. Because the Source Waters MOU is not binding, the forthcoming Definitive Agreement would further address these water rights. The MOU suggests that the Water Resources Agency will exclusively retain the water rights under the permit, in which case a separate agreement would be needed between the Water Resources Agency and MRWPCA. |

# Appendix D

# Pure Water Monterey Groundwater Replenishment Project Water Quality Statutory and Regulatory Compliance Technical Report

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Pure Water Monterey
A Groundwater Replenishment Project

# Pure Water Monterey Groundwater Replenishment Project
# Water Quality Statutory and Regulatory Compliance Technical Report

**February 12, 2015**

Nellor Environmental Associates, Inc.

**Margaret H. Nellor, P.E., #C31997**
**Nellor Environmental Associates, Inc.**

*In conjunction with:*
*Denise Duffy & Associates • Todd Groundwater • Trussell Technologies • James Crook*

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## 1. Executive Summary

The Monterey Regional Water Pollution Control Agency (MRWPCA) is preparing an Environmental Impact Report (EIR) in accordance with the provisions of the California Environmental Quality Act (CEQA) for the proposed Pure Water Monterey Groundwater Replenishment Project (GWR Project). The GWR Project would create a reliable source of water supply by collecting a variety of new source waters that would be combined with existing incoming raw wastewater flows for conveyance to and treatment at MRWPCA's Regional Wastewater Treatment Plant (RTP). The RTP effluent not further treated to tertiary levels and used for agricultural irrigation in northern Salinas Valley would be conveyed to a new advanced water treatment facility (AWT Facility) that would produce highly-purified recycled water (purified water). The purified water would be used to replenish the Seaside Groundwater Basin (Seaside Basin) by injecting this high quality water into a series of shallow and deep injection wells. Once injected into the Seaside Basin, the purified water would mix with the groundwater present in the aquifers and be stored for future extraction from existing potable water supply wells.

The GRW Project would enable California American Water Company (CalAm) to reduce its diversions from the Carmel River system by up to 3,500 acre-feet per year (AFY) by injecting the same amount of purified water into the Seaside Basin. CalAm is under a State order to secure replacement water supplies and cease over-pumping of the Carmel River by January 2017.

The GWR Project would also result in additional tertiary recycled water supply for agricultural irrigation in northern Salinas Valley. Currently, the only sources of supply for the existing tertiary recycled water are municipal wastewater and small amounts of urban dry weather runoff.[1] Municipal wastewater flows have declined in recent years due to aggressive water conservation efforts by the MRWPCA member entities. By increasing the amount and type of source waters entering the existing wastewater collection system, additional tertiary recycled water can be provided for use in the Castroville Seawater Intrusion Project's (CSIP's) agricultural irrigation system. It is anticipated that approximately 4,750 AFY of additional recycled water supply could be created for CSIP irrigation purposes. Some modifications would be made to the water recycling facility to optimize and enhance the delivery of recycled water to growers. The tertiary recycled water complies with statutory and regulatory requirements for the production and use of recycled water per California Water Code Sections 13500 – 13577 and California Code of Regulations, Title 22, Sections 60301 – 60357.

The GWR Project would also include a drought reserve component. The GWR Project would provide for an additional 200 AFY of purified water that would be injected in the Seaside Basin in wet and normal years up to a total of 1,000 acre feet (AF). Thus, the GWR Project would inject up to 3,700 AF into the Seaside Basin in some years, rather than the 3,500 AF needed for CalAm supplies. This would result in a "banked" drought reserve. During dry years, less than 3,500 AF of GWR Project purified water would be delivered to the Seaside Basin, and the source waters that are not sent to the AWT Facility would be further treated to tertiary recycled water specification and sent to the SVRP to increase irrigation supplies for the agricultural lands. CalAm would be able to extract the banked water to make up the difference to its supplies, such that its extractions and deliveries would not fall below 3,500 AFY.

Planning for the GWR Project has included a pilot study of some of the source waters and treatment technologies intended to be part of the new AWT Facility. The proposed full-scale AWT Facility would consist of pre-treatment (using ozone, and potentially biologically activated filtration); membrane filtration (MF); reverse osmosis (RO); advanced oxidation (AOP) using ultraviolet light and hydrogen peroxide; and post-treatment stabilization. In addition, hydrogeologic modeling and soil and geochemical analyses have been performed for the GWR Project. The California State Water Resources Control Board Division of Drinking Water (DDW), the Central Coast Regional Water Quality Control Board, and a National Water Research

[1] Salinas River water is stored and used for irrigation during the period April 1 to October 31, but is not a source of supply for the tertiary treatment facility.

Institute Independent Advisory Committee have provided oversight for these studies and project planning. DDW has conditionally approved the GWR Project based on MRWPCA's proposal that presents the general concepts of the project (MRWPCA, 2014). More information must be provided as part of the Proposed Project's Engineering Report for DDW approval.

In conjunction with the EIR, this technical report was prepared to present pertinent information related to the following: (1) the status of recycled water regulations pertaining to groundwater replenishment; (2) studies of other similar projects that have assessed the effects of using recycled water for groundwater replenishment on groundwater quality and public health; (3) studies that have been specifically conducted for the project related to the AWT Facility design and performance; (4) studies that have been specifically conducted for the project regarding protection of groundwater quality and quantity; (5) GWR Project compliance with applicable statutes, policies, and regulations; (6) GWR Project effects on groundwater; and (7) the significance of this information for the EIR.

This evaluation has concluded that:

- California has established numerous state laws, regulations and policies governing the use of recycled water for groundwater replenishment to protect groundwater quality and the health of individuals who drink groundwater that is replenished using recycled water, including:
    - Comprehensive regulations for the use of purified water for replenishment of groundwater (Groundwater Replenishment Regulations);
    - State policies related to maintaining high quality water;
    - A Water Quality Control Plan (Basin Plan) implemented by the Central Coast Regional Water Quality Control Board including standards, objectives, and guidelines for the protection of groundwater quality in the GRW Project area; and
    - Effective July 1, 2014, consolidation of the regulatory structure for water, recycled water and wastewater into one agency, the State Water Resources Control Board, to protect public health and promote comprehensive protection of drinking water and other beneficial uses of the state's waters.
- Studies have been conducted for other similar potable reuse projects , including epidemiology studies, risk assessments, and investigations that analyze and compare the toxicological properties of recycled water to those of drinking water. These studies have shown:
    - There is no association between the use of recycled water and adverse health outcomes in individuals consuming groundwater containing recycled water; and
    - Purified water from an appropriately designed and operated AWT Facility presents less risk from in terms of regulated chemicals, pathogens, and trace organics compared to the risk from conventional drinking water sources.
- Based on the analytical results of monitoring the source waters to be used for the GWR Project, the water quality results of the pilot plant testing (using ozone, MF, and RO), information on the predicted performance and water quality of the proposed full-scale AWT Facility based on other existing groundwater replenishment projects and related research/studies:
    - The GWR Project would comply with the Groundwater Replenishment Regulations and would meet all Central Coast Basin Plan standards, objectives, and guidelines.
    - An Independent Advisory Panel and the State Division of Drinking Water (DDW) have reviewed the GWR Project concept. The DDW has conditionally approved the GWR Project proposal, pending submittal of additional information per the Groundwater Replenishment Regulations.

- The full-scale proposed AWT Facility and recharge of the purified water would provide reliability and redundancy through the use of multiple treatment barriers. Including the Regional Treatment Plant in combination with the AWT Facility, the integrated treatment system would achieve chemical constituent removal redundancy by employing at least two treatment processes for each constituent type and at least four treatment processes for each pathogen category, as shown in the table below.

**Proposed Groundwater Replenishment Project Treatment Barriers**

| Process | Chemical Constituents | | | | | Pathogenic Microorganisms | | |
|---|---|---|---|---|---|---|---|---|
| | Nitrogen | TOC[a] | DPBs[b] | Inorganics | CECs[c] | Bacteria | Viruses | Protozoa |
| RTP Primary/ Secondary | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Ozone | | | ✓ | | ✓ | ✓ | ✓ | ✓ |
| MF | | ✓ | | ✓ | | ✓ | | ✓ |
| RO | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| AOP | | | ✓ | | ✓ | ✓ | ✓ | ✓ |
| Underground Residence Time | | | | | | ✓ | ✓ | ✓ |

a. Total organic carbon – TOC.
b. Disinfection by-products – DBPs.
c. Constituents of emerging concern - CECs

- To evaluate compliance with the State Recycled Water Policy, studies were conducted to (1) analyze the recharge components of the GWR Project, including recharge wells, operational facilities, and the fate and transport of the purified water in the groundwater basin, and (2) conduct geochemical modeling to test stabilized RO pilot test water[2] compatibility with ambient groundwater. The studies found that:
    - No documented groundwater contamination or contaminant plumes were identified in the GWR Project area. Therefore, injection of purified water associated with the GWR Project would not exacerbate existing groundwater contamination or cause plumes of contaminants to migrate.
    - When two water types with different water chemistry are mixed (such as the GWR Project purified water and groundwater), geochemical reactions could occur in the groundwater system that could potentially result in leaching of natural or anthropogenic constituents, which could also potentially impact groundwater quality. The risk of geochemical impacts from incompatibility would be addressed at the proposed AWT Facility by including a treatment process to ensure that the purified water is stabilized and non-corrosive. The design of the treatment stabilization process will be informed by the geochemical modeling studies.
- A Salt/Nutrient Management Plan (SNMP) has been prepared for the Seaside Basin to comply with the Recycled Water Policy. As documented in the SNMP, ambient groundwater generally exceeds the Basin Plan groundwater objective for total dissolved solids (TDS) in many areas of the Seaside Basin, while nitrate and chloride concentrations generally meet Basin Plan objectives. Studies

[2] The samples were RO permeate collected from the MRWPCA pilot plant. The RO permeate was stabilized using a bench-scale post-treatment stabilization unit to better approximate the water quality anticipated for the proposed AWT Facility.

conducted to evaluate the water quality of the stabilized RO pilot test water found that the concentrations of TDS, nitrate, and chloride in the RO water met all Basin Plan objectives. Further, these concentrations were generally lower than average concentrations in groundwater. As such, replenishment of the Seaside Basin using the GWR Project purified water would not degrade, but would provide benefits to, local groundwater quality.

- Based on the source water sampling, results of the pilot testing and hydrogeologic studies, other relevant research, and information from other groundwater replenishment projects, the following conclusions are offered with regard to the GWR Project's effect on groundwater resources:
  - The GWR Project purified water would meet groundwater quality standards in the Basin Plan and state drinking water quality standards. A monitoring program would document project performance.
  - The GWR Project purified water would contain much lower concentrations of TDS and chloride than ambient groundwater and would be expected to provide a benefit to the basin groundwater quality.
  - No documented groundwater contamination or contaminant plumes have been identified in the GWR Project area. Therefore, injection associated with the GWR Project would not exacerbate existing groundwater contamination or cause plumes of contaminants to migrate.
  - Injection of AWT Facility purified water would not degrade groundwater quality.
  - The GWR Project purified water would be stabilized as part of the AWT Facility to ensure no adverse geochemical impacts. Geochemical modeling will be used to inform the AWT Facility stabilization procedures, which can be adjusted as needed.
  - The GWR Project would result in both higher and lower water levels in wells throughout the Seaside Basin at various times. Although water levels would be slightly lower during some time periods, the difference is generally small and judged insignificant. Modeling indicates that the GWR Project would not lower water levels below protective levels in coastal wells and would not exacerbate seawater intrusion

## 2. Introduction

In accordance with the provisions of the California Environmental Quality Act (CEQA), the Monterey Regional Water Pollution Control Agency (MRWPCA), as the CEQA lead agency, is preparing an Environmental Impact Report (EIR) for the proposed Pure Water Monterey Groundwater Replenishment Project (GWR Project). The GWR Project is being proposed by MRWPCA in partnership with the Monterey Peninsula Water Management District (Water Management District). The GWR Project would create a reliable source of water supply by collecting a variety of new source waters that would be combined with existing incoming raw wastewater flows for conveyance to and treatment at MRWPCA's Regional Wastewater Treatment Plant (RTP). The RTP effluent not further treated and used for agricultural irrigation in northern Salinas Valley, as part of the Salinas Valley Reclamation Project (SVRP), would be conveyed to a new advanced water treatment facility (AWT Facility) that would produce highly-purified recycled water (purified water). The purified water would be used to replenish the Seaside Groundwater Basin (Seaside Basin) by injecting this water into a series of shallow and deep injection wells. Once injected into the Seaside Basin, the purified water would mix with the groundwater present in the aquifers and be stored for future extraction from existing potable water supply wells. The primary purpose of the GWR Project is to provide 3,500 acre-feet per year (AFY)[3] of high quality replacement water to California American Water Company (Cal-Am) for extraction and delivery to its customers in the Monterey District service area. The 3,500 AFY will enable Cal-Am to reduce its diversions from the Carmel River system by this same amount.[4] Cal-Am is under a state order to secure replacement water supplies and cease over-pumping of the Carmel River by January 2017.

The GWR Project would also provide for a drought reserve component that would provide for an additional 200 AFY of purified water to be injected in the Seaside Basin in wet and normal years up to a total of 1,000 acre feet (AF). This component would result in a "banked" drought reserve. During dry years, the GWR Project would deliver less than 3,500 AF to the Seaside Basin, and the source waters that are not sent to the AWT Facility during dry years would be sent to the SVRP to increase irrigation supplies for the agricultural lands. CalAm would be able to extract the banked water to make up the difference to its supplies, such that its extractions and deliveries would not fall below 3,500 AFY. .

Finally, the GWR Project would produce additional tertiary recycled water supply for agricultural irrigation in northern Salinas Valley. Currently, the only sources of supply for the existing water recycling facility at the Regional Treatment Plant are municipal wastewater and small amounts of urban dry weather runoff.[5] Municipal wastewater flows have declined in recent years due to aggressive water conservation efforts by the MRWPCA member entities. By increasing the amount and type of source waters entering the existing wastewater collection system, additional recycled water can be provided for use in the Castroville Seawater Intrusion Project's (CSIP) agricultural irrigation system. It is anticipated that approximately 4,750 AFY of additional recycled water supply could be created for CSIP irrigation purposes. Some modifications would be made to the water recycling facility to optimize and enhance the delivery of recycled water to growers. The tertiary recycled water complies with statutory and regulatory requirements for the production and use of recycled water per California Water Code (CWC) Sections 13500 – 13577 and California Code of Regulations (CCR), Title 22, Sections 60301 – 60357, and is regulated under Central Coast Regional Water Quality Control Board (RWQCB) Order No. 94-82.

MRWPCA currently operates the RTP that includes primary and secondary treatment, a tertiary water recycling facility (the SVRP), a non-potable water distribution system (CSIP), sewage collection pipelines, wastewater pump stations, and an ocean outfall. The RTP has a permitted design capacity to treat 29.6 million gallons per day (mgd) of wastewater; it currently treats approximately 17 to 18 mgd. At the RTP,

[3] An acre-foot (AF) is enough water to flood one-acre (which is approximately the size of a football field) to be 1 foot deep (325,861 gallons). A family of five on the Monterey Peninsula typically uses about 0.5 AFY.

[4] Cal-Am is an investor-owned public utility that serves approximately 38,500 customers in the Monterey Peninsula area.

[5] Salinas River water is stored and used for irrigation during the period April 1 to October 31, but is not a source of supply for the tertiary treatment facility.

wastewater is treated to two different standards: (1) recycled water that meets criteria in CCR Title 22 for unrestricted use of recycled water for agricultural irrigation (tertiary filtration and disinfection), and (2) primary and secondary treatment for discharge through the ocean outfall that meets standards in the California Ocean Plan. Disinfected tertiary recycled water is distributed to nearly 12,000 acres of farmland in the northern Salinas Valley for irrigation. While the RTP predominantly treats municipal wastewater, it also accepts some dry weather urban runoff and other discrete wastewater flows.

The GWR Project includes the following components:

1. Source water diversion and storage – To produce up to 3,700 AFY of purified water for injection into the Seaside Basin and approximately, 4,750 AFY of additional CSIP irrigation water, the GWR Project requires the diversion of new source waters to the existing municipal wastewater collection system and conveyance of those waters to the existing RTP. The new source waters would originate from (1) City of Salinas agricultural wash water, (2) stormwater flows from the southwestern part of Salinas and the Lake El Estero facility in Monterey, (3) surface water and agricultural tile drain water that is captured in the Salinas Reclamation Ditch and Tembladero Slough, and (4) surface water and agricultural tile drain water that flows in the Blanco Drain.
2. Treatment facilities at the RTP – These would consist of the existing primary and secondary treatment facilities at the RTP, a new AWT Facility to produce the purified water, stabilization of water after AOP, purified water pump station, and reverse osmosis (RO) concentrate disposal facilities (that include a brine mixing facility and the existing ocean outfall). The AWT Facility will include: pre-treatment (using ozone, and potentially biologically activated filtration (BAF)); membrane filtration (MF); RO; and advanced oxidation (AOP) using ultraviolet light (UV) and hydrogen peroxide. Water stabilization will use calcium and alkalinity addition.
3. Purified water conveyance facilities – These would consist of new pipelines, an initial purified water pump station and a booster pump station, and appurtenant facilities to move the purified water from the AWT Facility to the Seaside Basin injection well facilities.
4. Injection well facilities – These would include new deep injection wells and vadose zone wells to inject the purified water into the Seaside Basin, backflushing facilities to percolate water pumped for well maintenance back into the Seaside Basin, pipelines, electricity/power distribution facilities, and electrical/motor control buildings.
5. Distribution of groundwater from Seaside Basin – This would include new CalAm distribution system improvements needed to convey extracted groundwater and deliver it to CalAm customers.
6. The GWR Project also would include modifications to the existing Salinas Industrial Wastewater Treatment Facility to allow the use of the existing treatment ponds for storage of excess winter source water flows.

An understanding of the potential public health implications for the use of purified water as a groundwater replenishment source is a fundamental and essential component of the EIR. Thus, as part of the work being performed for the EIR, this technical study was undertaken to evaluate (1) the status of recycled water regulations pertaining to groundwater replenishment; (2) studies of other similar projects that have assessed the effects of using recycled water for groundwater replenishment on groundwater quality and public health; (3) studies that have been specifically conducted for the GWR Project related to the AWT Facility design and performance; (4) studies that have been specifically conducted for the GWR Project regarding protection of groundwater quality and quantity; (5) GWR Project compliance with applicable statutes, policies, and regulations; (6) GWR Project effects on groundwater; and (7) the significance of this information for the EIR.

The remainder of this report is organized into the following sections:

- Section 3 - Overview of Statutory Requirements for Groundwater Replenishment
- Section 4 – Environmental Impact Report Groundwater Significance Criteria

- Section 5 - California Recycled Water Regulations for Groundwater Replenishment
- Section 6 - Overview of Drinking Water Standards and Advisory Levels
- Section 7 - State Water Resources Control Board Policies
- Section 8 - Central Coast Regional Water Quality Control Board Requirements
- Section 9 - Permitting Groundwater Replenishment Projects
- Section 10 - Studies and Tools to Assess the Safety of the Use of Recycled Water for Groundwater Replenishment
- Section 11 - Role and Activities of the Independent Advisory Panel
- Section 12 - Proposed Groundwater Replenishment Project Treatment Design
- Section 13 - Summary of the Groundwater Replenishment Project Water Quality and Compliance with Groundwater Replenishment Regulations and Central Coast Basin Plan
- Section 14 - Summary of Hydrogeologic and Geochemical Modeling
- Section 15 - Environmental Impact Report Groundwater Resources Significance Determination
- Section 16 - Constituents of Emerging Concern – Source Waters and Pilot Testing Results
- Seciton 17 - Summary of the Groundwater Replenishment Project Compliance with Regulations and Policies
- Section 18 - References
- Section 19 - Acronyms
- Section 20 - Glossary
- Appendix A – June 5, 2014 Letter from the Division of Drinking Water Regarding the Pure Water Monterey Groundwater Replenishment Project Concept
- Appendix B – All Analytes Included in the Source Water Sampling Program that were Detected in at Least One Sample of Any of the Untreated Source Waters
- Appendix C – Projected Monthly Flows of Source Waters to the Regional Treatment Plant Influent

## 3. Overview of Statutory Requirements for Groundwater Replenishment

The use of recycled water for planned groundwater replenishment projects in California is regulated under the Federal Safe Drinking Water Act, and several State laws, regulations, and policies, with different responsibilities assigned to the State Water Resources Control Board (SWRCB), the nine RWQCBs, and the SWRCB Division of Drinking Water (DDW) formerly the California Department of Public Health (CDPH).[6,7] Applicable federal statutes related to drinking water standards and regulations related to injection wells are addressed in later sections of this report.

The CWC and Health and Safety Code (H&SC) contain California's statutes that regulate the use of water, recycled water, and the protection of water quality, which are applicable to all groundwater replenishment projects that use recycled water. Some of the key statutes that ensure protection of water quality and public health are presented in **Table 1**.

**Table 1. Key California Statutes for Protection of Water Quality and Public Health**

| Code | Purpose |
|---|---|
| *Recycled Water Definitions* | |
| CWC Sections 13050, 13512, 13576, 13577, 13350, and 13552-13554[8] | Recycled water is defined in the CWC as water, which as a result of treatment of waste, is suitable for a direct beneficial use or a controlled use that would not otherwise occur and therefore considered a valuable resource. |
| CWC Sections 13561 | Defines direct potable reuse and indirect potable reuse for groundwater replenishment. |
| *Water Quality* | |
| CWC Section 13170 | Authorizes the SWRCB to adopt State policies for water quality control. |
| CWC Sections 13240-42 | Authorizes the RWQCB to adopt Water Quality Control Plans (Basin Plans) that assign beneficial uses for surface waters and groundwaters, and contain numeric and narrative water quality objectives that provide reasonable protection of the beneficial uses of the groundwater. One of the factors that must be considered when establishing water quality objectives is the need to develop and use recycled water. Basin Plans must include an implementation program for achieving the water quality objectives. |
| H&SC Sections 116270 et seq. | This is the California Safe Drinking Water Act that establishes primary and secondary maximum contaminant levels (MCLs) as included in the California Code of Regulations, Title 17 – Public Health, Chapter 5, Subchapter 1, Group 4 – Drinking Water Supplies, Sections 7583 through 7630.[9] |
| H&SC Section 116455 | Requires public water systems to take certain actions if drinking water exceeds Notification Levels (NLs). NLs are health-based advisory levels established by the DDW for chemicals in drinking water that lack MCLs. When chemicals are found at concentrations greater than their NLs, certain requirements and recommendations apply.[10] |
| *Recycled Water Permits* | |
| CWC Sections 13260, 13263, 13269, 13523.1 | Dischargers proposing to discharge waste that could affect the quality of waters of the state must file a report of waste discharge (ROWD) to the RWQCB. After receiving this report, the RWQCB can issue specific or general Waste Discharge Requirements (WDRs) and/or Water Recycling Requirements (WRRs) that reasonably protect all beneficial uses and that implement any relevant water quality |

[6] Note disposal of concentrate resulting from advanced treatment of recycled water that is mixed with secondary effluent for ocean discharge is regulated under the Clean Water Act and state laws, regulations, and policies. This aspect of the GWR Project is assessed in a separate Technical Memo and concludes that the GWR Project would comply with California Ocean Plan objectives (Trussell Technologies, 2015).

[7] Effective July 1, 2014, the CDPH Drinking Water Program (including recycled water responsibilities) was transferred to the SWRCB, and named the Division of Drinking Water.

[8] The Porter-Cologne Water Quality Control Act is contained in CWC Division 7 Water Quality, Sections 13000 et seq.

[9] See http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/documents/lawbook/dwregulations-2014-07-01.pdf

[10] See http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/NotificationLevels.shtml

| Code | Purpose |
|---|---|
| | control plans and policies. The RWQCB can also issue a Master Reclamation Permit, which is a WDR that covers multiple non-potable reuse applications and requires periodic site inspections and adoption of rules and regulations for recycled water use. A RWQCB may require a discharger to provide monitoring program reports or conduct studies. |
| CWC Section 13552.5 | Authorizes the SWRCB to adopt General Waste Discharge Requirements for Landscape Irrigation Uses of Municipal Recycled Water to streamline tertiary disinfected recycled water use. The General Permit was adopted in 2009; in 2014 the SWRCB adopted a new General Permit that supersedes this permit and covers all non-potable reuse applications.[11] |
| H&SC Section 116271 | Effective July 1, 2014 transfers the DDW Drinking Water Program to the SWRCB, including water reclamation and direct and indirect potable reuse; creates the Deputy Director of the new SWRCB DDW. |
| CWC Section 13528.5 | Effective July 1, 2014, the SWRCB may carry out the duties and authority granted to a RWQCB pursuant to Chapter 7 of the CWC (Water Reclamation Sections 13500 – 13557, which include issuing potable reuse permits). |
| *Recycled Water Regulations* | |
| CWC Sections 13500-13529.4; H&SC 116800 et seq. | Requires DDW to establish uniform statewide recycling criteria. DDW has developed these criteria for non-potable reuse and groundwater replenishment, and they are codified in Title 22 of the CCR. Regulations for cross connections are codified in Title 17. |
| CWC Section 13540 | Prohibits the use of any waste well that extends into a water-bearing stratum that is, or could be, used as a water supply for domestic purposes; injection wells or vadose zone wells used for replenishment are part of this category (injection wells or vadose zone wells are considered waste wells under the CWC). An exception can be provided if (1) the RWQCB finds that water quality considerations do not preclude controlled replenishment by direct injection, and (2) DDW finds, following a public hearing, that the proposed replenishment will not degrade groundwater quality as a source of domestic water supply. This Section of the CWC also allows DDW to make and enforce regulations pertaining to replenishment of recycled water using injection wells. |
| CWC Sections 13522.5 and 13523 | Requires any person who proposes to recycle or to use recycled water to file an Engineering Report with the RWQCB on the proposed use. After receiving the report, and consulting with and receiving recommendations from DDW, and any necessary evidentiary hearing, the RWQCB must issue a permit (WDRs and/or WRRs) for the use. |
| CWC Sections 13562-13563 | Requires DDW to adopt uniform water recycling criteria for groundwater replenishment by June 30, 2014 as emergency regulations, and for surface water augmentation by December 31, 2016 and requires DDW to investigate the feasibility of developing criteria for direct potable reuse and to provide a final report on that investigation to the Legislature by December 31, 2016. By February 14, 2015, DDW must convene an expert panel to advise DDW on water recycling criteria for surface water augmentation and the feasibility of direct potable reuse. |

## 4. Environmental Impact Report Groundwater Significance Criteria

CEQA is a California statute that requires state and local agencies to identify the significant environmental impacts of their actions and to avoid or mitigate those impacts, if feasible. The CEQA Guidelines are the regulations that explain and interpret the law for both the public agencies required to administer CEQA and for the public generally. The Guidelines are found in the California Code of Regulations, in Chapter 3 of Title 14.

Appendix G of the CEQA Guidelines provides the following two questions regarding groundwater resources:

- Would the project substantially deplete groundwater supplies or interfere substantially with groundwater replenishment such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop

[11] See http://www.waterboards.ca.gov/board_decisions/adopted_orders/water_quality/2014/wqo2014_0090_dwq_revised.pdf

to a level which would not support existing land uses or planned uses for which permits have been granted)?

- Would the project violate any water quality standards or otherwise degrade water quality?

The following factors are relevant to addressing the above-listed questions from the CEQA Guidelines Appendix G:

- Whether the GWR Project, taking into consideration the proposed treatment processes and groundwater attenuation and dilution, would:
  (1) Impact groundwater quality so that it no longer met standards (e.g., Basin Plan beneficial uses and water quality objectives, including drinking water MCLs established to protect public health).
  (2) Degrade groundwater quality subject to statutory requirements, and to the SWRCB Anti-degradation Policy[12] and Recycled Water Policy.
- Whether operation of the GWR Project would result in groundwater mounding, change groundwater gradients, or lower groundwater levels such that nearby municipal or private groundwater production wells experience a reduction in well yield or physical damage (due to exposure of well screens) resulting in a well not being capable of supporting existing land uses or planned uses for which permits have been granted.
- Whether the GWR Project would result in changes to groundwater levels such that it would exacerbate seawater intrusion.

This report focuses on the effects of the proposed GWR Project on water quality, groundwater levels, and groundwater quantity, including compliance with standards and the potential to degrade groundwater quality.

## 5. Recycled Water Regulations for Groundwater Replenishment

### 5.1. Regulations in Title 22 Prior to June 2014

Prior to June 18, 2014, the Water Recycling Criteria (Title 22 of the California Code of Regulations) included narrative requirements (e.g., general descriptions of requirements rather than numeric limits or specified treatment schemes) for planned groundwater replenishment projects. The regulations required that recycled water must be at all times of a quality that fully protected public health with DDW recommendations made on an individual case basis taking into consideration all relevant aspects of each project, including the following factors: treatment provided; effluent quality and quantity; spreading area operations; soil characteristics; hydrogeology; residence time; and distance to withdrawal. Since 1976, DDW issued numerous draft versions of progressively more detailed groundwater replenishment regulations that served as guidance for the six existing groundwater replenishment projects, all of which are located in Southern California (see **Table 2**), as well as for planning groundwater replenishment projects.[13]

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[12] Also included in the RWQCB Water Quality Control Plan.

[13] On additional project also has been permitted. In November 2014, the Central Coast RWQCB adopted a permit for the Cambria Emergency Water Supply Project. Unlike planned groundwater replenishment projects using recycled water, this project treats well water through an AWT Facility for injection into groundwater near potable supply wells. The well water being treated is comprised mostly of brackish groundwater, but depending on groundwater pumping it will also include secondary effluent from nearby secondary effluent disposal ponds. The project is necessary because of drought conditions and lack of natural replenishment water for the local groundwater basin. It is intended to only operate on a limited basis. The AWT Facility consists of MF, RO, UV/peroxide AOP, and free chlorine treatment. It was conditionally approved by DDW based on the June 2014 Groundwater Replenishment Regulations.

**Table 2. Permitted Groundwater Replenishment Projects in California**

| Project | Type of Groundwater Replenishment Application | Years of Operation | Recycled Water Treatment | Dilution Water | Recycled Water Volume AFY | Planned Recycled Water Expansion AFY |
|---|---|---|---|---|---|---|
| Montebello Forebay Project, Los Angeles County | Surface spreading | 52 | Disinfected tertiary | Storm water, potable water, groundwater underflow | 55,000[a] | 21,000[a] |
| West Coast Basin Seawater Intrusion Barrier, Los Angeles County | Injection | 20 | AWT | Potable water; will use 100% recycled water for future expansion | 17,000[a] | 7,200[a,b] |
| Dominquez Gap Seawater Intrusion Barrier, Los Angeles County | Injection | 11 | AWT | Potable water; will use 100% recycled water for future expansion | 5,400[a] | 7,500[a,c] |
| Chino Basin Project, San Bernardino County | Surface spreading | 9 | Disinfected tertiary | Storm water, potable water, groundwater underflow | 22,000[d] | --- |
| Alamitos Gap Seawater Intrusion Barrier Project, Los Angeles County | Injection | 9 | AWT | Potable water; will use 100% recycled water for future expansion | 3,400[a] | 8,900[a,b] |
| Groundwater Replenishment System (GWRS), Orange County | Injection (seawater barrier) and spreading | 5[e] | AWT | Use 100% AWT recycled water | 78,000[f] | 25,000[f] |

a. Source: information used for the Central and West Basin Salt Nutrient Management Plan (Nellor et al., 2012). The permit was amended in April 2014 to allow up to 45% recycled water to be used for replenishment.

b. Expected to be online in 2015. The permit was amended in June 2014 to allow up to 100% recycled water to be used for replenishment.

c. Expected to be online in 2017/18.

d. Source: from RWQCB Order No. R8-2005-0033.

e. Prior to GWRS, the Orange County Water District operated Water Factory 21 that blended AWT recycled water and local groundwater for injection to serve as a seawater intrusion barrier.

f. Source: http://www.gwrsystem.com/images/stories/GWRS%20Expansion_State%20and%20Local.pdf; construction to be completed in 2015.

## 5.2. June 2014 Groundwater Replenishment Regulations

Final Groundwater Replenishment with Recycled Water Regulations hereafter, referred to as "Groundwater Replenishment Regulations," went into effect June 18, 2014 (SWRCB, 2014).

The overarching principles taken into consideration by DDW in developing the Groundwater Replenishment Regulations were:

- Groundwater replenishment projects are replenishing groundwater basins that are used as sources of drinking water.

- Control of pathogenic microorganisms should be based on a low tolerable risk that was defined as an annual risk of infection[14] from pathogen microorganisms in drinking water of one in 10,000 ($10^{-4}$). This risk level is the same as that used for the federal Surface Water Treatment Rule for drinking water.
- Compliance with drinking water standards for regulated chemicals.
- Controls for unregulated chemicals.
- No degradation of an existing groundwater basin used as a drinking water source.
- Use of multiple barriers to protect water quality and human health.
- Projects should be designed to identify and respond to a treatment failure. A component of this design acknowledges that groundwater replenishment projects inherently will include storage in a groundwater aquifer and include some natural treatment.

The key provisions of the Groundwater Replenishment Regulations that apply to subsurface application (e.g., the use of injection or vadose zone wells) that use 100% recycled water for application are summarized in **Table 3**.

**Table 3. Summary of June 2014 Groundwater Replenishment Regulations**

| Control Mechanism | Requirements |
|---|---|
| Source Control | Entities that supply recycled water to a groundwater replenishment project must administer a comprehensive source control program to prevent undesirable chemicals from entering wastewater. The source control program must include: (1) an assessment of the fate of DDW and RWQCB-specified contaminants through the wastewater and recycled water treatment systems; (2) provisions for contaminant source investigations and contaminant monitoring that focus on DDW and RWQCB-specified contaminants; (3) an outreach program to industrial, commercial, and residential communities; and (4) an up-to-date inventory of contaminants. |
| Pathogen Control | To meet the low tolerable risk level (a basic principle of the regulations), pathogen reduction requirements have been established for treatment of recycled water similar to the approach used for drinking regulations. The Groundwater Replenishment Regulations require a project to achieve a 12-log enteric virus reduction, a 10-log *Giardia* cyst reduction, and a 10-log *Cryptosporidium* oocyst reduction using at least 3 treatment barriers. To ensure that a barrier is significant, each barrier must achieve at least 1.0-log reduction. No treatment process can be credited with more than 6-log reduction. The log reductions must be verified using a procedure approved by DDW. Log reduction refers to the reduction of pathogenic microorganism concentrations on a log-scale (e.g., 3 logs is 99.9% removal). Failure to meet the specified reductions requires notification to DDW and RWQB, investigation, and/or discontinuation of recycled water use until a problem is corrected. Trussell et al. (2013) conducted an extensive review of the proposed pathogen reduction requirements in the Groundwater Replenishment Regulations and concluded that the assumptions used to derive the log reductions were conservative and provide a large factor of safety that likely reduces the actual risk of infection below the $10^{-4}$ level, particularly for control of the amount of a particular disease present in a community. |
| Nitrogen Control | To ensure protection of groundwater, the concentration of total nitrogen in recycled water must meet 10 milligrams per liter (mg/L) before or after recharge. Failure to meet this value requires follow-up sampling, notification to DDW and RWQCB, and/or discontinuation of recycled water use until a problem is corrected. |
| Regulated Chemicals Control | The recycled water must meet drinking water MCLs as specified by the Groundwater Replenishment Regulations. Failure to meet MCLs requires follow-up sampling, notification to DDW and RWQCB, and/or discontinuation of recycled water use until the problem is corrected. |

[14] There is a difference between infection and disease. Infection, often the first step, occurs when a pathogen enters a body and begins to multiply. Disease occurs when the cells in the body are damaged as a result of the infection and signs and symptoms of an illness appear. Infection necessarily precedes disease, but infection typically only leads to disease in a fraction of cases. Many factors influence the infection-to-disease ratio.

| Control Mechanism | Requirements |
|---|---|
| Unregulated Chemicals Control | Monitoring the concentrations and toxicities of thousands of potential organic compounds in any water supply would be an infeasible task. Control of unregulated chemicals for all groundwater replenishment projects using 100% AWT recycled water is accomplished through limits for Total Organic Carbon (TOC) and performance of treatment for constituents of emerging concern (CECs)[15]. TOC is used as a surrogate for unregulated and unknown organic chemicals. For subsurface application projects (injection and vadose wells), the entire recycled water flow must be treated using RO and AOP. After treatment, the TOC in the recycled water cannot exceed an average of 0.5 mg/L. Specific performance criteria for RO and AOP processes have been included in the Groundwater Replenishment Regulations. Failure to meet the requirements established for a groundwater replenishment project results in notifications to DDW and RWQCB, response actions, and in some cases cessation of the use of recycled water. |
| Response Retention Time (RRT) | The intent of the RRT is to provide time to retain recycled water underground to identify any treatment failure so that inadequately treated recycled water does not enter a potable water system. Sufficient time must elapse to allow for: a response that will protect the public from exposure to inadequately treated water; and provide an alternative source of water or remedial treatment at the wellhead if necessary. The RRT is the aggregate period of time between treatment verification samples or measurements; time to make the measurement or analyze the sample; time to evaluate the results; time to make a decision regarding the appropriate response; time to activate the response; and time for the response to work. The minimum RRT is 2 months, but must be justified by the groundwater replenishment project sponsor. |
| Monitoring Program | Comprehensive monitoring programs are established for recycled water and groundwater for regulated and unregulated constituents. |
| Operation and Optimization Plan | The intent of the plan is to assure that the facilities are operated to achieve compliance with the Groundwater Replenishment Regulations, to achieve optimal reduction of contaminants, and to identify how the project will be operated and monitored. |
| Boundaries Restricting Locations of Drinking Water Wells | Project sponsors must establish a "zone of controlled well construction," which represents the greatest of the horizontal and vertical distances reflecting the underground retention times required for pathogen control or for the RRT. Drinking water wells cannot be located in this zone. Project sponsors must also create a "secondary boundary" representing a zone of *potential* controlled well construction that may be beyond the zone of controlled well construction, thereby requiring additional study before a drinking water well is drilled. |
| Adequate Managerial and Technical Capability | A project sponsor must demonstrate that it possess adequate managerial and technical capability to comply with the regulations. |
| Engineering Report | The project sponsor must submit an Engineering Report to DDW and RWQCB that indicates how a groundwater replenishment project will comply with all regulations and includes a contingency plan to insure that no untreated or inadequately treated water will be used. The report must be approved by DDW. |
| Reporting | Annual reports must be submitted to DDW, RWQCB, and groundwater providers downgradient of injection wells; the Engineering Report must be updated every 5 years. |
| Alternatives | Alternatives to any of the provisions are allowed if: the project sponsor demonstrates that the alternative provides the same level of public health protection; the alternative has been approved by DDW; and an expert panel has reviewed the alternative unless otherwise specified by DDW. |
| Public Hearing | The project sponsor must hold a public hearing for a groundwater replenishment project after DDW approves the Engineering Report; based on the Engineering Report, the hearing, and public comments, DDW issues a conditional approval letter to the RWQCB for inclusion in the WDRs and/or WRRs issued by the RWQCB. Thus, including the hearing for the RWQCB permit, there are two public hearings for a groundwater replenishment project. Should DDW obtain primacy for issuing groundwater replenishment permits, the RWQCB would provide recommendations and conditions for inclusion in the WDRs and/or WRRs and the SWRCB would hold the permit hearing. |

[15] CECs include pharmaceuticals, ingredients in personal care products, and endocrine disrupting chemicals.

## 6. Overview of Drinking Water Standards and Advisory Levels

The Federal Safe Drinking Water Act allows the U.S. Environmental Protection Agency (USEPA) to promulgate national primary drinking water standards specifying MCLs for each contaminant present in a public water system with an adverse effect on human health, taking into consideration cost and technical feasibility. Primary MCLs have been established for approximately 90 contaminants in drinking water.[16] In cases where the MCLs cannot be feasibly ascertained, the USEPA may elect to identify and establish a schedule of "treatment techniques" preventing adverse effects on human health to the extent feasible. DDW has established its own set of MCLs either based on the Federal MCLs or as part of its own regulatory process. For example, California has an MCL for perchlorate while there is no Federal MCL.[17]

Drinking water MCLs are established in two steps. For the Federal process, the USEPA establishes MCL goals (MCLGs) and, for the State purposes, DDW establishes Public Health Goals (PHGs), which are the maximum levels of a contaminant in drinking water at which no known or anticipated adverse effect on the health of persons would occur, and which allow an adequate margin of safety. The MCLGs have been historically set at zero for microbial and carcinogenic contaminants; chemical PHGs for carcinogens are set at the $10^{-6}$ risk level. Once the MCLG or PHG is established, the USEPA or DDW determines the feasible MCL or treatment technology level that may be achieved with the use of the best available technology and treatment techniques, and taking cost into consideration.

There are also a variety of chemicals of health concern whose occurrence is too infrequent in conventional drinking water sources to justify the establishment of national standards, but are addressed using advisory levels. The USEPA establishes health advisories to address many of these latter chemicals. The DDW has established its own health advisories for chemicals in drinking water without MCLs: NLs and Response Levels.[18] If a chemical concentration is greater than its NL in drinking water, the utility that distributes the water must inform its customers and consumers about the presence of the chemical, and about health concerns associated with exposure to it. If a chemical is present in drinking water that is provided to consumers at concentrations greater than the NL (10 to 100 times greater depending on the toxicological endpoint of the constituent), DDW recommends that the source be taken out of service (this concentration is called the Response Level). The Groundwater Replenishment Regulations include requirements for monitoring recycled water for NLs and actions to be taken if concentrations exceed NLs.

## 7. State Water Resources Control Board Policies

There are two policies of particular importance with respect to groundwater replenishment projects for protection of water quality and human health: (1) anti-degradation policies, and (2) the Recycled Water Policy.

### 7.1. Anti-degradation Policies

California's anti-degradation policies are found in Resolution 68-16, Policy with Respect to Maintaining Higher Quality Waters in California, and Resolution 88-63, Sources of Drinking Water Policy.[19] These resolutions are binding on all State agencies. They apply to both surface waters and groundwaters (and thus groundwater replenishment projects), protect both existing and potential beneficial uses of surface water and groundwater, and are incorporated into RWQCB Basin Plans.

***Resolution 68-16 (Anti-degradation Policy)***

The Anti-degradation Policy requires that existing high water quality be maintained to the maximum extent possible, but allows lowering of water quality if the change is "consistent with maximum benefit to the

[16] For a current list of MCLs, see http://www.epa.gov/safewater/contaminants/index.html.
[17] For a comparison see: http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/Chemicalcontaminants.shtml
[18] See http://www.waterboards.ca.gov/drinking_water/certlic/drinkingwater/NotificationLevels.shtml
[19] See http://www.swrcb.ca.gov/plans_policies/.

people of the state, will not unreasonably effect present and anticipated use of such water (including drinking), and will not result in water quality less than prescribed in policies." The Anti-degradation Policy also stipulates that any discharge to existing high quality waters will be required to "meet waste discharge requirements which will result in the best practicable treatment or control of the discharge to ensure that (a) pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained."

***Resolution 88-63 (Sources of Drinking Water Policy)***

The Sources of Drinking Water Policy designates the municipal and domestic supply (MUN) beneficial use for all surface waters and groundwater except for those: (1) with total dissolved solids (TDS) exceeding 3,000 mg/L, (2) with contamination that cannot reasonably be treated for domestic use, (3) where there is insufficient water supply, (4) in systems designed for wastewater collection or conveying or holding agricultural drainage, or (5) regulated as a geothermal energy producing source. Resolution 88-63 addresses only designation of water as drinking water source; it does not establish objectives for constituents that threaten source waters designated as MUN.

## 7.2. Recycled Water Policy

The Recycled Water Policy was adopted by the SWRCB in February 2009. It was subsequently amended in 2013 with regard to CEC monitoring for groundwater replenishment projects. The Recycled Water Policy was a critical step in creating uniformity in how RWQCBs were individually interpreting and implementing Resolution 68-16 for water recycling projects, including groundwater replenishment projects. The critical provisions in the Policy related to groundwater replenishment projects are discussed in the following subsections.

***Salt/Nutrient Management Plans***

In recognition that some groundwater basins in the state contain salts and nutrients that exceed or threaten to exceed Basin Plan groundwater objectives, and that some Basin Plans do not have adequate implementation measures to achieve compliance, the Recycled Water Policy includes provisions for managing salts and nutrients on a regional or watershed basis through development of Salt/Nutrient Management Plans (SNMPs) rather than imposing requirements on individual recycled water projects (which had been the practice prior to adoption of the Recycled Water Policy). Unfavorable groundwater salt and nutrient conditions can be caused by natural soils, discharges of waste, irrigation using surface water, groundwater, or recycled water, and water supply augmentation using surface or recycled water. Regulation of recycled water alone will not address these conditions.

SNMPs are to be developed for every groundwater basin/sub-basin by May 2014 (May 2016 with a RWQCB-approved extension). The SNMP must identify salt and nutrient sources; identify basin/sub-basin assimilative capacity and loading estimates; and evaluate the fate and transport of salts and nutrients. The SNMP must include implementation measures to manage salt and nutrient loadings in the basin on a sustainable basis and an anti-degradation analysis demonstrating that all recycling projects identified in the plan will collectively satisfy the requirements of Resolution No. 68-16. The SNMP must also include an appropriate cost effective network of monitoring locations to determine if salts, nutrients and other constituents of concern (as identified in the SNMPs) are consistent with applicable water quality objectives.

***Regional Water Quality Control Board Groundwater Requirements***

The Recycled Water Policy does not limit the authority of a RWQCB to include more stringent requirements for groundwater replenishment projects to protect designated beneficial uses of groundwater, *provided* that any proposed limitations for the protection of public health may only be imposed following regular consultation with DDW. The Recycled Water Policy also does not limit the authority of a RWQCB to impose additional requirements for a proposed groundwater replenishment project that has a substantial adverse effect on the fate and transport of a contaminant plume (for example those caused by industrial contamination or gas stations), or changes the geochemistry of an aquifer thereby causing the dissolution of naturally occurring constituents, such as arsenic, from the geologic formation into groundwater. These provisions require additional assessment of the impacts of a groundwater replenishment project on areas of contamination in a basin and/or if the quality of the water used for replenishment causes constituents, such as naturally occurring arsenic, to become mobile and impact groundwater.

***Anti-degradation and Assimilative Capacity***

Assimilative capacity is the ability for groundwater to receive contaminants without detrimental effects to human health or other beneficial uses. It is typically derived by comparing background ambient chemical concentrations in groundwater to the concentrations of the applicable Basin Plan groundwater quality objectives. The difference between the ambient concentration and groundwater quality objective is the available assimilative capacity.

The Recycled Water Policy establishes two assimilative capacity thresholds in the absence of an adopted SNMP. A groundwater replenishment project that utilizes less than 10% of the available assimilative capacity in a groundwater basin/sub-basin (or multiple projects utilizing less than 20% of the available assimilative capacity in a groundwater basin/sub-basin) are only required to conduct an anti-degradation analysis verifying the use of the assimilative capacity. In the event a project or multiple projects utilize more than the designated fraction of the assimilative capacity (e.g., 10% for a single project or 20% for multiple projects), the project proponent must conduct a RWQCB-deemed acceptable (and more elaborate) anti-degradation analysis. A RWQCB has the discretionary authority to allocate assimilative capacity to groundwater replenishment projects. There is a presumed assumption that allocations greater than the Recycled Water Policy thresholds would not be granted without concomitant mitigation or an amendment to the Basin Plan groundwater quality objective to create more assimilative capacity for allocation. Groundwater replenishment projects that utilize AWT recycled water will use very little to essentially none of the available assimilative capacity because of the high quality of the water.

## 7.3. Constituents of Emerging Concern

***Background on CECs***

Among the perceived risks of using recycled water for groundwater replenishment is concern about the presence of trace concentrations of pharmaceuticals, ingredients in personal care products (such as insecticides and flame retardants), and chemicals that can affect the human endocrine system in terms of growth, reproduction, and sexual behavior (e.g., endocrine disrupting chemicals). These chemicals are often grouped together and are called CECs in the Recycled Water Policy. Low concentrations of CECs have been found in wastewater, recycled water, surface water, drinking water, and groundwater. The ability to detect these chemicals at very low levels has outpaced the ability to completely remove them (if needed) from the environment.

CECs are effectively removed by many recycled water treatment processes, including the oxidative processes and RO in AWT, but can sometimes be detected after treatment. For example, N,N-diethyl-metatoluamide (DEET), is the active ingredient in many insect repellent products, specifically used to repel mosquitoes and ticks. DEET has been measured in tertiary recycled water at a 90$^{th}$ percentile[20] concentration of 1.52 micrograms per liter (µg/L)[21] (Anderson et al., 2010) and is removed in AWT by more than 90% (Drewes et al., 2008). More information on CECs in the context of the pilot testing for the GWR Project is provided later in the report.

Simply detecting a compound, however, does not mean that its presence is of health significance. Because many CECs do not have established drinking water standards or advisory levels, researchers have developed a method to estimate concentrations that can be ingested daily over a lifetime without appreciable risk. This method utilizes information on chemical toxicity (often described on a per-body-weight basis), along with

[20] 90% of the samples tested are less than this value.
[21] A µg/L is one part per billion, or the equivalent of two drops of water in a typical 15,000-gallon backyard swimming pool.

assumptions about the population and their water consumption. The procedure to derive this estimated "safe" amount involves collecting all relevant toxicity data, ascertaining the completeness of the data, determining the most sensitive toxicity outcome (taking into account sensitive population groups such as infants, children, pregnant women, and those with compromised health), and applying appropriate safety factors. Health outcomes include therapeutic doses of medications, the no observed adverse effect level (NOAEL), the lowest observed no adverse effect level (LOAEL), and carcinogenicity. To account for the variability and uncertainty that are reflected in differences between test animals and humans and variability within the human population, the numerical health outcomes are lowered by applying uncertainty factors thereby adding a layer of conservatism. Depending on the researcher conducting the study, these estimated safe amounts are called different names: Tolerable Daily Intakes (TDIs), Acceptable Daily Intakes (ADIs), or Predicted No Effect Concentrations (PNEC) (Schwab et al., 2005, Environment Protection and Heritage Council et al., 2008, Environment Protection and Heritage Council et al, 2008, Anderson et al., 2010, Bruce et al., 2010a,b).

These research projects have selected CECs for evaluation, considering the approximately 3,000 most used chemicals that might be present in recycled or drinking water, including prescription drugs, drugs of abuse, over-the-counter drugs, veterinary pharmaceuticals, personal care products, components of household products, and chemicals that can disrupt the human endocrine system. The selection process considers:

- The likelihood of occurrence in recycled water on the basis of evidence of detection in wastewater treatment plant effluents, effluent-dominated surface waters, and/or drinking water; the rate of pharmaceutical use; or physical/chemical properties predictive of resistance to water treatment and the potential to migrate in groundwater.
- The likelihood to cause adverse health effects in humans at very low, chronic exposure levels, particularly given any evidence of carcinogenicity, impairment of fertility, or developmental toxicity in animal or human studies.
- Public, scientific, and regulatory interest.
- The ability of different chemical or drug groups to represent different mechanisms of action or use patterns.

In order to compare the estimated safe amounts to concentrations of chemicals in recycled water or drinking water, researchers calculate a Drinking Water Equivalent Level (DWEL). The DWEL represents the concentration of a chemical in drinking water that would be equivalent to the TDI/ADI/PNEC, assuming a 150-pound person (70 kilograms or kg) consumes 2 liters (L) of water per day (d) (or about 8½ cups) using the following equation:

$$\textbf{DWEL } (\mu g/L) = \frac{\textbf{TDI } (\mu g/kg/day) \times 70 \text{ kg}}{2 \text{ L/day}}$$

Anderson et al. (2010) presents a compendium of TDIs, ADIs, PNECs, and DWELs for over 400 CECs.

To put the DWELs into understandable terms to support risk communication, they can be compared to the highest (worst case) concentrations that have been detected in wastewater, recycled water, or drinking water sources. It is then possible to calculate the number of 8-ounce glasses of water containing the detected concentrations that a person would have to drink to reach the upper limit of acceptable levels (the DWEL).

$$\textbf{Required water consumption (L/day)} = \frac{\textbf{DWEL } (\mu g/L) \times 2L/day}{\textbf{Detected water concentration } (\mu g/L)}$$

Some examples of DWELs and water consumption rates to reach the DWEL are presented in **Table 4**.

**Table 4. Daily Water Consumption Equal to the Drinking Water Equivalent Level[a]**

| Compound | Type of Compound | DWEL µg/L | Consumption Rate Required to Equal DWEL (8-ounce Glasses/Day)[b] |
|---|---|---|---|
| Alprazolam | Anti-anxiety medication | 14 | 39 |
| Ciprofloxacin | Antibiotic | 17 | 4,800 |
| Clonidine | Blood pressure medication | 0.028 | >99 |
| DEET | Insecticide | 81 | 3,500 |
| Ibuprofen | Analgesic | 34 | 290 |
| Morphine | Analgesic | 1.0 | 42 |
| Primidone | Anticonvulsant | 0.85 | 55 |
| Salicylic acid | Skin care product ingredient | 54 | 420 |
| TCEP[c] | Flame retardant | 4.4 | 84 |
| Di-*n*-butyl phthalate | Plasticizer | 14 | 200 |

a. Source: Bruce et al., 2010a.

b. The water concentrations used to derive the consumption rates are to serve as an example only and are based on Bruce et al. (2010a), and do not reflect the data for the GWR Project. Bruce et al. (2010a) used the highest concentration of a CEC detected in water (surface and groundwater) and wastewater found in the literature, from studies in the U.S. and overseas, and thus was a very conservative approach.. As discussed later in this report, none of the example CECs were detected in the RO permeate from the pilot testing or would be found after treatment at the full-scale AWT Facility.

c. TCEP - Tris(2-chloroethyl)phosphate.

In general, for those CECs whose presence in recycled water, drinking water or other water sources has been evaluated, CECs were many times lower than the acceptable concentrations based on the DWELs.

***CEC Monitoring***

As part of the SWRCB Recycled Water Policy, a Science Advisory Panel was formed to identify a list of CECs for monitoring in recycled water used for groundwater replenishment. The Panel completed its report in June 2010 and recommended monitoring a specific list of selected health-based and treatment performance indicator CECs and surrogates (Anderson et al., 2010). The groundwater replenishment monitoring recommendations were directed at (1) surface spreading using tertiary recycled water, specifically monitoring recycled water and groundwater; and (2) injection projects using RO and AOP, specifically monitoring recycled water. The framework used to select CECs for monitoring compared Measured Environmental Concentrations (MECs) in recycled water to Monitoring Trigger Levels (MTLs). The MTLs are equivalent to DWELs discussed in the CEC background section of this report.

The Panel embedded a number of conservative assumptions within the framework used to identify CECs for monitoring in recycled water:

- The Panel elected to use available MEC data for secondary and tertiary recycled water. This approach results in MECs that are on the order of 40 to 800 times higher than what is likely observed in purified water that has also received AWT.
- No credit was given to the MECs for dilution through mixing with native groundwater, although this will naturally occur for both of the aquifers involved in the GWR Project.
- The 90$^{th}$ percentiles of MECs were used, which provides a safety factor of approximately 10-fold.
- The derivation of the MTLs include safety factors ranging from 100 to 10,000.

Overall, the assumptions used by the Panel to identify CECs for monitoring groundwater replenishment projects included between 6 to 11 orders of magnitude of conservatism. Some of the CECs were selected for monitoring based on their potential to pose a human health risk if present in drinking water, while others were selected to evaluate recycled water treatment performance, or both.

The SWRCB amended the Recycled Water Policy in 2013 to include the Panel's recommended CEC monitoring program, including the final list of specific CECs and monitoring frequencies for groundwater replenishment projects (see **Table 5**), and procedures to evaluate the data and for responding to the monitoring results (see **Table 6**). For health-based CECs, the responses in Table 6 are based on comparing measured concentrations in recycled water after treatment (RO or RO with AOP for subsurface application projects) to the MTLs. The monitoring and response requirements will be incorporated into groundwater replenishment project permits. As part of the Groundwater Replenishment Regulations, DDW has its own CEC requirements and monitoring locations that must be met (and established on a project-by-project basis) in addition to the Recycled Water Policy requirements. The next update of CEC monitoring by a SWRCB expert panel will occur in 2015.

**Table 5. Recycled Water Policy - Monitoring for Constituents of Emerging Concern for Groundwater Replenishment Projects**

| Constituent | Constituent Group | Relevance / Indicator Type | Method Reporting Limit (µg/L)[a,b] | MTL (µg/L) | Example of Treatment % Removal[c] |
|---|---|---|---|---|---|
| 17β-estradiol | Steroid hormones | Health | 0.001 | 0.0009 | ---[f] |
| Caffeine | Stimulant | Health & Performance | 0.05 | 0.35 | >90 |
| NDMA[d] | Disinfection byproduct | Health & Performance | 0.002 | 0.01 | 25-50, >80[e] |
| Triclosan | Antimicrobial | Health | 0.05 | 0.35 | ---[f] |
| DEET | Personal care product | Performance | 0.05 | ---[g] | >90 |
| Sucralose | Food additive | Performance | 0.1 | ---[g] | >90 |

a. The Method Reporting Level is the smallest measured concentration of a substance that can reliably be measured using a given analytical method.
b. Monitoring frequency is quarterly for the initial assessment phase; semi-annually for the baseline phase; and semi-annually to annually for the standard operation phase; CEC monitoring can be removed or increased based on the results.
c. These percentages are one example from one study that evaluated treatment performance; specific removal percentages are to be established for each groundwater replenishment project.
d. NDMA – N-nitrosodimethylamine.
e. For RO, the range is 25-50%; for RO with AOP, the removal is greater than 80%.
f. Not applicable.
g. The Panel used "N/A" in its report for the MTL because DEET is a performance indicator; DEET does have a DWEL of 2.5 µg/L (Environment Protection and Heritage Council et al., 2008).
h. The Panel used "N/A" in its report for the MTL but showed the MEC/MTL ratio equal to 0.02. Based on the sucralose MEC of 26,390,000 µg/L, a calculated MTL would be 527,800 µg/L. This value is higher than a calculated DWEL of 175,000 µg/L based on the Food and Drug Administration's ADI for sucralose, which is an artificial sweetener. Because sucralose is present in wastewater (and is not toxic), it serves as an excellent treatment performance indicator.

**Table 6. Recycled Water Policy - Thresholds and Response Actions for Health-based Indicators**

| MEC/MTL Threshold | Response Action |
|---|---|
| If greater than 75% of the MEC/MTL ratio results for a CEC are less than or equal to 0.1 during the baseline monitoring phase and/or subsequent monitoring | A) After completion of the baseline-monitoring phase, consider requesting removal of the CEC from the monitoring program. |
| If MEC/MTL ratio is greater than 0.1 and less than or equal to 1 | B) Continue to monitor. |
| If MEC/MTL ratio is greater than 1 and less than or equal to 10 | C) Check the data.<br>Continue to monitor. |
| If MEC/MLT ratio is greater than 10 and less than or equal to 100 | D) Resample immediately and analyze to confirm CEC result.<br>Continue to monitor. |
| If MEC/MLT ratio is greater than 100 | E) Resample immediately and analyze to confirm result.<br>Continue to monitor.<br>Contact the RWQCB and DDW to discuss additional actions.<br>(Additional actions may include, but are not limited to, additional monitoring, toxicological studies, engineering |

| MEC/MTL Threshold | Response Action |
|---|---|
| | removal studies, modification of facility operation, implementation of a source identification program, and monitoring at additional locations.) |

## 8. Central Coast Regional Water Quality Control Board Requirements

The Central Coast RWQCB is currently responsible for regulating recycled water discharges to groundwater, which are subject to state water quality regulations and statutes.

### 8.1. Groundwater Beneficial Uses and Water Quality Objectives

WDRs issued by the Central Coast RWQCB are required to implement applicable State water quality control policies and plans, including water quality objectives and implementation policies established in the Basin Plan.[22] The Basin Plan designates beneficial uses and groundwater quality objectives on a sub-basin basis. Groundwater throughout the Central Coast Basin (except for the Soda Lake Sub-basin) is suitable for agricultural water supply (AGR), MUN, and industrial use. The Basin Plan has:

- General narrative groundwater objectives that apply to all groundwaters for taste and odor and radioactivity.
- For MUN beneficial uses - groundwater criteria for bacteria and DDW primary and secondary MCLs.
- For AGR beneficial uses - objectives to protect soil productivity, irrigation, and livestock watering.

Permit limits for groundwater replenishment projects are set to ensure that groundwater does not contain concentrations of chemicals in amounts that adversely affect beneficial uses or degrade water quality. For some specific groundwater sub-basins, the Basin Plan establishes specific mineral water quality objectives for TDS, chloride, sulfate, boron, sodium, and nitrogen. No specific numeric objectives have been established in the Basin Plan for the Seaside Basin for these constituents other than those with MCLs.

## 9. Permitting Groundwater Replenishment Projects

### 9.1. Division of Drinking Water and Regional Water Quality Control Board Roles

The current (potentially interim) process for project approval and permitting of groundwater replenishment projects is depicted in **Figure 1**. The RWQCB issues the permit based on the Groundwater Replenishment Regulation, any specific DDW conditions, and requirements consistent with Basin Plans, SNMPs, and State policies. Effective July 1, 2014, the DDW as part of the SWRCB has the authority to issue WDRs and WRRs. As the DDW transition proceeds during fiscal year 2014/15, more information will be available on how permitting responsibilities will be handled by DDW and RWQCBs.

[22] See http://www.waterboards.ca.gov/rwqcb3/publications_forms/publications/basin_plan/.

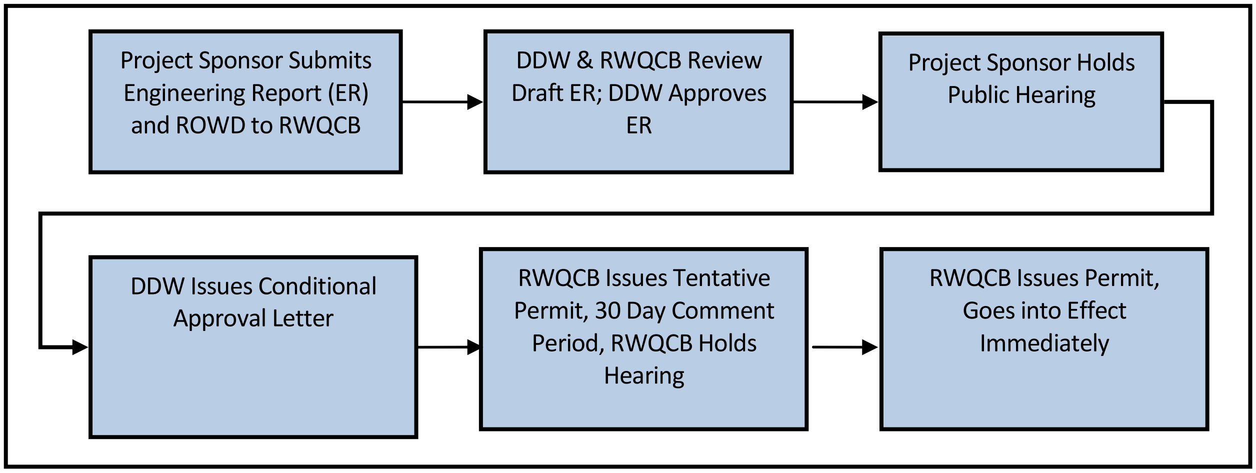


**Figure 1. Current Regulatory Process for Groundwater Replenishment Projects Using Recycled Water**

If DDW becomes the permitting authority for groundwater replenishment projects, the possible approval and permitting process may follow the steps shown in **Figure 2.**

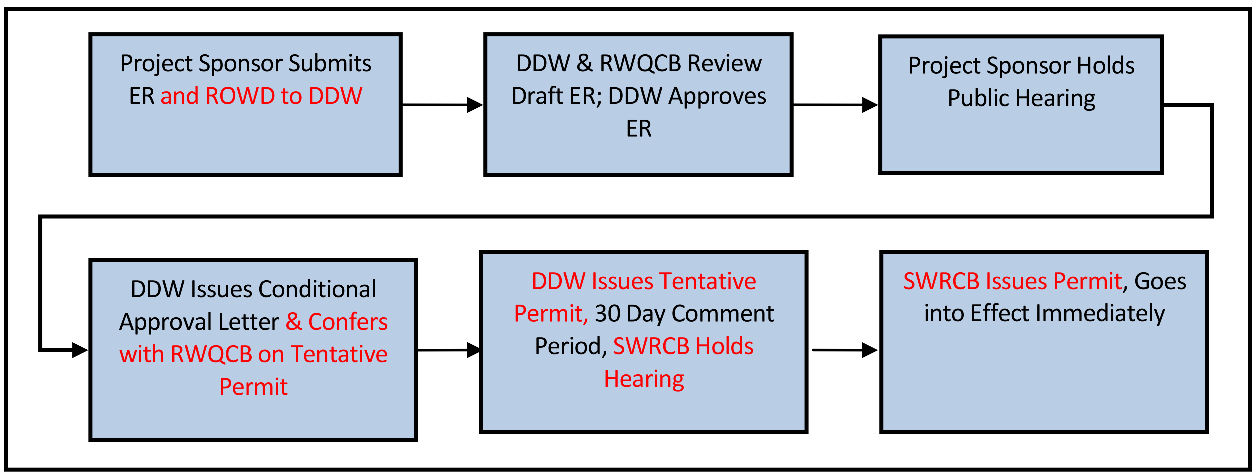


**Figure 2. Potential Regulatory Process for Groundwater Replenishment Projects Using Recycled Water**

In some cases, as a step before proceeding with an Engineering Report, a project sponsor will seek conditional approval from DDW of a conceptual project proposal. This approach was taken for the GWR Project. In May 2014, MRWPCA submitted a proposal, which was reviewed by the IAP, for review by DDW (MRWPCA, 2014). On June 5, 2014, DDW submitted a letter to MRWPCA (see Appendix A) that conditionally approved the GWR Project proposal. DDW also listed the following future submittal requirements:

- The Engineering Report, final design and Contingency Plan.
- The Operations Plan.
- The Response Plan.
- The Water Quality Monitoring Plan.
- Monitoring well program justification.
- Information on MRWPCA's technical and managerial capacity with a focus on treatment plant operators.

### 9.2. Federal Requirements for Groundwater Replenishment Projects (Underground Injection Control)

At this time there are no Federal permitting requirements for surface application groundwater replenishment projects; the USEPA's underground injection control (UIC) program does apply to injection wells, but has no permitting consequences for the GWR Project. The UIC program has categorized injection wells into five classes, only one of which (Class V) applies to groundwater replenishment projects. Under the existing Federal regulations, Class V injection wells are "authorized by rule" which means they do not require a Federal permit if they do not endanger underground sources of drinking water and comply with other UIC program requirements. For California, USEPA Region 9 is the permitting administrator for Class V wells. Any injection project planned in California must meet the State Sources of Drinking Water Policy, which ensures protection of groundwater quality for drinking water supplies, and therefore a Federal permit would not be necessary.[23] All Class V injection well owners in California are required to submit information to USEPA Region 9 on the well for USEPA's inventory.[24]

## 10. Studies and Tools to Assess the Safety of the Use of Recycled Water for Groundwater Replenishment

This Section presents information on studies and tools designed to evaluate the effects of recycled water used for groundwater replenishment on human health. These types of studies and tools show that the use of recycled water for such use is a safe sustainable practice.

- Epidemiological studies.
- Risk assessments.
- Bio-analytical screening tools.

### 10.1. Epidemiology Studies

Epidemiological studies evaluate the relation between an environmental pollutant and human health using data to characterize exposures to the pollutant, including concentrations in the environment, the probability and characteristics of human exposure, and the distributions of internal doses, as well as trends or differences in the health status of exposed people. Over the past 30 years, a limited number of epidemiology studies have specifically been conducted to evaluate the public health implications of using recycled water for groundwater replenishment and for direct potable reuse.[25]

The epidemiology studies rely on exposure and outcome data for groups rather than individuals. The diseased persons in the study may not be the most exposed individuals, but this cannot be determined. Nor is information on important risk factors (such as smoking, alcohol consumption, and occupational/environmental exposure that might affect disease incidence) typically available or controllable in the analysis. Other confounding factors can include population migration in and out of the study areas and the use of bottled water. Although epidemiology is helpful as part of an evaluative suite of analytical tools used to assess risk, epidemiology may be most useful at bounding the extent of risk, rather than actually determining the presence of risk at any level (NRC, 2012).

A summary of the relevant projects and related studies is presented in **Table 7**. The Montebello Forebay Project, which uses tertiary recycled water for groundwater replenishment, has been the subject of three epidemiology studies that have shown that there was no association between use of tertiary recycled water and mortality or morbidity.

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[23] See http://water.epa.gov/type/groundwater/uic/class5/frequentquestions.cfm#do_i.

[24] http://www.epa.gov/region9/water/groundwater/uic-classv.html, and http://www.epa.gov/region9/water/groundwater/injection-wells-register.html.

[25] California law defines direct potable reuse as the planned introduction of recycled water either directly into a public water system or into a raw water supply immediately upstream of a water treatment plant.

**Table 7. Summary of Potable Reuse Epidemiology Studies**

| Project | Description | Studies/Results |
|---|---|---|
| **Groundwater Replenishment** | | |
| Montebello Forebay Groundwater Recharge Study, Los Angeles County, California (Nellor, et al., 1984; Sloss et al., 1996; Sloss et al. 1999) | Recycled water has been used as a source of replenishment since 1962; other replenishment sources are imported river water (Colorado River and State Project water) and local storm runoff. Water is percolated into the groundwater using two sets of spreading grounds. From 1962 to 1977, the water used for replenishment was disinfected secondary effluent. Granular media filtration was added later to enhance virus inactivation during final disinfection. During this time period, the amount of recycled water spread annually averaged 27,000 acre-feet (AF), which was 16% of the inflow to the groundwater basin. At that time an arbitrary cap of 32,700 AFY of recycled water had been established. In 1987, the project was allowed in increase the amount of recycled water to 50,000 AFY. The current permit allows for a maximum recycled water contribution of 35% based on a 10-year average. The recycled water meets drinking water standards for chemical constituents and also meets California recycling criteria for total coliforms < 2.2/100 milliliters (mL), and turbidity < 2 Nephelometric Turbidity Units (NTU). | The studies have looked at health outcomes for 900,000 people that received some recycled water in their household water supplies in comparison to 700,000 people in a control population. Three sets of studies have been conducted: 1) the Health Effects Study, which evaluated mortality, morbidity, cancer incidence, and birth outcomes for the period 1962-1980; 2) the Rand Study (Sloss et al., 1996), which evaluated mortality, morbidity, and cancer incidence for the period 1987-1991; and 3) the second Rand Study (Sloss et al. 1999), which evaluated adverse birth outcomes for the period 1982-1993.<br><br>Health Effects Study (1962-1980): the epidemiological studies focused on a broad spectrum of health concerns that could potentially be attributed to constituents in drinking water. Health parameters evaluated included: mortality (death from all causes, heart disease, stroke, all cancers and cancers of the colon, stomach, bladder and rectum); cancer incidence (all cancers, and cancers of the colon, stomach, bladder, and rectum); infant and neonatal mortality; low birth weight; congenital malformations; and selected infectious diseases (including *Hepatitis A* and *Shigella*). Another part of the study consisted of a telephone interview of adult females living in recycled water and control areas. Information was collected on spontaneous abortions and other adverse reproductive outcomes, bed-days, disability-days, and perception of well being. The survey was able to control for the confounding factors of bottled water usage and mobility.<br><br>Rand (1987–1991): the study evaluated cancer incidence (all cancers, and cancer of the bladder, colon, esophagus, kidney, liver, pancreas, rectum, stomach); mortality (death from all causes, cancer, cancer of the bladder, colon, esophagus, kidney, liver, pancreas, rectum, stomach, heart disease, cerebrovascular disease); and infectious diseases (including *Giardia*, *Hepatitis A*, *Salmonella*, *Shigella*).<br><br>Rand (1982–1993): the evaluation focused on two types of adverse birth outcomes: (a) prenatal development and infant mortality (including: low birth weight (full term only), low birth weight (all births), very low birth weight, preterm birth, infant mortality); and (b) birth defects (all defects, neural tube defects, other nervous system defects, ears, eyes, face, neck defects; major cardiac defects, patent ductus arteriosus, other cardiac defects, and respiratory system defects; cleft defects, pyloric stenosis, intestinal artesias, other digestive system defects; limb, other musculoskeletal, integument and all other defects; chromosomal syndromes and syndromes other than chromosomal).<br><br>These three studies found that after almost 30 years of groundwater replenishment, there was no association between tertiary recycled water consumption and higher rates of cancer, mortality, infectious disease, or adverse birth outcomes. |
| **Direct Potable Reuse** | | |
| Windhoek, Namibia (Isaacson and Sayed, 1988) | This is an ongoing direct reuse project that began in 1968. At the time the study was conducted, | The study, which was conducted for the period 1976–1983, looked at cases of diarrheal diseases. For the Caucasian population of similar socio-economic status studied, disease |

| Project | Description | Studies/Results |
|---|---|---|
| | the recycled water was treated using sand filtration and granular activated carbon (GAC), and the recycled water was added to the drinking water supply system. The treatment system for this project has been upgraded since this work was conducted. The highly treated recycled water is blended with treated dam water and/or groundwater. The maximum portion of recycled water fed into the potable water distribution system is 50% in times of low water demand (winter season) (Lahnsteiner and Lempert, 2007). The drinking water system serves 250,000 people. Water quality guarantee values have been established for the project based on the World Health Organization Guidelines, the Rand Water Guidelines (South Africa), and the Namibian Guidelines for Group A Water. | incidence was marginally lower in persons supplied with recycled water than those with water from conventional sources. Incidence rates were significantly higher in black populations, all of whom received conventional water only. Age-specific incidence rates in children of the various ethnic groups also showed differences characteristically associated with socio-economic stratification. The study concluded that the consumption of recycled water did not increase the risk of diarrheal diseases caused by waterborne infectious agents. |
| Chanute, Kansas (Metzler et al., 1958) | This project provided emergency use of recycled water during a drought for 150 days during 1956-57. The Neosho River was dammed below the outfall of the sewage treatment plant and the treated effluent backed up to the water intake. The impounding acted as waste stabilization and water was chlorinated prior to service. The use ended when heavy rains washed out the temporary dam. The river water source already contained wastewater prior to this event. | An epidemiology study showed fewer cases of stomach and intestinal illness during the period when recycled water was used than the following winter when Chanute returned to using river water. |

## 10.2. Risk Assessment

Risk assessment can be defined as the determination of a quantitative or qualitative value of risk related to a specific situation and a recognized threat (or hazard). Typically, the goal of an environmental risk assessment is to estimate the severity and likelihood of harm to human health or the environment occurring from exposure to a (chemical or microbiological) risk agent (Cohrssen and Covello, 1989). Information obtained from risk assessments can be used to make risk management and policy decisions.

In 1983, in response to a request by the U.S. Congress, the National Academy of Sciences National Research Council (NRC), developed a risk assessment framework that primarily addressed human health effects associated with exposure to chemical contaminants in the environment and how risk assessment should be addressed as part of the development of regulations (NRC, 1983). The framework has also served as a template for the development of numerous subsequent risk assessments and risk assessment frameworks. Those steps in that framework include:

- Hazard identification: Evaluate data and identify detected chemicals that can be used to represent the potential carcinogenic risk and noncarcinogenic hazard posed by the test waters.

- Dose response assessment: Evaluate the potential carcinogenicity and noncarcinogenic effects of the chemicals of concern.
- Exposure assessment: Estimate the potential doses based on observed concentrations and assumed intake levels or rates.
- Risk characterization: Compute the potential health risks associated with the test waters.

Risk assessment following a modified form of this framework can also be conducted for microorganisms.

The 1983 risk assessment framework was enhanced in 2009 by expanding on problem formulation and risk-based decision-making, and by including provisions for internal and external stakeholder involvement in all stages of risk assessment (NRC, 2009).

The USEPA Office of Drinking Water uses a "regulatory window" of $10^{-6}$ to $10^{-4}$ for evaluation of risk where $10^{-4}$ is the baseline risk for all regulations and $10^{-6}$ is the *de minimis* risk level, where *de minimis* risk levels infer that the activity is essentially "risk free." Acceptable risk differs from *de minimis* risk in that it incorporates factors beyond health-based criteria alone, such as the technological feasibility or economic impacts of achieving a given level of risk. Under ideal conditions, the acceptable risk would meet the *de minimis* criteria while being technically and economically practical. However, a compromise between the lower levels of risk and the availability of technology and/or economic limitations is sometimes justified.

Several representative quantitative risk assessment studies have been conducted evaluating the risks to human health associated with the use of recycled water for groundwater replenishment. Quantitative "relative" risk assessments (QRRAs) differ from conventional risk assessments in that they calculate doses on the basis of observed concentrations in water and an *assumed* standard water intake in lieu of deriving a site-specific water intake rate, because determinations of absolute exposure in terms of the amount of water consumed in a study population cannot be reliably or easily derived. For example, absolute exposure is impacted by use of bottled water, consuming different water at home rather than at work, population mobility, etc. Thus, a QRRA does not assess the absolute risk from ingestion of water at the tap but rather compares the relative risk of the scenario being evaluated assuming everyone is drinking the same amount of water at the same concentration. This is likely a more conservative approach than using absolute exposure information.

QRRAs were conducted for the Montebello Forebay Project and the Chino Basin Project. The recycled water used for these projects meets the Title 22 Water Recycling Criteria standard for disinfected filtered recycled water and federal and state drinking water MCLs in recycled water before or after surface application. Both of these projects apply recycled water using spreading basins. Dilution waters are also used for replenishment (stormwater, potable water, or other sources of non-wastewater origin) such that the recycled water contributions (RWCs) for the projects range from 35% to 45%.[26] The QRRAs were based on chemicals that are currently regulated or under consideration for regulation (Soller and Nellor, 2011, a,b). Relative human health risks were used to evaluate the potential human health risks rather than using a more traditional approach of making comparisons to drinking water standards because MCLs are based on varying levels of risk. The study evaluated eight years of historical data including approximately 200 chemicals, and identified constituents that were detected in groundwater and had associated health-based criteria such as noncarcinogenic toxicity information and/or cancer slope factors that could be used to quantify the estimated relative potential risk presented by ingestion of groundwater. The wells studied included those with and without recycled water.

[26] The RWC is the ratio of the volume of recycled water applied divided by the sum of the volume of recycled water and dilution water (called diluent water in the Groundwater Replenishment Regulations). For surface application projects, the maximum allowable RWC is also a function of the TOC in recycled water (before or after recharge). For subsurface application projects, the TOC cannot exceed an average of 0.5 mg/L.

The hazard index method was used to assess the overall potential for noncarcinogenic effects. This approach calculated the ratio between the concentration of a detected chemical in groundwater and its toxicity (either the NOAEL or LOAEL). The ratios were added together for all detected chemicals. If the cumulative sum of the added ratios was equal to or greater than unity ("1"), there was a potential risk. If the cumulative sum was less than 1, there was no risk. The QRRAs found that for non-carcinogenic risk, the hazard index for all of the wells was below 1.

The QRRAs also assessed carcinogenic risks. Carcinogenic risks were estimated as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to a potential carcinogen. Probabilistic simulations were conducted to estimate the carcinogenic risk associated with a hypothetical drinking water exposure for the wells under investigation using cancer slope factors. Twenty-five thousand (25,000) individual simulations were carried out for each well. The results of the carcinogenic risk assessment showed no significant difference in risk for groundwater wells with and without recycled water; the carcinogenic risks were in the range of 1 in 100,000.

The results showed that for both groundwater replenishment projects, it was unlikely that recycled water used for groundwater replenishment contributed substantially to the human health risk. Naturally occurring arsenic (not impacted by recycled water used for groundwater replenishment) was the highest contributor to risk in groundwater.

The Orange County Water District (OCWD) in Southern California conducted a QRRA (Soller et al., 2000) using available chemical and microbial data to compare alternative water sources used to replenish the potable Orange County Groundwater Basin. The alternatives considered were Santa Ana River water (which includes a substantial contribution of wastewater from upstream dischargers), Colorado River water (which also includes a substantial contribution of wastewater from upstream dischargers), California State Water Project water, and AWT recycled water. The QRRA found that for non-carcinogenic risk, the hazard index for each type of water was below 1, where 1 is considered the threshold for potential health effects, with the AWT recycled water index lower than the Colorado River and State Water Project waters (imported waters) and the Santa Ana River water. For carcinogenic risks, the risk levels were lower for the AWT recycled water and imported waters in comparison to the Santa Ana River water. Although the levels of arsenic were below the then existing drinking water MCL of 50 µg/L and the then proposed MCL of 10 µg /L, arsenic represented the majority of risk. Arsenic concentrations in the AWT recycled water were 60 times lower than the Santa Ana River water and 35 times lower than the imported water levels. The results also showed that the AWT recycled water was projected to present much less risk than the other waters from bacteria, parasites, and viruses provided that all unit treatment processes in the AWT Facility were fully operational and operating properly.

As part of the NRC's evaluation of potable reuse, the NRC conducted an analysis that was termed as a "risk exemplar," which compared the estimated risks of a common drinking water source generally perceived as safe (but which was comprised of a 5% wastewater component, e.g., *de facto* potable reuse[27]) against the estimated risks of two planned potable reuse scenarios: (1) a deep well in a groundwater aquifer fed by recycled water through soil percolation (receiving soil aquifer treatment or SAT) and (2) a deep well drawing from a groundwater aquifer fed by direct injection of recycled water from an AWT Facility (NRC, 2012). The analysis examined the presence of selected pathogens and trace organic chemicals (for example, chemicals of emerging concern) in final recycled waters from the *de facto* potable reuse scenario and the two potable reuse scenarios to assess whether there are likely to be significantly greater human health concerns from exposure via ingestion to contaminants in these hypothetical reuse scenarios, compared with a common *de facto* reuse scenario. For the chemicals in each of the scenarios, a risk-based action level was used, such as USEPA's MCLs, Australian drinking water guidelines, or World Health Organization drinking water guideline

[27] *De facto* reuse is defined as a drinking water supply that contains a significant fraction of wastewater effluent. This can occur in surface water from upstream discharge of treated wastewater and in groundwater from land disposal of wastewater or discharge from septic tanks. This term is also called unplanned or unintended reuse.

values. Also, a margin of safety was applied, which was defined as the ratio between a risk-based action level (such as an MCL) and the actual concentration of a chemical in recycled water. For microorganisms, the dose-response relationships were used to compute risk from a single day of exposure. The NRC focused on four pathogens commonly of concern in reuse applications and selected 24 chemicals representing different classes of contaminants.

The results showed that following proper design and operational strategies, potable reuse systems can provide protection from trace organic contaminants comparable to what the public experiences in many drinking water supplies today. For microbial agents, the analysis showed that the potable reuse scenarios represented a reduction in microbial risk when compared with the *de facto* reuse example.

### 10.3. Bio-analytical Screening Tools

A number of studies have sought to analyze and compare the toxicological properties of recycled water to those of drinking water; some of these studies attempted to use the combination of toxicology assays and chemical methods to isolate and identify constituents of potential health significance in recycled water used for planned potable reuse. A summary of these projects and related studies is presented in **Table 8**. In general these studies show that bio-analytical methods can be used to evaluate treatment effectiveness, but are not yet ready to evaluate health significance.

**Table 8. Summary of Bio-analytical Screening Studies**

| Project | Types of Water Studied | Health-effects data |
|---|---|---|
| Montebello Forebay Project (Nellor, et al., 1984) | Disinfected tertiary effluent, storm water, and imported river water used for groundwater replenishment; also recovered groundwater. | This study used the Ames *Salmonella* test and mammalian cell transformation assay using organic concentrates of the different waters (concentrated 10,000 to 20,000 times), and subsequent chemical identification was attempted using the Ames assays. Samples were collected from the late 1970s to the early 1980s. The level of mutagenic activity (in decreasing order) was storm runoff > dry weather runoff > tertiary recycled water > groundwater > imported water. No relation was observed between the percentage of tertiary recycled water in wells and observed mutagenicity of residues isolated from wells. The residues did not yield significant cytotoxicity in the mammalian cell assays.<br><br>To facilitate the isolation and identification of the components in sample concentrates, the residues were first fractionated by high performance liquid chromatography followed by testing of the fractions for mutagens and analysis of the mutagenic fractions by gas chromatography-electron ionization mass spectrometry. Results indicated that mutagenicity generally occurred in the least polar (most hydrophobic) fractions of each sample. In most cases, the sum of the mutagenicity in sample fractions was similar in magnitude to that observed in the whole sample. There was no evidence of synergistic effects in these assays. The chemical analysis of mutagenic fractions from 34 samples yielded only four known Ames mutagens in six samples (fluoranthene, benzo(a)pyrene, N-nitrosomorpholine, and N-nitrosopiperidine). However, these compounds were considered to contribute little to the observed overall mutagenicity of the samples. Several unknown compounds detected in the mutagenic fractions could not have caused the mutagenicity in all of the samples, because their frequency of occurrence, distribution in the fractions, and concentrations were not consistent with the bioassay results. Selected sample residues were then evaluated qualitatively by chemical derivatization techniques to determine which classes of compounds might be contributing to the mutagenic activity. Since mutagens are |

| Project | Types of Water Studied | Health-effects data |
|---|---|---|
| | | considered to be electrophilic, two nucleophilic reagents were used to selectively remove epoxide and organohalide mutagens from the residues. Analysis of mutagenic residues of groundwater and replenishment water by negative ion chemical ionization gas chromatography-mass spectrometry and Ames assay before and after derivatization supported (but did not unequivocally prove) the role of at least these two classes of electrophiles in the observed mutagenicity. Several samples had more than 100 reactive components, containing chlorine, bromine, iodine, or epoxides, with concentrations at the part-per-trillion level. However, the structures of these compounds could not be determined, nor were the sources of the compounds identified. Because positive chemical identifications of specific mutagens could not be made and because the estimated concentrations of the components were so low, the biological significance of these materials remained in doubt.<br><br>Follow-up toxicity testing of tertiary recycled water residues in the mid-1990s (not published) showed no Ames test response, while preserved residues from the earlier testing still showed a response indicating that the character of the recycled water has changed over time, perhaps as a result of increased source-control activities. |
| Denver Potable Water Reuse Demonstration Project (Lauer et al., 1996; NRC, 1988) | AWT effluent (with ultrafiltration or RO) and finished drinking water (current supply). The purpose of the project was to evaluate the feasibility of direct potable reuse by producing high quality recycled water; the proposed project was not implemented. | This study used 150 to 500 times organic residue concentrates in 2-year *in vivo* chronic/carcinogenicity study in rats and mice and a reproductive/teratology study in rats. No treatment-related effects were observed. |
| Tampa Water Resource Recovery Project (CH2M Hill, 1993, Pereira et al., undated; NRC, 1988) | AWT effluent (using GAC and ozone disinfection) and Hillsborough River water using ozone disinfection (the current drinking water supply). The proposed project involved augmentation of the Hillsborough River raw water supply; it was not implemented. | This study used Ames *Salmonella*, micronucleus, and sister chromatid exchange tests for three dose levels with organic concentrates (up to 1,000 times). No mutagenic activity was observed in any of the samples. *In vivo* testing included mouse skin initiation, strain A mouse lung adenoma, a 90-day subchronic assay on mice and rats, and a reproductive study on mice. All tests were negative, except for some fetal toxicity exhibited in rats, but not mice, for the AWT sample. |
| Total Resource Recovery Project, City of San Diego (Western Consortium for Public Health, 1996; NRC, 1988; Erickson, 2004) | AWT effluent (RO and GAC) and raw reservoir water (after treatment this is the current drinking water supply). This is a proposed surface water augmentation project that would utilize AWT recycled water to supplement the raw reservoir water. The project and treatment system are currently being re-evaluated. | This study used organic concentrates (150–600 times) in the Ames *Salmonella* test, mouse micronucleus, 6-thoguanine resistance, and mammalian cell transformation assays. The Ames test showed some weak mutagenic activity, but recycled water was less active than the drinking water. The micronucleus test showed positive results only at the high (600 times) doses for both types of water. The 6-thoguanine assay run on whole samples and fractions of each type of water showed no mutagenic effect. The mammalian cell transformation assay, showed a strong response for the reservoir sample, but the single test may not have been significant.<br><br>*In vivo* fish bio-monitoring using fathead minnows (28-day bioaccumulation and swimming tests) showed no positive results. There was greater evidence of bioaccumulation of pesticides in fish exposed to raw water than recycled water. |
| Potomac Estuary Experimental Wastewater Treatment Plant | Study of the wastewater-contaminated Potomac River | This study used 150 times organic concentrates in the Ames *Salmonella* and mammalian cell transformation tests. Results |

| Project | Types of Water Studied | Health-effects data |
|---|---|---|
| (James M. Montgomery, Inc., 1983; NRC, 1988) | Estuary; 1:1 blend of estuary water and nitrified secondary effluent, AWT effluent (filtration and GAC), and finished drinking waters from three water treatment plants. | showed low levels of mutagenic activity in the Ames test, with AWT water exhibiting less activity than finished drinking water. The cell-transformation test showed a small number of positive samples with no difference between AWT water and finished drinking water. |
| Essex & Suffolk Water Langford Recycling Scheme, UK (Walker, 2000) | Secondary treatment, coagulant and polymer addition, sedimentation, nitrification/denitrification in biologically aerated filter, ultraviolet radiation disinfection. | Toxicological tests using fish indicated no significant estrogenic effects |
| Singapore Water Reclamation Study (Kahn and Roser, 2007) | AWT effluent (MF, RO, UV) and untreated reservoir water. The largest amount of Singapore's NeWater is currently used for industrial (semi-conductor manufacturing) and commercial use. At the time the study was conducted, a smaller amount was blended with raw water in reservoirs, which is then treated for domestic use. | Japanese medaka fish (*Oryzias latipes*) testing over a 12-month period with two generations of fish showed no evidence of carcinogenic or estrogenic effects in AWT effluent; however, the study was repeated owing to design deficiencies. The repeated fish study was completed in 2003 and confirmed the findings of no estrogenic or carcinogenic effects.<br><br>Groups of mouse strain (B6C3F1) fed 150 times and 500 times concentrates of AWT effluent and untreated reservoir water over 2 years. The results presented to an expert panel indicated that exposure to concentrated AWT effluent did not cause any tissue abnormalities or health effects. |
| Santa Ana River Water Quality Monitoring Study (Deng, 2008) | Shallow groundwater adjacent to the Santa Ana River and control water.<br>This is an unplanned indirect potable reuse project where the OCWD diverts Santa Ana River water for recharge into the Orange County Groundwater Basin. The Santa Ana River base flow is comprised primarily of tertiary-treated effluent. | Three rounds of testing were conducted in 2004 and 2005. In the first two rounds, Japanese Medaka fish were analyzed for tissue pathology, vitellogenin induction, reproduction, and gross morphology. In the third round, fish were analyzed for vitellogenin induction, reproduction, limited tissue pathology, and gross morphology. In the first two rounds, no statistically significant differences in gross morphological endpoints, gender ratios, tissue pathology, or reproduction were observed between the test water (shallow groundwater adjacent to the Santa Ana River) and the control water. In the third round, no statistically significant differences were observed in reproduction, tissue pathology (limited to evaluation of gonads and ovaries), or vitellogenin induction between the test water and the control water. |
| Soil Aquifer Treatment Study (Fox et al., 2006) | Wastewater (various facilities), soil aquifer treatment water, storm water. | The study used a variety of analytical methods to characterize and measure chemical estrogenicity: *in vitro* methods (estrogen binding assay, glucocorticoid receptor competitive binding assay, yeast-based reporter gene assay, and MCF-7 cell proliferation assay); *in vivo* fish vitellogenin synthesis assay; enzyme-linked immunosorbent assays; and gas chromatography–mass spectrometry. Procedures were developed to extract estrogenic compounds from solids, liquid/liquid methods for direct extraction from aqueous suspensions such as primary and secondary effluents, and concentration of estrogenic (and other) organics on hydrophobic resins followed by organic fractionation during elution in a solvent (alcohol/water) gradient. Field applications of these techniques were designed to measure estrogenic activity derived from conventional wastewater treatment and from SAT. The stability of estrogenic contaminants that are removed on soils SAT was investigated by extracting and measuring nonylphenol from infiltration basin soils as well as by measuring total estrogenic activity in soil extracts. The researchers attempted to separate and measure estrogenic and anti-estrogenic activities in wastewater effluent and conducted a |

| Project | Types of Water Studied | Health-effects data |
|---|---|---|
| | | multi-laboratory experiment in which a variety of wastewater effluents and effluents spiked with known concentrations of specific estrogenic chemicals were tested for estrogenic activity. Significant variability in recycled water estrogenicity was observed in bioassay results. Facilities with the longest hydraulic retention times tended to have the lowest observed levels of estrogenicity. Estrogenicity was efficiently removed during SAT. The study also presented information on the advantages and disadvantages of the bioassay test procedures evaluated. |
| Toxicological Relevance of EDCs and Pharmaceuticals in Drinking Water – Water Research Foundation #3085 (Snyder, 2007; Bruce et al., 2010b) | Drinking water (20 facilities), wastewater (4 facilities - raw and recycled), and food products. | The researchers used an *in vitro* cellular bioassay (E-screen) with a method reporting limit of 0.16 nanograms per liter (ηg/L); results were also converted to estradiol equivalents. The results showed that the vast majority of drinking waters were less than the method reporting limit. The level of estrogenicity (in decreasing order) was food and beverage products (particularly soy based products) > raw wastewater > recycled water > finished drinking water. |

## 11. Role and Activities of the Independent Advisory Panel

MRWPCA has contracted with the National Water Research Institute (NWRI) to form and coordinate the activities of an Independent Advisory Panel (IAP) for a 16-month timeframe to provide expert peer review of the technical, scientific, regulatory, policy, and outreach aspects of the GWR Project. The IAP has been tasked with providing specific input on:

- The proposed treatment technologies and operations, including the design and testing protocol for the pilot system.
- Review of the performance and operations of the pilot system.
- Review of water quality data from the pilot system.
- Feedback on the anticipated water quality of the proposed AWT Facility based on pilot system results.
- Feedback on hydrodynamics, hydrology, and the fate and transport of constituents in the AWT Facility project water after subsurface application.
- Feedback on protection of public health and groundwater quality.
- Feedback on project planning, permitting, and public outreach.

The IAP is comprised of four experts in disciplines relevant to groundwater replenishment projects such as engineering, regulatory criteria, public health, hydrogeology, risk assessment, and other relevant fields. The IAP members are:

- George Tchobanoglous, Ph.D., P.E., NAE; University of California, Davis (Davis, CA)[28]
- Jean-François Debroux, Ph.D., Kennedy/Jenks Consultants (San Francisco, CA)
- Martin B. Feeney, P.G. CHG, Consulting Hydrogeologist (Santa Barbara, CA)[29]
- Michael P. Wehner, MPA, REHS, OCWD (Fountain Valley, CA)[30]

[28] Ph.D. – Doctor of Philosophy, P.E. – Professional Engineer, NAE – National Academy of Engineering.
[29] P.G. – Professional Geologist, CHG – Certified Hydrogeologist.
[30] MPA – Masters of Public Administration, REHS – Registered Environmental Health Specialist.

The IAP held two meetings (October 2013 and May 2014) and provided two reports on their findings and recommendations. Topics reviewed included source water characterization; the preliminary results of the pilot testing; information on groundwater quality, groundwater modeling, and the vadose zone leaching analysis; public outreach; water rights; and source control. The IAP also reviewed and provided input on the conceptual project proposal submitted to DDW.

## 12. Proposed Groundwater Replenishment Project Treatment Design

Treatment for the GWR Project would be provided by the RTP's existing primary and secondary treatment processes and the new AWT Facility as described below. A description and analysis of the treatment provided for the SVRP for tertiary recycled water for the Castroville Seawater Intrusion Project area is not provided herein, but is provided in the Water and Wastewater Section of the EIR.

### 12.1. Regional Treatment Plant and New Source Waters

The existing RTP would provide primary and secondary treatment, the latter of which consists of non-nitrifying trickling filters, bioflocculation, and clarification. The RTP currently receives and treats approximately 17 to 18 mgd of residential, commercial, industrial wastewater and also accepts some dry weather urban runoff, septage, and other discrete wastewater flows. It has an average dry weather design capacity of 29.6 mgd and a peak wet weather design capacity of 75.6 mgd; therefore, the RTP has capacity to treat additional flows. As part of the GWR Project, new source waters will be diverted to the MRWPCA sewer collection system and combined with municipal wastewater for treatment at the RTP. The new source waters would be:

- Monterey Peninsula urban stormwater and runoff, including water that flows into Lake El Estero;
- City of Salinas urban stormwater and runoff from the southwest portion of the city;
- Salinas agricultural wash water, 80 to 90% of which is water used for washing produce;
- Urban and agricultural runoff and tile drainage water from the Reclamation Ditch and Tembladero Slough (to which the Reclamation Ditch is tributary); and
- Water from the Blanco Drain, an artificial, open-channel, drainage ditch that collects agricultural tile drainage from approximately 6,400 acres of agricultural lands near Salinas.

### 12.2. Advanced Water Treatment Facility

The proposed new AWT Facility would have a design capacity to produce 4.0 mgd of purified water. The facility would be operated to produce up to 3,500 AFY of purified water for injection.

***Pilot Testing of the Advanced Treatment Facility***

The AWT Facility would provide full advanced treatment (treatment of secondary effluent by MF, RO, and AOP) as required in the State's Groundwater Replenishment Regulations for subsurface application projects. The AWT Facility would also include ozone as membrane pretreatment and post-treatment stabilization after AOP.  If needed, a BAF process can be added to the AWT Facility following the ozone treatment process.

A pilot plant testing  program was conducted between mid-October 2013 and mid-July 2014, with extensive sampling conducted between December 2013 and June 2014.  The pilot facility treated a flow of 30 gallons per minute (gpm) of undisinfected RTP secondary effluent with the goals of (1) evaluating the performance of the ozone-MF-RO portion of the AWT Facility processes, and (2) developing design criteria for each unit process.  Although AOP will be included in the AWT Facility, it was not included in the pilot testing and sampling program as design of an AOP system typically does not require a pilot demonstration and sufficient information on treatment efficacy is available from existing groundwater replenishment projects. During the pilot testing and the source water sampling campaign, agricultural wash water was diverted to the RTP as influent to the headworks and mixed with municipal wastewater from April 1, 2014 through the end of the sampling program.[31] Data from this period are reflective of the blended water quality of these two sources. The results of the pilot testing are presented later in the report.

The three main design parameters investigated in the pilot were:

- Ozone dose: High concentrations of large organic molecules present in the RTP secondary effluent result in MF fouling, which reduces the flux[32] through the membrane treatment systems; ozone pretreatment can increase MF flux by breaking down these large molecules. The optimal ozone dose would allow for a higher MF flux without generating excess ozone.
- MF flux: Standard practice is to pilot MF systems to develop the design flux, which is influenced by the quality of water undergoing treatment and by pretreatment, such as ozone.
- RO recovery: This refers to the proportion of RO influent that becomes feedwater to the AOP system (RO permeate) versus the fraction of the influent that will be a waste stream containing the concentrated contaminants by RO (RO concentrate). Theoretical demonstrations of RO recovery are limited; thus, RO piloting is necessary to increase confidence in the design recovery of the RO system.

***Description of the Advanced Water Treatment Facility***

The AWT Facility would receive secondary effluent from the RTP for treatment. The following is a list of the proposed AWT Facility structures and facilities:

- Inlet source water diversion facilities to bring secondary effluent to the AWT Facility;
- Advanced treatment process facilities, including
  - Ozonation.
  - Biologically active filtration (optional).
  - MF treatment.
  - Booster pumping of the membrane filtration filtrate (with intermediate storage).
  - Cartridge filtration.
  - Chemical addition.
  - RO membrane treatment.
  - AOP using UV and hydrogen peroxide.
  - Decarbonation.
  - Stabilization with calcium, alkalinity and pH adjustment.
- Final purified water storage and distribution pumping.
- Brine mixing facilities.

**Figure 3** provides a simplified process flow diagram illustrating the proposed treatment facilities.

[31] Source water was sampled in September 2013 prior to the beginning of the pilot testing.
[32] Flux is the flow rate through an individual membrane filter module expressed per unit of membrane surface area.

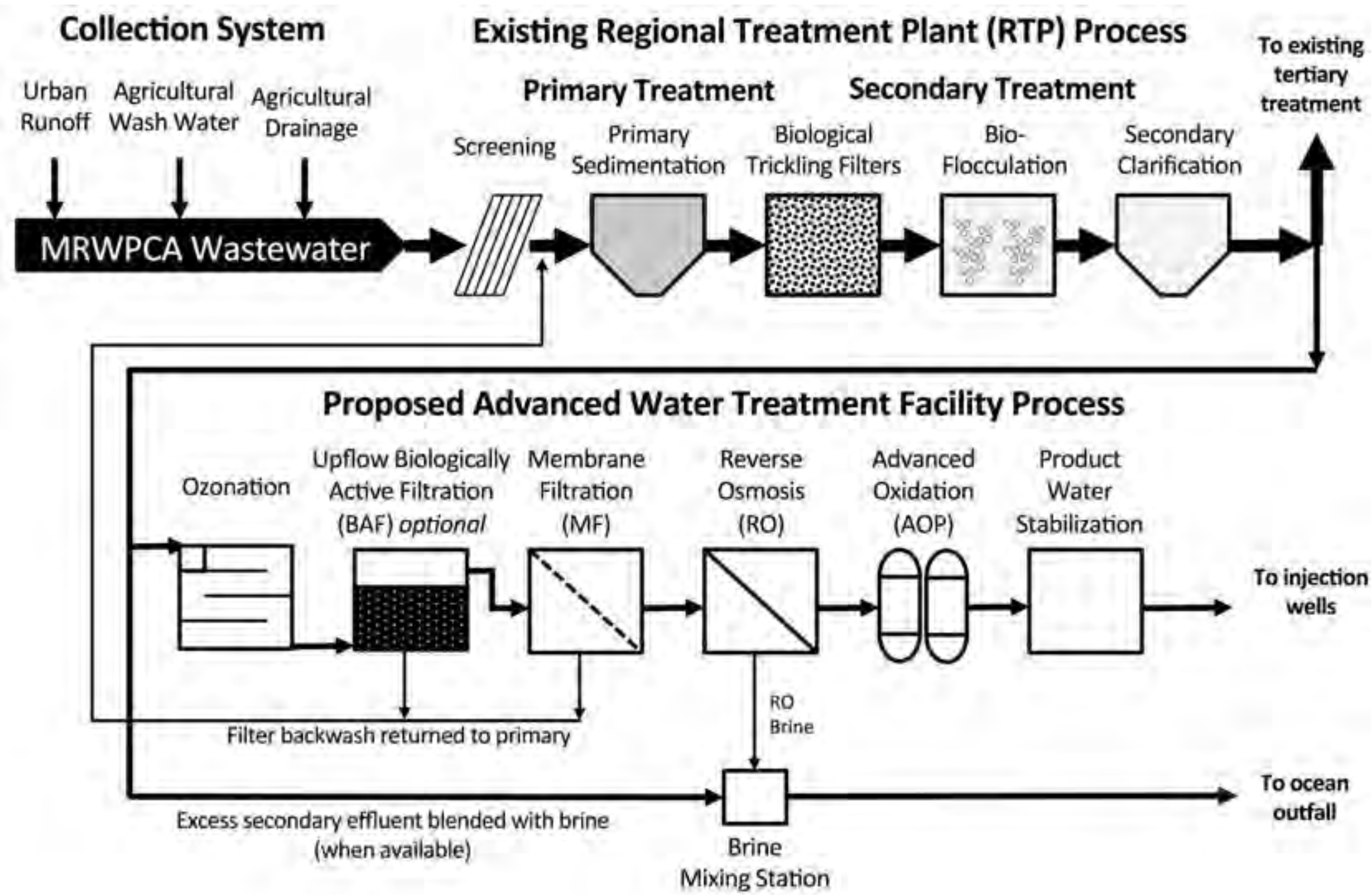


**Figure 3. Simplified Flow Schematic of Regional Treatment Plant and Proposed Advanced Water Treatment Facility Processes**

# 13. Summary of the Groundwater Replenishment Project Water Quality and Compliance with Groundwater Replenishment Regulations and Central Coast Basin Plan

This Section summarizes the water quality requirements for groundwater replenishment via subsurface application of recycled water pursuant to (1) the 2014 Groundwater Replenishment Regulations and (2) Central Coast Region Basin Plan, as well as the GWR Project's ability to meet these water quality requirements. This analysis was conducted using water quality data for source waters[33] to the AWT Facility, data from the pilot plant testing that evaluated several of the AWT Facility processes (ozone, MF, and RO) for the removal of selected parameters, and documented removal efficiencies for the proposed AWT Facility processes. In addition to the AWT Facility processes piloted, the GWR Project would also include AOP using hydrogen peroxide and UV and water stabilization following AOP.

## 13.1. <u>Water Quality Requirements Specified in the Groundwater Replenishment Regulations</u>

The Groundwater Replenishment Regulations (SWRCB, 2014) specify compliance with recycled water quality requirements, including controls for microbial pathogens (virus, *Giardia*, and *Cryptosporidium*), compliance with drinking water standards for regulated chemicals, and controls for nitrogen and unregulated chemicals. More specifically, the recycled water used for subsurface application must comply with the following:

- Pathogenic microorganism treatment requirements: the wastewater must receive treatment that achieves at least 12-log enteric virus reduction, 10-log *Giardia* cyst reduction, and 10-log *Cryptosporidium* oocyst reduction using at least three treatment barriers, including residence time underground for virus
- Primary MCLs in the CCR, Title 22:
  - inorganic chemicals in Table 64431-A, except for nitrogen compounds
  - radionuclide chemicals in Tables 64442 and 64443
  - organic chemicals in Table 64444-A-A
  - disinfection byproducts in Table 644533-A
- Secondary MCLs in CCR, Title 22, Tables 64449-A and 64449-B (upper limit)
- Title 22 action levels for lead and copper
- Other constituents:
  - 10 mg/L total nitrogen
  - 0.5 mg/L TOC
- NLs[34]

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[33] Secondary-treated effluent from the RTP would be the major source water for the AWT Facility. Additional sources of water will be diverted into the existing MRWPCA wastewater collection system and treated by the RTP's primary and secondary processes. These additional source waters include: Lake El Estero and City of Salinas urban stormwater and runoff; Salinas agricultural wash water; and agricultural and other drainage waters from the Blanco Drain, Tembladero Slough, and the Reclamation Ditch. Although Lake El Estero has been proposed as a potential source water, its use would only occur if all other sources do not provide adequate quantities for the recycled water needs. In addition, under the GWR Project its contribution to total influent flows to the RTP would be small (maximum 6% in some circumstances, with a monthly average of 2% only in a very dry year). Excess wastewater that has been treated to a secondary level at the RTP that would otherwise be discharged to the ocean would be included as feed water to the AWT Facility.

[34] The NL requirements are more complex than a single exceedance of the numeric NL. The purified water used for replenishment is monitored quarterly for NLs with accelerated monitoring initiated if the result is greater than an NL. If the running 4-week average is greater than the NL for 16 consecutive weeks, the project sponsor must notify DDW and RWQCB and the project sponsor must take corrective actions.

## 13.2. Source Water Monitoring

A one-year monitoring program from July 2013 to June 2014 was conducted for five of the potential source waters. Regular monthly and quarterly sampling was carried out for the RTP secondary effluent, agricultural wash water, and Blanco Drain drainage water. Limited sampling of stormwater from Lake El Estero was performed due to seasonal availability, and there was one sampling event for the Tembladero Slough drainage water.[35]

### *Pathogenic Microorganisms*

To protect public health, groundwater replenishment projects must inactivate or remove pathogenic microorganisms from the wastewater that is treated to produce recycled water prior to distribution. The Groundwater Replenishment Regulations require minimum pathogenic reductions of 12, 10, and 10 logs for viruses, *Giardia* cysts, and *Cryptosporidium* oocysts, respectively.

During the 2013 to 2014, source waters were monitored for *Cryptosporidium* oocysts*, Giardia* cysts*,* total coliform, and *E. coli*. The source waters were not monitored for viruses as part of the pilot testing based on the expected low number of indigenous virus expected to be present in runoff (Rajal et al., 2007) and RTP secondary effluent (Rose et al., 2004). Instead, indicator bacteria (total coliform and E. *coli*) were used as surrogates for virus. A summary of the concentrations of pathogens and indicator organisms measured in the source waters is presented in **Table 9**. The concentrations of pathogens and indicator organisms are typical of a non-disinfected secondary effluent and are well below the pathogen concentrations that DDW assumed when developing the pathogen control requirements as part of the Groundwater Replenishment Regulations.

**Table 9. Summary of Pathogens Measured in Source Waters**

| Parameter[a] | Undisinfected RTP Secondary Effluent N = 12[b] | Agricultural Wash Water N = 10 | Blanco Drain N = 11 | Lake El Estero N = 2 | Tembladero Slough N = 1 |
|---|---|---|---|---|---|
| *Cryptosporidium*[c] (oocysts/L) | 0.38 (<0.10 – 0.9) | <0.33 | 0.185 (<0.18 – 0.2) | <0.3 | <0.09 |
| *Giardia*[c] (cysts/L) | <0.1 (<0.1 – 0.2) | <0.33 | <0.18 | <0.3 | <0.09 |
| Total coliform[d] (MPN[2]/100 mL) | $7.1x10^5$ ($1.9x10^5$ – $1.6x10^6$) | $7.7x10^6$ ($6.2x10^5$ –$9.6x10^7$) | $4.3x10^4$ ($8.4x10^3$ –$2.0x10^6$) | $3.5x10^3$ | $1.7x10^5$ |
| *E. coli*[d] (MPN/100 mL) | $1.8x10^5$ ($2.9x10^4$ –$5.8x10^5$) | <20 (<20 – 18) | $2.4x10^2$ (75 – $2x10^3$) | <100 | $7.5x10^2$ |

a. N is the number of samples.
b. Four of the samples included diversion of agricultural wash water mixed with sewage and treated at the RTP.
c. Values are median values and data range (minimum concentration to maximum concentration) where applicable.
d. Values are geometric means with the observed range (minimum concentration to maximum concentration) where applicable.

The source waters that were sampled are all expected to have a lower pathogenic microorganism count than raw municipal wastewater. Therefore, adding the new source waters would not increase the concentrations of these organisms; the RTP and AWT Facility treatment technologies typical for groundwater replenishment projects would remove these organisms as demonstrated by existing groundwater replenishment projects elsewhere, and as discussed later in the report based on the pilot testing.

[35] A Salinas stormwater sample was collected on December 2, 2014 and analyzed for an abridged set of chemical parameters, but these data were not included in this assessment.

***Water Quality Constituents***

The 2013-2014 source water sampling and pilot study included a detailed characterization of the source waters (RTP effluent, agricultural wash waster, and Blanco Drain on a quarterly basis; Lake El Estero and Tembladero Slough one time each), with an expanded monitoring list for pesticides given the high levels of agricultural activity in the area. The source water sampling and monitoring analysis was designed to assess the full list of water quality parameters – including many not required to be monitored for groundwater replenishment projects. The types of constituents that were included in the source water monitoring program are the following:

- General water quality parameters, including total nitrogen and TOC
- Constituents with California Primary and Secondary MCLs
  - Inorganic chemicals
  - Organic chemicals
  - Disinfection by-products (DBPs)
  - Radionuclides
- Constituents with California action levels for lead and copper
- Constituents with California NLs
  - Current NLs as of December 14, 2010
  - Archived Advisory Levels (AALs)[36]
- Priority Pollutants
- Constituents included in the USEPA Unregulated Contaminant Monitoring Rule (UCMR) Lists 1, 2 and 3 (excluding pathogenic organisms)
- Pesticides of local interest (PoLi) based on the agricultural activity/usage in the area[37]
- CECs

As previously noted, the Groundwater Replenishment Regulations include numeric water quality criteria for primary and secondary MCLs, action levels for lead and copper, total nitrogen, and TOC. The Groundwater Replenishment Regulations include requirements for numeric NLs based on the results of monitoring recycled water. For purposes of this project, the numeric NLs were used as compliance goals. Therefore, the source waters were analyzed for the constituents (also referred to as analytes) with regulatory criteria and goals.

The Groundwater Replenishment Regulations also require that the recycled water be monitored for additional constituents, but do not specify numeric criteria for the following: priority pollutants; chemicals specified by DDW based on the Engineering Report, affected groundwater basin, and source control program; and indicator chemicals to characterize the presence of CECs. Although the Groundwater Replenishment Regulations do not require monitoring for AALs, contaminants included in the UCMR, PoLi, or all of the CECs sampled in the source waters, they were included in the source water sampling program to provide a comprehensive data set to evaluate source water quality and the performance of the pilot system.

During source water sampling and pilot testing programs, the sampling program evaluated a total of 435 analytes, including constituents with and without regulatory criteria/goals. Of these, 194 analytes were detected in at least one sample, and 241 were below detection limits in all of the source waters. The median

[36] Per the H&S Code, advisory levels were renamed as NLs.
[37] Many of these constituents had applicable MCLs or AALs, and thus are addressed under those regulatory requirements/goals.

concentration and concentration range of each analyte, as well as number of samples with positive detections, are provided in Appendix B. Some analytes are listed more than once in the appendix because different analytical techniques were used to determine their concentrations.

As previously noted, the GWR Project includes the collection of a variety of new source waters that would be combined with existing incoming wastewater flows for conveyance to and treatment at the RTP. Constituent reduction prior to use of the purified water for replenishment would occur in two ways.

1. In many cases, the blending of waters prior to treatment at the RTP would reduce concentrations of some constituents in each source water. The average flow of municipal wastewater currently receiving primary and secondary treatment at the RTP is approximately 17 mgd in comparison to an annual total of 7.6 mgd for the other source waters. Based on a combined total flow of 24.6 mgd, the new source waters would represent 31% of the flow, with seasonal differences (e.g., less source water in the winter and more during the summer). The estimated quantities of source waters that would be mixed with the RTP municipal wastewater influent and receive primary and secondary treatment prior to treatment in the AWT Facility are provided in Appendix C.
2. Some constituents in the new source waters would be reduced prior to reaching the AWT Facility through the RTP primary and secondary treatment.
3. The secondary treated wastewater that is not sent to the SVRP tertiary treatment plant for agricultural irrigation would be treated at the AWT Facility, which would include ozonation, BAF (optional), MF, RO, AOP using UV/peroxide, and water stabilization. These treatment technologies are typical for groundwater replenishment projects and would effectively remove these constituents as demonstrated by existing groundwater replenishment projects elsewhere and as discussed in the following sections of this report.

***Constituents with Maximum Contaminant Levels and Notification Levels***

During the pilot study, two monitoring frequencies were used for source water monitoring: (1) quarterly monitoring of all parameters to understand occurrence of the various constituents, and (2) monthly monitoring of a select list of constituents for understanding the variability of key design parameters. The quarterly sampling list for constituents/parameters with primary MCLs, secondary MCLs, and NLs are listed in **Table 10**, **Table 11**, and **Table 12**, respectively.

**Table 10. Constituents with Primary Maximum Contaminant Levels Included in the Source Water Monitoring**

| | | |
|---|---|---|
| 1,1-Dichloroethane | Carbon Tetrachloride | Nickel |
| 1,1-Dichloroethylene | Chlordane | Nitrate[a] |
| 1,1,1-Trichloroethane | Chlorite | Nitrate+Nitrite[a] |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane | Chromium | Nitrite (as N)[a] |
| 1,1,2-Trichloroethane | cis-1,2-Dichloroethylene | Oxamyl |
| 1,1,2,2-Tetrachloroethane | Cyanide | Pentachlorophenol |
| 1,2-Dichlorobenzene | Dalapon | Perchlorate |
| 1,2-Dichloroethane | Di(2-ethylhexyl)adipate | Picloram |
| 1,2-Dichloropropane | Di(2-ethylhexyl)phthalate | Polychlorinated Biphenyls |
| 1,2,4-Trichlorobenzene | Dibromochloropropane | Radium-226 |
| 1,3-Dichloropropene | Dichloromethane | Radium-228 |
| 1,4-Dichlorobenzene | Dinoseb | Selenium |
| 2,3,7,8-TCDD | Diquat | Simazine |
| 2,4-D | Endothall | Strontium-90 |
| 2,4,5-TP | Endrin | Styrene |
| Alachlor | Ethylbenzene | Tetrachloroethylene |
| Aluminum | Ethylene Dibromide | Thallium |
| Antimony | Fluoride | Thiobencarb |
| Arsenic | Glyphosate | Toluene |
| Asbestos | Gross Alpha Particle | Total Haloacetic acids |
| Atrazine | Heptachlor | Toxaphene |
| Barium | Heptachlor Epoxide | Total trihalomethanes |
| Bentazon | Hexachlorobenzene | trans-1,2-Dichloroethylene |
| Benzene | Lindane | Trichloroethylene |
| Benzo(a)pyrene | Hexachlorocyclopentadiene | Trichlorofluoromethane |
| Beryllium | Mercury | Tritium |
| Beta/photon emitters (K40 adjusted) | Methoxychlor | Uranium |
| Bromate | Methyl-tert-butyl ether | Vinyl Chloride |
| Cadmium | Molinate | Xylenes |
| Carbofuran | Monochlorobenzene | |

a. The Groundwater Replenishment Regulations do not require that the MCLs for nitrate, nitrite, and nitrate + nitrite be met. The regulations require that the total nitrogen concentration in the recycled water not exceed 10 mg/L as nitrogen (N). However, also see later discussion in the report regarding compliance with Basin Plan MCL-based groundwater objectives, which include nitrate, nitrite, and nitrate+nitrite.

**Table 11. Constituents with Secondary Maximum Contaminant Levels Included in the Source Water Monitoring**

| | | |
|---|---|---|
| Aluminum | Iron | Thiobencarb |
| Chloride | Manganese | Total Dissolved Solids |
| Color | Methyl-tert-butyl ether | Turbidity |
| Conductivity | Odor-Threshold | Zinc |
| Copper | Silver | |
| Foaming Agents | Sulfate | |

**Table 12. Constituents with Notification Levels Included in the Source Water Monitoring**

| | |
|---|---|
| 1,2,3-Trichloropropane | ***Nitrosamines (List of 9)*** [a] |
| 1,2,4-Trimethylbenzene | N-nitrosodi-n-propylamine |
| 1,3,5-Trimethylbenzene | N-nitrosodiethyamine |
| 1,4-Dioxane | NDMA |
| 2-Chlorotoluene | N-nitroso-di-n-butylamine |
| 2,4,6-Trinitrotoluene | N-nitrosodiphenylamine |
| 4-Chlorotoluene | N-nitrosomorpholine |
| Boron | N-nitrosopiperidine |
| Carbon disulfide | N-nitroso-methylethylamine |
| Chlorate | N-nitrosopyrrolidine |
| Diazinon | Naphthalene |
| Dichlorodifluoromethane (Freon 12) | n-Propylbenzene |
| Ethylene glycol | Propachlor |
| Formaldehyde | RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine) |
| HMX (or Octogen) | sec-Butylbenzene |
| Isopropylbenzene | tert-Butylbenzene |
| Manganese | Tertiary butyl alcohol |
| Methyl isobutyl ketone | Vanadium |
| n-Butylbenzene | |

a. DDW NLs include only three nitrosamines: N-nitrosodiethyamine, NDMA, and N-nitrosodi-n-propylamine; the source water monitoring included a total of nine nitrosamine compounds.

A summary of the numbers of constituents/parameters with MCLs, NLs, and AALs detected[38] in each of the "untreated" source waters is presented in **Table 13**. In this context, untreated means the following:

- For the RTP effluent, prior to AWT Facility treatment.
- For the other source waters, prior to treatment at the RTP/AWT Facility.

Table 5 also includes the numbers of constituents above their relevant regulatory limits, NLs or AALs. It is noted that in many cases, the constituents were detected above their regulatory limits in one or more of the untreated source waters. Therefore, the numbers in each category are not additive.

**Table 13. Number of Constituents with Maximum Contaminant Levels and Notification Levels Detected in Untreated Source Waters**

| Source Water | Number of Constituents Detected | | | |
|---|---|---|---|---|
| | Primary MCLs | Secondary MCLs | NLs | AALs |
| RTP Effluent | 12<br>(1)[a] | 12<br>(6) | 9<br>(1) | 3<br>(0) |
| Agricultural Wash Water | 20<br>(5) | 12<br>(8) | 9<br>(2) | 2<br>(0) |
| Blanco Drain | 15<br>(2) | 12<br>(9) | 6<br>(0) | 3<br>(1) |
| Lake El Estero | 12<br>(0) | 11<br>(7) | 5<br>(0) | 0 |
| Tembladero Sough | 13<br>(2) | 9<br>(8) | 3<br>(0) | 1<br>(0) |

a. Numbers in parentheses are the number of analytes detected (at least once) above a regulatory limit or advisory level.

[38] Detected means that the concentration was above the Minimum Reporting Level (MRL). The MRL represents an estimate of the lowest concentration of a compound that can be detected in a sample for which the concentration can be quantified and reported with a reasonable degree of accuracy and precision.

**Table 14** provides the concentrations of constituents with primary and secondary MCLs that were determined to be above their regulatory limits in at least one sample in any of the untreated source waters. Very few constituents were above primary or secondary MCLs in the various untreated source waters. For the NLs, only two constituents were found in two of the five untreated source waters (RTP effluent and agricultural wash water) above the current NLs as shown in Table 14. For the AALs, only three constituents were detected with one above the advisory level (see **Table 15**). Treatment would occur through the primary and secondary processes at the RTP and AWT Facility. These treatment technologies are typical for groundwater replenishment projects and would remove these constituents to below regulatory levels and goals as demonstrated by existing groundwater replenishment projects elsewhere and as discussed later in the report.

**Table 14. Constituents with Maximum Contaminant Levels Above Regulatory Limits in at Least One Sample of Any of the Untreated Source Waters**

| Source Water | Comparison to Primary MCLs | | | Comparison to Secondary MCLs | | |
|---|---|---|---|---|---|---|
| | Constituent | Primary MCL | Highest Concentration Detected | Constituent | Secondary MCL | Highest Concentration Detected |
| RTP Effluent | Di(2-ethylhexyl)phthalate | 4 µg/L | 78 µg/L | Color | 15 units | 75 units |
| | | | | Conductivity (Specific Conductance) | 900 µS/cm[a] | 1623 µS/cm |
| | | | | Iron | 0.3 mg/L | 0.537 mg/L |
| | | | | Odor-Threshold | 3 units | 200 units |
| | | | | TDS | 500 mg/L[b] | 803 mg/L |
| | | | | Aluminum | 0.2 mg/L | 0.256 mg/L |
| Agricultural Wash Water | Fluoride | 2 mg/L | 31.9 mg/L | Chloride | 250 mg/L[c] | 292 mg/L |
| | 1,3-Dichloropropene | 0.5 µg/L | 0.7 µg/L | Color | 15 units | 175 units |
| | Di(2-ethylhexyl)phthalate | 4 µg/L | 16 µg/L | Conductivity (Specific Conductance) | 900 µS/cm[a] | 1830 µS/cm |
| | Total haloacetic acids (HAAs) | 60 µg/L | 390 µg/L | Iron | 0.3 mg/L | 0.875 mg/L |
| | Total trihalomethanes | 80 µg/L | 160 µg/L | Odor-Threshold | 3 units | 350 units |
| | | | | TDS | 500 mg/L[b] | 1594 mg/L |
| | | | | Turbidity | 5 NTU | 72 NTU |
| | | | | Aluminum | 0.2 mg/L | 0.598 mg/L |
| Blanco Drain | Aluminum | 1 mg/L | 2.04 mg/L | Chloride | 250 mg/L[c] | 307 mg/L |
| | 1,3-Dichloropropene | 0.5 µg/L | 0.62 µg/L | Color | 15 units | 85 units |
| | | | | Conductivity (Specific Conductance) | 900 µS/cm[a] | 2929 µS/cm |
| | | | | Iron | 0.3 mg/L | 3.891 mg/L |
| | | | | Odor-Threshold | 3 units | 40 units |
| | | | | Sulfate | | 530 mg/L |
| | | | | TDS | 500 mg/L[b] | 2066 mg/L |
| | | | | Turbidity | 5 NTU | 150 NTU |
| | | | | Aluminum | 0.2 mg/L | 2.04 mg/L |
| Lake El Estero | None | | -- | Chloride | 250 mg/L[c] | 514 mg/L |
| | | | | Color | 15 units | 75 units |
| | | | | Conductivity (Specific Conductance) | 900 µS/cm[a] | 2559 µS/cm |
| | | | | Iron | 0.3 mg/L | 0.508 mg/L |

| Source Water | Comparison to Primary MCLs | | | Comparison to Secondary MCLs | | |
|---|---|---|---|---|---|---|
| | Constituent | Primary MCL | Highest Concentration Detected | Constituent | Secondary MCL | Highest Concentration Detected |
| | | | | TDS | 500 mg/L[b] | 1506 mg/L |
| | | | | Turbidity | 5 NTU | 18 NTU |
| | | | | Aluminum | 0.2 mg/L | 0.402 mg/L |
| Tembladero Slough | Aluminum | 1 mg/L | 1.54 mg/L | Chloride | 250 mg/L[c] | 394 mg/L |
| | Di(2-ethylhexyl)phthalate | 4 µg/L | 78 µg/L | Color | 15 units | 175 units |
| | | | | Conductivity (Specific Conductance) | 900 µS/cm[a] | 2939 µS/cm |
| | | | | Iron | 0.3 mg/L | 2.962 mg/L |
| | | | | Sulfate | 250 mg/L[c] | 412 mg/L |
| | | | | TDS | 500 mg/L[b] | 1968 mg/L |
| | | | | Turbidity | 5 NTU | 50 NTU |
| | | | | Aluminum | 0.2 mg/L | 1.54 mg/L |

a. µS/cm – Micro-siemens per centimeter; recommended consumer acceptance level; upper range 1600 µS/cm.
b. Recommended consumer acceptance level; upper range 1000 mg/L.
c. Recommended consumer acceptance level; upper range 500 mg/L.

**Table 15. Constituents with Concentrations Above Notification Levels or Archived Action Levels in at Least One Sample in Any of the Untreated Source Waters**

| Source Water | Comparison to NLs | | | Comparison to AALs | | |
|---|---|---|---|---|---|---|
| | Constituent | NL | Highest Levels Detected | Constituent | AAL | Highest Levels Detected |
| RTP Effluent | NDMA | 10 ηg/L | 16 ηg/L | None | --- | --- |
| Agricultural Wash Water | Formaldehyde<br>NDMA | 100 µ/L<br>10 ηg/L | 120 µg/L<br>340 ηg/L | None | --- | --- |
| Blanco Drain | None | --- | | Dieldrin | 0.002 µg/L | 0.028 µg/L |
| Lake El Estero | None | --- | -- | None | --- | --- |
| Tembladero Slough | None | --- | -- | None | --- | --- |

### *Lead and Copper Action Levels*

The Groundwater Replenishment Regulations require that recycled water not exceed the action levels for lead and copper, which are 0.015 mg/L and 1.3 mg/L, respectively. The maximum concentrations of lead and copper measured in any of the untreated source waters was 0.0018 mg/L, and 0.073 mg/L, respectively. Thus, the source water sampling program found that lead and copper were below their respective action levels in all of the untreated source waters sampled. Further, the GWR Project would include post-treatment water stabilization, which would control corrosion.

### *Total Organic Carbon*

The Groundwater Replenishment Regulations require that, prior to injection, the TOC concentration in recycled water not exceed 0.5 mg/L, based on the 20-week running average of all TOC results and the average of the last four TOC results. As shown in **Table 16**, the median concentration and range of TOC in the various untreated source waters are similar except for the agricultural wash water, which has a significantly higher TOC concentration. However, all of the untreated source waters would undergo treatment through the primary and secondary processes at the RTP and advanced treatment at the AWT Facility. These treatment technologies are typical for groundwater replenishment projects and would produce TOC concentrations at or below 0.5 mg/L as demonstrated by existing groundwater replenishment projects elsewhere. The MF and RO membranes are the primary barriers for TOC removal. During the piloting program (described later) the TOC concentration in the RO permeate consistently was less than 0.5 mg/L when the system was operated in a manner consistent with how the full-scale system would be operated.

**Table 16. Summary of Total Organic Carbon Concentrations Measured in Untreated Source Waters**

| Parameter[a] | RTP Effluent | Agricultural Wash Water | Blanco Drain | Lake El Estero | Tembladero Slough |
|---|---|---|---|---|---|
| TOC (mg/L) | 15<br>(12-17) | 295<br>(66-340) | 3<br>(2.5-11) | 14 | 8.8 |

a. Median values and data range (minimum concentration to maximum concentration) where applicable.

***Total Nitrogen***

The Groundwater Replenishment Regulations require that the applied recycled water not exceed a total nitrogen concentration of 10 mg/L. Samples may be collected before or after subsurface application. As indicated in **Table 17**, the total nitrogen concentration in untreated Lake El Estero water meets the requirement, while the other untreated source waters do not. However, after treatment at the AWT Facility, all of the source waters would meet the total nitrogen requirement based on the treatment technologies to be provided that are typical for groundwater replenishment projects and as demonstrated by existing groundwater replenishment projects elsewhere. The average total nitrogen removal observed through the piloting program (described later) was 94.3%, which is sufficient to reduce these concentrations to levels below 10 mg/L. The principal AWT Facility nitrogen removal mechanism would be reduction through the RO membranes.

**Table 17. Summary of Total Nitrogen Concentrations in Untreated Source Waters**

| Parameter[a] | RTP Effluent | Agricultural Wash Water | Blanco Drain | Lake El Estero | Tembladero Slough |
|---|---|---|---|---|---|
| Total nitrogen (mg/L as N) | 44.2<br>(35.7-50.5) | 25.3<br>(19-51.1) | 70.1<br>(63-77.3) | 1.3 | 58 |

a. Median values and data range (minimum concentration to maximum concentration) where applicable.

***Priority Pollutants***

The Groundwater Replenishment Regulations require that recycled water and groundwater (from downgradient monitoring wells) be monitored for priority pollutants (chemicals listed in 40 CFR Section 131.38, "Establishment of numeric criteria for priority toxic pollutants for the State of California") specified by DDW, based on the DDW's review of the project's engineering report. A total of 32 of the 126 priority pollutants were detected during source waters sampling. Of the 32 chemicals detected, 19 were chemicals with either MCLs or NLs. As described later, 16 priority pollutants were found in the RO permeate after the pilot testing all of which had MCLs or NLs.

### 13.3. Pilot Plant Results and Compliance with Groundwater Replenishment Regulations

***Pathogenic Microorganisms***

The Groundwater Replenishment Regulations grant log reduction credits for unit processes that have been demonstrated to remove pathogens under expected operating conditions. The proposed pathogen reduction credits for the unit processes in the full-scale AWT Facility are shown in **Table 18**, and have conceptually been approved by DDW. The log reduction credits listed in the table are typical of what other advanced water treatment facilities in California operating under similar conditions have achieved. The AWT Facility is expected to achieve log reduction credits of 13.5, 11.5, and 11.5 for viruses, *Giardia* cysts, and *Cryptosporidium* oocysts, respectively, which exceed the minimum log reduction requirements in the Groundwater Replenishment Regulations. The extra credits, not including additional credits that can be granted for primary and secondary treatment at the RTP, will provide additional redundancy of pathogenic microorganisms removal to achieve the total credits required by the Groundwater Replenishment Regulations.

**Table 18. Proposed Pathogen Reduction Credits for the Proposed Full-scale Advanced Water Treatment Facility Processes**

| Process | Conditions | Log Reduction Credits | | |
|---|---|---|---|---|
| | | Virus | *Giardia* | *Crypto* |
| Ozone[a] | Not pursing credit for ozone | 0 | 0 | 0 |
| MF | Daily pressure decay test | 0 | 4 | 4 |
| RO | Online TOC or conductivity monitoring | 1.5 | 1.5 | 1.5 |
| UV/Peroxide | 1,000 $mJ/cm^{2}$[(b)] | 6 | 6 | 6 |
| Underground Residence Time | 6-month underground residence or retention time[c] | 6[b] | 0 | 0 |
| **Regulatory Requirement** | | **12** | **10** | **10** |
| **Total Credits Achieved by Proposed AWT Facility Processes** | | **13.5** | **11.5** | **11.5** |

a. Ozone CT (contact time multiplied by ozone residual) may be included in the future if additional credit for redundancy is needed.
b. Millijoule per square centimeter ($mJ/cm^2$).
c. Groundwater modeling has demonstrated an estimated underground retention time for the GWR Project of a minimum of 327 days from injection to extraction and 5.5-log credit (Todd Groundwater, 2015b). Tracer testing to be conducted after project startup is expected to show the actual retention time to be equal to or greater than 6 months to achieve the 6-log credit.

Pilot plant testing of the ozone, MF, and RO portion of AWT Facility processes was conducted to evaluate the reduction of *Cryptosporidium* oocysts, *Giardia* cysts, total coliforms, and *E. coli*. The influent to the pilot plant treatment train was secondary effluent from the RTP. As indicated in **Table 19**, pathogen and indicator organism levels were observed to be below detection after treatment by the pilot plant. In addition, the UV/peroxide AOP, which was not included in the pilot testing, would be designed for 6-logs of removal credit for viruses, *Cryptosporidium oocysts*, and *Giardia cysts*.

**Table 19. Summary of Pathogen and Indicator Removal Observed Through the Pilot Plant**

| Pathogen/Indicator[a] | Pilot Influent | Ozone Effluent | MF Effluent | RO Permeate |
|---|---|---|---|---|
| *Cryptosporidium* (oocysts/L) | 0.35 (<0.09-0.9) | *2.65*[b] (0.3-23.3) | <0.09 | -- |
| *Giardia* (cysts/L) | 0.15 (<0.09-1.1) | <0.2[b] (<0.09-4.4) | <0.09 | -- |
| Total coliform[c] (MPN/100 mL) | $2.8x10^5$ ($2.4x10^3 – 1.6x10^6$) | $6.3x10^2$ ($5.5x10^1 – 3.1x10^3$) | <1 | <1 |
| *E. coli*[c] (MPN/100 mL) | $6.0x10^4$ ($4.9x10^2 – 3.3x10^5$) | $2.7x10^1$ ($<1 – 5.5x10^2$) | <1 | <1 |

a. Median values and data range (minimum concentration to maximum concentration) where applicable.
b. There were consistently higher *Cryptosporidium* concentrations in the ozone effluent than the pilot influent. This effect appears to be an artifact of the method of sampling and water quality analysis. The ozonation of the water likely increased the method recovery for *Cryptosporidium* since ozone made it easier to detect protozoa in the samples.
c. Values are geometric means with the observed range (minimum – maximum) where applicable. Most probable number per 100 milliliters (MPN/100 mL).

The data in Tables 18 and 19 clearly indicate that the GWR Project would meet all of the pathogen control requirements specified in the Groundwater Replenishment Regulations. Based on the results of the source water testing and pilot performance, the inclusion of the additional source waters not used/treated by the pilot testing would also be able to be treated to meet the regulations because they had lower concentrations of pathogens than the municipal wastewater.

***Constituents with Maximum Contaminant Levels***

A summary of the constituents detected in RO permeate with primary and secondary MCLs, is presented in **Table 20**. Fourteen constituents with MCLs were detected in the RO permeate at least once as shown in Table 20, and with the exception of the odor threshold secondary MCL, none of them exceeded their regulatory limit. For the full-scale AWT Facility, odor would be reduced to levels below the MCL after UV/peroxide AOP treatment (Agus et al., 2011). Thus, results of the pilot testing based on the ozone-MF-RO portion of the AWT Facility and the expected benefit from full-scale treatment with AOP show that the water treated by RO and AOP would comply with all of the MCLs that are required to be met for groundwater replenishment of recycled water. Based on the results of the source water testing (e.g., the types of constituents detected above the MCLs) and pilot performance for these constituents, the inclusion of the additional source waters not used/treated by the pilot testing would also be able to be treated to meet the MCLs.

**Table 20. Constituents with Maximum Contaminant Levels Detected in Pilot Plant Reverse Osmosis Permeate**

| Parameter | Unit | MCL | Median[a] (Range) |
|---|---|---|---|
| ***Secondary MCLs Consumer Acceptance*** | | | |
| Chloride | mg/L | 250 | 3 (<1-6) |
| Conductivity | µS/cm | 900 | 38 (32-46) |
| Odor threshold | units | 3 | 5[b] |
| Sulfate | mg/L | 250 | <1 (<1 – 1) |
| TDS | mg/L | 500 | <10 (<10 – 26) |
| Turbidity | NTU | 5 | <0.05 (<0.05 – 0.1) |
| ***Primary MCLs Inorganics*** | | | |
| Aluminum | mg/L | 0.2 | <0.01 (<0.01 – 0.045) |
| Arsenic | mg/L | 0.01 | <0.001 (<0.001 – 0.002) |
| Chromium | mg/L | 0.05 | 0.005 |
| Cyanide | mg/L | 0.15 | <0.005 (<0.005 – 0.007) |
| Fluoride | mg/L | 2 | <0.1 (<0.1 – 0.2) |
| Selenium | mg/L | 0.05 | <0.002 (<0.002 – 0.01) |
| ***Primary MCLs Synthetic Organic Compounds*** | | | |
| Total trihalomethanes | µg/L | 80 | 1.85 (0.68 – 5) |

| Parameter | Unit | MCL | Median[a] (Range) |
|---|---|---|---|
| *Primary MCLs Radionuclides* | | | |
| Radium-226 | pCi/L | 5 | 0.298±0.327 |

a. Parameters with no range were only sampled for during one complete MCL/NL sampling event. Includes samples when the agricultural wash water was combined with raw wastewater and treated at the RTP.

b. The odor threshold test was conducted on the RO permeate without dechlorination, and the majority of odor is assumed to be a result of the chloramine residual. The chloramine residual would be reduce through the UV/peroxide AOP and further reduced as a result of chloramine decay at the injection site. In addition, UV/peroxide AOP has been shown to significantly reduce odor compounds in RO permeate (Agus et al., 2011), such that the secondary MCL for odor would be met in the purified water.

### *Constituents with Notification Levels and Advisory Action Levels*

Five constituents with NLs were detected at least once in the RO permeate as shown in **Table 21**, but only NDMA was found at concentrations above its NL. None of the constituents with AALs were detected in RO permeate.[39] For NDMA, the full-scale AWT Facility would include a UV/AOP process that would be designed to produce purified water at or below the NDMA NL. The addition of the other source waters not evaluated during pilot testing should not impact NDMA levels based on the data from the source water testing (e.g., low NDMA and low TOC levels in comparison to the agricultural wash water and municipal wastewater).

**Table 21. Constituents with Notification Levels and Archived Action Levels Detected in Reverse Osmosis Permeate**

| Constituent | Unit | NL | Median[a] (Range) |
|---|---|---|---|
| Boron | mg/L | 1 | 0.18 (0.16 – 0.23) |
| Formaldehyde | mg/L | 0.1 | 0.028 |
| NDMA | ηg/L | 10 | 27 (20 – 32) |
| N-Nitrosodi-n-propylamine (NDPA) | ηg/L | 10 | <2 (<2 – 2.9) |
| 1,4-dioxane | µg/L | 1 | <1 |

a. Parameters with no range were only sampled once during a complete MCL/NL/AAL sampling event.

### *Total Organic Carbon*

The Groundwater Replenishment Regulations require that the recycled water must meet an average TOC concentration not exceeding 0.5 mg/L. The TOC concentrations in the RO permeate are impacted by the ozone dose used in the ozone pretreatment unit process. The TOC concentrations in the RO permeate at a time when ozone dose was 10 mg/L were consistently below 0.5 mg/L, ranging from 0.27 mg/L to 0.42 mg/L, including the period when the agricultural wash water was added to the municipal wastewater for treatment at the RTP. However, when the ozone dose was increased to 20 mg/L, the TOC concentration in some of the RO permeate samples exceeded 0.5 mg/L. This information helped in the selection of the design ozone dose chosen for the full-scale AWT Facility; namely the lower dose of 10 mg/L, which, coupled with the expected reduction in TOC from blending with other low-TOC source waters and treatment through the other AWT Facility unit processes (primarily RO), would consistently produce purified water not exceeding 0.5 mg/L TOC. Thus, the TOC limit will readily be met in the purified water in compliance with the Groundwater Replenishment Regulations.

### *Total Nitrogen*

The Groundwater Replenishment Regulations require that the applied recycled water not exceed a total nitrogen concentration of 10 mg/L (before or after subsurface application). The total nitrogen concentration

[39] Dieldrin is removed by RO (99%) and would be further reduced by UV/AOP.

for all tests conducted during pilot plant testing of the ozone-MF-RO portion of AWT Facility processes found that the total nitrogen ranged from 1.5 mg/L to 2.9 mg/L, significantly lower than the 10 mg/L regulatory limit.

Although two of the source waters (Blanco Dain and Tembladero Slough) were found to have total nitrogen concentrations greater than that in the RTP secondary effluent (concentration of 44.2 mg/L), an analysis of monthly flows for the composite of all projected flows to the RTP and (after secondary treatment) to the AWT Facility predicted that the total nitrogen in the effluent from the AWT Facility pilot plant would have a maximum concentration of 3.1 mg/L. Therefore, despite the high levels of total nitrogen in some of the untreated source waters, the full-scale AWT Facility would meet the total nitrogen requirement specified in the Groundwater Replenishment Regulations.

**Lead and Copper**

As previously discussed, lead and copper were below their respective action levels in all of the source waters sampled and, thus, would not exceed their action levels in the purified water after treatment in the AWT Facility. Therefore, there was no need to sample for lead and copper in the pilot plant testing.

**Priority Pollutants**

Sixty-four priority pollutants were sampled and analyzed during the pilot plant sampling program. Of these constituents, 48 were found to be below detection limits in the RO permeate. Sixteen constituents were detected, all of which had either MCLs or NLs that are addressed elsewhere in this Section. It is noted that of the 16 priority pollutants detected, only NDMA was found above its NL. The UV/peroxide AOP process, which will follow the RO process in the full-scale AWT Facility, will be designed to reduce the NDMA concentration to below the NL of 10 ηg/L.

## 13.4. Reliability and Redundancy

The full-scale AWT Facility and recharge of the purified water would provide reliability and redundancy through the use of multiple treatment barriers for each type of constituent as shown in **Table 22**. Including the RTP in combination with the AWT Facility, the integrated treatment system would achieve chemical constituent removal redundancy by employing at least two treatment technologies for most constituent types and at least five technologies for each pathogen category, as shown in the table below.

**Table 22. Proposed Groundwater Replenishment Project Treatment Barriers**

| Process | Chemical Constituents | | | | | Pathogenic Microorganisms | | |
|---|---|---|---|---|---|---|---|---|
| | Nitrogen | TOC | DPBs | Inorganics | CECs | Bacteria | Viruses | Protozoa |
| Primary/ Secondary | ✓ | ✓ | | ✓ | ✓ | ✓ | ✓ | ✓ |
| Ozone | | | ✓ | | ✓ | ✓ | ✓ | ✓ |
| MF | | ✓ | | ✓ | | ✓ | | ✓ |
| RO | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ | ✓ |
| UV/$H_2O_2$ | | | ✓ | | ✓ | ✓ | ✓ | ✓ |
| Aquifer | | | | | | ✓ | ✓ | ✓ |

## 13.5. Basin Plan Compliance

For the Seaside Basin, the Basin Plan includes general narrative groundwater objectives for taste and odor and radioactivity, and numeric objectives based on primary and secondary MCLs. As previously discussed, the RO permeate followed by AOP would meet all MCLs, including those that would satisfy the narrative objectives. Based on the results of the source water testing (e.g., the types of constituents detected above the MCLs) and pilot performance for these constituents, the inclusion of the additional source waters not used/treated by the pilot testing would also be able to be treated to meet the MCLs.

The Basin Plan also includes guidelines to protect soil productivity, irrigation, and livestock watering. The guidelines are shown in **Table 23** along with the highest detected concentrations in the untreated source waters. With regard to salinity and chloride, the RO permeate concentrations were below the guidelines. One of the Basin Plan guidelines is the Sodium Adsorption Ration (SAR), which is used to determine if irrigation water affects the rate of water infiltration. It is not a constituent, but a calculated value based on the square root of the ratio of sodium to calcium plus magnesium. The cations (calcium, magnesium, and sodium) used to derive an SAR would be removed by RO as part of the full-scale AWT Facility. As discussed earlier in this Section, even including all of the source waters, the predicted total nitrogen concentration after secondary treatment at the RTP and treatment through the full-scale AWT Facility would result in maximum purified water concentration of 3.1 mg/L, which is below the individual guidelines for ammonia and nitrate. The chemical stabilization process following AOP in the full-scale AWT Facility will influence bicarbonate and pH concentrations in the purified water. These concentrations will be within the Basin Plan Guidelines as demonstrated by existing groundwater replenishment projects elsewhere.

**Table 23. Basin Plan Guidelines for Interpretation of Water Quality for Irrigation**

| Source Water | Constituent | Guideline[a] | Highest Concentration Detected in Untreated Water | Median/Range in RO Permeate |
|---|---|---|---|---|
| RTP Effluent | Salinity (EC)[b] | 750 µS/cm | 1623 µS/cm | 38 (32-46) |
| | Permeability (EC) | >500 µS/cm | 1623 µS/cm | 38 (32-46) |
| | Permeability SAR (unit less) | <6.0 (adjusted)[c] | 6.4[d](not adjusted) | 1.6[e](not adjusted) |
| | Chloride (foliar absorption, e.g., sprinklers) | < 106 mg/L | 235 | 6 mg/L |
| | Ammonia-N | < 5 mg/L | 39.7 mg/L | --- |
| | Nitrate-N | < 5 mg/L | 42 mg/L | 0.7 mg/L |
| | Bicarbonate | < 90 mg/L | 420 mg/L | --- |
| | pH | Normal range | 8 | --- |
| Agricultural Wash Water | Salinity (EC) | 750 µS/cm | 1830 µS/cm | --- |
| | Permeability (EC) | >500 µS/cm | 1830 µS/cm | |
| | Permeability SAR (unit less) | <6.0 (adjusted) | 4.3 (not adjusted) | |
| | Chloride (foliar absorption, e.g., sprinklers) | < 106 mg/L | 292 mg/L | |
| | Ammonia-N | < 5 mg/L | 7.5 mg/L | |
| | Nitrate-N | < 5 mg/L | 1.5 mg/L | |
| | Bicarbonate | < 90 mg/L | 310 mg/L | |
| | pH | Normal range | 7.3 | |
| Blanco Drain | Salinity (EC) | 750 µS/cm | 2929 µS/cm | --- |
| | Permeability (EC) | >500 µS/cm | 2929 µS/cm | |
| | Permeability SAR, unit less | <6.0 (adjusted) | 3.4 (not adjusted) | |
| | Chloride (foliar absorption, e.g., sprinklers) | < 106 mg/L | 307 mg/L | |

| Source Water | Constituent | Guideline[a] | Highest Concentration Detected in Untreated Water | Median/Range in RO Permeate |
|---|---|---|---|---|
| | Ammonia-N | < 5 mg/L | < 0.5 mg/L | |
| | Nitrate-N | < 5 mg/L | 352 mg/L | |
| | Bicarbonate | < 90 mg/L | 455 mg/L | |
| | pH | Normal range | 8.6 | |
| Lake El Estero | Salinity (EC) | 750 µS/cm | 2559 µS/cm | |
| | Permeability (EC) | >500 µS/cm | 2559 µS/cm | |
| | Permeability SAR, unit less | <6.0 (adjusted) | 5.6 (not adjusted) | |
| | Chloride (foliar absorption, e.g., sprinklers) | < 106 mg/L | 514 mg/L | --- |
| | Ammonia-N | < 5 mg/L | < 0.05 mg/L | |
| | Nitrate-N | < 5 mg/L | < 0.1 mg/L | |
| | Bicarbonate | < 90 mg/L | 259 mg/L | |
| | pH | Normal range | 8.3 | |
| Tembladero Slough | Salinity (EC) | 750 µS/cm | 2939 µS/cm | |
| | Permeability (EC) | >500 µS/cm | 2939 µS/cm | |
| | Permeability SAR, unit less | <6.0 (adjusted) | 4.4 (not adjusted) | |
| | Chloride (foliar absorption, e.g., sprinklers) | < 106 mg/L | 394 mg/L | --- |
| | Ammonia-N | < 5 mg/L | < 0.5 | |
| | Nitrate-N | < 5 mg/L | 0.5 mg/L | |
| | Bicarbonate | < 90 mg/L | 443 mg/L | |
| | pH | Normal range | 8 | |

a. No problems expected at these levels with interpretation based on possible effects on crops and/or soils. Guidelines are flexible and should be modified when warranted by local experience or special conditions of crops, soils, and method of irrigation.
b. Electrical Conductivity (EC).
c. Adjusted mathematically to account for calcium precipitation. Because the non-adjusted SAR values for the source waters and RO permeate are slightly higher or substantively less than the guideline, it was not necessary to convert the SAR values to adjusted SARs.
d. Based on RTP secondary effluent.
e. Based on a stabilized RO permeate sample from the pilot testing.

Finally, the Basin Plan includes water quality objectives for agricultural use for irrigation supply and livestock watering as shown in **Table 24**. Of the 21 constituents with objectives, 14 have MCLs (aluminum, arsenic, beryllium, cadmium, chromium, fluoride, iron, manganese, mercury, nickel, nitrate+nitrite, nitrite, selenium, and zinc). All of the agricultural objectives are set at higher concentrations than the MCLs with the exception of the three constituents shown in Table 24, along with the RO permeate results from the pilot testing. Thus, the RO permeate for these MCL-based constituents either meets MCLs or meets the less stringent Basin Plan agricultural objectives.

**Table 24. Constituents with Maximum Contaminant Levels Less Stringent than Basin Plan Agricultural Objectives and Pilot Plan Reverse Osmosis Permeate Results**

| Parameter | Agricultural Objective[a] | MCL | Piloting RO Permeate Concentration Median (Range) |
|---|---|---|---|
| ***Secondary MCLs Consumer Acceptance*** | | | |
| Zinc, mg/L | 5 | 5 | ND[b] |
| ***Primary MCLs Inorganics*** | | | |
| Fluoride, mg/L | 1 | 2 | <0.1 (<0.1 – 0.2) |
| Selenium, mg/L | 0.02 | 0.05 | <0.002 (<0.002 – 0.01) |

a. Maximum values – considered as 90th percentile values not to be exceeded.
b. ND – not detected.

The Basin Plan also incudes agricultural objectives for copper and lead. In the case of copper, the objectives for irrigation supply (0.2 mg/L) and livestock watering (0.5 mg/L) are more stringent than the drinking water action level (1.3 mg/L). The maximum concentrations of copper measured in any of the untreated source waters was 0.073 mg/L, which is below the agricultural objectives prior to advanced treatment. For lead, the Basin Plan objectives for irrigation supply (5.0 mg/L) and livestock watering (0.1 mg/L) are less stringent than the drinking water action level (0.015 mg/L). The maximum concentration of lead measured in any of the untreated source waters was 0.0018 mg/L, which is well below the agricultural objectives prior to advanced treatment. Thus, the source water sampling program found that lead and copper were below their respective agricultural basin plan objectives in all of the untreated source waters sampled.

The Basin Plan includes agricultural objectives for two constituents with NLs: boron and vanadium. In the case of boron, the agricultural objective for irrigation supply (0.75 mg/L) is more stringent than the NL of 1 mg/L. Vanadium was not detected in the RO permeate from the pilot testing. The median boron concentration in the RO permeate was 0.18 mg/L (range 0.16 to 0.23 mg/L). Thus, the piloting testing found that boron and vanadium were below their respective agricultural basin plan objectives in RO permeate.

The three remaining agricultural objectives do not have regulatory standards or goals: cobalt, lithium, and molybdenum. Studies of RO treatment have shown that it is effective in removing metals such as these from secondary wastewater. Cobalt and molybdenum were removed to below detection levels, and lithium was removed by 68% with a median concentration of 0.01 mg/L, which is below agricultural objectives for irrigation supply ranging from 0.075 to 2.5 mg/L (Department of Health, Western Australia, 2009).

Based on the source water sampling, piloting testing results, and pertinent research, the purified water that would be produced by the RTP and full-scale AWT Facility would meet Basin Plan guidelines for irrigation and the objectives for agricultural reuse.

## 14. Summary of Hydrogeologic and Geochemical Modeling

The GWR Project purified water would be injected within a portion of the Seaside Subbasin of the Salinas Valley Groundwater Basin, which is an adjudicated basin with an established perennial natural safe yield of between 2,581 AFY to 2,913 AFY. Groundwater pumping in the Seaside Groundwater Basin provides water supply for municipal, irrigation (primarily golf courses), and industrial uses. Prior to basin adjudication in 2006, pumping exceeded the perennial natural safe yield and contributed to significant basin-wide water level declines. Over-pumping in the coastal subareas resulted in water levels declining below sea level at the coast, placing aquifers at risk of seawater intrusion. Since 2008, groundwater pumping has declined in accordance with the judgment. In addition, the Monterey Peninsula Aquifer Storage and Recovery Project (ASR Project) has provided about 1,500 to 1,800 AF of treated Carmel River Basin groundwater for injection and recovery into the basin.[40] The ASR project is located downgradient and within about 1,000 feet from the GWR Project injection well facilities.

Purified water would be recharged into the Seaside Basin's two primary aquifers used for water supply - the Paso Robles Aquifer and the underlying Santa Margarita Aquifer. Recharge would be accomplished through relatively shallow vadose zone wells (Paso Robles Aquifer) and deep injection wells (Santa Margarita Aquifer).

In support of the GWR Project EIR, Todd Groundwater prepared two technical reports that addressed potential recharge impacts and field investigations. The Recharge Impacts Assessment Report analyzed the recharge components of the project, including recharge wells, operational facilities, and the fate and transport of the purified water in the groundwater basin (Todd Groundwater, 2015a). The Field Investigation Report included geochemical modeling to test stabilized RO permeate compatibility with ambient groundwater (Todd Groundwater, 2015b).

### 14.1. Compliance with Underground Retention Time Requirements

The Groundwater Replenishment Regulations establish specific requirements for underground retention time of recycled water:

- The Response Retention Time (RRT) that requires recycled water to be retained underground for a sufficient period of time (as proposed by a project sponsor) to identify and respond to any treatment failure so that inadequately treated recycled water does not enter a potable water system. The RRT has to be at least two months.
- To meet the 12-log virus reduction requirement, projects can be credited with a 1-log virus reduction per month up to 6 months (i.e., 6-logs).

Notwithstanding the effectiveness of the RTP[41] and AWT Facility in controlling pathogens, the GWR Project also would include up to a 6-log virus reduction credit by keeping the purified water underground for six months prior to arrival at the closest downgradient production wells. The RRT for the GWR Project is expected to be 5 to 6 months, similar to the RRT approved by DDW for the Alamitos Barrier Groundwater Replenishment Project. The underground retention time would be demonstrated through a field tracer test within the first three months of operation in compliance with the Groundwater Replenishment Regulations.

For the purposes of planning projects, the Groundwater Replenishment Regulations allow for use of models with safety factors to estimate retention times. For the GWR Project, the Watermaster groundwater model was used to demonstrate underground retention time. When this type of model is used to demonstrate travel time, the required retention time is doubled to account for uncertainty in the method of analysis as required by the Groundwater Replenishment Regulations. Therefore, the model would need to demonstrate a travel time of one year to allow for a six-month planning credit. Preliminary modeling for the GWR Project indicated that seven of the eight GWR Project wells would meet the one-year requirement. However, modeling indicated that purified water injected at one injection well would reach a drinking water well in 327 days under certain pumping conditions. This travel time is 38 days short of the model-based one-year travel time requirement.

While the required underground retention time of six months remains applicable to the GWR Project, demonstration of compliance would need to be made with the tracer test rather than modeling alone. Until that test can occur, it is assumed for planning purposes that the estimated minimum of approximately 11 months travel time will limit the virus reduction credit to a 5.0-log credit for the GWR Project. Based on the proposed AWT Facility virus reduction credits (12-logs) and the 5.0-log retention time credits, the GWR Project would exceed the 12-log virus reduction requirements in the Groundwater Replenishment Regulations.

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[40] Currently, Carmel River Basin water (extracted from riverbank wells) is treated to drinking water standards and conveyed to the ASR wells for recharge when excess water is available.

[41] The GWR Project is not taking credit for removal of pathogens through primary and secondary treatment.

## 14.2. Compliance with Anti-degradation and Recycled Water Policies

### *Assessment of Impact of GWR Project on Contaminant Plumes*

The Recycled Water Policy does not limit the authority of a RWQCB to impose additional requirements for a proposed groundwater replenishment project that has a substantial adverse effect on the fate and transport of a contaminant plume. Thus, a study was performed to evaluate the potential impacts of the GWR Project in areas of contamination in the Seaside Basin (Todd Groundwater, 2015a).

The GWR Project injection well facilities would be located on a portion of the former Fort Ord military base (referred to as Site 39), which provided training and staging for U.S. troops from 1917 to 1994. Site 39 contained at least 28 firing ranges that were used for small arms and high explosive ordnance training using rockets, artillery, mortars and grenades. Considerable expended and unexploded ordnance have been documented in various areas of Site 39. Beginning in 1984, numerous environmental investigation and remediation activities have occurred on Site 39. During these investigations, metals and various compounds associated with explosives have been detected in soil. Remediation, including removal of munitions and explosives, has been more extensive in areas targeted for redevelopment, an area that includes the GWR Project injection well facilities site (Todd Groundwater, 2015a). Groundwater analyses do not indicate that former Fort Ord activities have impacted groundwater in the existing wells near the GWR Project injection site (Todd Groundwater, 2015a).

No documented groundwater contamination or contaminant plumes have been identified in the GWR Project injection well facilities area. Therefore, injection associated with the GWR Project would not exacerbate existing groundwater contamination or cause plumes of contaminants to migrate. As a result, additional RWQCB requirements related to groundwater contaminants would not be necessary for the GWR Project.

### *Assessment of Impact of GWR Project on Dissolution of Natural or Anthropogenic Constituents*

The Recycled Water Policy does not limit the authority of a RWQCB to impose additional requirements for a proposed groundwater replenishment project that causes constituents, such as naturally occurring arsenic, to become mobile and impact groundwater quality.

When two water types with different water chemistry are mixed (such as the GWR Project purified water and groundwater), geochemical reactions could occur in the groundwater system. These reactions could potentially result in leaching of natural or anthropogenic constituents, which could potentially impact groundwater quality. The risk of geochemical impacts from incompatibility would be addressed at the proposed AWT Facility by including a stabilization process to ensure that purified water is stabilized and non-corrosive.

Laboratory leaching tests were conducted using the stabilized RO pilot water[42], with the results used to conduct a detailed geochemical modeling analysis that will be used to inform the design of the AWT Facility stabilization system (Todd Groundwater, 2015b). The geochemical modeling assessment is summarized in a field investigation report. Based on modeling results, potential changes in groundwater concentrations as a result of the GWR Project are expected to be minor and would not result in exceedances of groundwater quality standards (Todd Groundwater, 2015b).

### *Salt/Nutrient Management Plan*

A SNMP has been prepared for the Seaside Basin to comply with the Recycled Water Policy (HydroMetrics, 2014). The SNMP was developed with basin stakeholder input through the Seaside Basin Watermaster and has been adopted by the Water Management District. The SNMP has been submitted to the Central Coast Region RWQCB for consideration as a Basin Plan amendment.

[42] The samples were RO permeate collected from the MRWPCA pilot plant. The RO permeate was stabilized using a bench-scale post-treatment stabilization unit to better approximate the water quality anticipated for the proposed AWT Facility.

As documented in the SNMP, ambient groundwater generally exceeds the TDS Basin Plan groundwater objective in many areas of the Seaside Basin, while nitrate and chloride concentrations generally meet Basin Plan objectives (Todd Groundwater, 2015a). A study that evaluated the water quality of the stabilized RO pilot water found that the concentrations of TDS, nitrate, and chloride in the purified water meet all Basin Plan objectives (Todd Groundwater, 2015a). Further, these concentrations are generally lower than average concentrations in groundwater. As such, replenishment of the Seaside Basin using the GWR Project purified water would not adversely impact salt and nutrient loading in the basin and would provide benefits to local groundwater quality

***Anti-degradation***

Per the results of the SNMP, the GWR Project would not degrade groundwater or utilize assimilative capacity above the 10% threshold cited in the Recycled Water Policy that requires a more detailed anti-degradation analysis. As described in previous sections of this report, the GWR Project purified water would be treated and stabilized to meet all drinking water quality objectives and other Basin Plan objectives. Further, the GWR Project purified water would be expected to be higher quality water than ambient groundwater with respect to TDS, chloride, and nitrate. As such, the GWR Project will neither cause a violation of a groundwater quality standard nor adversely impact beneficial uses. Rather, the GWR Project purified water would have a beneficial effect on local groundwater quality.

### 14.3. Studies of Groundwater Levels and Storage

Because the GWR Project provides additional water for downgradient groundwater extraction, it results in both higher and lower water levels in existing basin wells over time depending on the timing of extraction and the buildup of storage in the basin. Hydrometrics (2015) examined changes in water levels for eight key production wells for a 33-year simulation period (including 25 years of the GWR Project operation). The results showed that the water levels would be sometimes lower because of increased pumping at existing extraction wells. However, water levels would be lowered only about 10 feet or less and would be lowered for a relatively short duration, typically for a few months. In addition, water levels would be generally higher than pre-GWR Project levels. As such, none of the municipal or private production wells would experience a reduction in well yield or physical damage. All existing wells would be capable of pumping the current level of production or up to the permitted production rights (Todd, Groundwater, 2015a).

The analysis of the closest shallow coastal well indicated that increased pumping of the GWR Project water would not result in water levels falling below elevations protective of seawater intrusion (Hydrometrics, 2015). Although it would take time for the beneficial impacts of recharge to reach coastal pumping wells, the increased pumping of nearby production wells would only reduce water levels about two feet near the coast. The analysis showed that for the duration of the model simulation period, the closest coastal well would remain above protective elevations for seawater intrusion.

In addition, Todd Groundwater (2015a) found that there would be no adverse impacts to the quantity of groundwater resources. Because the GWR Project would only recover the amount of purified water injected, there would be no long-term change in groundwater storage because the purified water being injected would eventually be extracted for municipal use.

## 15. Constituents of Emerging Concern – Source Waters and Pilot Testing Results

Constituents of emerging concern were evaluated using the Eurofins Eaton Analytical Liquid Chromatography Tandem Mass Spectrometry method that specifically addresses 92 constituents. For the source waters, samples were collected quarterly for one year from the RTP effluent, agricultural wash water, and Blanco Drain, and once from in the Lake El Estero and Tembladero Slough waters. The highest occurrence of CECs was in the RTP secondary effluent. This was expected, as these compounds are common in wastewater and are often not significantly removed by conventional primary and secondary wastewater treatment (see **Figure 4**). For the 92 CECs that were included in the Eurofins method, 59 were detected in at least one source water, with the maximum concentrations being observed in the RTP secondary effluent for 50 of the 59 constituents. Of the nine other constituents, five were seen at the highest concentration in the agricultural wash water, and the other four maximum concentrations were detected in the drainage waters. It should be noted that for the new source waters, the concentrations presented in Figure 4 are raw water concentrations that do not take into account blending with the other waters and treatment reduction through the RTP primary and secondary treatment processes, nor treatment through the pilot test facility or full scale AWT Facility.

The pilot testing was conducted using both the existing RTP secondary effluent and a combination of RTP secondary effluent and the agricultural washwater, which captured the waters with the overall highest levels of CECs. Samples were collected in the pilot influent, ozone effluent, and RO permeate. Ozonation consistently reduced the concentrations of many of the CECs to levels below detection. On average, there were approximately 40 CECs detected in the pilot influent and 26 detected in the ozone effluent. With a few exceptions described below, the RO system removed the remaining CECs to below levels of detection. In addition, the full-scale AWT Facility would include AOP, which would create an additional barrier to destroy CECs. The CECs removals observed across the pilot system are shown in **Figure 5** (Trussell Technologies, 2014).

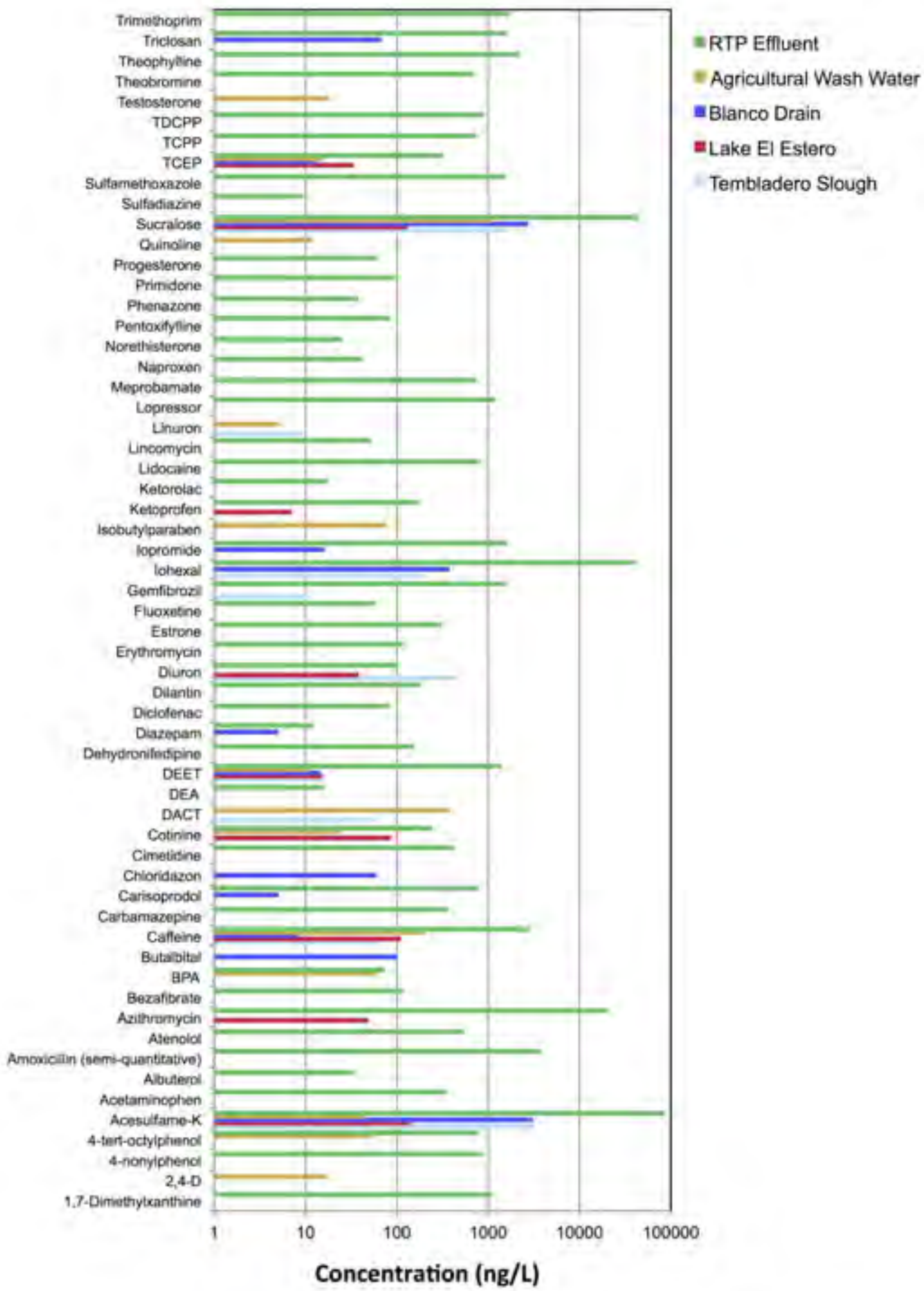


**Figure 4. Constituents of Emerging Concern – Maximum Values Detected in the Various Proposed Project Source Waters**

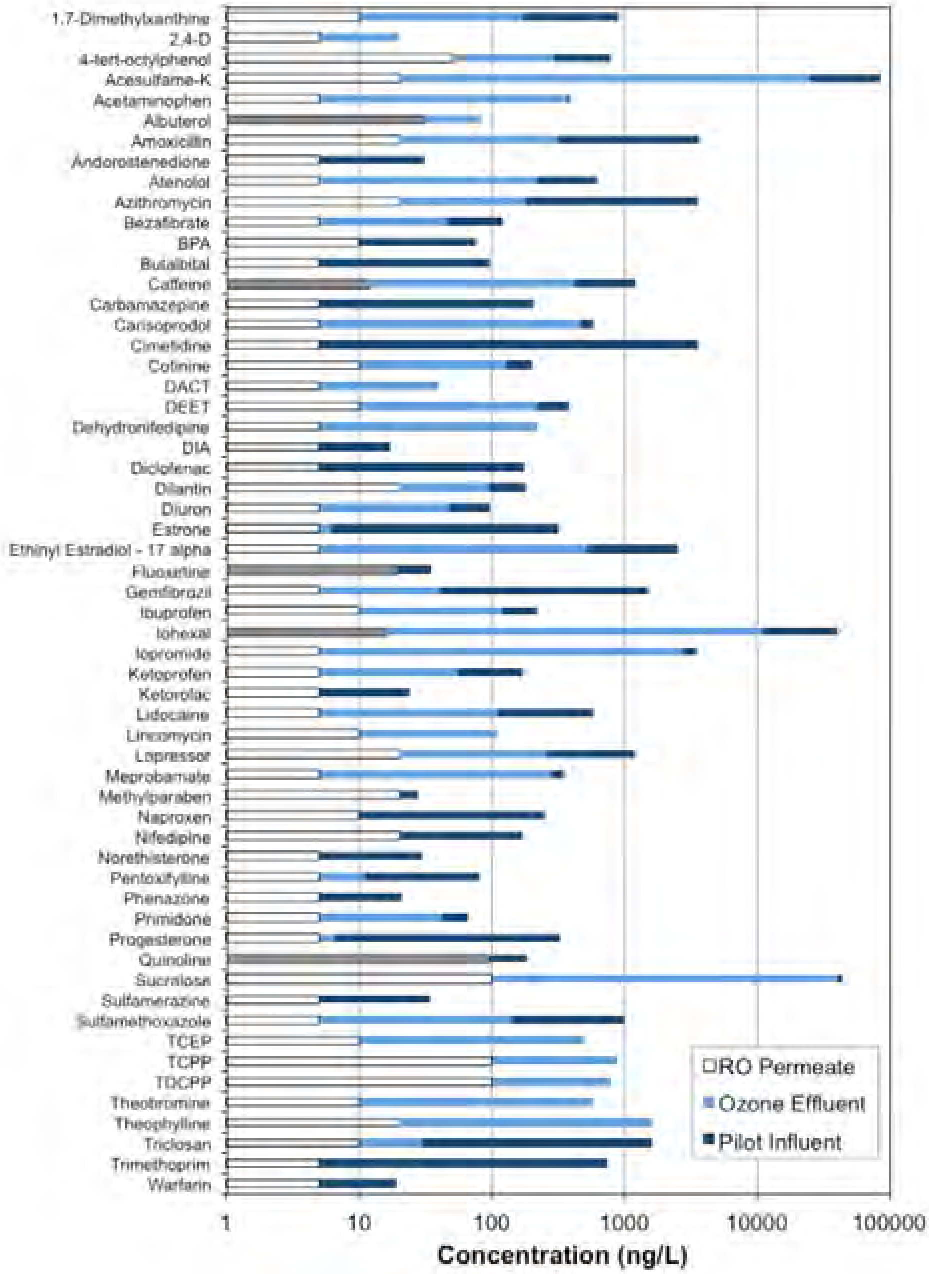


**Figure 5. Constituents of Emerging Concern - Removal During Pilot Testing (Maximum Values Observed)**[43]

In three of the seven monthly sampling events, there were a few CECs detected in the RO permeate (not including previously discussed NDMA). These compounds were erythromycin, caffeine, iohexal, albuterol, carbadox, fluoxetine, and quinolone. In all cases, these constituents were detected in only one sample, and it is likely that several of the detections were actually false laboratory positives due to sample or laboratory contamination. Specifically, erythromycin and carbadox (both antibiotics) were not detected in either the pilot influent or the ozone effluent, and thus the RO permeate detection from these compounds

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[43] For the RO permeate, white (open) boxes indicate that the constituent was not detected and the reported value is the detection limit, while gray boxes indicate the constituent was detected. No ozone effluent value is shown for cases where the constituent was below detection in the ozone effluent. In addition, in cases where there was no reduction through the ozone system (i.e., the pilot influent was equal to or less than the ozone effluent), only the ozone effluent concentration is shown.

was excluded from the analysis. For quinoline (a chemical found in cigarettes and automobile exhaust) and fluoxetine (an antidepressant), the RO permeate values exceeded the ozone effluent value, and it is strongly suspected that these results are false positives as well. The remaining compounds detected in the RO permeate were caffeine (a simulant), iohexal (a contrast agent), and albuterol (an asthma medication). They were detected at concentrations near the detection limit and it is unclear whether or not they are actual values. For all of these constituents, it is important to keep in mind that (1) the concentrations detected were many orders of magnitude below any demonstrated health related levels as shown in **Table 25**, and (2) these compounds have all been shown to be effectively removed (up to 90%) by UV/peroxide AOP that will be part of the full-scale AWT Facility. With this additional treatment barrier, it is expected that all of these CECs would be below current detection levels in the purified water.

**Table 25. Comparison of Detected Constituents of Emerging Concern in Reverse Osmosis Permeate to Drinking Water Equivalent Levels**

| Constituent | Classification | Maximum Observed Concentration in RO Permeate (ηg/L) | DWEL (ηg/L) |
|---|---|---|---|
| Caffeine | Stimulant | 10 | 87,000,000[a] |
| Iohexal | Contrast agent | 10 | 725,000[b] |
| Albuterol | Asthma medication | 50 | 41,000[c] |

a. Intertox, 2009.
b. Environment Protection and Heritage Council et al., 2008.
c. Schwab, 2005.

## 16. Environmental Impact Report Groundwater Resources Significance Determination

Based on the source water sampling, results of the pilot testing and hydrogeologic studies, other relevant research, and information from other groundwater replenishment projects, the following conclusions are offered with regard to the groundwater resources significance determination:

- The GWR Project purified water would meet groundwater quality standards in the Basin Plan and drinking water quality standards. Further, the treatment processes that would be incorporated into the AWTF would be selected and operated to ensure that all water quality standards would be met by the purified water and in groundwater. A monitoring program would document project performance.
- The GWR Project purified water would exhibit much lower concentrations of TDS and chloride than ambient groundwater and would be expected to provide a localized benefit to groundwater quality.
- No documented groundwater contamination or contaminant plumes have been identified in the GWR Project area. Therefore, injection associated with the GWR Project would not exacerbate existing groundwater contamination or cause plumes of contaminants to migrate.
- Injection of AWT Facility purified water would not degrade groundwater quality.
- The GWR Project purified water would be stabilized as part of the AWT Facility to ensure no adverse geochemical impacts. Geochemical modeling indicates that the potential for impacts to groundwater quality from leaching is low and that the GWR Project will not cause exceedances of water quality standards. Further, modeling results will be used to inform AWTF stabilization procedures, which can be adjusted as needed.
- The GWR Project would result in both higher and lower water levels in wells throughout the Seaside Basin at various times. Although water levels would be slightly lower during some time periods, the difference would generally be small and judged insignificant. Modeling indicates that the GWR Project would not lower water levels below protective levels in coastal wells and would not exacerbate seawater intrusion (Todd Groundwater, 2015a).

## 17. Summary of the Groundwater Replenishment Project Compliance Regulation and Policies

**Table 25** presents a summary of how the GWR Project would comply with applicable regulations and policies for the use of recycled water for groundwater replenishment.

**Table 26. Proposed Groundwater Replenishment Project Compliance Summary**

| | Requirements | Proposed Compliance Description |
|---|---|---|
| ***Groundwater Replenishment Regulations*** | | |
| Source Control | Entities that supply recycled water to a groundwater replenishment project must administer a comprehensive source control program that includes: (1) an assessment of the fate of Division of Drinking Water (DDW) and Regional Water Quality Control Board (RWQCB)-specified contaminants through the wastewater and recycled water treatment systems; (2) provisions for contaminant source investigations and contaminant monitoring that focus on DDW and RWQCB-specified contaminants; (3) an outreach program to industrial, commercial, and residential communities; and (4) an up-to-date inventory of contaminants. | Monterey Regional Water Pollution Control Agency (MRWPCA) administers an approved pretreatment program under National Pollutant Discharge Elimination System (NPDES) Permit R3-2008-0008. These activities are conducted in accordance with MRWPCA Ordinance No. 2008-01[44] and federal pretreatment regulations pursuant to 40 Code of Federal Regulations Part 403 (40 CFR 403) and Sections 307 and 402 of the Clean Water Act (CWA). The MRWPCA source control program would meet the requirements as follows:<br>– Contaminant Assessment. The GWR Project's pilot testing evaluated the fate of chemicals and contaminants through the Regional Treatment Plant (RTP) and treatment systems for the Advanced Water Treatment (AWT) Facility. This list of chemicals and contaminants being evaluated included priority pollutants, constituents with maximum contaminant levels (MCLs) and notification levels (NLs), and constituents of emerging concern (CECs), and pesticides of local interest. Future studies would be conducted at the request of DDW and RWQCB or based on monitoring data collected by MRWPCA.<br>– Contaminant Source Investigation. MRWPCA would conduct investigations and monitoring as requested by DDW and RWQCB or based on monitoring data collected by MRWPCA.<br>– Outreach: MRWPCA currently administers an effective outreach program that consists of RTP facility tours, classroom presentations, information on the GWR Project, information on pharmacies offering drug take-back programs, participation/exhibits in community events, school outreach (presentations, materials, teacher curriculum training and workshops), RTP tours, commercials and advertising for controlling fats, oil and grease, and participation in the Monterey County Oil Recycling Program. The program would be modified pending implementation of the GWR Project.<br>– Contaminant Inventory. MRWPCA's source control program tracks and identifies industrial users and discharges, including contaminants discharged through industrial monitoring. MRWPCA maintains its industrial inventory by reviewing the phone book and online telephone |

[44] An *Ordinance Establishing Regulations for the Interception, Treatment and Disposal of Sewage and Wastewater; Providing for and Requiring Charges and Fees Therefore; and Fixing Penalties for Violation of Said Regulations*.

| | Requirements | Proposed Compliance Description |
|---|---|---|
| | | information sites, referrals from the MRWPCA Customer Service Department for new or expanded sewer connections, building permit sign-offs from all member entity building inspection departments, and service area canvassing. The inventory would also address the new source waters based on the results of the source water monitoring and subsequent monitoring when the source waters and any related industrial contributors are delivered to the RTP.<br>– Annual Reporting. MRWPCA currently prepares an annual report on the pretreatment program. Future reports would address compliance with the source control provisions pending implementation of the GWR Project. |
| Pathogen Control | Groundwater replenishment projects must achieve a 12-log enteric virus reduction, a 10-log *Giardia* cyst reduction, and a 10-log *Cryptosporidium* oocyst reduction using at least 3 treatment barriers that each achieve at least 1.0-log reduction. No treatment process can be credited with more than 6-logs reduction. The log reductions must be verified using a monitoring procedure approved by DDW. Failure to meet the specified reductions requires notification to DDW and RWQB, investigation, and/or discontinuation of recycled water use until a problem is corrected. | The GWR Project will meet the pathogen log reduction requirements by using the combination of treatment afforded by: (1) the RTP primary and secondary unit treatment processes (no credit is being sought for the reductions through these treatment processes); (2) the AWT Facility, which includes ozonation, membrane filtration (MF), reverse osmosis (RO), and advanced oxidation (AOP) using ultraviolet light (UV) and hydrogen peroxide; and; (3) six-month residence time underground prior to withdrawal at any potable water supply well (as validated by a tracer study). The tracer study, which would be approved by DDW, would start after the first 3 months of operation. MRWPCA will ensure achievement of the pathogen reductions by monitoring the RTP and AWT Facility treatment system performance using operational parameters and surrogates per DDW requirements. |
| Nitrogen Control | The concentration of total nitrogen in recycled water must meet 10 milligrams per liter (mg/L) before or after subsurface application. Failure to meet this value requires follow-up sampling, notification to DDW and RWQCB, and/or discontinuation of recycled water use until a problem is corrected. | The GWR Project will meet the 10 mg/L total nitrogen limit in the AWT Facility purified water. The RO membrane treatment system will be the key process to remove nitrogen. The predicted total nitrogen concentration in the purified water produced by the AWT Facility would achieve an expected maximum total nitrogen concentration of 3.1 mg/L including all source waters, based on the piloting and source water monitoring. MRWPCA will determine compliance with the with the 10 mg/L limit by monitoring RO performance using operational parameters and by monitoring the quality of AWT Facility purified water. |
| Regulated Chemicals Control | The recycled water must meet primary and secondary drinking water maximum contaminant levels (MCLs). Failure to meet MCLs requires follow-up sampling, notification to DDW and RWQCB, and/or discontinuation of recycled water use until the problem is corrected. | The GWR Project will meet MCLs in the AWT Facility purified water. The results of the pilot testing based on the ozone-MF-RO portion of the AWT Facility and the expected benefits of full-scale treatment with AOP show that the water treated by RO and AOP would comply with all MCLs. Based on the results of the source water testing (e.g., the types of constituents detected above the MCLs) and pilot performance for these constituents, the inclusion of the additional source waters not used/treated by the pilot testing would also be able to be treated to meet the MCLs. MRWPCA will determine compliance with MCLs by monitoring treatment performance and the quality of the AWT Facility |

| | Requirements | Proposed Compliance Description |
|---|---|---|
| | | purified water. |
| Notification Levels (NLs) | The recycled water is monitored quarterly for NLs with accelerated monitoring if the result is greater than the NL; if the running 4-week average is greater than the NL for 16 consecutive weeks, the project sponsor must notify DDW and RWQCB. | Based on the results of the pilot testing and the inclusion of the AOP system, the full-scale AWT Facility will produce purified water below NLs, including the additional source waters to be treated. |
| Unregulated Chemicals Control | Control of unregulated chemicals for all groundwater replenishment projects using 100% AWT recycled water is accomplished through limits for total organic carbon (TOC) and performance of treatment for constituents of emerging concern (CECs). TOC is used as a surrogate for unregulated and unknown organic chemicals. For subsurface application projects, the entire recycled water flow must be treated using RO and AOP. After treatment, the TOC cannot exceed an average of 0.5 mg/L. Specific performance criteria for RO and AOP processes have been included in the Groundwater Replenishment Regulations. Failure to meet the requirements established for a groundwater replenishment project results in notifications to DDW and RWQCB, response actions, and in some cases cessation of the use of recycled water. | The GWR Project will address unregulated constituents by meeting TOC limits in the AWT Facility purified water and the AWT treatment performance criteria for RO and AOP. MRWPCA will monitor unregulated chemicals and surrogates specified by DDW after AOP and in the AWT Facility purified water. |
| Response Retention Time (RRT) | The intent of the RRT is to provide time to retain recycled water underground to identify any treatment failure so that inadequately treated recycled water does not enter a potable water system. Sufficient time must elapse to allow for: a response that will protect the public from exposure to inadequately treated water; and provide an alternative source of water or remedial treatment at the wellhead if necessary. The RRT is the aggregate period of time between: identifying that the recycled water is out of compliance, treatment verification samples or measurements; time to make the measurement or analyze the sample; time to evaluate the results; time to make a decision regarding the appropriate response; time to activate the response; and time for the response to become effective. The minimum RRT is 2 months, but must be justified by the groundwater replenishment project sponsor. | MRWPCA will develop a RRT taking into consideration the following safety features that are part of the GWR Project: (1) continuous online monitoring of RO treatment with real-time results reviewed by the AWT Facility operators; (2) multiple levels of critical control points for RTP and AWT Facility operations, alarms, and unit process redundancy; and (3) the ability to shut down the AWT Facility at a moment's notice. As part of the RRT development, MWRPCA will also consider the time necessary to provide an alternative water supply should DDW determine that the GWR Project has impacted a drinking water well so that it can no longer be used as a drinking water supply. The RRT would be validated by a tracer study approved by DDW. |
| Monitoring Program | Comprehensive monitoring programs are established for recycled water and groundwater for regulated and unregulated constituents. | MRWPCA will develop a monitoring program that satisfies DDW and RWQCB requirements for the RTP, AWT Facility, and groundwater for nitrogen, TOC, and regulated and unregulated constituents, including CECs. The monitoring program will be included in the approved groundwater replenishment permit for the GWR Project, including sampling locations, sampling frequencies, analytical methods, and reporting. |
| Operation and Optimization Plan | The intent of the plan is to assure that the facilities are operated to achieve compliance with the Groundwater Replenishment Regulations, to achieve optimal reduction of contaminants, and to identify how the project will be operated and monitored. | Prior to startup of the GWR Project, MRWPCA will develop and submit an Operations and Optimization Plan to DDW and the RWQCB that identifies the operations, maintenance, analytical methods, and monitoring necessary to meet DDW and RWQCB requirements. MRWPCA will update the Plan as necessary to make sure that it is representative of current operations, maintenance, and monitoring of the GWR Project. |

| | Requirements | Proposed Compliance Description |
|---|---|---|
| Response Plan | A project sponsor must obtain approval from DDW on a plan that describes the steps that will be taken to provide an alternative source of potable water to all users of a producing drinking water well or a DDW-approved treatment system for a well that as a result of a replenishment project as determined by DDW causes the well to violate drinking water standards, has been degraded so that is no longer a safe source of drinking water, or fails to meet the pathogen control requirements. | Prior to start-up of the GWR Project, MRWPCA will develop and submit a plan to DDW to provide an alternative source of water or a DDW-approved treatment system should the GWR Project impact a drinking water well so that it cannot be used was a water supply or the GWR Project fails to meet the pathogen control requirements. |
| Boundaries Restricting Locations of Drinking Water Wells | Project proponents must establish a "zone of controlled well construction," which represents the greatest of the horizontal and vertical distances reflecting the underground retention times required for pathogen control or for the RRT. Drinking water wells cannot be located in this zone. Project proponents must also create a "secondary boundary" representing a zone of *potential* controlled well construction that may be beyond the zone of controlled well construction, thereby requiring additional study before a drinking water well is drilled. | Based on the greater of the retention times established to meet the DDW pathogen control requirements or the RRT, MRWPCA will submit a map to DDW depicting the boundary representing the zone of controlled potable well construction and the secondary boundary. The map will also show the location of all monitoring wells and drinking water wells within a two-year travel time of the GWR Project. |
| Adequate Managerial and Technical Capability | A project sponsor must demonstrate that it possess adequate managerial and technical capability to comply with the regulations. The Safe Drinking Water Act (SDWA) requires public water systems to demonstrate their capability to provide a safe drinking water supply. To that end, DDW has developed a Technical Managerial and Financial Assessment (TMF) Form. For groundwater replenishment projects, DDW has indicated that project sponsors can use portions of the TMF form to demonstrate compliance with the managerial and technical capability requirements in the Groundwater Replenishment Regulations. | Prior to startup, MRWPCA will provide information demonstrating managerial and technical capability using the TMF Form; namely, information on certified operators, the operations plan, training, organization, the emergency response plan, and (as appropriate) policies. MRWPCA has operated an AWT pilot facility to demonstrate technical experience with operation of the AWT Facility and will provide DDW with an Operations and Optimization Plan for the GWR Project. |
| Engineering Report | The project sponsor must submit an Engineering Report to DDW and RWQCB that indicates how a groundwater replenishment project will comply with all regulations and includes a contingency plan to insure that no untreated or inadequately treated water will be used. The report must be approved by DDW. | MRWPCA will develop an Engineering Report that contains a description of the design of the GWR Project and clearly indicates how the GWR Project will comply with the Groundwater Replenishment Regulations. It is anticipated that the engineering report will be finalized and submitted to DDW in 2015. |
| Alternatives | Alternatives to any of the provisions in the Groundwater Replenishment Regulations are allowed if the project sponsor demonstrates that: the alternative provides the same level of public health protection; the alternative has been approved by DDW; and an expert panel has reviewed the alternative unless otherwise specified by DDW. | MRWPCA will not seek alternatives to any of the provisions of the Groundwater Replenishment Regulations. |
| ***SWRCB Policy and RWQCB Basin Plan Requirements*** | | |
| | **Requirement** | **Proposed Compliance Descriptions** |
| Anti-degradation Policy | The State Anti-degradation Policy requires that existing high quality (including groundwater be maintained to the maximum extent possible, but allows lowering of water quality if the change is consistent with maximum benefit to the people of the state, will not unreasonably effect present and anticipated use of such water, and will not result in water quality less than prescribed in policies. The Anti-degradation Policy also stipulates that any discharge to existing high quality | The GWR Project will meet the Anti-degradation Policy by creating purified water for injection that is of higher quality than the local groundwater, meets Basin Plan objectives, and protects groundwater beneficial uses; by utilizing advanced treatment technologies that result in best practicable treatment or control; and by recycling water, which in accordance with the State Recycled Water Policy is a maximum benefit to the people of the State. |

| | Requirements | Proposed Compliance Description |
|---|---|---|
| | waters will be required to meet waste discharge requirements which will result in the best practicable treatment or control of the discharge to ensure that (a) pollution or nuisance will not occur and (b) the highest water quality consistent with maximum benefit to the people of the State will be maintained. | |
| Recycled Water Policy | Assimilative Capacity - A groundwater replenishment project that utilizes less than 10% of the available assimilative capacity in a groundwater basin/sub-basin (or multiple projects utilizing less than 20% of the available assimilative capacity in a groundwater basin/sub-basin) is only required to conduct an anti-degradation analysis verifying the use of the assimilative capacity. In the event a project or multiple projects utilize more than the fraction of the assimilative capacity (e.g., 10% for a single project or 20% for multiple projects), the project proponent must conduct a RWQCB-deemed acceptable (and more elaborate) anti-degradation analysis. | The GWR Project would utilize less than 10% of the assimilative capacity and therefore does not require a more detailed anti-degradation analysis. The GWR Project purified water would be treated and stabilized to meet all drinking water quality objectives and other Basin Plan objectives. Further, the GWR Project purified water would be expected to have a higher quality water than ambient groundwater with respect to total dissolved solids (TDS), chloride, and nitrate. As such, the GWR Project will neither cause a violation of a groundwater quality standard nor adversely impact beneficial uses, and would have a beneficial effect on local groundwater quality. |
| | Impact on Contaminant Plumes – If necessary, a RWQCB may impose requirements on a proposed groundwater replenishment project that has a substantial adverse effect on the fate and transport of a contaminant plume (for example those caused by industrial contamination or gas stations. | No documented groundwater contamination or contaminant plumes have been identified in the GWR Project area. Therefore, injection associated with the GWR Project would not exacerbate existing groundwater contamination or cause plumes of contaminants to migrate. As a result, additional RWQCB requirements related to groundwater contaminants would not be necessary for the GWR Project. |
| | Dissolution of Contaminants - If necessary, a RWQCB may impose requirements on a proposed groundwater replenishment project that changes the geochemistry of an aquifer thereby causing the dissolution of naturally occurring constituents, such as arsenic, from the geologic formation into groundwater. | The risk of geochemical impacts from incompatibility would be addressed at the proposed AWT Facility by including a stabilization process to ensure that the purified water is stabilized, non-corrosive, and prevents dissolution in the geologic formation. |
| | CEC Monitoring - For subsurface injection projects, based on the recommendations of an expert panel, the Recycled Water Policy establishes a list of specific health-based CEC indicators, performance-based CEC indicators, and surrogates that must be monitored in recycled water after RO or after RO/AOP, depending on the specific indicator/surrogate. The Recycled Water Policy also establishes procedures for evaluating data and actions to be taken depending on the monitoring results. | MRWPCA will monitor the CECs and unregulated chemicals and surrogates in the AWT Facility purified water as specified by the Recycled Water Policy, and will evaluate data and implement any follow-up actions based on monitoring results. For performance indicator CECs, MRWPCA will compare water quality before treatment by RO/AOP and prior to injection. If the performance changes over time, MRWPCA will evaluate if there are changes in the incoming concentration of the CEC indicator or if RO/AOP treatment system performance has changed. For health indicator CECs, MRWPCA will compare the purified water quality to the Policy's Monitoring Trigger Levels (MTLs), and based on the results take follow up actions including additional monitoring, discussion with DDW and RWQCB, and implementing studies. |
| Basin Plan Requirements | Per the Basin Plan, the Seaside Groundwater Basin is suitable for agricultural (AGR), municipal and domestic supply (MUN), and industrial use. The Basin Plan establishes general narrative groundwater objectives for taste and odor and radioactivity that apply to all groundwater basins; for MUN, groundwater objectives | Based on the source water sampling, piloting testing results, and pertinent research, the purified water that would be produced by the RTP and full-scale AWT Facility would meet all Basin Plan objectives and guidelines. MRWPCA will confirm compliance with the Basin Plan by monitoring the quality of the |

| | Requirements | Proposed Compliance Description |
|---|---|---|
| | for bacteria and primary and secondary MCLs, and for AGR beneficial uses, groundwater guidelines and objectives to protect soil productivity, irrigation, and livestock watering and objectives for irrigation supply and livestock watering. | AWT Facility purified water and groundwater. |

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## 19. Acronyms

| | |
|---|---|
| AALs | Archived Action Levels |
| ADI | Acceptable Daily Intakes |
| AF | Acre-feet |
| AFY | Acre-feet per year |
| AGR | Agricultural Water Supply |
| AOP | Advanced oxidation process |
| ASR Project | Monterey Peninsula Aquifer Storage and Recovery Project |
| AWT | Advanced water treatment |
| BAF | Biologically activated filtration |
| CalAm | California American Water Company |

| | |
|---|---|
| CCR | California Code of Regulations |
| CDPH | California Department of Public Health |
| CECs | Constituents of Emerging Concern |
| CEQA | California Environmental Quality Act |
| CFR | Code of Federal Regulations |
| CHG | Certified Hydrogeologist |
| CSIP | Castroville Seawater Intrusion Project |
| CT | Chlorine residual in mg/L times contact time in minutes |
| CWA | Clean Water Act |
| CWC | California Water Code |
| d | day |
| DBPs | Disinfection by-products |
| DDW | Division of Drinking Water |
| DEET | N,N-diethyl-meta-toluamide |
| DWEL | Drinking Water Equivalent Level |
| EC | Electrical Conductivity |
| EIR | Environmental Impact Report |
| ER | Engineering report |
| GAC | Granular activated carbon |
| gpm | Gallons per minute |
| GWR | Groundwater replenishment |
| GWRS | Groundwater Replenishment System |
| H&SC | Health and Safety Code |
| IAP | Independent Advisory Panel |
| kg | kilogram |
| L | Liter |
| LOAEL | Lowest observed no adverse effect level |
| MCL | Maximum Contaminant Level |
| MCLG | Maximum Contaminant Level Goal |
| MCWD | Marina Coast Water District |
| MEC | Measured Environmental Concentration |
| mgd | Million gallons per day |
| mg/L | Milligrams per liter |
| $mJ/cm^2$ | Millijoules per square centimeter |
| mL | Milliliters |

| | |
|---|---|
| MF | Membrane filtration (or microfiltration) |
| MOU | Memorandum of Understanding Regarding Source Waters and Water Recycling |
| MPA | Masters of Public Administration |
| MPN/100 mL | Most probable number per 100 milliliters |
| MRL | Minimum Reporting Level |
| MRWPCA | Monterey Regional Water Pollution Control Agency |
| MTL | Monitoring Trigger Level |
| MUN | Municipal and Domestic Supply |
| N | Nitrogen |
| NAE | National Academy of Engineering |
| ND | Not detected |
| NDMA | N-nitrosodimethylamine |
| ηg/L | Nanograms per liter |
| NOAEL | No observed adverse affect level |
| NL | Notification Level |
| NPDES | National Pollutant Discharge Elimination System |
| NRC | National Academy of Sciences National Research Council |
| NTU | Nephelometric Turbidity Units |
| NWRI | National Water Research Institute |
| OCWD | Orange County Water District |
| P.E. | Professional Engineer |
| P.G. | Professional Geologist |
| Ph.D. | Doctor of Philosophy |
| PHG | Public Health Goal |
| PNEC | Predicted No Effect Concentrations |
| PoLi | Pesticides of local interest |
| QRRA | Quantitative Relative Risk Assessment |
| REHS | Registered Environmental Health Specialist |
| RO | Reverse osmosis |
| ROWD | Report of Waste Discharge |
| RRT | Response Retention Time |
| RTP | Regional Wastewater Treatment Plant |
| RWC | Recycled Water Contribution |
| RWQCB | Regional Water Quality Control Board |
| SAR | Sodium Adsorption Ratio |

| | |
|---|---|
| SAT | Soil aquifer treatment |
| SDWA | Safe Drinking Water Act |
| SNMP | Salt Nutrient Management Plan |
| SVGB | Salinas Valley Groundwater Basin |
| SVRP | Salinas Valley Reclamation Project |
| SWRCB | State Water Resources Control Board |
| TCEP | Tris(2-chloroethyl)phosphate |
| TDI | Tolerable Daily Intakes |
| TDS | Total Dissolved Solids |
| TOC | Total Organic Carbon |
| TMF | Technical Managerial and Financial Assessment |
| µg/L | micrograms per liter |
| µS/cm | Micro-siemens per centimeter |
| UIC | Underground Injection Control |
| USEPA | United States Environmental Protection Agency |
| UV | Ultraviolet light |
| WDRs | Waste Discharge Requirements |
| WRRs | Water Recycling Requirements |

## 20. Glossary

**Acre-foot** – A unit of volume that is one acre in area by one foot in depth.

**Advanced Oxidation** – A chemical oxidation process that relies on the production of a hydroxyl radical for the destruction of trace organic constituents found in water.

**Advanced Water Treatment** – Wastewater treatment technologies used to remove total dissolved solids, pathogens, trace organics, and or other trace constituents for specific reuse applications.

**Alkalinity** – The acid neutralizing capacity of solutes in a water sample, reported in mill equivalents of calcium carbonate per liter.

**Anthropogenic** – Being derived from human activities, as opposed to those occurring in natural environments without human influences.

**Aquifer** – A geologic formation under the ground that is saturated with groundwater and sufficiently permeable to allow movement of quantities of water to wells and springs.

**Assimilative Capacity** – The condition in which existing water quality is better than that required to support the most sensitive beneficial use(s) of a groundwater basin, i.e., a contaminant concentration in groundwater is below the applicable water quality objective. It is also the difference between water quality objectives and average ambient groundwater quality in the groundwater basin.

**Biologically Activated Filtration** – Biological filters that remove contaminants by three main mechanisms: biodegradation, adsorption, and filtration of suspended solids.

**Brine** – A waste stream containing elevated concentrations of total dissolved solids.

**California Environmental Quality Act (CEQA)** – A California law that requires State and local agencies determine the potential significant environmental impacts of proposed projects and identify measures to avoid or mitigate these impacts where feasible. The CEQA Guidelines, which provide the protocol by which State and local agencies comply with CEQA requirements, are detailed in California Code of Regulations, Title 14 § 15000 et seq. The basic purposes of CEQA are to: (1) inform decision makers and public about the potential significant environmental effects of a proposed project, (2) identify ways that environmental damage may be mitigated, (3) prevent significant, avoidable damage to the environment by requiring changes in projects, through the selection of alternative projects or the use of mitigation measures when feasible, and (4) disclose to the public why an agency approved a project if significant effects are involved (California Code Regulations, Title 14, § 15002(a)).

**Concentrate** – The portion of a feed stream that retains the constituents that were rejected during reverse osmosis treatment.

**Constituent** – A term used to describe either a chemical or compound.

**Constituents of Emerging Concern** – Constituents of emerging concern are generally chemicals for which there are no established water quality standards. These chemicals may be present in waters at very low concentrations and are now detected as the result of more sensitive analytical methods. CECs include several types of chemicals such as pesticides, pharmaceuticals and ingredients in personal care products, veterinary medicines, endocrine disruptors, and others.

**Clean Water Act** – Federal law that is the cornerstone of surface water quality protection in the United States. The statute employs a variety of regulatory and non-regulatory tools to reduce direct pollutant discharges into waterways, finance municipal wastewater treatment facilities, and manage polluted runoff.

**Conductivity** – A measure of the ability of an aqueous solution to carry an electric current.

***De Minimis* Risk** – A level of risk that the scientific and regulatory community asserts is too insignificant to regulate.

**Disinfection By-products** – Chemicals that are formed with the residual matter found in treated reclaimed water as a result of the addition of a strong oxidant, such as chlorine or ozone, for the purpose of disinfection.

**Environmental Impact Report (EIR)** – An EIR is a detailed report written by the lead agency describing and analyzing the significant environmental effects of a proposed project, identifying alternatives and discussing ways to reduce or avoid the possible environmental damage.

**Endocrine Disrupting Chemicals** – Synthetic and natural compounds that mimic, block, stimulate or inhibit natural hormones in the endocrine systems of animals, humans, and aquatic life.

**Epidemiology** – The study of disease patterns in human populations.

**Flux** – The flow rate per unit of membrane surface area.

**Groundwater** – Water found in the spaces between soil particles and cracks in rocks underground.

**Groundwater Gradient** – The slope of the water table.

**Groundwater Mounding** – An outward and upward expansion of the free water table caused by surface or sub-surface recharge. Mounding can alter groundwater flow rates and direction; however, the effects are usually localized and may be temporary, depending upon the frequency and duration of the surface recharge events.

**Groundwater Replenishment** – The process of adding a water source such as recycled water to aquifers under controlled conditions to supplement groundwater or act as a barrier to prevent seawater from entering the aquifer. Water can be recharged by infiltration in spreading basins, injection wells, or vadose zone wells.[45]

**Indicator** – An individual compound or chemical that represents the physical, chemical, and biodegradable characteristics of a specific family of trace organics.

***In vitro*** – Biological studies that take place in isolation from a living organism, such as a test tube or Petri dish.

***In vivo*** – Biological studies that take place within a living organism.

**Maximum Contaminant Levels (MCLs)** – The highest level of a contaminant that is allowed in drinking water and is protective of human health.

**Membrane** – A membrane is thin layer of material that will only allow certain constituents to pass through it. Which material will pass through the membrane is determined by the size and the chemical characteristics of the membrane and the material being filtered.

**Membrane Treatment (or Microfiltration)** – A treatment system that passes liquid through semipermeable membranes to exclude suspended solids (typically solids that are larger than 0.03 to 0.3 $\mu$m).

**Microgram per liter** – A concentration unit of measurement that is one millionth of a gram per volume of water in liters. It is equivalent to one part per billion.

**Milligram per liter** – A unit of measurement that is one thousandth of a gram per volume of water in liters. It is equivalent to one part per million.

**Minimum Reporting Level** – An estimate of the lowest concentration of a compound that can be detected in a sample for which the concentration can be quantified and reported with a reasonable degree of accuracy and precision.

**Monitoring Well** – Specially constructed wells used for collecting representative samples of ground water for water quality testing.

**Most Probable Number** – An index of the number of coliform bacteria that, more probably than any other number, would give the results shown by laboratory examination; it is not an actual enumeration.

**Nanogram per liter** – A unit of measurement that is one billionth of a gram per volume of water in liters. It is equivalent to a part per trillion.

**National Pollutant Discharge Elimination System (NPDES) Permit** – Permit required for all point sources discharges of pollutants to surface waters.

**Notification Levels (NLs)** – Health-based advisory levels established by the State Water Resources Control Board Division of Drinking Water for chemicals in drinking water that lack Maximum Contaminant Levels. When chemicals are found at concentrations greater than their NLs, certain requirements and recommendations apply to drinking water purveyors.

**Ozonation** – A chemical oxidation treatment process that uses ozone to react with contaminants in water. It is also used for disinfection.

**Pathogens –** Microorganisms including bacteria, protozoa, helminthes, and viruses capable of causing disease in animals and humans.

**Percolation** – The flow or filtering of water or other liquids through subsurface rock or soil layers, usually continuing to groundwater.

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[45] Note: The CWC defines groundwater recharge as follows: "Indirect potable reuse for groundwater recharge" means the planned use of recycled water for replenishment of a groundwater basin or an aquifer that has been designated as a source of water supply for a public water system, as defined in Section 116275 of the Health and Safety Code.

**Permeate** – The liquid stream that passes through a membrane.

**Pesticide** – (a) Chemical used to kill destructive insects or other small animals. (b) A general term for insecticides, herbicides and fungicides. Insecticides kill or prevent the growth of insects. Herbicides control or destroy plants. Fungicides control or destroy fungi. Some pesticides can accumulate in the food chain and contaminate the environment.

**pH** – A measure of the acidity or alkalinity of a substance.

**Pilot-scale Treatment Studies** – Studies that typically use treatment units that are significantly smaller than needed for full-scale operation, but that are large enough to accurately represent treatment behavior at full-scale. They can be used to evaluate the effectiveness of different types of treatment processes or different vendors of the same treatment process.

**Protozoa** – Single celled organisms such as *Giardia* and *Cryptosporidium*.

**Plume** – A body of contaminated groundwater flowing from a specific source.

**Potable Reuse** – The planned use of recycled water to augment drinking water supplies.

**Publicly Owned Treatment Work** – A wastewater treatment plant owned by a state or municipality.

**Primary Maximum Contaminant Level** – Numeric standards or treatment technologies established by the United States Environmental Protection Agency and the California Department of Public Health to protect public health.

**Primary Treatment** – A treatment process that allows for heavier solids in raw sewage to settle to the bottom of a tank and for the lighter materials, like plastic and grease, which float to the top, to be skimmed and removed and recycled back into the treatment process.

**Priority Pollutants** – The 126 chemical pollutants regulated by the U.S. Environmental Protection Agency. The current list chemicals can be found in Appendix A of Section 40 of the Code of Federal Regulations, Part 423.

**Purified Water** – Recycled water that has been produced using advanced treatment.

**Quality Assurance/Quality Control** – A set of operating principles that, if strictly followed during sample collection and analysis, will produce data of known and defensible quality.

**Quality of the water** – Refers to chemical, physical, biological, bacteriological, radiological, and other properties and characteristics of water that affect its use.

**Recycled Water** – Domestic or municipal wastewater which has been treated to a quality suitable for a beneficial use.

**Redundancy** – The use of multiple treatment barriers for the same contaminant, so that if one fails, performs ineffectively, or is taken off-line for maintenance, the system still effectively performs and risk is reduced

**Reliability** – For direct potable reuse, to consistently achieve the desired water quality. A reliable system is redundant, robust and resilient.

**Reverse Osmosis** – A treatment process where pressure greater than the osmotic pressure is applied to water to drive the more concentrated solution to the other side of the membrane and the membrane acts as a barrier to contaminants, such as salts. The permeate water passes through the membrane and has reduced contaminant concentration. A reject flow stream is produced that contains salts and other constituents rejected by the membrane process.

**Runoff** – Rainfall or snow melt which is not absorbed by soil, evaporated, or transpired by plants, but finds its way into streams as surface flow.

**Safe Drinking Water Act** – The main federal law that ensures the quality of United States drinking water.

**Salinity** – Of, characteristic of, or containing common salt, or sodium chloride; salty.

**Salt Water Intrusion** – The invasion of a body of fresh water (surface or ground water) by a body of salt water.

**Secondary Maximum Contaminant Level** – Water quality standard established to manage drinking water for aesthetic considerations, such as taste, color, and odor. Contaminants with only secondary MCLs are not considered to pose a risk to human health.

**Secondary Treatment** – A biological treatment process used for the removal of soluble organic matter and particulates using microorganisms. The microorganisms form flocculant particles that are separated from the water using sedimentation (settling), and the settled material is returned to the biological process or wasted.

**Surrogate** – A measurable physical or chemical property that has can be used to measure the effectiveness of trace organic removal by a treatment process. For example, a reverse osmosis treatment process is expected to substantially reduce the electrical conductivity (salinity) of the recycled water being treated. Surrogates, such as coliforms, are also used in place of directly measuring pathogens.

**Tertiary Recycled Water** – Recycled water that has been processes using tertiary treatment and meets requirements in California Code of Regulations, Title 22.

**Tertiary Treatment** – A treatment process where wastewater that has undergone secondary treatment is processed using granular media or carbon filters and then disinfected.

**Total Dissolved Solids** – An overall measure of the minerals in water. Total salinity is commonly expressed in terms of TDS as milligrams per liter (mg/L). Elevated TDS concentrations above the Secondary Maximum Contaminant Level of 1,000 mg/L are undesirable for aesthetic reasons related to taste, odor, or appearance of the water and not for health reasons.

**Total Nitrogen** – The sum of organic nitrogen, nitrate, nitrite, and ammonia expressed as nitrogen.

**Total Organic Carbon** – The concentration of organic carbon present in water, both dissolved and suspended.

**Tracer** – A non-reactive substance, with measurable characteristics distinctly different from the receiving groundwater. Tracers can be added to recycled water or intrinsically present in recycled water.

**Treatment** – Any process that changes the physical, chemical, or biological character of a water or wastewater.

**Treatment Process –** A combination of treatment operations and processes used to produce water meeting specific water quality levels.

**Ultraviolet** – UV irradiation is the process by which chemical bonds of the contaminants are broken by the energy associated with UV light (photolysis). UV also has germicidal properties and is used for disinfection.

**Vadose Zone** (also called **Unsaturated** zone) – The area between the land surface and the regional groundwater table (upper surface of the groundwater).

**Vadose Zone well** – A vadose zone well is an injection well installed in the unsaturated zone above the water table. These wells typically consist of a large-diameter borehole with a casing/screen assembly installed with a filter pack. The well is used as a conduit for transmitting water into the subsurface, allowing infiltration into the vadose zone through the well screen and percolation to the underlying water table.

**Water Quality** – A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.

**Water Quality Standards** – Beneficial uses of groundwater and water quality objectives to protect beneficial uses.

**Wastewater** – Liquid waste discharged from municipal activities, including residential, commercial, and industrial activities.

**Well Yield** – The amount of water that can be pumped from a given well per unit of time.

# Appendix A
# June 5, 2014 Letter from the Division of Drinking Water Regarding the Pure Water Monterey Groundwater Replenishment Project Concept

State of California—Health and Human Services Agency
California Department of Public Health

RON CHAPMAN, MD, MPH
Director & State Health Officer

EDMUND G. BROWN JR.
Governor

June 5, 2014

Robert Holden, Principal Engineer
Monterey Regional Water Pollution Control Agency
5 Harris Court, Building D
Monterey, CA 93940

Dear Mr. Holden:

**Pure Water Monterey Groundwater Replenishment Project Concept**
**Monterey Regional Water Pollution Control Agency- Recycled Water System No. 2790002**

The California Department of Public Health (CDPH) has reviewed the DRAFT May 19, 2014 *Monterey Regional Water Pollution Control Agency, Pure Water Monterey Groundwater Replenishment Project, Proposal to Inject Highly-Treated Recycled Water into the Seaside Groundwater Basin*. The purpose of this letter is to respond to the Monterey Regional Water Pollution Control Agency (MRWPCA)'s request for CDPH review and approval of the project concept. CDPH has developed draft groundwater replenishment regulations. MRWPCA has committed to meet the requirements specified in the CDPH draft groundwater replenishment regulations.

The MRWPCA proposed project for groundwater injection will involve injecting highly-treated recycled water from a proposed new advanced water treatment facility (AWTF) into the Seaside Groundwater Basin. The AWTF would receive secondary effluent from the MRWPCA Regional Treatment Plant (RTP) as source water for treatment. The following is a list of the proposed AWTF processes:

- ozonation,
- biologically active filtration (optional),
- membrane filtration (MF) treatment,
- reverse osmosis (RO) membrane treatment, and
- advanced oxidation process using ultraviolet light and hydrogen peroxide ($H_2O_2$).

The proposed pathogen reduction credits for the unit processes and underground retention time are shown in Table 1, *Proposed Pathogen Reduction Credits for AWT Processes* in the Draft Proposal. These pathogen reduction credits must be substantiated in the engineering report and operations plan. Please note that RO via online TOC or conductivity monitoring can only demonstrate 1.0 to 1.5 log removal rather than 2 log removal. Still, the log reduction credits for viruses, Giardia, and Cryptosporidium should far exceed the log reduction requirements in the draft CDPH groundwater replenishment regulations. The extra log removal credits will provide an additional safeguard to ensure adequate pathogen reduction.

To obtain CDPH approval for an actual project, MRWPCA must provide an adequate basis for CDPH to make a finding that the project meets the requirements in the Health & Safety Code (H&S Code). CDPH has authority to condition a permit (H&S Code Section 116540) "as it deems necessary to assure a reliable and adequate supply of water at all times that is pure, wholesome, potable, and does not endanger the health of consumers". Nothing in this letter is intended to waive CDPH's authority.

Based on CDPH's review of MRWPCA's draft concept proposal, CDPH has concluded that the project, as conceived, when properly designed, constructed, and operated, should meet the requirements in the draft CDPH groundwater replenishment regulations. Therefore, CDPH conditionally approves the *Pure Water Monterey Groundwater Replenishment Project, Proposal to Inject Highly-Treated Recycled Water into the Seaside Groundwater Basin* Draft Concept. At a minimum, the conditions and future submittal requirements are described below.

**Future Submittals**
In order for CDPH to make the finding that the project poses no significant threat to public health and recommend issuance of a permit, MRWPCA will need to provide the additional information outlined below, including, but not limited to: engineering report, the final design, contingency plan, operations plan, response plan, water quality monitoring plan, and monitoring well locations.

Engineering Report, Final Design and Contingency Plan
Once project details are finalized, the project's Engineering Report must be submitted to CDPH for review and approval. Please refer to the current draft recharge regulations for guidance on content. Final design must be reviewed and approved before start of construction. The Engineering Report must contain an AWTF contingency plan which will assure that no untreated or inadequately-treated wastewater will be delivered to the use area.

Operations Plan
An Operations Plan must be developed to optimize individual treatment unit processes. Real-time monitoring with online instruments must be implemented to track, verify, and optimize performance of critical treatment processes in order to protect public health. The current demonstration project should provide data that would assist in accomplishing this. Full-scale commissioning and startup testing should finalize the treatment optimization process and be incorporated in the final Operations Plan.

Response Plan
Prior to operation, MRWPCA must submit a response plan for review and approval that will be implemented if needed to respond to a failure to meet product water quality requirements. The response plan should describe the steps to provide either:

1. an alternative source of drinking water supply to all users of a drinking water well, or
2. an approved treatment mechanism provided to all owners of a drinking water well

Water Quality Monitoring and Operational Reliability
Prior to discharge to Seaside Groundwater Basin, MRWPCA must develop and submit for approval a comprehensive Water Quality Monitoring Plan to determine compliance with all drinking water maximum contaminant levels (MCLs) and other pertinent standards. In addition, the Monitoring Plan shall include a sampling and analytical strategy for chemicals for which CDPH has established notification levels. To ensure proper performance of unit operations, full-scale commissioning and startup testing is required. This will confirm appropriate surrogate parameters and performance

indicator compounds that are tailored to monitor the contaminant removal efficiency of individual unit processes.

Seaside Groundwater Basin and Monitoring Well Requirements
The number and proper location of monitoring wells must be justified. Based on information provided to date, an additional set of monitoring wells may be needed to evaluate water quality along the path of flow from the GWR Well Site #3 to the ASR Wells 1 and 2. CDPH understands that MRWPCA intends to perform a tracer study to determine travel time to the nearest drinking water wells and confirm the theoretical estimates from the modeling.

Technical and Managerial Capacity, with Focus on Treatment Plant Operators
Adequate technical and managerial capacity must be demonstrated by the MRWPCA for the project. The MRWPCA must hire, train, and retain a sufficient number of qualified operators. A response/contingency plan including communication and notification procedures must be developed to address serious water quality problems arising from treatment plant failures that could compromise the use of Seaside Groundwater Basin as a source of drinking water.

CDPH staff will continue to be available to your staff for technical discussions and to answer questions on CDPH's requirements for the project.

If you have any questions, please feel free to contact Jan Sweigert at (831) 655-6934 or myself at (510) 620-3474.

Sincerely,

Stefan Cajina, P.E., Chief
North Coastal Region
Drinking Water Program

cc: Peter vonLangen
Central Coast Regional Water Quality Control Board
895 Aerovista Place, Suite 101
San Luis Obispo, CA 93401

Monterey County Environmental Health Bureau
1270 Natividad Road
Salinas CA 93906

# Appendix B

## All Analytes Included in the Source Water Sampling Program that were Detected in at Least One Sample of Any of the Untreated Source Waters

| Sampling Constituent | Contaminant List | Analytical Method | Units | CDPH MCL/NL | RTP Effluent | | Ag Wash Water | | Blanco Drain | | Lake El Estero | | Tembladero Slough |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | |
| ***General Water Quality Parameters*** | | | | | | | | | | | | | |
| Aggressiveness Index | – | SM2330 | - | – | 12.4 (12-12.4) | 4 / 4 | 11.8 (11.3-12) | 3 / 3 | 13.3 (13.2-14) | 4 / 4 | 13.0 (12.8-13.1) | 2 / 2 | 13.3 |
| Alkalinity (in CaCO3 units) | – | SM 2330B | mg/L | – | 316 (277-344) | 12 / 12 | 168 (157-280) | 3 / 3 | 358 (327-373) | 4 / 4 | 186 (157-212) | 2 / 2 | 363 |
| -Bicarbonate alkalinity as HCO3 | – | SM 2330B | mg/L | – | 384 (338-420) | 9 / 9 | 205 (192-310) | 3 / 3 | 427 (399-455) | 4 / 4 | 228 (192-259) | 2 / 2 | 443 |
| Ammonia as N | – | SM 4500NH3F,G | mg/L | – | 32.8 (31.3-38.7) | 11 / 11 | 5.0 (2.4-7.6) | 2 / 2 | *(<0.05–<0.5)* | 1 / 3 | *<0.05* | 0 / 1 | *<0.5* |
| Anion sum | – | SM 1030E | meq/L | – | 14.49 (14.05-15.81) | 9 / 9 | 16 (13.51-18.1) | 3 / 3 | 30.38 (17.48-30.89) | 4 / 4 | 15.18 | 1 / 1 | |
| BOD, 5-day @ 20°C | – | SM 5210B | mg/L | – | 84 (10-180) | 12 / 12 | 483 (58-858) | 10 / 10 | <2 (<2-5) | 4 / 11 | 14 | 1 / 1 | <2 |
| Bromide | – | EPA 300.0 | mg/L | – | *<0.2 (<0.1-0.5)* | 10 / 11 | *<0.2 (<0.1-4.8)* | 8 / 9 | 1.8 (1.2-2.8) | 10 / 10 | 0.8 | 1 / 1 | 2.6 |
| Calcium | – | EPA 200.7 | mg/L | – | 58 (54-62) | 12 / 12 | 81 (78-100) | 10 / 10 | 155 (128-189) | 11 / 11 | 100 (77-122) | 2 / 2 | 166 |
| Cation sum | – | SM 1030E | meq/L | – | 14.19 (13-15.28) | 9 / 9 | 18 (15.25-18.01) | 3 / 3 | 28.37 (19.32-30.18) | 4 / 4 | 14.2 | 1 / 1 | |
| Chemical Oxygen Demand (COD) | – | EPA 410.4/Hach 8000 | mg/L | – | 110 (33-158) | 12 / 12 | 1004 (260-1152) | 10 / 10 | 48 (<5-183) | 9 / 11 | 92 | 1 / 1 | 23 |
| Chloride | sMCL | EPA 300.0 | mg/L | 250 | 217 (183-236) | 12 / 12 | 237 (164-292) | 9 / 9 | 274 (241-307) | 10 / 10 | 423 (332-514) | 2 / 2 | 384 |
| Color | sMCL | SM 2120B | units | 11 | 60 (45-75) | 4 / 4 | 170 (150-175) | 3 / 3 | 73 (45-85) | 4 / 4 | 75 | 1 / 1 | 175 |
| Conductivity (Specific Conductance) | sMCL | SM 2510B | µS/cm | 900 | 1578 (1508-1623) | 12 / 12 | 1625 (1278-1830) | 10 / 10 | 2881 (2647-2828) | 11 / 11 | 2083 (1607-2558) | 2 / 2 | 2839 |
| Copper | sMCL, EPA PP | EPA 200.8 | mg/L | 1.3/1.0 | *<0.0096 (0.009–<0.01)* | 2 / 4 | 0.012 (<0.01-0.073) | 2 / 3 | *<0.01 (<0.01-0.013)* | 2 / 4 | *<0.009 (0.008–<0.01)* | 1 / 2 | *<0.01* |
| Dissolved organic carbon (DOC) | | SM 5310C | mg/L | -- | 14 (12-14) | 10 / 10 | 280 (100-320) | 9 / 9 | 3.2 (2.8-8.2) | 10 / 10 | 11 | 1 / 1 | 7.9 |
| Dissolved oxygen (DO) | – | Field/SM4500-O | mg/L | -- | 7.6 (5.8-10.5) | 11 / 11 | 7.8 (3.9-8.5) | 9 / 9 | 8.5 (6.9-13.3) | 10 / 10 | 10.8 | 1 / 1 | 6.8 |
| Foaming Agents (MBAS) | sMCL | SM 5540C | mg/L | 0.5 | 0.17 (0.16-0.18) | 2 / 2 | 0.068 (0.05-0.082) | 2 / 3 | 0.11 (0.07-0.14) | 2 / 2 | | 0 / 1 | |
| Iron | sMCL | EPA 200.7 | mg/L | 0.3 | 0.339 (0.175-0.537) | 12 / 12 | 0.43 (0.3-0.876) | 3 / 3 | 1.563 (0.639-3.881) | 4 / 4 | 0.355 (0.202-0.508) | 2 / 2 | 2.862 |
| Langelier Index (15C) | – | SM 2330B | - | -- | 0.44 (0.41-0.48) | 4 / 4 | 0.34 | 1 / 1 | 1.22 (1.07-1.9) | 4 / 4 | 1.22 (1.06-1.37) | 2 / 2 | |
| Magnesium | – | EPA 200.7 | mg/L | – | 22 (20-24) | 12 / 12 | 34 (28-38) | 4 / 4 | 146 (140-177) | 5 / 5 | 42 (32-52) | 2 / 2 | 169 |
| Manganese | sMCL, NL | EPA 200.8 | mg/L | 0.5/0.5 | 0.045 (0.034-0.061) | 12 / 12 | 0.049 (0.038-0.061) | 3 / 3 | 0.243 (0.08-0.448) | 4 / 4 | 0.281 (0.219-0.342) | 2 / 2 | 0.108 |
| Nitrate (as NO3) | pMCL | EPA 300.0 | mg/L | 45 | 21.5 (<1-42) | 11 / 12 | 22.5 (<1.1-28) | 9 / 10 | 282 (70.3-352) | 11 / 11 | *<1* | 0 / 2 | 256 |
| Nitrite (as N) | pMCL | EPA 300.0 | mg-N/L | 1 | 1.4 (0.4-2.2) | 12 / 12 | 0.8 (<0.1-1.5) | 3 / 5 | 0.3 (0.2-0.8) | 8 / 8 | <0.1 | 0 / 2 | 0.5 |
| Nitrate+Nitrite (sum as N) | pMCL | EPA 300.0 | mg-N/L | 10 | 6.5 (2.3-11) | 11 / 11 | 6.2 (<0.1-7.7) | 4 / 5 | 69.8 (63-77.3) | 8 / 8 | *<0.1 (<0.1-0.1)* | 1 / 2 | 58 |
| Odor-Threshold | sMCL | SM 2150B | units | 3 | 18 (8-200) | 4 / 4 | 300 (200-350) | 3 / 3 | 7 (2-40) | 4 / 4 | 2 | 1 / 1 | 2 |
| Oil and Grease | – | EPA 1664 | mg/L | -- | <5 | 0 / 4 | <5 *(<5-7)* | 1 / 3 | *<5* | 0 / 4 | <5 | 0 / 1 | |
| pH | – | SM 2330B/SM4500H+B | pH | -- | 7.76 (7.34-8) | 12 / 12 | 6.86 (6.46-7.3) | 10 / 10 | 8.1 (7.7-8.6) | 11 / 11 | 8.3 | 2 / 2 | 8 |
| Phosphate (Orthophosphate as P) | – | EPA 300.0 | mg/L | – | 3.1 (2.2-13) | 11 / 11 | 15.8 (3.1-47.2) | 9 / 9 | *<0.1 (<0.1-0.2)* | 2 / 10 | <0.1 | 0 / 2 | *<0.1* |

| Sampling Constituent | Contaminant List | Analytical Method | Units | CDPH MCL/NL | RTP Effluent | | Ag Wash Water | | Blanco Drain | | Lake El Estero | | Tembladero Slough |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | |
| Potassium | – | EPA 200.7 | mg/L | – | 21 (18-23) | 12 / 12 | 36 (32-42) | 5 / 5 | 2.3 (1-2.7) | 8 / 8 | 7.8 (6.2-9.3) | 2 / 2 | 4.9 |
| Settleable Solids | – | SM 2540F | mL/L | – | <0.1 (<0.1-0.2) | 2 / 4 | 0.7 (<0.1-1.75) | 2 / 3 | <0.1 (<0.1-0.2) | 1 / 4 | <0.1 | 0 / 1 | <0.1 |
| Silica | – | EPA 200.7 | mg/L | – | 40.5 (39-44) | 12 / 12 | 44 (41-48) | 10 / 10 | 29 (28-83) | 11 / 11 | <0.5 | 0 / 1 | 30 |
| Silver | sMCL, EPA PP | EPA 200.8 | mg/L | 0.1 | <0.01 | 0 / 4 | <0.01 | 0 / 3 | <0.01 | 0 / 4 | <0.01 | 0 / 2 | <0.01 |
| Sodium | – | EPA 200.7 | mg/L | – | 161 (144-173) | 12 / 12 | 177 (133-201) | 9 / 9 | 241 (199-288) | 10 / 10 | 235 (174-296) | 2 / 2 | 333 |
| Sulfate | sMCL | EPA 300.0 | mg/L | 250 | 88 (83-151) | 12 / 12 | 170 (153-172) | 3 / 3 | 523 (488-530) | 4 / 4 | 157 (127-186) | 2 / 2 | 412 |
| Temperature | – | Field/SM 2550B | °C | – | 12.3 (6.1-25.8) | 10 / 11 | 12.8 (7.7-16) | 9 / 9 | 15.5 (8.7-25) | 10 / 10 | 19 | 1 / 1 | 18 |
| Total Dissolved Solids (TDS) | sMCL | EPA 160.1/SM 2540C | mg/L | 500 | 783 (771-803) | 12 / 12 | 1282 (787-1581) | 10 / 10 | 2003 (1822-2068) | 11 / 11 | 1228 (948-1508) | 2 / 2 | 1988 |
| Total hardness as CaCO3 | – | SM 2340B | mg/L | – | 233 (220-250) | 10 / 10 | 358 (318-420) | 4 / 4 | 981 (908-1118) | 5 / 5 | 422 (324-519) | 2 / 2 | 1089 |
| Total Kjehldahl Nitrogen (TKN) | – | EPA 351.2/SM 4500B,C | mg/L | – | 37.2 (23.8-42.7) | 12 / 12 | 19.5 (12.5-43.8) | 10 / 10 | <0.5 (<0.2-8.8) | 4 / 11 | 1.2 | 1 / 1 | <1 |
| Total Nitrogen | – | calculation | mg/L | – | 44.2 (26.8-50.5) | 12 / 12 | 25.3 (18-51.1) | 5 / 5 | 70.1 (63-77.3) | 8 / 8 | 1.3 | 1 / 1 | 58 |
| Total Organic Carbon (TOC) | – | SM 5310C | mg/L | – | 15 (12-17) | 12 / 12 | 295 (88-340) | 10 / 10 | 3 (2.5-11) | 11 / 11 | 14 | 1 / 1 | 8.8 |
| Total Phosphorus as P | – | SM 4500-PE/EPA 365.1 | mg/L | – | 3.9 (3.4-4.3) | 4 / 4 | 45 (6.9-46) | 3 / 3 | 0.36 (0.3-0.68) | 4 / 4 | 0.39 | 1 / 1 | 0.82 |
| Dissolved Phosphorus | – | SM 4500-PE/EPA 365.1 | mg/L | – | 4.1 (3.4-8.8) | 4 / 4 | 17 (6.4-27) | 2 / 2 | 0.27 (0.26-0.47) | 3 / 3 | 0.28 | 1 / 1 | 0.65 |
| Total Suspended Solids (TSS) | – | SM 2540D | mg/L | – | <5 (5-<10) | 11 / 12 | 98 (54-140) | 10 / 10 | 48 (16-336) | 11 / 11 | 18 | 1 / 1 | 82 |
| Turbidity | sMCL | EPA 180.1 | NTU | 5 | 3.2 (1.5-4.8) | 12 / 12 | 51 (28-72) | 10 / 10 | 28 (7.1-160) | 11 / 11 | 15 (12-18) | 2 / 2 | 50 |
| UV-254 Absorbance | – | SM 5910 | $cm^{-1}$ | – | 0.208 (0.189-0.228) | 12 / 12 | 0.278 (0.207-0.488) | 3 / 3 | 0.225 (0.188-0.263) | 4 / 4 | 0.279 | 1 / 1 | 0.318 |
| UV Transmittance | – | calculation | % | – | 62% (58%-65%) | 12 / 12 | 53% (33%-82%) | 3 / 3 | 60% (58%-63%) | 4 / 4 | 53% | 1 / 1 | 48% |
| Zinc | sMCL, EPA PP | EPA 200.8 | mg/L | 5 | <0.018 (0.018-<0.05) | 1 / 4 | 0.112 (0.062-0.135) | 3 / 3 | (<0.01-<0.05) | 1 / 4 | 0.032 (0.022-0.042) | 2 / 2 | |
| ***Microbiological Quality*** | | | | | | | | | | | | | |
| *Cryptosporidium* | – | EPA 1623 | oocysts/L | TT | 0.39 (<0.10-0.8) | 3 / 4 | <0.35 | 0 / 3 | <0.19 (<0.15-0.2) | 1 / 4 | <0.3 | 0 / 1 | <0.09 |
| *Giardia* | – | EPA 1623 | cysts/L | - | <0.1 (<0.1-0.2) | 1 / 4 | <0.35 | 0 / 3 | <0.15 | 0 / 4 | <0.3 | 0 / 1 | <0.09 |
| Total coliform | pMCL | SM 9223B | MPN/100mL | TT | $7.3x10^5$ ($1.9x10^3$-$1.6x10^6$) | 9 / 11 | $7.7x10^5$ ($8.2x10^3$-$9.8x10^7$) | 2 / 3 | $7.3x10^4$ ($8.4x10^3$-$2.0x10^5$) | 4 / 4 | $3.6x10^3$ | 1 / 1 | $1.7x10^4$ |
| *E. coli* | pMCL | SM 9223B | MPN/100mL | TT | $1.8x10^5$ ($2.8x10^4$-$6.8x10^5$) | 11 / 11 | <$2x10^1$ ($1.8x10^1$-<$1.0x10^2$) | 1 / 3 | $2.7x10^2$ ($7.6x10^1$-$2.0x10^3$) | 4 / 4 | <$1.0x10^2$ | 0 / 1 | $7.6x10^2$ |
| Enterococcus | – | SM 9230B | MPN/100 mL | - | $2.3x10^4$ ($3.7x10^3$-$8.2x10^4$) | 4 / 4 | <$2x10^1$ ($2.0x10^1$-<$1.0x10^2$) | 2 / 3 | $1.8x10^2$ ($1.0x10^1$-$2.2x10^2$) | 4 / 4 | $2.0x10^2$ | 1 / 1 | $8.4x10^1$ |
| ***DDW Drinking Water Maximum Contaminant Levels (MCLs) - primary MCLs (pMCLs) and secondary MCLs (sMCLs)*** | | | | | | | | | | | | | |
| ***MCLs – Inorganics*** | | | | | | | | | | | | | |
| Aluminum | pMCL, sMCL, EPA CCL | EPA 200.8 | mg/L | 1/0.2 | 0.048 (0.021-0.256) | 10 / 11 | 0.237 (0.14-0.588) | 3 / 3 | 0.77 (0.28-2.04) | 4 / 4 | 0.298 (0.189-0.402) | 2 / 2 | 1.54 |
| Antimony | pMCL, EPA PP | EPA 200.8 | mg/L | 0.006 | <0.001 | 0 / 4 | <0.001 | 0 / 3 | <0.001 | 0 / 4 | <0.001 (<0.001-0.001) | 1 / 2 | 0.001 |
| Arsenic | pMCL, EPA PP | EPA 200.8 | mg/L | 0.01 | 0.0025 (0.002-0.0041) | 4 / 4 | 0.0039 (0.003-0.004) | 3 / 3 | 0.0075 (0.007-0.0085) | 4 / 4 | 0.004 | 2 / 2 | 0.011 |

| Sampling Constituent | Contaminant List | Analytical Method | Units | CDPH MCL/NL | RTP Effluent | | Ag Wash Water | | Blanco Drain | | Lake El Estero | | Tembladero Slough |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | |
| Asbestos | pMCL, EPA PP | EPA 100.2 | MFL | 7 | <5.4 (<4.02–<5.8) | 0 / 4 | <5.4 (<4.02–<5.8) | 0 / 3 | <8.4 (<4.02-<8.8) | 0 / 4 | 1 | 1 / 1 | <5.7 |
| Barium | pMCL | EPA 200.8 | mg/L | 1 | 0.012 (0.011-0.026) | 4 / 4 | 0.096 (0.082-0.109) | 3 / 3 | 0.068 (0.054-0.079) | 4 / 4 | 0.086 (0.065-0.107) | 2 / 2 | 0.119 |
| Beryllium | pMCL, EPA PP | EPA 200.8 | mg/L | 0.004 | <0.001 | 0 / 4 | <0.001 | 0 / 3 | <0.001 | 0 / 4 | <0.001 | 0 / 2 | <0.001 |
| Cadmium | pMCL, EPA PP | EPA 200.8 | mg/L | 0.005 | <0.0005 | 0 / 4 | <0.0005 (<0.0005-0.002) | 1 / 3 | <0.0005 | 0 / 4 | <0.0005 (<0.0005-0.0005) | 1 / 2 | <0.0005 |
| Chromium | pMCL, EPA PP, UCMR 3 | EPA 200.8 | mg/L | 0.05 | 0.0018 (0.00092-0.003) | 4 / 4 | 0.009 (0.0048-0.01) | 3 / 3 | 0.0048 (0.0017-0.018) | 4 / 4 | 0.0026 (0.002-0.003) | 2 / 2 | 0.019 |
| Cyanide | pMCL, EPA PP | SM 4500CN-F | mg/L | 0.15 | 0.049 (0.008-0.13) | 4 / 4 | 0.076 (0.011-0.089) | 3 / 3 | <0.005 (<0.005-0.127) | 1 / 4 | <0.005 | 0 / 1 | <0.005 |
| Fluoride | pMCL | SM 4500F-C/EPA 300.0 | mg/L | 2 | 0.8 (0.4-0.8) | 4 / 4 | 0.3 (<0.1-31.9) | 2 / 3 | 0.7 (0.66-0.9) | 4 / 4 | 0.3 | 2 / 2 | 0.7 |
| Mercury | pMCL, EPA PP | EPA 245.1 | mg/L | 0.002 | <0.0002 | 0 / 4 | <0.0002 | 0 / 3 | <0.0002 | 0 / 4 | <0.0002 | 0 / 2 | <0.0002 |
| Nickel | pMCL, EPA PP | EPA 200.8 | mg/L | 0.1 | <0.01 | 0 / 4 | <0.01 (<0.01-0.01) | 1 / 3 | 0.025 (0.02-0.038) | 4 / 4 | <0.0055 (0.007-<0.01) | 1 / 2 | 0.034 |
| Perchlorate | pMCL, UCMR 1 | EPA 314 | mg/L | 0.006 | <0.002 | 0 / 4 | <0.002 | 0 / 3 | <0.002 | 0 / 4 | <0.002 | 0 / 1 | <0.002 |
| Selenium | pMCL, EPA PP | EPA 200.8 | mg/L | 0.05 | 0.0025 (0.002-<0.005) | 3 / 4 | <0.005 (<0.005-0.005) | 2 / 3 | 0.013 (0.0082-0.018) | 4 / 4 | 0.0055 (0.005-0.006) | 2 / 2 | 0.015 |
| Thallium | pMCL, EPA PP | EPA 200.8 | mg/L | 0.002 | <0.001 | 0 / 4 | <0.001 | 0 / 3 | <0.001 (<0.001-0.001) | 1 / 4 | <0.001 | 0 / 2 | <0.001 |
| ***MCLs - Volatile Organic Chemicals (VOCs)*** | | | | | | | | | | | | | |
| 1,1-Dichloroethane | pMCL, EPA PP, UCMR 3 | EPA 524.2 | µg/L | 5 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| 1,1-Dichloroethylene | pMCL, EPA PP | EPA 524.2 | µg/L | 6 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| 1,1,1-Trichloroethane | pMCL, EPA PP | EPA 524.2 | µg/L | 200 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| 1,1,2-Trichloro-1,2,2-Trifluoroethane (Freon 113) | pMCL | EPA 524.2 | µg/L | 1,200 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| 1,1,2-Trichloroethane | pMCL, EPA PP | EPA 524.2 | µg/L | 5 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| 1,1,2,2-Tetrachloroethane | pMCL, EPA PP | EPA 524.2 | µg/L | 1 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| 1,2-Dichlorobenzene | pMCL, EPA PP | EPA 524.2 | µg/L | 600 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| 1,2-Dichloroethane | pMCL, EPA PP | EPA 524.2 | µg/L | 0.5 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| 1,2-Dichloropropane | pMCL, EPA PP | EPA 524.2 | µg/L | 5 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| 1,2,4-Trichlorobenzene | pMCL, EPA PP | EPA 524.2 | µg/L | 5 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| 1,3-Dichloropropene | pMCL, PoLI, EPA PP | EPA 524.2 | µg/L | 0.5 | <0.5 | 0 / 4 | <0.5 (<0.5-0.7) | 1 / 3 | <0.5 (<0.5-0.82) | 1 / 4 | <0.5 | 0 / 1 | <0.5 |
| 1,4-Dichlorobenzene | pMCL, EPA PP | EPA 524.2 | µg/L | 5 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Benzene | pMCL, EPA PP | EPA 524.2 | µg/L | 1 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Carbon Tetrachloride | pMCL, EPA PP | EPA 524.2 | µg/L | 0.5 | <0.5 | 0 / 4 | <0.5 (<0.5-0.52) | 1 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| cis-1,2-Dichloroethylene | pMCL | EPA 524.2 | µg/L | 6 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Dichloromethane | pMCL, EPA PP | EPA 524.2 | µg/L | 5 | <0.5 | 0 / 4 | <0.5 (<0.5-0.84) | 1 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Ethylbenzene | pMCL, EPA PP | EPA 524.2 | µg/L | 300 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Methyl-tert-butyl ether (MTBE) | pMCL, sMCL, UCMR 1 | EPA 524.2 | µg/L | 13 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Monochlorobenzene | pMCL | EPA 524.2 | µg/L | 70 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Styrene | pMCL | EPA 524.2 | µg/L | 100 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Tetrachloroethylene | pMCL, EPA PP | EPA 524.2 | µg/L | 5 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Toluene | pMCL, EPA PP | EPA 524.2 | µg/L | 150 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| trans-1,2-Dichloroethylene | pMCL | EPA 524.2 | µg/L | 10 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Trichloroethylene | pMCL, EPA PP | EPA 524.2 | µg/L | 5 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Trichlorofluoromethane | pMCL | EPA 524.2 | µg/L | 150 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Vinyl Chloride | pMCL, EPA PP | EPA 524.2 | µg/L | 0.5 | <0.3 | 0 / 4 | <0.3 | 0 / 3 | <0.3 | 0 / 4 | <0.3 | 0 / 1 | <0.3 |
| Xylenes | pMCL | EPA 524.2 | µg/L | 1,750 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |

| Sampling Constituent | Contaminant List | Analytical Method | Units | CDPH MCL/NL | RTP Effluent | | Ag Wash Water | | Blanco Drain | | Lake El Estero | | Tembladero Slough |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | |
| ***MCLs - Non-Volatile Synthetic Organic Chemicals (SOCs)*** | | | | | | | | | | | | | |
| 2,4-D | pMCL | EPA 515.4 | µg/L | 70 | 0.29 (<0.1-0.78) | 2 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| Acetaldehyde | EPA CCL 3 | EPA 556 | µg/L | -- | 4.5 (3.3-4.8) | 4 / 4 | 160 (2.5-320) | 3 / 3 | 1.5 (1.2-2.2) | 4 / 4 | 2 | 1 / 1 | <1 |
| Alachlor | pMCL, UCMR 2 | EPA 505 | µg/L | 2 | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 8 | <0.1 | 0 / 1 | <0.05 |
| Atrazine | pMCL | EPA 525.2 | µg/L | 1 | <0.05 | 0 / 4 | <0.05 | 0 / 3 | <0.05 | 0 / 4 | <0.05 | 0 / 1 | <0.05 |
| Bentazon | pMCL | EPA 515.4 | µg/L | 18 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Benzo(a)pyrene | pMCL, EPA PP | EPA 525.2 | µg/L | 0.2 | <0.02 | 0 / 4 | <0.02 | 0 / 3 | <0.02 | 0 / 4 | <0.02 | 0 / 1 | <0.02 |
| Bromate | pMCL | EPA 317 | µg/L | 10 | <1 | 0 / 4 | <1 | 0 / 3 | <1 | 0 / 4 | <1 | 0 / 1 | <1 |
| Carbofuran | pMCL | EPA 531.2 | µg/L | 18 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Chlordane | pMCL, EPA PP | EPA 505 | µg/L | 0.1 | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 8 | <0.1 | 0 / 1 | <0.1 |
| Chlorite | pMCL | EPA 300.1 | µg/L | 1,000 | <10 | 0 / 4 | <10 | 0 / 3 | <10 | 0 / 4 | <10 | 0 / 1 | <10 |
| Dalapon | pMCL | EPA 515.4 | µg/L | 200 | <1 | 0 / 4 | <1 | 0 / 3 | <1 | 0 / 4 | <1 | 0 / 1 | <1 |
| Di(2-ethylhexyl)adipate | pMCL | EPA 525.2 | µg/L | 400 | <0.6 | 0 / 4 | <0.8 (<0.8-0.86) | 1 / 3 | <0.6 | 0 / 4 | <0.6 | 0 / 1 | <0.6 |
| Di(2-ethylhexyl)phthalate | pMCL, EPA PP | EPA 525.2 | µg/L | 4 | 1.5 (1-78) | 4 / 4 | 3.2 (<0.6-5.8) | 2 / 3 | <0.6 | 0 / 4 | <0.6 | 0 / 1 | 78 |
| Di(2-ethylhexyl)phthalate | pMCL, EPA PP | EPA 8720C | µg/L | 4 | <4 | 0 / 4 | 10 (<4-18) | 2 / 3 | <4 | 0 / 4 | <4 | 0 / 1 | <4 |
| Dibromochloropropane | pMCL | EPA 551.1 | µg/L | 0.2 | <0.01 | 0 / 4 | <0.01 | 0 / 3 | <0.01 | 0 / 4 | <0.01 | 0 / 1 | <0.01 |
| Dinoseb | pMCL | EPA 515.4 | µg/L | 7 | <0.2 | 0 / 4 | <0.2 | 0 / 3 | <0.2 | 0 / 4 | <0.2 | 0 / 1 | <0.2 |
| Diquat | pMCL, PoLI | EPA 549.2 | µg/L | 20 | <0.4 | 0 / 4 | <0.4 | 0 / 3 | <0.4 | 0 / 4 | <0.4 | 0 / 1 | <0.4 |
| Endothall | pMCL | EPA 548.1 | µg/L | 100 | <20 | 0 / 4 | <20 | 0 / 3 | <20 | 0 / 4 | <20 | 0 / 1 | <20 |
| Endrin | pMCL | EPA 505 | µg/L | 2 | <0.01 | 0 / 4 | <0.01 | 0 / 3 | <0.01 | 0 / 8 | <0.01 | 0 / 1 | <0.01 |
| Ethylene Dibromide | pMCL | EPA 551.1 | µg/L | 0.05 | <0.01 | 0 / 4 | <0.01 | 0 / 3 | <0.01 | 0 / 4 | <0.01 | 0 / 1 | <0.01 |
| Glyphosate | pMCL, PoLI | EPA 547 | µg/L | 700 | <6 | 0 / 4 | <6 | 0 / 3 | 7.5 (<6-9.2) | 2 / 4 | <6 | 0 / 1 | <6 |
| Total Haloacetic acids (HAA5) | pMCL | SM6251B | µg/L | 60 | 3.7 (2.4-4.4) | 4 / 4 | 200 (82-380) | 3 / 3 | <2 | 0 / 4 | <2 | 0 / 1 | 2.8 |
| *Trichloroacetic acid* | - | SM6251B | µg/L | -- | 3.4 (2.4-4.1) | 4 / 4 | 110 (80-230) | 3 / 3 | <1 | 0 / 4 | <1 | 0 / 1 | 2.8 |
| *Dichloroacetic acid* | - | SM6251B | µg/L | -- | <1 (<1-1) | 1 / 4 | 79 (1.8-140) | 3 / 3 | <1 | 0 / 4 | <1 | 0 / 1 | <1 |
| Heptachlor | pMCL, EPA PP | EPA 505 | µg/L | 0.01 | <0.01 | 0 / 4 | <0.01 | 0 / 3 | <0.01 | 0 / 8 | <0.01 | 0 / 1 | <0.01 |
| Heptachlor Epoxide | pMCL, EPA PP | EPA 505 | µg/L | 0.01 | <0.01 | 0 / 4 | <0.01 | 0 / 3 | <0.01 | 0 / 8 | <0.01 | 0 / 1 | <0.01 |
| Hexachlorobenzene | pMCL | EPA 525.2 | µg/L | 1 | <0.05 | 0 / 4 | <0.05 | 0 / 3 | <0.05 | 0 / 4 | <0.05 | 0 / 1 | <0.05 |
| Hexachlorocyclopentadiene | pMCL | EPA 525.2 | µg/L | 50 | <0.05 | 0 / 4 | <0.05 | 0 / 3 | <0.05 | 0 / 4 | <0.05 | 0 / 1 | <0.05 |
| Lindane | pMCL, PoLI | EPA 505 | µg/L | 0.2 | <0.01 | 0 / 4 | <0.01 | 0 / 3 | <0.01 | 0 / 8 | <0.01 | 0 / 1 | <0.01 |
| Methoxychlor | pMCL | EPA 505 | µg/L | 30 | <0.05 | 0 / 4 | <0.05 | 0 / 3 | <0.05 | 0 / 8 | <0.05 | 0 / 1 | <0.05 |
| Molinate | pMCL, UCMR 1 | EPA 525.2 | µg/L | 20 | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| Oxamyl | pMCL, PoLI | EPA 531.2 | µg/L | 50 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 (<0.5-2.4) | 1 / 4 | <0.5 | 0 / 1 | <0.5 |
| Pentachlorophenol | pMCL, EPA PP | EPA 515.4 | µg/L | 1 | <0.04 | 0 / 4 | <0.04 | 0 / 3 | <0.04 (<0.04-0.06) | 1 / 4 | 0.06 | 1 / 1 | <0.04 |
| Picloram | pMCL | EPA 515.4 | µg/L | 500 | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| Polychlorinated Biphenyls | pMCL | EPA 505 | µg/L | 0.5 | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 7 | <0.1 | 0 / 1 | <0.1 |
| Simazine | pMCL, PoLI | EPA 525.2 | µg/L | 4 | <0.05 | 0 / 4 | <0.05 | 0 / 3 | <0.05 | 0 / 4 | <0.05 | 0 / 1 | <0.05 |
| Thiobencarb | pMCL, sMCL, PoLI | EPA 525.2 | µg/L | 70 | <0.2 | 0 / 4 | <0.2 | 0 / 3 | <0.2 | 0 / 4 | <0.2 | 0 / 1 | <0.2 |
| Toxaphene | pMCL, EPA PP | EPA 505 | µg/L | 3 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 8 | <0.5 | 0 / 1 | <0.5 |
| 2,3,7,8-TCDD (Dioxin) | pMCL, EPA PP | EPA 1613 | µg/L | 3.00E-05 | <2.1E-06 | 0 / 4 | <1.80E-06 | 0 / 3 | <1.8E-06 | 0 / 4 | <1.9E-06 | 0 / 1 | <1.9E-06 |
| 2,4,5-TP (Silvex) | pMCL | EPA 515.4 | µg/L | 50 | <0.2 | 0 / 4 | <0.2 | 0 / 3 | <0.2 | 0 / 4 | <0.2 | 0 / 1 | <0.2 |

| Sampling Constituent | Contaminant List | Analytical Method | Units | CDPH MCL/NL | RTP Effluent | | Ag Wash Water | | Blanco Drain | | Lake El Estero | | Tembladero Slough |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | |
| Total trihalomethanes (TTHM) | pMCL | EPA 551.1 | µg/L | 80 | <0.5 (<0.5-0.82) | 1 / 4 | 83 (2.8-180) | 3 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| ***MCLs - Radionuclides*** | | | | | | | | | | | | | |
| Gross Alpha Particle (excluding radon and uranium) | pMCL | EPA 900.0 | pCi/L | 15 | <2.02±0.86 (<1.35±0.828-4.55±2.07) | 1 / 4 | 2.4±1.3 (<2.07±1.27-6.32±2.84) | 2 / 3 | 8.8±2.21 (4.47±2.21-9.82±2.47) | 4 / 4 | 2.15±1.33 | 1 / 1 | 1.81±5.89 |
| Gross Beta | | | pCi/L | 4 mrem/yr | 15±4.5 (14.8±1.59-18±2.45) | 4 / 4 | 21±2.3 (17.8±2.09-25±2.41) | 2 / 2 | 3.8±3.0 (<3±3.7-4.88±2.28) | 1 / 2 | 15.2±2.05 | 1 / 1 | <5.110±3.66 |
| Radium-226 | pMCL | EPA 903.1 | pCi/L | 5 (Combined) | <0.906±0.364 (0.318±0.38-<0.94±0.552) | 1 / 4 | (<0.764±0.479-<0.827±0.487) | 0 / 3 | (<0.51±0.374-<0.923±0.398) | 0 / 4 | <0.784±0.548 | 0 / 1 | <0.602±0.311 |
| Radium-228 | pMCL | EPA 904.0 | pCi/L | | (<0.52±0.368-<0.971±0.464) | 0 / 4 | <0.86±0.403 (<0.671±0.333-0.86±0.504) | 1 / 3 | (<0.509±0.266-<0.976±0.439) | 0 / 4 | <0.814±0.394 | 0 / 1 | <0.991±0.452 |
| Strontium-90 | pMCL | EPA 905.0 | pCi/L | 8 | (<0.38±0.204-<1.44±0.569) | 0 / 4 | (<0.546±0.29-<1.26±0.584) | 0 / 3 | (<0.756±0346-<1.7±0.872) | 0 / 4 | <0.671±0.226 | 0 / 1 | <0.738±0.409 |
| Tritium | pMCL | EPA 906.0 | pCi/L | 20,000 | (<193±112-<222±127) | 0 / 4 | (<204±107-<215±118) | 0 / 3 | (<213±115-<217±129) | 0 / 4 | <230±128 | 0 / 1 | <225±124 |
| Uranium | pMCL | EPA 900.0 | pCi/L | 20 | 2.15 (1.8-2.4) | 4 / 4 | 5.7 (3.2-8.7) | 3 / 3 | 12.5 (11-13) | 4 / 4 | 1.4 | 1 / 1 | 10 |
| ***DDW Drinking Water Notification Levels*** | | | | | | | | | | | | | |
| Boron | NL | EPA 200.7 | µg/L | 1,000 | 300 (280-350) | 4 / 4 | 210 (190-280) | 3 / 3 | 670 (580-700) | 4 / 4 | 180 (110-240) | 2 / 2 | 510 |
| n-Butylbenzene | NL | EPA 524.2 | µg/L | 260 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| sec-Butylbenzene | NL, EPA CCL | EPA 524.2 | µg/L | 260 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| tert-Butylbenzene | NL | EPA 524.2 | µg/L | 260 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Carbon disulfide | NL | EPA 524.2 | µg/L | 160 | <0.5 | 0 / 4 | <0.5 (<0.5-0.87) | 1 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Chlorate | NL, UCMR 3 | EPA 300.1 | µg/L | 800 | <20 | 0 / 4 | <20 (<20-420) | 1 / 3 | <20 | 0 / 4 | 3.8 | 1 / 1 | <20 |
| 2-Chlorotoluene | NL | EPA 524.2 | µg/L | 140 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.4 | 0 / 1 | <0.5 |
| 4-Chlorotoluene | NL | EPA 524.2 | µg/L | 140 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Diazinon | NL, UCMR 1, PoLI | EPA 525.2 | µg/L | 1.2 | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 11 | <0.1 | 0 / 1 | <0.1 |
| Dichlorodifluoromethane (Freon 12) | NL | EPA 524.2 | µg/L | 1,000 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| 1,4-Dioxane | NL, UCMR 3 | EPA 522 | µg/L | 1 | <1 (<1-1.2) | 4 / 11 | <1 | 0 / 10 | <1 | 0 / 11 | <1 | 0 / 1 | <1 |
| Ethylene glycol | NL | EPA 8270C | µg/L | 14,000 | <40 | 0 / 4 | <40 | 0 / 3 | <40 | 0 / 4 | <40 | 0 / 1 | <40 |
| Formaldehyde | NL, EPA CCL | EPA 556 | µg/L | 100 | 11 (8.7-13) | 4 / 4 | 70 (6.8-120) | 3 / 3 | <5 (<5-8.3) | 1 / 4 | 5.3 | 1 / 1 | <5 |
| HMX (or Octogen) | NL | LC-MS-MS | µg/L | 350 | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| Isopropylbenzene | NL | EPA 524.2 | µg/L | 770 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Methyl isobutyl ketone (MIBK) | NL | EPA 524.2 | µg/L | 120 | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Naphthalene | NL | EPA 524.2 | µg/L | 17 | <0.3 | 0 / 4 | <0.3 | 0 / 3 | <0.3 | 0 / 4 | <0.3 | 0 / 1 | <0.3 |
| N-Nitrosodiethyamine (NDEA) | NL, UCMR 2 | EPA 521 | ng/L | 10 | 2.1 (<2-3.7) | 2 / 4 | <2 (<2-3.2) | 1 / 3 | <2 | 0 / 4 | <2 | 0 / 1 | <2 |
| N-Nitrosodimethylamine (NDMA) | NL, EPA PP, UCMR 2 | EPA 521 | ng/L | 10 | 5.1 (2.0-16) | 11 / 11 | 10 (<2-340) | 7 / 10 | <2 (<2-2.4) | 1 / 11 | <2 | 0 / 1 | <2 |
| N-Nitrosodi-n-propylamine (NDPA) | NL, EPA PP, UCMR 2 | EPA 521 | ng/L | 10 | <2 (<2-8.8) | 1 / 4 | <2 | 0 / 3 | <2 | 0 / 4 | <2 | 0 / 1 | <2 |
| Propachlor | NL | EPA 525.2 | µg/L | 90 | <0.05 | 0 / 4 | <0.05 | 0 / 3 | <0.05 | 0 / 4 | <0.05 | 0 / 1 | <0.05 |
| n-Propylbenzene | NL | EPA 524.2 | µg/L | 260 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine) | NL, UCMR 1&2 | LC-MS-MS | µg/L | 0.3 | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| Tertiary butyl alcohol (TBA) | NL | EPA 524.2m | µg/L | 12 | 2.8 (2.8-3.3) | 4 / 4 | <2 (<2-3) | 1 / 3 | <2 (<2-2) | 1 / 4 | <2 | 0 / 1 | <2 |
| 1,2,3-Trichloropropane (1,2,3-TCP) | NL | EPA 524.2m | µg/L | 0.005 | <0.005 | 0 / 4 | <0.005 | 0 / 3 | <0.005 | 0 / 4 | <0.005 | 0 / 1 | <0.005 |
| 1,2,4-Trimethylbenzene | NL, EPA PP | EPA 524.2 | µg/L | 330 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |

| Sampling Constituent | Contaminant List | Analytical Method | Units | CDPH MCL/NL | RTP Effluent | | Ag Wash Water | | Blanco Drain | | Lake El Estero | | Tembladero Slough |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | |
| 1,3,5-Trimethylbenzene | NL | EPA 524.2 | µg/L | 330 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| 2,4,6-Trinitrotoluene (TNT) | NL, UCMR 2 | LC-MS-MS | µg/L | 1 | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| Vanadium | NL, UCMR 3 | EPA 200.8 | µg/L | 50 | 4<br>(3.4-9.8) | 4 / 4 | 16<br>(13-18) | 3 / 3 | 16<br>(13-30) | 4 / 4 | 3.3 | 1 / 1 | 21 |
| ***DDW Drinking Water Archived Advisory Levels*** | | | | | | | | | | | | | |
| 3-Hydroxycarbofuran | EPA CCL 3 | EPA 531.2 | µg/L | -- | 1.5<br>(1.4-2.1) | 4 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Aldicarb | aNL | EPA 531.2 | µg/L | 7 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Aldrin | aNL | EPA 505 | µg/L | 0.002 | <0.01 | 0 / 4 | <0.01 | 0 / 3 | <0.01 | 0 / 8 | <0.01 | 0 / 1 | <0.01 |
| Baygon | aNL | EPA 531.2 | µg/L | 30 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 5 | <0.5 | 0 / 1 | <0.5 |
| alpha-BHC | aNL | EPA 8081A | µg/L | 0.015 | <0.05 | 0 / 4 | <0.05 | 0 / 3 | <0.05 | 0 / 4 | <0.05 | 0 / 1 | <0.05 |
| beta-BHC | aNL | EPA 8081A | µg/L | 0.025 | <0.05 | 0 / 4 | <0.05 | 0 / 3 | <0.05 | 0 / 4 | <0.05 | 0 / 1 | <0.05 |
| Captan | NL, EPA CCL, Po | EPA 8081/8082 | µg/L | 15 | <0.05 | 0 / 3 | <0.05 | 0 / 2 | <0.05 | 0 / 4 | <0.05 | 0 / 1 | <0.05 |
| Carbaryl | aNL, PoLI | EPA 531.2 | µg/L | 700 | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Chloropicrin | aNL, PoLI | EPA 551.1 | µg/L | 50 | <0.5 | 0 / 4 | <0.5<br>(<0.5-0.51) | 1 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Chloropropham (CIPC) | aNL | EPA 8321 | µg/L | 1,200 | <2 | 0 / 4 | <2 | 0 / 3 | <2 | 0 / 4 | <2 | 0 / 1 | <2 |
| 1,3-Dichlorobenzene | aNL | EPA 8270C | µg/L | 600 | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Dieldrin | aNL, EPA PP | EPA 525.2 | ng/L | 2 | <200 | 0 / 4 | <200 | 0 / 3 | <200 | 0 / 11 | <200 | 0 / 1 | <200 |
| Dieldrin | EPA PP, aNL | EPA 505 | ng/L | 2 | <10 | 0 / 4 | <10 | 0 / 3 | 17<br>(<10-28) | 8 / 8 | <10 | 0 / 1 | <10 |
| Dieldrin | aNL, EPA PP | EPA 8081/8082 | ng/L | 2 | <50 | 0 / 4 | <50 | 0 / 3 | <50 | 0 / 4 | <50 | 0 / 1 | <50 |
| Dimethoate | NL, UCMR 2, Pol | EPA 525.2 | µg/L | 1 | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| 2,4-Dimethylphenol | aNL, EPA PP | EPA 8270C | µg/L | 100 | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Diphenamide | aNL | EPA 8141 | µg/L | 200 | <0.1 | 0 / 3 | <0.1 | 0 / 2 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| Ethion | aNL | EPA 8141 | µg/L | 4 | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| Malathion | aNL, PoLI | EPA 525.2 | µg/L | 160 | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1<br>(<0.1-0.14) | 1 / 4 | <0.1 | 0 / 1 | <0.1 |
| Methylisothiocyanate | aNL | EPA 131 | µg/L | 190 | <1<br>(<1-7.4) | 1 / 4 | <1 | 0 / 3 | <1 | 0 / 4 | <1 | 0 / 1 | <1 |
| Methyl parathion | aNL | EPA 8141 | µg/L | 2 | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| Parathion | aNL | EPA 525.2 | µg/L | 40 | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| Pentachloronitrobenzene | aNL | EPA 8270C | µg/L | 20 | <10 | 0 / 4 | <10 | 0 / 3 | <10 | 0 / 4 | <10 | 0 / 1 | <10 |
| Phenol | aNL, EPA PP | EPA 8270C | µg/L | 4,200 | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <1 | 0 / 1 | <5 |
| 2,3,5,6-Tetrachloroterephthalate (DCPA) | aNL | EPA 515.4 | µg/L | 3,500 | 0.68<br>(0.62-0.88) | 4 / 4 | <0.1<br>(<0.1-0.16) | 1 / 3 | 38<br>(36-40) | 4 / 4 | <0.1 | 0 / 1 | 17 |
| Trithion | aNL | EPA 8081/8082 | µg/L | 7 | <0.05 | 0 / 2 | <0.05 | 0 / 2 | <0.05 | 0 / 3 | <0.05 | 0 / 1 | |
| ***EPA Unregulated Contaminant Monitoring Rule (UCMR) Lists 1 through 3*** | | | | | | | | | | | | | |
| 1,1-Dichloroethane | UCMR 3 | EPA 524.3 | ug/L | -- | <0.03 | 0 / 4 | <0.03 | 0 / 3 | <0.03 | 0 / 4 | <0.03 | 0 / 1 | <0.03 |
| 1,2,3-Trichloropropane (1,2,3-TCP) | UCMR 3 | EPA 524.3 | ug/L | -- | <0.03 | 0 / 4 | <0.03 | 0 / 3 | <0.03 | 0 / 4 | <0.03 | 0 / 1 | <0.03 |
| 1,3-Butadiene | UCMR 3 | EPA 524.3 | ug/L | -- | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| 1,3-Dinitrobenzene | UCMR 2 | EPA 8270C | ug/L | -- | <10 | 0 / 4 | <10 | 0 / 3 | <10 | 0 / 4 | <10 | 0 / 1 | <10 |
| 2,2',4,4'-tetrabromodiphenyl ether (BDE-47) | UCMR 2 | EPA 527 | ug/L | -- | <0.3 | 0 / 4 | <0.3 | 0 / 3 | <0.3 | 0 / 4 | <0.3 | 0 / 1 | <0.3 |
| 2,2',4,4',5-pentabromodiphenyl ether (BDE-99) | UCMR 2 | EPA 527 | ug/L | -- | <0.9 | 0 / 4 | <0.9 | 0 / 3 | <0.9 | 0 / 4 | <0.9 | 0 / 1 | <0.9 |
| 2,2',4,4',5,5'-hexabromobiphenyl (HBB) | UCMR 2 | EPA 527 | ug/L | -- | <0.7 | 0 / 4 | <0.7 | 0 / 3 | <0.7 | 0 / 4 | <0.7 | 0 / 1 | <0.7 |
| 2,2',4,4',5,5'-hexabromodiphenyl ether (BDE-153) | UCMR 2 | EPA 527 | ug/L | -- | <0.8 | 0 / 4 | <0.8 | 0 / 3 | <0.8 | 0 / 4 | <0.8 | 0 / 1 | <0.8 |
| 2,2',4,4',6-pentabromodiphenyl ether (BDE-100) | UCMR 2 | EPA 527 | ug/L | -- | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| 2-methyl-Phenol (o-cresol) | UCMR 1 | EPA 8270C | ug/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <1 | 0 / 1 | <5 |
| 4-androstene-3,17-dione | CECs | EPA 539 | ug/L | -- | 0.0040<br>(0.002-0.0047) | 4 / 4 | 0.00062<br>(<0.0003-0.0011) | 2 / 3 | <0.0003<br>(<0.0003-0.00044) | 1 / 4 | <0.0003 | 0 / 1 | <0.0003 |

| Sampling Constituent | Contaminant List | Analytical Method | Units | CDPH MCL/NL | RTP Effluent | | Ag Wash Water | | Blanco Drain | | Lake El Estero | | Tembladero Slough |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | |
| Acetochlor | UCMR 1&2 | EPA 525.2 | ug/L | -- | <0.01 | 0 / 4 | <0.01 | 0 / 3 | <0.01 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| Acetochlor ethanesulfonic acid (ESA) | UCMR 2 | EPA 535 | ug/L | -- | <1 | 0 / 4 | <1 | 0 / 3 | <1 | 0 / 4 | <1 | 0 / 1 | <1 |
| Acetochlor oxanilic acid (OA) | UCMR 2 | EPA 535 | ug/L | -- | <2 | 0 / 4 | <2 | 0 / 3 | <2 | 0 / 4 | <2 | 0 / 1 | <2 |
| Alachlor ethanesulfonic acid (ESA) | UCMR 1&2 | EPA 535 | ug/L | -- | <1 | 0 / 4 | <1 | 0 / 3 | <1 | 0 / 4 | <1 | 0 / 1 | <1 |
| Alachlor oxanilic acid (OA) | UCMR 2 | EPA 535 | ug/L | -- | <2 | 0 / 4 | <2 | 0 / 3 | <2 | 0 / 4 | <2 | 0 / 1 | <2 |
| Chromium-6 | UCMR 3 | EPA 218.6 | ug/L | -- | <0.02 | 0 / 4 | **3.8** (<0.02-4.8) | 2 / 3 | **0.53** (0.38-1.1) | 4 / 4 | **0.082** | 1 / 1 | **0.72** |
| Cobalt | UCMR 3 | EPA 200.8 | ug/L | -- | <1 | 0 / 4 | <1 (<1-2.1) | 1 / 3 | **1.8** (1.3-3.8) | 4 / 4 | <1 | 0 / 1 | <1 |
| DCPA mono and di-acid degradate | UCMR 1 | EPA 515.4 | ug/L | -- | **0.58** (0.52-0.88) | 4 / 4 | <0.1 (<0.1-0.18) | 1 / 3 | **38** (38-40) | 4 / 4 | <0.1 | 0 / 1 | **17** |
| Disulfoton | UCMR 1 | EPA 8270C | ug/L | -- | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <10 | 0 / 1 | <0.1 |
| Diuron | UCMR 2 | EPA 8321 | ug/L | -- | <1 | 0 / 4 | <1 | 0 / 3 | <1 | 0 / 4 | <1 | 0 / 1 | **1** |
| EPTC | UCMR 1, PoLI | EPA 525.2 | ug/L | -- | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| Equilin | UCMR 3 | EPA 539 | ug/L | -- | <0.004 | 0 / 4 | <0.004 | 0 / 3 | <0.004 | 0 / 4 | <0.004 | 0 / 1 | <0.004 |
| Estradiol (17-beta estradiol) | UCMR 3 | EPA 539 | ug/L | -- | **0.0044** (0.0028-0.0081) | 4 / 4 | <0.0004 | 0 / 3 | <0.0004 | 0 / 4 | <0.0004 | 0 / 1 | <0.0004 |
| Estriol | UCMR 3 | EPA 539 | ug/L | -- | <0.0022 (<0.0008-0.0042) | 3 / 4 | <0.0008 | 0 / 3 | <0.0008 | 0 / 4 | <0.0008 | 0 / 1 | <0.0008 |
| Estrone | UCMR 3 | EPA 539 | ug/L | -- | **0.21** (0.084-0.36) | 4 / 4 | <0.002 (<0.002-0.0037) | 1 / 3 | <0.002 (<0.002-0.0022) | 1 / 4 | <0.002 | 0 / 1 | <0.006 |
| Ethinyl Estradiol (17-alpha ethynyl estradiol) | UCMR 3 | EPA 539 | ug/L | -- | <0.0009 (<0.0009-0.011) | 1 / 4 | <0.0009 | 0 / 3 | <0.0009 | 0 / 4 | <0.0009 | 0 / 1 | <0.0009 |
| Fonofos | UCMR 1 | EPA 526 | ug/L | -- | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Halon 1011 (bromochloromethane) | UCMR 3 | EPA 524.3 | ug/L | -- | <0.06 | 0 / 4 | **0.075** (<0.06-0.26) | 2 / 3 | <0.06 | 0 / 4 | <0.06 | 0 / 1 | <0.06 |
| Halon 1011 (bromochloromethane) | UCMR 3 | EPA 524.2 | ug/L | -- | <0.5 | 0 / 3 | <0.5 | 0 / 2 | <0.5 | 0 / 3 | <0.5 | 0 / 1 | <0.5 |
| HCFC-22 (Chlorodifluoromethane) | UCMR 3 | EPA 524.3 | ug/L | -- | <0.08 | 0 / 4 | <0.08 | 0 / 3 | <0.08 | 0 / 4 | <0.08 | 0 / 1 | <0.08 |
| Linuron | UCMR 1 | EPA 8321 | ug/L | -- | <1 | 0 / 4 | <1 | 0 / 3 | <1 | 0 / 4 | <1 | 0 / 1 | <1 |
| Metolachlor | UCMR 2 | EPA 525.2 | ug/L | -- | <0.05 | 0 / 4 | <0.05 | 0 / 3 | <0.05 | 0 / 4 | <0.05 | 0 / 1 | <0.05 |
| Metolachlor ethanesulfonic acid (ESA) | UCMR 2 | EPA 535 | ug/L | -- | <1 | 0 / 4 | <1 | 0 / 3 | <1 | 0 / 4 | <1 | 0 / 1 | <1 |
| Metolachlor oxanilic acid (OC) | UCMR 2 | EPA 535 | ug/L | -- | <2 | 0 / 4 | <2 | 0 / 3 | <2 | 0 / 4 | <2 | 0 / 1 | <2 |
| Molybdenum | UCMR 3 | EPA 200.8 | ug/L | -- | **8.8** (4-13) | 4 / 4 | **43** (23-78) | 3 / 3 | **105** (82-220) | 4 / 4 | **12** | 1 / 1 | **82** |
| N-nitroso-di-n-butylamine (NDBA) | UCMR 2 | EPA 521 | ng/L | -- | **4.3** (<2-8.7) | 3 / 4 | <2 | 0 / 3 | <2 | 0 / 4 | <2 | 0 / 1 | <2 |
| N-nitroso-methylethylamine (NMEA) | UCMR 2 | EPA 521 | ng/L | -- | <2 | 0 / 4 | <2 | 0 / 3 | <2 | 0 / 4 | <2 | 0 / 1 | <2 |
| N-Nitrosopyrrolidine (NPYR) | UCMR 2 | EPA 521 | ng/L | -- | **2.05** (<2-2.5) | 2 / 4 | <2 (<2-4.7) | 1 / 3 | <2 | 0 / 4 | <2 | 0 / 1 | <2 |
| N-Nitrosomorpholine | – | EPA 8270C | ug/L | -- | <10 | 0 / 4 | <10 | 0 / 3 | <10 | 0 / 4 | <10 | 0 / 1 | <10 |
| N-Nitrosopiperidine (NPIP) | – | EPA 8270C | ug/L | -- | <10 | 0 / 4 | <10 | 0 / 3 | <10 | 0 / 4 | <10 | 0 / 1 | <10 |
| Perfluorooctane sulfonic acid (PFOS) | UCMR 3 | EPA 537 | ug/L | -- | <0.04 | 0 / 4 | **0.073** (<0.04-0.3) | 2 / 3 | <0.04 | 0 / 4 | <0.04 | 0 / 1 | <0.04 |
| Perfluorooctanoic acid (PFOA) | UCMR 3 | EPA 537 | ug/L | -- | <0.02 | 0 / 4 | <0.02 | 0 / 3 | <0.02 | 0 / 4 | **0.021** | 1 / 1 | <0.02 |
| Perfluorononanoic acid (PFNA) | UCMR 3 | EPA 537 | ug/L | -- | <0.02 | 0 / 4 | <0.02 | 0 / 3 | <0.02 | 0 / 4 | <0.02 | 0 / 1 | <0.02 |
| Perfluorohexanesulfonic acid (PFHxS) | UCMR 3 | EPA 537 | ug/L | -- | <0.03 | 0 / 4 | <0.03 | 0 / 3 | <0.03 | 0 / 4 | <0.03 | 0 / 1 | <0.03 |
| Perfluoroheptanoic acid (PFHpA) | UCMR 3 | EPA 537 | ug/L | -- | <0.01 | 0 / 4 | <0.01 | 0 / 3 | <0.01 | 0 / 4 | <0.01 | 0 / 1 | <0.01 |
| Perfluorobutanesulfonic acid (PFBS) | UCMR 3 | EPA 537 | ug/L | -- | <0.09 | 0 / 4 | <0.09 | 0 / 3 | <0.09 | 0 / 4 | <0.09 | 0 / 1 | <0.09 |
| Prometon | UCMR 1 | EPA 526 | ug/L | -- | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Strontium | UCMR 3 | EPA 200.8 | ug/L | -- | **385** (290-740) | 4 / 4 | **580** (510-1300) | 3 / 3 | **1250** (990-2200) | 4 / 4 | **500** | 1 / 1 | **1800** |
| Terbacil | UCMR 1 | EPA 525.2 | ug/L | -- | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| Terbufos | UCMR 1 | EPA 526 | ug/L | -- | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Terbufos sulfone | UCMR 2 | EPA 527 | ug/L | -- | <0.4 | 0 / 4 | <0.4 | 0 / 3 | <0.4 | 0 / 4 | <0.4 | 0 / 1 | <0.4 |

| Sampling Constituent | Contaminant List | Analytical Method | Units | CDPH MCL/NL | RTP Effluent | | Ag Wash Water | | Blanco Drain | | Lake El Estero | | Tembladero Slough |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | |
| ***EPA Clean Water Act Priority Pollutants (PPs)*** | | | | | | | | | | | | | |
| 1,2-diphenylhydrazine | EPA PP, UCMR 1 | EPA 8270C | ug/L | -- | <10 | 0 / 4 | <10 | 0 / 3 | <10 | 0 / 4 | <1 | 0 / 1 | <10 |
| 1,2-trans-dichloroethylene | EPA PP | EPA 524.2 | ug/L | -- | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| 1,3-dichlorobenzene | EPA PP | EPA 524.2 | ug/L | -- | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| 2-chloroethyl vinyl ethers | EPA PP | EPA 524.2 | ug/L | -- | <0.5 | 0 / 6 | <0.5 | 0 / 5 | <0.5 | 0 / 8 | <0.5 | 0 / 1 | <0.5 |
| 2-chloronaphthalene | EPA PP | EPA 8270C | ug/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <1 | 0 / 1 | <5 |
| 2-chlorophenol | EPA PP | EPA 8270C | ug/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <1 | 0 / 1 | <5 |
| 2-nitrophenol | EPA PP | EPA 8270C | ug/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5.1 | 0 / 1 | <5 |
| 2,4-dichlorophenol | EPA PP, UCMR 1 | EPA 8270C | ug/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <1 | 0 / 1 | <5 |
| 2,4-dinitrophenol | EPA PP, UCMR 1 | EPA 8270C | ug/L | -- | <50 | 0 / 4 | <50 | 0 / 3 | <50 | 0 / 4 | <5.1 | 0 / 1 | <50 |
| 2,4-dinitrotoluene | EPA PP, UCMR 1 | EPA 525.2 | ug/L | -- | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <1 | 0 / 1 | <0.1 |
| 2,4,6-trichlorophenol | EPA PP, UCMR 1 | EPA 8270C | ug/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <1 | 0 / 1 | <5 |
| 2,6-dinitrotoluene | EPA PP, UCMR 1 | EPA 525.2 | ug/L | -- | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| 3,3-dichlorobenzidine | EPA PP | EPA 8270C | ug/L | -- | <50 | 0 / 4 | <50 | 0 / 3 | <50 | 0 / 4 | <2 | 0 / 1 | <50 |
| 4-bromophenyl phenyl ether | EPA PP | EPA 8270C | ug/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5.1 | 0 / 1 | <5 |
| 4-chlorophenyl phenyl ether | EPA PP | EPA 8270C | ug/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <1 | 0 / 1 | <5 |
| 4-nitrophenol | EPA PP | EPA 8270C | ug/L | -- | <10 | 0 / 4 | <10 | 0 / 3 | <10 | 0 / 4 | <5.1 | 0 / 1 | <10 |
| 4,4-DDD | EPA PP | EPA 525.2 | ug/L | -- | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| 4,4-DDE | EPA PP, UCMR 1 | EPA 525.2 | ug/L | -- | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 (<0.1-0.021) | 1 / 4 | <0.1 | 0 / 1 | 0.012 |
| 4,4-DDT | EPA PP | EPA 525.2 | ug/L | -- | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| 4,6-dinitro-o-cresol | EPA PP | EPA 8270C | ug/L | -- | <50 | 0 / 4 | <50 | 0 / 3 | <50 | 0 / 4 | <5.1 | 0 / 1 | <50 |
| Acenaphthene | EPA PP | EPA 525.2 | ug/L | -- | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| Acenaphthylene | EPA PP | EPA 525.2 | ug/L | -- | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| Acrolein | EPA PP, EPA CCL | EPA 624 | ug/L | -- | <2 | 0 / 4 | 4.8 (<2-22) | 2 / 3 | <2 | 0 / 4 | <2 | 0 / 1 | <2 |
| Acrylonitrile | EPA PP | EPA 624 | ug/L | -- | <2 | 0 / 4 | 3.8 (<2-4.2) | 2 / 3 | <2 | 0 / 4 | <2 | 0 / 1 | <2 |
| Aldrin | EPA PP | EPA 505 | ug/L | -- | <0.01 | 0 / 4 | <0.01 | 0 / 3 | <0.01 | 0 / 4 | <0.01 | 0 / 1 | <0.01 |
| Alpha-BHC | EPA PP | EPA 525.2 | ug/L | -- | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| Alpha-endosulfan | EPA PP | EPA 525.2 | ug/L | -- | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| Anthracene | EPA PP | EPA 525.2 | ug/L | -- | <0.02 | 0 / 4 | <0.02 | 0 / 3 | <0.02 | 0 / 4 | <0.02 | 0 / 1 | <0.02 |
| Benzidine | EPA PP | EPA 8270C | ug/L | -- | <50 | 0 / 4 | <50 | 0 / 3 | <50 | 0 / 4 | <5.1 | 0 / 1 | <50 |
| benzo(a) anthracene | EPA PP | EPA 525.2 | ug/L | -- | <0.05 | 0 / 4 | <0.05 | 0 / 3 | <0.05 | 0 / 4 | <0.05 | 0 / 1 | <5 |
| Benzo(b) fluoranthene | EPA PP | EPA 525.2 | ug/L | -- | <0.02 | 0 / 4 | <0.02 | 0 / 3 | <0.02 | 0 / 4 | <0.02 | 0 / 1 | <0.02 |
| Benzo(ghi) perylene | EPA PP | EPA 525.2 | ug/L | -- | <0.05 | 0 / 4 | <0.05 | 0 / 3 | <0.05 | 0 / 4 | <0.05 | 0 / 1 | <0.05 |
| Benzo(k) fluoranthene | EPA PP | EPA 525.2 | ug/L | -- | <0.02 | 0 / 4 | <0.02 | 0 / 3 | <0.02 | 0 / 4 | <0.02 | 0 / 1 | <0.02 |
| Beta-BHC | EPA PP | EPA 525.2 | ug/L | -- | <0.1 (<0.1-0.15) | 1 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| Beta-endosulfan | EPA PP | EPA 525.2 | ug/L | -- | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| Bis(2-chloroethoxy) methane | EPA PP | EPA 8270C | ug/L | -- | <10 | 0 / 4 | <10 | 0 / 3 | <10 | 0 / 4 | <1 | 0 / 1 | <10 |
| Bis(2-chloroethyl) ether | EPA PP | EPA 8270C | ug/L | -- | <10 | 0 / 4 | <10 | 0 / 3 | <10 | 0 / 4 | <1 | 0 / 1 | <10 |
| Bis(2-chloroisopropyl) ether | EPA PP | EPA 8270C | ug/L | -- | <10 | 0 / 4 | <10 | 0 / 3 | <10 | 0 / 4 | <1 | 0 / 1 | <10 |
| Bromoform | EPA PP | EPA 524.2 | ug/L | -- | <0.5 | 0 / 4 | 0.86 (<0.5-2.4) | 2 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Bromoform | EPA PP | EPA 551.1 | ug/L | -- | <0.5 | 0 / 4 | 1.2 (<0.5-1.8) | 2 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Butyl benzyl phthalate | EPA PP | EPA 525.2 | ug/L | -- | <0.5 | 0 / 4 | 1.2 (<0.5-1.8) | 2 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |

| Sampling Constituent | Contaminant List | Analytical Method | Units | CDPH MCL/NL | RTP Effluent | | Ag Wash Water | | Blanco Drain | | Lake El Estero | | Tembladero Slough |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | |
| Chlorobenzene | EPA PP | EPA 524.2 | ug/L | -- | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Chlorodibromomethane | EPA PP | EPA 524.2 | ug/L | -- | <0.5 | 0 / 4 | 2.2 (<0.5-11) | 2 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Chlorodibromomethane | EPA PP | EPA 551.1 | ug/L | -- | <0.5 | 0 / 4 | 3.8 (<0.5-8.3) | 2 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Chloroethane | EPA PP | EPA 524.2 | ug/L | -- | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Chloroform | EPA PP | EPA 524.2 | ug/L | -- | <0.5 (<0.5-0.78) | 1 / 4 | 38 (2.5-86) | 3 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Chloroform | EPA PP | EPA 551.1 | ug/L | -- | <0.5 (<0.5-0.82) | 1 / 4 | 49 (2.8-150) | 3 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Chrysene | EPA PP | EPA 525.2 | ug/L | -- | <0.02 | 0 / 4 | <0.02 | 0 / 3 | <0.02 | 0 / 4 | <0.02 | 0 / 1 | <0.02 |
| Delta-BHC | EPA PP | EPA 525.2 | ug/L | -- | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| Di-N-Butyl Phthalate | EPA PP | EPA 8270C | ug/L | -- | <10 | 0 / 4 | <10 | 0 / 3 | <10 | 0 / 4 | <1 | 0 / 1 | <10 |
| Di-n-octyl phthalate | EPA PP | EPA 8270C | ug/L | -- | <10 | 0 / 4 | <10 | 0 / 3 | <10 | 0 / 4 | <2 | 0 / 1 | <10 |
| Dibenz(a,h) anthracene | EPA PP | EPA 525.2 | ug/L | -- | <0.05 | 0 / 4 | <0.05 | 0 / 3 | <0.05 | 0 / 4 | <0.05 | 0 / 1 | <0.05 |
| Dichlorobromomethane | EPA PP | EPA 524.2 | ug/L | -- | <0.5 | 0 / 4 | 5.8 (0.52-28) | 3 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Dichlorobromomethane | EPA PP | EPA 551.1 | ug/L | -- | <0.5 | 0 / 4 | <0.5 (<0.5-8) | 1 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Diethyl Phthalate | EPA PP | EPA 525.2 | ug/L | -- | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Dimethyl phthalate | EPA PP | EPA 525.2 | ug/L | -- | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Endosulfan sulfate | EPA PP | EPA 525.2 | ug/L | -- | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| Endrin | EPA PP | EPA 525.2 | ug/L | -- | <0.2 | 0 / 4 | <0.2 | 0 / 3 | <0.2 | 0 / 5 | <0.2 | 0 / 1 | <0.2 |
| Endrin aldehyde | EPA PP | EPA 525.2 | ug/L | -- | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| Fluoranthene | EPA PP | EPA 525.2 | ug/L | -- | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| Fluorene | EPA PP | EPA 525.2 | ug/L | -- | <0.05 | 0 / 4 | <0.05 | 0 / 3 | <0.05 | 0 / 4 | <0.05 | 0 / 1 | <0.05 |
| Gamma-BHC | EPA PP | EPA 505 | ug/L | -- | <0.01 | 0 / 4 | <0.01 | 0 / 3 | <0.01 | 0 / 4 | <0.01 | 0 / 1 | <0.01 |
| Hexachlorobenzene | EPA PP | EPA 8270C | ug/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <1 | 0 / 1 | <5 |
| Hexachlorobutadiene | EPA PP | EPA 524.2 | ug/L | -- | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Hexachloroethane | EPA PP | EPA 8270C | ug/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <1 | 0 / 1 | <5 |
| Hexachlorocyclopentadiene | EPA PP | EPA 525.2 | ug/L | -- | <0.05 | 0 / 4 | <0.05 | 0 / 3 | <0.05 | 0 / 4 | <0.05 | 0 / 1 | <0.05 |
| Indeno (1,2,3-cd) pyrene | EPA PP | EPA 525.2 | ug/L | -- | <0.05 | 0 / 4 | <0.05 | 0 / 3 | <0.05 | 0 / 4 | <0.05 | 0 / 1 | <0.05 |
| Isophorone | EPA PP | EPA 525.2 | ug/L | -- | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Lead | EPA PP | EPA 200.8 | ug/L | -- | <0.5 | 0 / 4 | 0.93 (0.8-1.3) | 3 / 3 | 0.7 (<0.5-0.88) | 2 / 4 | 3 | 1 / 1 | 1.8 |
| Methyl bromide | EPA PP, UCMR 3, PoLI | EPA 524.2 | ug/L | -- | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Methyl chloride | EPA PP, UCMR 3 | EPA 524.2 | ug/L | -- | 0.51 (<0.5-0.64) | 2 / 4 | <0.5 (<0.5-1.7) | 2 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Methyl chloride | EPA PP, UCMR 3 | EPA 524.3 | ug/L | -- | <0.2 | 0 / 4 | 0.37 (<0.2-0.404) | 2 / 3 | <0.2 | 0 / 4 | <0.2 | 0 / 1 | <0.2 |
| Nitrobenzene | EPA PP, UCMR 1 | EPA 8270C | ug/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <1 | 0 / 1 | <5 |
| N-nitrosodiphenylamine | EPA PP, EPA CCL | EPA 8270C | ug/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <1 | 0 / 1 | <5 |
| Naphthalene | EPA PP | EPA 525.2 | ug/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <0.3 | 0 / 1 | <0.3 |
| Parachlorometa cresol (p-Chloro-m-cresol) | EPA PP | EPA 8270C | ug/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| PCB-1016 (Arochlor 1016) | EPA PP | EPA 505 | ug/L | -- | <0.08 | 0 / 4 | <0.08 | 0 / 3 | <0.08 | 0 / 8 | <0.08 | 0 / 1 | <0.08 |
| PCB-1221 (Arochlor 1221) | EPA PP | EPA 505 | ug/L | -- | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 8 | <0.1 | 0 / 1 | <0.1 |
| PCB-1232 (Arochlor 1232) | EPA PP | EPA 505 | ug/L | -- | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 8 | <0.1 | 0 / 1 | <0.1 |
| PCB-1242 (Arochlor 1242) | EPA PP | EPA 505 | ug/L | -- | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 8 | <0.1 | 0 / 1 | <0.1 |
| PCB-1248 (Arochlor 1248) | EPA PP | EPA 505 | ug/L | -- | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 8 | <0.1 | 0 / 1 | <0.1 |
| PCB-1254 (Arochlor 1254) | EPA PP | EPA 505 | ug/L | -- | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 8 | <0.1 | 0 / 1 | <0.1 |
| PCB-1260 (Arochlor 1260) | EPA PP | EPA 505 | ug/L | -- | <0.1 | 0 / 4 | <0.1 | 0 / 3 | <0.1 | 0 / 8 | <0.1 | 0 / 1 | <0.1 |
| Phenanthrene | EPA PP | EPA 525.2 | ug/L | -- | <0.04 | 0 / 4 | <0.04 | 0 / 3 | <0.04 | 0 / 4 | <0.04 | 0 / 1 | <0.04 |

| Sampling Constituent | Contaminant List | Analytical Method | Units | CDPH MCL/NL | RTP Effluent | | Ag Wash Water | | Blanco Drain | | Lake El Estero | | Tembladero Slough |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | |
| Pyrene | EPA PP | EPA 525.2 | ug/L | -- | <0.05 | 0 / 4 | <0.05 | 0 / 3 | <0.05 | 0 / 4 | <0.05 | 0 / 1 | <0.05 |
| ***Pesticides of Local Interest (PoLI)*** | | | | | | | | | | | | | |
| Chlorothalonil (Draconil, Bravo) | PoLI | EPA 525.2 | ug/L | -- | <0.1 | 0 / 4 | <0.1 (<0.1-0.1) | 1 / 3 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.1 |
| Chlorpyrifos | PoLI | EPA 525.2 | ug/L | -- | <0.05 | 0 / 4 | <0.05 | 0 / 3 | <0.05 | 0 / 11 | <0.05 | 0 / 1 | <0.05 |
| Chlorthal-Dimethyl (DCPA) | PoLI | EPA 515.4 | ug/L | -- | 0.56 (0.52-0.86) | 4 / 4 | <0.1 (<0.1-0.16) | 1 / 3 | 38 (36-40) | 4 / 4 | <0.1 | 0 / 1 | 17 |
| Glyphosate, Isopropylamine Salt | PoLI | EPA 547 | ug/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | 7.5 (<5-9.2) | 2 / 4 | <5 | 0 / 1 | 8.1 |
| Methidathion | PoLI | EPA 8141 | ug/L | -- | <0.1 | 0 / 3 | <0.1 | 0 / 2 | <0.1 | 0 / 4 | <0.1 | 0 / 1 | <0.5 |
| Methomyl | PoLI | EPA 531.2 | ug/L | -- | <0.5 (<0.5-0.53) | 1 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Naled | PoLI | EPA 8141 | ug/L | -- | <0.5 | 0 / 4 | <0.5 | 0 / 3 | <0.5 | 0 / 4 | <0.5 | 0 / 1 | <0.5 |
| Oxydemeton-Methyl (Demeton) | PoLI | EPA 8141A | ug/L | -- | <0.2 | 0 / 4 | <0.2 | 0 / 3 | <0.2 | 0 / 4 | <0.2 | 0 / 1 | <0.2 |
| Sulfur | PoLI | EPA 200.7 | mg/L | -- | 38 (36-41) | 4 / 4 | 68 (62-80) | 3 / 3 | 200 (200-210) | 4 / 4 | 50 | 1 / 1 | 140 |
| ***Contaminants of Emerging Concern (CECs)*** | | | | | | | | | | | | | |
| 1,7-Dimethylxanthine | CECs | LC-MS-MS | ng/L | -- | 125 (<10-1100) | 2 / 4 | <10 | 0 / 3 | <10 | 0 / 4 | <10 | 0 / 1 | <10 |
| 2,4-D | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 (<5-17) | 1 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| 4-nonylphenol - semi quantitative | CECs | LC-MS-MS | ng/L | -- | <100 (<100-880) | 1 / 4 | <100 | 0 / 3 | <100 | 0 / 4 | <100 | 0 / 1 | <100 |
| 4-tert-octylphenol | CECs | LC-MS-MS | ng/L | -- | 95 (<50-780) | 2 / 4 | <50 (<50-63) | 1 / 3 | <50 | 0 / 4 | <50 | 0 / 1 | <50 |
| Acesulfame-K | CECs | LC-MS-MS | ng/L | -- | 33000 (22000-85000) | 4 / 4 | 38 (22-44) | 3 / 3 | 1490 (580-3000) | 4 / 4 | 140 | 1 / 1 | 3100 |
| Acetaminophen | CECs | LC-MS-MS | ng/L | -- | <5 (<5-350) | 1 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Albuterol | CECs | LC-MS-MS | ng/L | -- | 14 (<5-33) | 2 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Amoxicillin (semi-quantitative) | CECs | LC-MS-MS | ng/L | -- | 2450 (2000-3700) | 4 / 4 | <20 | 0 / 3 | <20 | 0 / 4 | <20 | 0 / 1 | <20 |
| Androstenedione | CECs, UCMR 3 | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Atenolol | CECs | LC-MS-MS | ng/L | -- | 330 (<5-540) | 3 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Atrazine | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Azithromycin | CECs | LC-MS-MS | ng/L | -- | 1160 (<20-20000) | 2 / 4 | <20 | 0 / 3 | <20 | 0 / 4 | 48 | 1 / 1 | <20 |
| Bendroflumethiazide | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Bezafibrate | CECs | LC-MS-MS | ng/L | -- | 33 (<5-120) | 2 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| BPA | CECs | LC-MS-MS | ng/L | -- | <10 (<10-71) | 1 / 4 | 31 (<10-58) | 2 / 3 | <10 | 0 / 4 | <10 | 0 / 1 | <10 |
| Bromacil | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Butalbital | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 (<5-100) | 1 / 4 | <5 | 0 / 1 | <5 |
| Butylparben | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Caffeine | CECs | LC-MS-MS | ng/L | -- | 1065 (820-2800) | 4 / 4 | 150 (39-200) | 3 / 3 | 6.3 (<5-8.3) | 2 / 4 | 110 | 1 / 1 | 88 |
| Carbadox | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Carbamazepine | CECs | LC-MS-MS | ng/L | -- | 225 (120-360) | 4 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Carisoprodol | CECs | LC-MS-MS | ng/L | -- | 106 (<5-770) | 3 / 4 | <5 | 0 / 3 | <5 (<5-6.1) | 1 / 4 | <5 | 0 / 1 | <5 |
| Chloramphenicol | CECs | LC-MS-MS | ng/L | -- | <10 | 0 / 4 | <10 | 0 / 3 | <10 | 0 / 4 | <10 | 0 / 1 | <10 |
| Chloridazon | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 (<5-58) | 1 / 4 | <5 | 0 / 1 | <5 |
| Chlorotoluron | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |

| Sampling Constituent | Contaminant List | Analytical Method | Units | CDPH MCL/NL | RTP Effluent | | Ag Wash Water | | Blanco Drain | | Lake El Estero | | Tembladero Slough |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | |
| Cimetidine | CECs | LC-MS-MS | ng/L | -- | 88 (<5-430) | 2 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Clofibric Acid | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Cotinine | CECs | LC-MS-MS | ng/L | -- | 115 (25-240) | 4 / 4 | 16 (<10-24) | 2 / 3 | <10 | 0 / 4 | 88 | 1 / 1 | <10 |
| Cyanazine | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| DACT | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 (<5-370) | 1 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | 68 |
| DEA | CECs | LC-MS-MS | ng/L | -- | <5 (<5-16) | 1 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| DEET | CECs | LC-MS-MS | ng/L | -- | 325 (120-1400) | 4 / 4 | <10 (<10-11) | 1 / 3 | <10 (<10-14) | 1 / 4 | 16 | 1 / 1 | 16 |
| Dehydronifedipine | CECs | LC-MS-MS | ng/L | -- | 67 (82-160) | 4 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| DIA | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Diazepam | CECs | LC-MS-MS | ng/L | -- | <5 (<5-12) | 1 / 4 | <5 | 0 / 3 | <5 (<5-6) | 1 / 4 | <5 | 0 / 1 | <5 |
| Diclofenac | CECs | LC-MS-MS | ng/L | -- | 37 (<5-81) | 2 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Dilantin | CECs | LC-MS-MS | ng/L | -- | 140 (120-180) | 4 / 4 | <20 | 0 / 3 | <20 | 0 / 4 | <20 | 0 / 1 | <20 |
| Diuron | CECs | LC-MS-MS | ng/L | -- | 45 (<5-88) | 3 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | 38 | 1 / 1 | 460 |
| Erythromycin | CECs, EPA CCL | LC-MS-MS | ng/L | -- | 30 (<10-120) | 2 / 4 | <10 | 0 / 3 | <10 | 0 / 4 | <10 | 0 / 1 | <10 |
| Estradiol | CECs, UCMR 3 | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Estrone | CECs, UCMR 3 | LC-MS-MS | ng/L | -- | 80 (12-300) | 4 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Ethinyl Estradiol - 17 alpha | CECs, UCMR 3 | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Ethylparaben | CECs | LC-MS-MS | ng/L | -- | <20 | 0 / 4 | <20 | 0 / 3 | <20 | 0 / 4 | <20 | 0 / 1 | <20 |
| Flumeqine | CECs | LC-MS-MS | ng/L | -- | <10 | 0 / 4 | <10 | 0 / 3 | <10 | 0 / 4 | <10 | 0 / 1 | <10 |
| Fluoxetine | CECs | LC-MS-MS | ng/L | -- | 30 (<10-57) | 3 / 4 | <10 | 0 / 3 | <10 | 0 / 4 | <10 | 0 / 1 | <10 |
| Gemfibrozil | CECs | LC-MS-MS | ng/L | -- | 1150 (<5-1600) | 3 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | 11 |
| Ibuprofen | CECs | LC-MS-MS | ng/L | -- | <10 | 0 / 4 | <10 | 0 / 3 | <10 | 0 / 4 | <10 | 0 / 1 | <10 |
| Iohexal | CECs | LC-MS-MS | ng/L | -- | 11700 (7800-40000) | 4 / 4 | <10 | 0 / 3 | 105 (<10-370) | 2 / 4 | <10 | 0 / 1 | 190 |
| Iopromide | CECs | LC-MS-MS | ng/L | -- | 1400 (<5-1800) | 3 / 4 | <5 | 0 / 3 | <5 (<5-16) | 1 / 4 | <5 | 0 / 1 | <5 |
| Isobutylparaben | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | 7 (<5-74) | 2 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Isoproturon | CECs | LC-MS-MS | ng/L | -- | <100 | 0 / 4 | <100 | 0 / 3 | <100 | 0 / 4 | <100 | 0 / 1 | <100 |
| Ketoprofen | CECs | LC-MS-MS | ng/L | -- | 68 (<5-170) | 2 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | 6.9 | 1 / 1 | <5 |
| Ketorolac | CECs | LC-MS-MS | ng/L | -- | <5 (<5-17) | 1 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Lidocaine | CECs | LC-MS-MS | ng/L | -- | 485 (280-800) | 4 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Lincomycin | CECs | LC-MS-MS | ng/L | -- | 26 (<10-51) | 2 / 4 | <10 | 0 / 3 | <10 | 0 / 4 | <10 | 0 / 1 | <10 |
| Linuron | CECs, PoLI | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 (<5-6.3) | 1 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | 9.2 |
| Lopressor | CECs | LC-MS-MS | ng/L | -- | 610 (<20-1200) | 3 / 4 | <20 | 0 / 3 | <20 | 0 / 4 | <20 | 0 / 1 | <20 |
| Meclofenamic Acid | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Meprobamate | CECs | LC-MS-MS | ng/L | -- | 395 (220-730) | 4 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Metazachlor | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Methylparaben | CECs | LC-MS-MS | ng/L | -- | <20 | 0 / 4 | <20 | 0 / 3 | <20 | 0 / 4 | <20 | 0 / 1 | <20 |

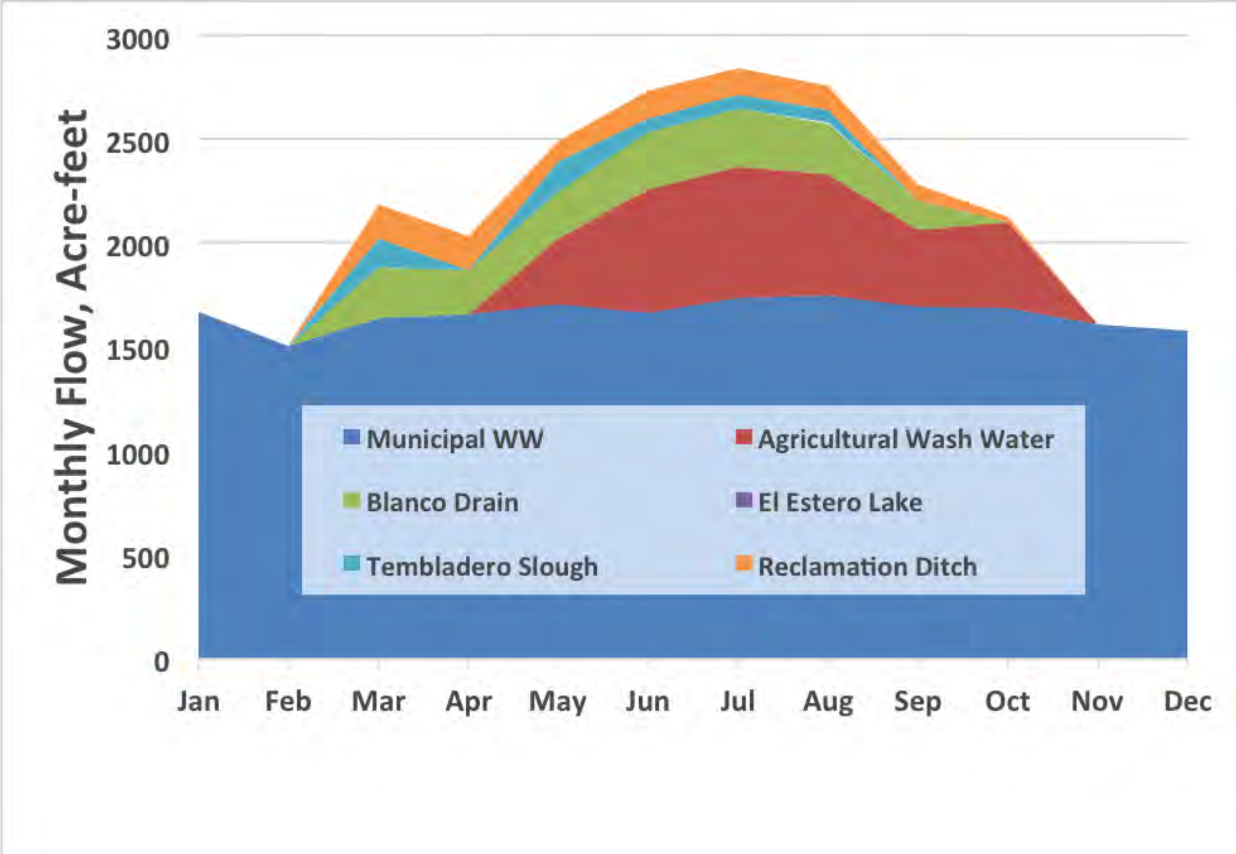
| Sampling Constituent | Contaminant List | Analytical Method | Units | CDPH MCL/NL | RTP Effluent | | Ag Wash Water | | Blanco Drain | | Lake El Estero | | Tembladero Slough |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | Median (Range) | Detected / Measured | |
| Metolachlor | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Naproxen | CECs | LC-MS-MS | ng/L | -- | <10 (<10-41) | 1 / 4 | <10 | 0 / 3 | <10 | 0 / 4 | <10 | 0 / 1 | <10 |
| Nifedipine | CECs | LC-MS-MS | ng/L | -- | <20 | 0 / 4 | <20 | 0 / 3 | <20 | 0 / 4 | <20 | 0 / 1 | <20 |
| Norethisterone | CECs | LC-MS-MS | ng/L | -- | <5 (<5-25) | 1 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Oxolinic Acid | CECs | LC-MS-MS | ng/L | -- | <10 | 0 / 4 | <10 | 0 / 3 | <10 | 0 / 4 | <10 | 0 / 1 | <10 |
| Pentoxifylline | CECs | LC-MS-MS | ng/L | -- | 14 (<5-80) | 3 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Phenazone | CECs | LC-MS-MS | ng/L | -- | <5 (<5-37) | 1 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Primidone | CECs | LC-MS-MS | ng/L | -- | 49 (31-94) | 4 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Progesterone | CECs | LC-MS-MS | ng/L | -- | 5 (<5-58) | 2 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Propazine | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Propylparaben | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Quinoline | CECs, EPA CCL | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 (<5-12) | 1 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Simazine | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Sucralose | CECs | LC-MS-MS | ng/L | -- | 37500 (35000-44000) | 4 / 4 | 280 (<100-1100) | 2 / 3 | 765 (110-2700) | 4 / 4 | 130 | 1 / 1 | 1800 |
| Sulfachloropyridazine | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Sulfadiazine | CECs | LC-MS-MS | ng/L | -- | <5 (<5-9.4) | 1 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Sulfadimethoxine | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Sulfamerazine | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Sulfamethazine | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Sulfamethizole | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Sulfamethoxazole | CECs | LC-MS-MS | ng/L | -- | 880 (470-1600) | 4 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Sulfathiazole | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| TCEP | CECs | LC-MS-MS | ng/L | -- | 120 (<10-320) | 3 / 4 | <10 (<10-16) | 1 / 3 | <10 (<10-13) | 1 / 4 | 33 | 1 / 1 | <10 |
| TCPP | CECs | LC-MS-MS | ng/L | -- | 570 (440-720) | 4 / 4 | <100 | 0 / 3 | <100 | 0 / 4 | <100 | 0 / 1 | <100 |
| TDCPP | CECs | LC-MS-MS | ng/L | -- | 635 (510-880) | 4 / 4 | <100 | 0 / 3 | <100 | 0 / 4 | <100 | 0 / 1 | <100 |
| Testosterone | CECs, UCMR 3 | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 (<5-18) | 1 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Theobromine | CECs | LC-MS-MS | ng/L | -- | <10 (<10-700) | 1 / 4 | <10 | 0 / 3 | <10 | 0 / 4 | <10 | 0 / 1 | <10 |
| Theophylline | CECs | LC-MS-MS | ng/L | -- | 225 (<20-2200) | 2 / 4 | <20 | 0 / 3 | <20 | 0 / 4 | <20 | 0 / 1 | <20 |
| Triclosan | CECs | LC-MS-MS | ng/L | -- | 325 (180-1600) | 4 / 4 | <10 | 0 / 3 | <15 (<10-67) | 1 / 4 | <10 | 0 / 1 | <10 |
| Trimethoprim | CECs | LC-MS-MS | ng/L | -- | 505 (48-1700) | 4 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |
| Warfarin | CECs | LC-MS-MS | ng/L | -- | <5 | 0 / 4 | <5 | 0 / 3 | <5 | 0 / 4 | <5 | 0 / 1 | <5 |

## Appendix C

## Projected Monthly Flows of Source Waters to the Regional Treatment Plant Influent

## RTP Source Water Flow Blends by Scenario and Month (flows in million gallons per day)

| Phase | Scenario | Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Phase A | Normal/Wet - Building Reserve | **Municipal WW** | 17.6 | 17.5 | 17.3 | 18.0 | 18.0 | 18.1 | 18.3 | 18.4 | 18.4 | 17.8 | 17.5 | 16.6 |
| | | **Ag Wash** | 0.0 | 0.0 | 0.0 | 0.6 | 3.3 | 6.4 | 6.7 | 6.8 | 5.5 | 4.4 | 0.0 | 0.0 |
| | | **Blanco Drain** | 0.0 | 0.0 | 0.0 | 1.9 | 1.9 | 1.9 | 0.7 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | **El Estero** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | **Tembladero Slough** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | **Rec Ditch** | 0.0 | 0.0 | 0.0 | 1.1 | 0.8 | 1.2 | 1.2 | 1.2 | 0.3 | 0.0 | 0.0 | 0.0 |
| | Normal/Wet - Full Reserve | **Municipal WW** | 17.6 | 17.5 | 17.3 | 18.0 | 18.0 | 18.1 | 18.3 | 18.4 | 18.4 | 17.8 | 17.5 | 16.6 |
| | | **Ag Wash** | 0.0 | 0.0 | 0.0 | 0.6 | 3.3 | 6.4 | 6.7 | 6.8 | 5.5 | 4.4 | 0.0 | 0.0 |
| | | **Blanco Drain** | 0.0 | 0.0 | 0.0 | 1.9 | 1.9 | 1.9 | 0.7 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | **El Estero** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | **Tembladero Slough** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | **Rec Ditch** | 0.0 | 0.0 | 0.0 | 1.1 | 0.8 | 1.2 | 1.2 | 1.2 | 0.3 | 0.0 | 0.0 | 0.0 |
| | Drought | **Municipal WW** | 17.6 | 17.5 | 17.3 | 18.0 | 18.0 | 18.1 | 18.3 | 18.4 | 18.4 | 17.8 | 17.5 | 16.6 |
| | | **Ag Wash** | 0.0 | 0.0 | 0.0 | 0.0 | 3.3 | 6.4 | 6.7 | 6.2 | 4.0 | 4.3 | 0.0 | 0.0 |
| | | **Blanco Drain** | 0.0 | 0.0 | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 | 1.9 | 1.5 | 0.0 | 0.0 | 0.0 |
| | | **El Estero** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | **Tembladero Slough** | 0.0 | 0.0 | 1.5 | 1.0 | 1.5 | 0.7 | 0.7 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | **Rec Ditch** | 0.0 | 0.0 | 1.0 | 1.1 | 0.8 | 1.2 | 1.2 | 1.2 | 0.8 | 0.0 | 0.0 | 0.0 |
| Phase B | Normal/Wet - Building Reserve | **Municipal WW** | 17.6 | 17.5 | 17.3 | 18.0 | 18.0 | 18.1 | 18.3 | 18.4 | 18.4 | 17.8 | 17.5 | 16.6 |
| | | **Ag Wash** | 0.0 | 0.0 | 0.0 | 0.6 | 4.8 | 6.4 | 6.7 | 6.8 | 4.0 | 4.4 | 0.0 | 0.0 |
| | | **Blanco Drain** | 0.0 | 0.0 | 0.0 | 1.6 | 0.1 | 1.5 | 0.1 | 0.7 | 0.8 | 0.0 | 0.0 | 0.0 |
| | | **El Estero** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | **Tembladero Slough** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | **Rec Ditch** | 0.0 | 0.0 | 0.0 | 1.9 | 1.5 | 2.0 | 1.8 | 1.4 | 1.1 | 0.0 | 0.0 | 0.0 |
| | Normal/Wet - Full Reserve | **Municipal WW** | 17.6 | 17.5 | 17.3 | 18.0 | 18.0 | 18.1 | 18.3 | 18.4 | 18.4 | 17.8 | 17.5 | 16.6 |
| | | **Ag Wash** | 0.0 | 0.0 | 0.0 | 0.6 | 4.8 | 6.4 | 6.7 | 6.8 | 4.0 | 4.4 | 0.0 | 0.0 |
| | | **Blanco Drain** | 0.0 | 0.0 | 0.0 | 1.7 | 0.6 | 2.1 | 0.5 | 0.8 | 1.0 | 0.0 | 0.0 | 0.0 |
| | | **El Estero** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | **Tembladero Slough** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | **Rec Ditch** | 0.0 | 0.0 | 0.0 | 1.8 | 1.0 | 1.4 | 1.4 | 1.3 | 0.9 | 0.0 | 0.0 | 0.0 |
| | Drought | **Municipal WW** | 17.6 | 17.5 | 17.3 | 18.0 | 18.0 | 18.1 | 18.3 | 18.4 | 18.4 | 17.8 | 17.5 | 16.6 |
| | | **Ag Wash** | 0.0 | 0.0 | 0.0 | 0.0 | 3.3 | 6.4 | 6.7 | 6.2 | 4.0 | 4.3 | 0.0 | 0.0 |
| | | **Blanco Drain** | 0.0 | 0.0 | 2.5 | 2.3 | 2.4 | 3.0 | 2.9 | 2.6 | 1.5 | 0.0 | 0.0 | 0.0 |
| | | **El Estero** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | **Tembladero Slough** | 0.0 | 0.0 | 1.5 | 0.0 | 1.5 | 0.7 | 0.7 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 |
| | | **Rec Ditch** | 0.0 | 0.0 | 1.7 | 1.8 | 1.0 | 1.4 | 1.4 | 1.3 | 0.9 | 0.2 | 0.0 | 0.0 |




**Monthly Blend Composition from Various Source Waters under Phase B, Drought Scenario**

Previous Interagency agreements established entitlements to recycled water produced from the existing municipal wastewater flows to the Regional Treatment Plant (RTP). As source flows for the GWR Project were studied and the seasonal variability of each was understood, the stakeholder Agencies entered into a Memorandum of Understanding Regarding Source Waters and Water Recycling (MOU). The Parties to the MOU are the Monterey Regional Water Pollution Control Agency, the Monterey County Water Resources Agency, the City of Salinas, the Marina Coast Water District (MCWD), and the Monterey Peninsula Water Management District. The MOU is an agreement to "negotiate a Definitive Agreement to establish contractual rights and obligations of all Parties," and includes (1) protection of MCWD's recycled water right entitlement, (2) provision of recycled water to Monterey County Water Resources Agency for Castroville Seawater Intrusion Project, (3) definition of a Phase A consisting of provisions for assuring adequate source water for the GWR Project and additional water for the existing Castroville Seawater Intrusion Project service area, and (4) definition of a Phase B that would increase diversion and use of the new source waters to benefit Castroville Seawater Intrusion Project. The MOU also includes provisions for creation of a drought reserve by producing up to 200 acre-fee per year (AFY) of additional purified water during wet and normal years for injection in the Seaside Groundwater Basin. During dry years, the GWR Project would reduce production to allow more of the source water to supply the Salinas Valley Reclamation Plant and Castroville Seawater Intrusion Project.

Water rights permits from the State Water Resources Control Board would be required for surface water diversions from the Reclamation Ditch, Blanco Drain, and Tembladero Slough. It is anticipated that these permits would be processed in two steps, defined as Phase A and B. Permits for diversion rates less than 3 cubic feet per second (cfs) may be processed as administrative actions, and would be requested initially. Diversions at greater rates require a more detailed permitting process, and could replace or amend the initial permits. For Phase A of the GWR Project, the estimated yields are based on diverting up to 2.99 cfs from each source. For Phase B of the Proposed Project, the diversion rates for the

Reclamation Ditch and Blanco Drain would be increased to up to 6 cfs. A maximum expected diversion flow has been developed based on an assessment of infrastructure capacity and peak flow availabilities in those water bodies. Flows in these channels are less seasonal than urban runoff, but still peak in the winter months during rain events. These sources would be diverted when flows are available and when the other sources of supply are not sufficient to meet the full Project demands. Radio-controlled supervisory control and data acquisition equipment at each diversion pump station would allow the system operators to adjust the diversion rates in response to daily rainfall and irrigation conditions.

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# Appendix E

# Air Quality and Greenhouse Gas Technical Analyses

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**CONSTRUCTION AIR QUALITY ANALYSIS**

**Illingworth & Rodkin, Inc.**

**December 2014**

# Figure 2-30
# Preliminary Draft Proposed Project Construction Schedule
# Monterey Peninsula Groundwater Replenishment Project

| Project Component | General Construction Activities | 2016 | | | | | | | 2017 | | | | | | | | | | | | 2018 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar |
| **Salinas Pump Station Site** | | | | | | | | | | | | | | | | | | | | | | | |
| including pipes, wet wells/diversion structures, valves, SCADA | Site preparation and Demolition | | X | | | | | | | | | | | | | | | | | | | | |
| | Excavate/form/cast Junction and Diversion structures | | | X | X | X | | | | | | | | | | | | | | | | | |
| | Pipeline Trenching and Installation | | | | X | X | | | | | | | | | | | | | | | | | |
| | Install valves/Gates in Diversion structures | | | | | X | X | | | | | | | | | | | | | | | | |
| | Install electrical and controls | | | | | | X | | | | | | | | | | | | | | | | |
| | Site Paving | | | | | | X | | | | | | | | | | | | | | | | |
| **Salinas Industrial Wastewater Treatment Facility** | | | | | | | | | | | | | | | | | | | | | | | |
| Return Facilities - Sliplining of new Force Main inside existing 33-inch IWW pipeline, on-site piping from Aeration Basin at IWTP to new Reture PS at IWTP and Return PS with Valve and Meter Vaults. | Site preparation and Demolition | X | | | | | | | | | | | | | | | | | | | | | |
| | Dewatering | X | X | X | | | | | | | | | | | | | | | | | | | |
| | Excavate/form/cast wet well and intake structures for Return PS at IWTP | X | X | X | | | | | | | | | | | | | | | | | | | |
| | Install valves/Gates in wet well and intake structures for Return PS at IWTP | | | X | | | | | | | | | | | | | | | | | | | |
| | Install FM in to Existing 33-inch IWW pipeline to Salinas PS | X | X | X | X | X | X | X | | | | | | | | | | | | | | | |
| | Install Gravity pipe line from Aeration Basin to Return PS | | X | X | | | | | | | | | | | | | | | | | | | |
| | Install electrical and controls | | | | X | | | | | | | | | | | | | | | | | | |
| | Site Paving | | | | | X | | | | | | | | | | | | | | | | | |
| Storage and Recovery Additions: New Pump station at Pond 3, Pipeline at IWTP to Return PS, and SCADA. | Site preparation and Demolition | | | | | | | | | | | X | | | | | | | | | | | |
| | Dewatering | | | | | | | | | | | | | | | | | | | | | | |
| | Excavate/form/cast wet well and intake structures at at Pond 3 IWTP | | | | | | | | | | | X | X | X | | | | | | | | | |
| | Pipeline Trenching and Installation at IWTP -Pond 3 to Return PS | | | | | | | | | | | X | X | X | X | X | | | | | | | |
| | Install electrical and controls | | | | | | | | | | | | | | X | | | | | | | | |
| | Start-up and testing | | | | | | | | | | | | | | | | X | | | | | | |
| | Site Paving | | | | | | | | | | | | | | | X | | | | | | | |
| **Reclamation Ditch at Davis Road** | | | | | | | | | | | | | | | | | | | | | | | |
| including pipes, pumps, wet wells/diversion structures, valves, and SCADA | Site preparation and Demolition | | | | | | | | | | | | X | | | | | | | | | | |
| | Bypass Flow Diversion | | | | | | | | | | | | X | X | X | X | | | | | | | |
| | Excavate/form/cast wet well and intake structure | | | | | | | | | | | | | X | X | X | | | | | | | |
| | Pipeline Trenching and Installation | | | | | | | | | | | | | | | X | | | | | | | |
| | Install valves/Gates in wet well and intake structures | | | | | | | | | | | | | | | X | | | | | | | |
| | Install electrical and controls | | | | | | | | | | | | | | | X | | | | | | | |
| | Start-up and testing | | | | | | | | | | | | | | | | X | | | | | | |
| | Site Paving | | | | | | | | | | | | | | | X | | | | | | | |
| **Tembladero Slough at Castroville Site** | | | | | | | | | | | | | | | | | | | | | | | |
| including pipes, pumps, wet wells/diversion structures, valves, and SCADA | Site preparation and Demolition | | | | | | | | | | | | X | | | | | | | | | | |
| | Bypass Flow Diversion | | | | | | | | | | | | X | X | X | X | | | | | | | |
| | Excavate/form/cast wet well and intake structure | | | | | | | | | | | | | X | X | X | | | | | | | |
| | Pipeline Trenching and Installation | | | | | | | | | | | | | | | X | | | | | | | |
| | Install valves/Gates in wet well and intake structures | | | | | | | | | | | | | | | X | | | | | | | |
| | Install electrical and controls | | | | | | | | | | | | | | | X | | | | | | | |
| | Start-up and testing | | | | | | | | | | | | | | | | X | | | | | | |
| | Site Paving | | | | | | | | | | | | | | | X | | | | | | | |
| **Blanco Drain Pump Station & Pipeline Site** | | | | | | | | | | | | | | | | | | | | | | | |
| including pipes, wet wells/diversion structures, valves, SCADA | Site preparation and Demolition | | | | | | | | | | | X | | | | | | | | | | | |
| | Bypass Flow Diversion | | | | | | | | | | | | | | | X | X | X | X | | | | |
| | Excavate/form/cast wet well and intake structure | | | | | | | | | | | | | | | | X | X | X | | | | |
| | Gravity Pipeline Trenching and Installation | | | | | | | | | | | X | X | X | | | | | | | | | |
| | Salinas River Crossing | | | | | | | | | | | | | | X | X | | | | | | | |
| | Install gravity pipeline to RTP | | | | | | | | | | | | | | | X | X | X | | | | | |
| | Install valves/Gates in wet well and intake structures | | | | | | | | | | | | | | | | | | X | | | | |
| | Install pumps, electrical and controls | | | | | | | | | | | | | | | | | X | X | | | | |
| | Start-up and testing | | | | | | | | | | | | | | | | | | | X | | | |
| | Site Paving | | | | | | | | | | | | | | | | | | X | | | | |
| **Lake El Estero Diversion Site** | | | | | | | | | | | | | | | | | | | | | | | |
| including new pumps in existing dry well structure, pipeline, valves, SCADA | Site preparation and Demolition | | | | | | | | | | | | | | | | X | | | | | | |
| | Bypass Flow Diversion | | | | | | | | | | | | | | | | X | X | | | | | |
| | Excavate/form/cast wet well and intake structure | | | | | | | | | | | | | | | | X | X | | | | | |
| | Pipeline Trenching and Installation | | | | | | | | | | | | | | | | | X | | | | | |
| | Install valves/Gates in wet well and intake structures | | | | | | | | | | | | | | | | | X | | | | | |
| | Install electrical and controls | | | | | | | | | | | | | | | | | X | | | | | |
| | Start-up and testing | | | | | | | | | | | | | | | | | | X | | | | |
| | Site Paving | | | | | | | | | | | | | | | | | X | | | | | |
| **RTP site (all new / modified facilities)** | | | | | | | | | | | | | | | | | | | | | | | |
| AWT Facility (incl. pipelines, diversion structures pretreatment, MF/RO/UV AOP, Brine Mixing Station, Product Water Pump Station) | Site Preparation | | X | X | | | | | | | | | | | | | | | | | | | |
| | Grading/Sheeting-Shoring/ Excavation | | | X | X | X | X | | | | | | | | | | | | | | | | |
| | Trenching | | | | X | X | X | X | | | | X | X | X | X | X | | | | | | | |
| | Cutting, laying and welding pipelines | | | | X | X | X | X | X | X | X | X | X | X | | | | | | | | | |
| | Pouring concrete | | | | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | | |
| | Building (exterior) | | | | | | | | | | | | | X | X | X | | | | | | | |
| | Building (interior) | | | | | | | | | | | | | | | X | X | X | X | X | | | |
| | Equipment Delivery and Set-Up | | | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | | | | |
| | Coating | | | | | | | | | | | | | | | | | X | X | X | | | |
| | Paving, Electrical, site Clean-up | | | | | | | | X | X | X | X | X | X | X | X | X | X | X | X | | | |
| | Final Facility Testing | | | | | | | | | | | | | | | | | | | X | X | X | X |
| SVRP Modifications (incl. new pipelines, sluice gates, contact basin mods and controls) | Dewater 80 AF pond | | | | | | X | X | X | X | | | | | | | | | | | | | |
| | Trenching/Installing Pipelines | | | | | | | X | X | | | | | | | | | | | | | | |
| | Inlet and outlet modifications | | | | | | X | X | X | | | | | | | | | | | | | | |
| | Sluice Gates | | | | | | | | | X | X | X | | | | | | | | | | | |
| | Gate motors and controls | | | | | | | | | | | X | X | X | X | | | | | | | | |
| | Chlorination Basin upgrades | | | | | | | X | X | | | | | | | | | | | | | | |
| **Product Water Conveyance (southern border of RTP to Injection Well Facilities Site)** | | | | | | | | | | | | | | | | | | | | | | | |
| Product Water Conveyance Pipeline | Pipeline Installation (250 feet/day for roadways and 400 feet/day open areas) | | | | | X | X | X | X | X | X | X | X | X | X | X | X | X | X | X | | | |
| Booster Pump Station (Coastal or RUWAP) | Site Preparation | | | | | | | | | | | X | | | | | | | | | | | |
| | Grading/ Excavation | | | | | | | | | | | | X | | | | | | | | | | |
| | Trenching | | | | | | | | | | | | X | X | | | | | | | | | |
| | Pouring concrete | | | | | | | | | | | | | X | X | | | | | | | | |
| | Building (exterior) | | | | | | | | | | | | | | X | X | X | | | | | | |
| | Building (interior) | | | | | | | | | | | | | | | | X | X | X | | | | |
| | Equipment Delivery and Site Clean-up | | | | | | | | | | | | | | | | X | X | X | | | | |
| | Paving/Landscaping | | | | | | | | | | | | | | | | | X | X | X | | | |
| | Final Facility Testing | | | | | | | | | | | | | | | | | | | X | X | X | X |
| **Injection Well Facilities** | | | | | | | | | | | | | | | | | | | | | | | |
| Access Road and Preliminary Grading | Soil stabilization for rig access | | | X | | | | | | | | | | | | | | | | | | | |
| Monitoring well (GWR-MW-1) | Drill, install, develop, sample | | | | X | | | | | | | | | | | | | | | | | | |
| Monitoring well (GWR-MW-2) | Drill, install, develop, sample | | | | | X | | | | | | | | | | | | | | | | | |
| Monitoring well (GWR-MW-3) | Drill, install, develop, sample | | | | | | X | | | | | | | | | | | | | | | | |
| Monitoring well (GWR-MW-4) | Drill, install, develop, sample | | | | | | | X | | | | | | | | | | | | | | | |
| Deep injection well (GWR-DIW-1) | Drill, install, develop,aquifer/injection testing | | | | | X | X | | | | | | | | | | | | | | | | |
| Deep injection well (GWR-DIW-2) | Drill, install, develop,aquifer/injection testing | | | | | | X | X | | | | | | | | | | | | | | | |
| Deep injection well (GWR-DIW-3) | Drill, install, develop,aquifer/injection testing | | | | | | | X | X | | | | | | | | | | | | | | |
| Deep injection well (GWR-DIW-4) | Drill, install, develop,aquifer/injection testing | | | | | | | | X | X | | | | | | | | | | | | | |
| Vadose zone well (GWR-VZ-1) | Drill, install, pilot injection testing | | | | | | | | X | X | | | | | | | | | | | | | |
| Vadose zone well (GWR-VZ-2) | Drill, install, test | | | | | | | | | | X | | | | | | | | | | | | |
| Vadose zone well (GWR-VZ-4) | Drill, install, test | | | | | | | | | | | X | | | | | | | | | | | |
| Vadose zone well (GWR-VZ-4) | Drill, install, test | | | | | | | | | | | | X | | | | | | | | | | |
| Motor/Electrical Control Buildings (4 bldgs, 1 per site) | Site preparation | | | | | | | | X | X | | | | | | | | | | | | | |
| | Building foundations and UG Conduits | | | | | | | | | X | X | X | | | | | | | | | | | |
| | Building construction | | | | | | | | | | | X | X | X | | | | | | | | | |
| | Paving/Electrical | | | | | | | | | | | | X | X | X | | | | | | | | |
| | Eqipment installation | | | | | | | | | | | | | X | X | X | | | | | | | |
| | Landscaping | | | | | | | | | | | | | | | | X | X | | | | | |
| | Final Testing and Clean-Up | | | | | | | | | | | | | | | | | | X | X | X | X | X |
| Pipelines / Conduits / Access Roads (including product water and backflush pipes) | Pipeline/Conduits (200 LF/day) | | | | | | | | | | | | X | X | X | | | | | | | | |
| | Final grading/drainage | | | | | | | | | | | | | | X | X | | | | | | | |
| | Roadway surfacing | | | | | | | | | | | | | | | X | X | | | | | | |
| Backflush Pumps/Motors Pipe, Backflush Basin | Site preparation | | | | | | | | X | | | | | | | | | | | | | | |
| | Install pumps/motors/pipes at wells | | | | | | | | | X | X | X | X | X | X | | | | | | | | |
| | Grade Backflush Basin | | | | | | | | | X | X | X | | | | | | | | | | | |
| | Install Pipes/Conduits at Basin | | | | | | | | | | | X | X | X | X | | | | | | | | |
| | Test Backflush Pumps, Pipelines and Basin | | | | | | | | | | | | | | | X | X | | | | | | |
| | Site Paving and Landscaping | | | | | | | | | | | | | | | | | X | X | X | | | |
| | Final Facility Testing | | | | | | | | | | | | | | | | | | | | X | X | X |
| **CalAm Transfer and Monterey Pipelines** | | | | | | | | | | | | | | | | | | | | | | | |
| Transfer Pipeline | Pipeline Installation (150 - 250 feet/day) | | | | | | | | | | | | | | X | X | X | X | X | X | | | |
| Monterey Pipeline | Pipeline Installation (150 - 250 feet/day) | | X | X | X | X | X | X | X | X | X | X | X | X | | | | | | | | | |

Revised by Todd Groundwater February 13, 2014, 5pm

Version updated by DD&A to include all expanded GWR project facilities, October 1, 2014, 5:00 p.m.

Updated by S&W 22 OCT 2014
Updated by E2 25OCT14

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## Pure Water Monterey Groundwater Repleneshment Project

**Construction Emissions**

| Description | ROG (Emissions in Tons) | NOx (Emissions in Tons) | PM10 (Emissions in Tons) | PM2.5 (Emissions in Tons) | CO2e | Construction Days | ROG (Emissions in Avg. Pounds Per Day) | NOx (Emissions in Avg. Pounds Per Day) | PM10 (Emissions in Avg. Pounds Per Day) | PM2.5 (Emissions in Avg. Pounds Per Day) | CO2e (Emission CO2e in Metric Tons) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Salinas Pump Station | 0.168020715 | 1.274148354 | 0.086199767 | 0.083529719 | 157 | 126 | 3 | 20 | 1 | 1 | 142 |
| SIWTF Storage and Recovery | 0.096464773 | 0.728291228 | 0.047704308 | 0.045169456 | 99 | 126 | 2 | 12 | 1 | 1 | 90 |
| Slip-Lining 33" pipeline | 0.391526103 | 3.055024254 | 0.209600107 | 0.204454817 | 379 | 147 | 5 | 42 | 3 | 3 | 344 |
| Reclamation Ditch Diversion at Davis Rd | 0.088790275 | 0.668715117 | 0.046883341 | 0.046158345 | 98 | 105 | 2 | 13 | 1 | 1 | 89 |
| Tembladero Slough Diversion at Castroville | 0.096320396 | 0.727025396 | 0.049574588 | 0.048600393 | 103 | 105 | 2 | 14 | 1 | 1 | 94 |
| Blanco Drain Diversion and Pipeline | 0.180974523 | 1.418882793 | 0.090884002 | 0.087580102 | 205 | 189 | 2 | 15 | 1 | 1 | 186 |
| El Estero lake Storage Construction | 0.008904861 | 0.065878296 | 0.004755501 | 0.004389178 | 9 | 63 | 0 | 2 | 0 | 0 | 9 |
| Advanced Water Treatment Facility | 0.760532947 | 6.31295134 | 0.376780834 | 0.353363399 | 733 | 378 | 4 | 33 | 2 | 2 | 665 |
| Product Water | 0.810184905 | 7.191388183 | 0.417319224 | 0.385684792 | 1093 | 315 | 5 | 46 | 3 | 2 | 991 |
| RUWAP | 0.810184905 | 7.191388183 | 0.417319224 | 0.385684792 | 1093 | 315 | 5 | 46 | 3 | 2 | 991 |
| Coastal | 0.716037383 | 6.276498832 | 0.374455225 | 0.349361553 | 904 | 315 | 5 | 40 | 2 | 2 | 820 |
| Well Site Improvements (incl. backflush, pumps, monitoring wells) | 1.184290721 | 11.56886554 | 0.562018343 | 0.53054773 | 1910.956 | 357 | 7 | 65 | 3 | 3 | 1,734 |
| Total Emissions | 3.79 | 33.01 | 1.89 | 1.79 | tons | | | | | | 4,343 MT |
| Average Daily Emissions based on 378 working days | 20 | 175 | 10 | 9 | lbs/day | | | | | Amortized (30 yr) | 145 MT/year |

**Maximum Daily Emissions in Pounds Per Day**

| | ROG | NOx | PM10 | PM2.5 | |
|---|---|---|---|---|---|
| Max. Day (RUWAP) - Equip exhaust and vehicle traffic | 62 | 496 | 26 | 22 | lbs/day |
| Max. Day (Coastal) - Equip exhaust and vehicle traffic | 59 | 452 | 24 | 21 | lbs/day |
| **Max. Day for Well Sites (i.e., non typical equipment)** | **10** | **104** | **5** | **5** | lbs/day |
| On-Site PM10 and PM2.5 (Fugitive + Construction exhaust) | | | 121 | 36 | lbs/day |
| Mitigated Max. On-Site PM10 and PM2.5 (Fugitive + Construction exhaust) | | | 55 | 24 | lbs/day |

**Additional Projects ( MGD Overlapping Construction Activities)**

| | ROG | NOx | PM10 | PM2.5 | CO2e | | |
|---|---|---|---|---|---|---|---|
| Monterey Pipeline Construction (from ESA) | 3.83 | 50.88 | 2.06 | 1.86 | 1,136 | lbs/day | 252 construction days |
| Transfer Pipeline Construction (from ESA) | 3.78 | 50.14 | 2.04 | 1.84 | 561 | lbs/day | 126 construction days |

| | ROG | NOx | PM10 | PM2.5 | | | |
|---|---|---|---|---|---|---|---|
| Total Additional Average Daily Emissions (from ESA) | 4 | 51 | 2 | 2 | lbs/day | | 6,039 |
| Total GWR + Transfer Pipelines (ESA) | 24 | 225 | 12 | 11 | lbs/day | Amortized (30 yr) | 201 |
| Max. Day (RUWAP) - Equip exhaust and vehicle traffic | 66 | 547 | 28 | 24 | lbs/day | | |
| Max. Day (Coastal) - Equip exhaust and vehicle traffic | 63 | 502 | 26 | 23 | lbs/day | | |
| **Max. Day for Well Sites** | | | | | | | |
| On-Site PM10 and PM2.5 (Fugitive + Construction exhaust) | | | 145 | 41 | lbs/day | | |
| Mitigated Max. On-Site PM10 and PM2.5 (Fugitive + Construction exhaust) | | | 64 | 27 | lbs/day | | |

**Pure Water Monterey Groundwater Repleneshment Project**

## Daily Air Pollutant Emissions

| Project Component | Daily Dimensions (feet) Length | Width | Worst Day Analysis Size | Units | Emission Type (Area, Pipe. Road) | Unmitigated Emissions Emission Factor (lbs/unit) PM10 | PM2.5 | Mitigated Emissions Emission Factor (lbs/unit) PM10 | PM2.5 |
|---|---|---|---|---|---|---|---|---|---|
| Salinas Pump Station Site | | | | | | | | | |
| Facility construction | -- | -- | 0.75 | acres | Area | | | | |
| Truck travel | vehicles = | 12 | 0.10 | miles | Road | | | | |
| Worker travel | vehicles = | 34 | 0.10 | miles | Road | | | | |
| SIWTF Storage and Recovery | | | | | | | | | |
| Facility construction | -- | -- | 0.25 | acres | Area | 5.0 | 1.0 | | |
| Pipeline from Pond 3 | 150 | 20 | 0.07 | acres | Area | 1.4 | 0.3 | | |
| Pipeline from Pond 3 | 150 | 6 | 400.00 | cy | Pipeline/trench | 0.7 | 0.2 | | |
| Truck travel | vehicles = | 13 | 0.10 | miles | Road | 2.5 | 0.3 | | |
| Worker travel | vehicles = | 10.5 | 0.10 | miles | Road | 0.8 | 0.1 | | |
| | | | | | | 10.4 | 1.9 | 3.6 | 0.7 |
| Slip-Lining 33" pipeline | | | | | | | | | |
| Force main gravity pipeline | | | 0.00 | acres | Area | | | | |
| Force main gravity pipeline | | | 0.00 | cy | Pipeline/trench | | | | |
| Truck travel | vehicles = | | 0.10 | miles | Road | | | | |
| Worker travel | vehicles = | | 0.10 | miles | Road | | | | |
| Reclamation Ditch Diversion at Davis Rd | | | | | | | | | |
| Facility construction | 120 | 50 | 0.14 | acres | Area | 2.8 | 0.6 | | |
| Truck travel | vehicles = | 6 | 0.10 | miles | Road | 1.2 | 0.1 | | |
| Worker travel | vehicles = | 13 | 0.10 | miles | Road | 1.0 | 0.1 | | |
| | | | | | | 4.9 | 0.8 | 1.7 | 0.3 |
| Tembladero Slough Diversion at Castroville | | | | | | | | | |
| Construction area | 200 | 50 | 0.23 | acres | Area | 4.6 | 1.0 | | |
| Truck travel | vehicles = | 6 | 0.10 | miles | Road | 1.2 | 0.1 | | |
| Worker travel | vehicles = | 13 | 0.10 | miles | Road | 1.0 | 0.1 | | |
| | | | | | | 6.8 | 1.2 | 2.4 | 0.4 |
| Blanco Drain Diversion and Pipeline | | | | | | | | | |
| Facility construction | 50 | 50 | 0.06 | acres | Area | 1.1 | 0.2 | | |
| Pipeline trenching | 250 | 6 | 666.67 | cy | Pipeline/trench | 1.1 | 0.3 | | |
| Truck travel | vehicles = | 40 | 0.10 | miles | Road | 7.8 | 0.8 | | |
| Worker travel | vehicles = | 18 | 0.10 | miles | Road | 1.4 | 0.1 | | |
| | | | | | | 11.4 | 1.5 | 4.0 | 0.5 |
| Lake El Estero Stroage Management Site | | | | | | | | | |
| Facility construction | 30 | 30 | 0.02 | acres | Area | | | | |
| Truck travel | vehicles = | 10 | 0.10 | miles | Road | | | | |
| Worker travel | vehicles = | 16 | 0.10 | miles | Road | | | | |
| | | | | | | 0.0 | 0.0 | 0.0 | 0.0 |
| Advanced Water Treatment Facility | | | | | | | | | |
| Facility construction | -- | -- | 0.86 | acres | Area | 17.2 | 3.6 | | |
| Salinas Valley Reclamation Plant pipeline | 100 | 6 | 266.67 | cy | Pipeline/trench | 0.4 | 0.1 | | |
| Truck travel | vehicles = | 10 | 0.10 | miles | Road | 2.0 | 0.2 | | |
| Worker travel | vehicles = | 22 | 0.10 | miles | Road | 1.7 | 0.2 | | |
| | | | | | | 21.3 | 4.1 | 7.4 | 1.4 |
| SVRP Modification | | | | | | | | | |
| Facility construction | 700 | 400 | 6.43 | acres | Area | | | 0.0 | 0.0 |
| Product Water Conveyance - Pipelines/Pumps | | | | | | | | | |
| RUWAP AWT to Booster Pump Station | 250 | 12 | 0.07 | acres | Area | 1.4 | 0.3 | | |
| RUWAP Booster Pump Station to Injection Wells | 250 | 6 | 0.03 | acres | Area | 0.7 | 0.1 | | |
| RUWAP AWT to Booster Pump Station | 250 | 12 | 1333.33 | cy | Pipeline/trench | 2.2 | 0.7 | | |
| RUWAP Booster Pump Station to Injection Wells | 250 | 6 | 666.67 | cy | Pipeline/trench | 1.1 | 0.3 | | |
| Truck travel | vehicles = | 10 | 0.10 | miles | Road | 2.0 | 0.2 | | |
| Worker travel | vehicles = | 26 | 0.10 | miles | Road | 2.0 | 0.2 | | |
| Booster Pump Station (one of two optional sites) | 100 | 60 | 0.14 | acres | Area | 2.8 | 0.6 | | |
| Truck travel | vehicles = | 6 | 0.10 | miles | Road | 1.2 | 0.1 | | |
| Worker travel | vehicles = | 11 | 0.10 | miles | Road | 0.8 | 0.1 | | |
| | | | | | | 14.0 | 2.6 | 4.9 | 0.9 |
| OR | | | | | | | | | |
| Coastal AWT Facility to Booster Pump Station | 250 | 12 | 0.07 | acres | Area | 1.4 | 0.3 | | |
| Coastal Booster Pump Station to Injection Wells | 250 | 6 | 0.03 | acres | Area | 0.7 | 0.1 | | |
| Coastal AWT Facility to Booster Pump Station | 250 | 12 | 1333.33 | cy | Pipeline/trench | 2.2 | 0.7 | | |
| Coastal Booster Pump Station to Injection Wells | 250 | 6 | 666.67 | cy | Pipeline/trench | 1.1 | 0.2 | | |
| Truck travel | vehicles = | 12 | 0.10 | miles | Road | 2.3 | 0.2 | | |
| Worker travel | vehicles = | 26 | 0.10 | miles | Road | 2.0 | 0.2 | | |
| Booster Pump Station (one of two optional sites) | 100 | 60 | 0.14 | acres | Area | 2.8 | 0.6 | | |
| Truck travel | vehicles = | 6 | 0.10 | miles | Road | 1.2 | 0.1 | | |
| Worker travel | vehicles = | 13 | 0.10 | miles | Road | 1.0 | 0.1 | | |
| | | | | | | 14.6 | 2.5 | 5.1 | 0.9 |
| Injection Well Facilities | | | | | | | | | |
| Facility Well cluster construction (x4) | 100 | 100 | 0.23 | acres | Area | 4.6 | 1.0 | | |
| Back-flush basin | 280 | 150 | 0.96 | acres | Area | | | | |
| Monitoring Well construction (x6) | 100 | 100 | 0.23 | acres | Area | | | | |
| Access Roads to Injection wells (conduit trenching) | 250 | 5 | 555.56 | cy | Pipeline/trench | 0.9 | 0.3 | | |
| Access roads to monitoring wells | 100 | 20 | 0.05 | acres | Area | 0.9 | 0.2 | | |
| Access Roads to Injection wells | 250 | 40 | 0.23 | acres | Area | 4.6 | 1.0 | | |
| | | | | | | 11.0 | 2.4 | 3.9 | 0.8 |
| - Injection Wells | | | | | | | | | |
| Truck travel | vehicles = | 16 | 0.10 | miles | Road | 3.1 | 0.3 | | |
| Worker travel | vehicles = | 18 | 0.10 | miles | Road | 1.4 | 0.1 | | |
| | | | | | | 4.5 | 0.4 | 1.6 | 0.2 |
| - Back-flush Pipes and Basin | | | | | | | | | |
| Truck travel | vehicles = | 26 | 0.10 | miles | Road | | | | |
| Worker travel | vehicles = | 22 | 0.10 | miles | Road | | | | |
| | | | | | | 0.0 | 0.0 | 0.0 | 0.0 |
| - Electrical Control | | | | | | | | | |
| Truck travel | vehicles = | 20 | 0.10 | miles | Road | | | | |
| Worker travel | vehicles = | 24 | 0.10 | miles | Road | | | | |
| | | | | | | 0.0 | 0.0 | 0.0 | 0.0 |
| - Product Water Pipelines and Pumps | | | | | | | | | |
| Truck travel | vehicles = | 4 | 0.25 | miles | Road | 2.0 | 0.2 | | |
| Worker travel | vehicles = | 20 | 0.10 | miles | Road | 1.5 | 0.2 | | |
| | | | | | | 3.5 | 0.3 | 1.2 | 0.1 |
| | | | | | Total | 102.3 | 17.6 | 35.8 | 6.2 |
| Additional Projects ( MGD Overlapping Construction Activities) | | | | | | | | | |
| Monterey Pipeline Construction | 325 | 8 | 1155.56 | cy | Pipeline/trench | 1.9 | 0.6 | | |
| Truck travel | vehicles = | 24 | 0.10 | miles | Road | 4.7 | 0.5 | | |
| Worker travel | vehicles = | 56 | 0.10 | miles | Road | 4.3 | 0.4 | | |
| Transfer Pipeline Construction | 325 | 8 | 1155.56 | cy | Pipeline/trench | 1.9 | 0.6 | | |
| Truck travel | vehicles = | 24 | 0.10 | miles | Road | 4.7 | 0.5 | | |
| Worker travel | vehicles = | 56 | 0.10 | miles | Road | 4.3 | 0.4 | | |
| | | | | | | 21.7 | 2.9 | 7.6 | 1.0 |

**Pure Water Monterey Groundwater Repleneshment Project**

| Component | Demo (tons) | Soil Export (CY) | Soil Import (CY) | Deliveries Tractor-trailer | Deliveries Smaller Trucks | Concrete Trucks | Duration Months | Days | Total Trips Computed Truck Trips (one way) Haul Trucks | Deliveries Smaller Trucks | Workers | Worker Trips (one way) Avg. | Peak | updated by ai 12/8/14 at 430 pm | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SOURCE WATER DIVERSION** | | | | | | | | | | | | | | | |
| Salinas Pump Station | 10 | 100 | 30 | 2 | 36 | 40 | 6 | 126 | 102 | 72 | 1260 | 10 | 34 | * | |
| Salinas Treatment Facilit | 0 | 1200 | 50 | 45 | 100 | 65 | 6 | 126 | 376 | 200 | 1890 | 15 | 24 | | |
| Slip Lining of 33-inch | 20 | 0 | 250 | 25 | 50 | 10 | 7 | 147 | 109 | 100 | 2205 | 15 | 24 | | |
| Reclamation Ditch | 1 | 100 | 20 | 5 | 5 | 6 | 5 | 105 | 37 | 10 | 1260 | 12 | 18 | | |
| Tembladero Slough | 2 | 100 | 20 | 15 | 10 | 5 | 5 | 105 | 56 | 20 | 1260 | 12 | 18 | | |
| Blanco Drain | 21 | 2300 | 60 | 15 | 25 | 20 | 9 | 189 | 373 | 50 | 3024 | 16 | 26 | | |
| Lake El Estero | 14 | 13 | 13 | 1 | 5 | 2 | 3 | 63 | 15 | 10 | 378 | 6 | 16 | * | |
| **TREATMENT FACILITIES AT REGIONAL TREATMENT PLANT** | | | | | | | | | | | | | | | |
| AWTF | 25 | 510 | 2100 | 230 | 800 | 720 | 18 | 378 | 2236 | 1600 | 6048 | 16 | 56 | | |
| SVRP | 8 | 150 | 0 | 5 | 25 | 25 | | 0 | 82 | 50 | 0 | 4 | 10 | | |
| **PRODUCT WATER CONVEYANCE** | | | | | | | | | | | | | | | |
| Pipeline - RUWAP | 21055 | 8670 | 0 | 118 | 469 | 40 | 15 | 315 | 9822 | 938 | 7560 | 24 | 26 | | The RUWAP pipeline is the longer, more urban route |
| Pipeline - Coastal | 11815 | 8280 | 0 | 111 | 442 | 30 | 15 | 315 | 6043 | 884 | 7560 | 24 | 26 | <--- | don't add this line item, that would be double-counting |
| Booster Pump Stn | 0 | 180 | 0 | 2 | 30 | 5 | 9 | 189 | 37 | 60 | 2268 | 12 | 36 | * | |
| AWT Pump Station | The AWT Pum station is included in the AWTF quantities | | | | | | | 0 | | 0 | 0 | | | <--- | This is included in construction assumptions at the RTP |
| Total RUWAP | | | | | | | | | 9858 | 998 | 9828 | | | | |
| Total Coastal | | | | | | | | | 6080 | 944 | 9828 | | | | |
| **INJECTION WELL FACILIT** | 0 | 8800 | 700 | 99 | 510 | 35 | 17 | 357 | 1456 | 1020 | 21420 | 60 | 132 | | This row is a sumation of the following rows |
| Pipelines/Basin/Road | 0 | 7500 | 500 | 15 | 30 | 10 | | 0 | 1050 | 60 | | | | | |
| 4 Deep Wells | 0 | 600 | 0 | 32 | 100 | 4 | | 0 | 147 | 200 | | | | | |
| 4 Vadose Wells | 0 | 320 | 0 | 8 | 80 | 0 | | 0 | 56 | 160 | | | | | |
| 6 Monitoring Wells | 0 | 320 | 0 | 24 | 180 | 6 | | 0 | 100 | 360 | | | | | |
| 4 Buildings | 0 | 60 | 200 | 20 | 120 | 15 | | 0 | 103 | 240 | | | | | |
| | | | | | | | | | 36682 | 6956 | | | | | |
| | | | | | | | | | 84% | | | | | | |

**Off Road Equipment Emission Factors from CalEEMod**

| | Typical Equipment Type & Load Factors | | |
|---|---|---|---|
| | OFFROAD Equipment Type | Horsepower | Load Factor |
| 7 | Aerial Lifts | 62 | 0.31 |
| 8 | Air Compressors | 78 | 0.48 |
| 9 | Bore/Drill Rigs | 205 | 0.5 |
| 10 | Cement and Mortar Mixers | 9 | 0.56 |
| 11 | Concrete/Industrial Saws | 81 | 0.73 |
| 12 | Cranes | 226 | 0.29 |
| 13 | Crawler Tractors | 208 | 0.43 |
| 14 | Crushing/Proc. Equipment | 85 | 0.78 |
| 15 | Dumpers/Tenders | 16 | 0.38 |
| 16 | Excavators | 162 | 0.38 |
| 17 | Forklifts | 89 | 0.2 |
| 18 | Generator Sets | 84 | 0.74 |
| 19 | Graders | 174 | 0.41 |
| 20 | Off-Highway Tractors | 122 | 0.44 |
| 21 | Off-Highway Trucks | 400 | 0.38 |
| 22 | Other Construction Equipment | 171 | 0.42 |
| 23 | Other General Industrial Equipment | 150 | 0.34 |
| 24 | Other Material Handling Equipment | 167 | 0.4 |
| 25 | Pavers | 125 | 0.42 |
| 26 | Paving Equipment | 130 | 0.36 |
| 27 | Plate Compactors | 8 | 0.43 |
| 28 | Pressure Washers | 13 | 0.2 |
| 29 | Pumps | 84 | 0.74 |
| 30 | Rollers | 80 | 0.38 |
| 31 | Rough Terrain Forklifts | 100 | 0.4 |
| 32 | Rubber Tired Dozers | 255 | 0.4 |
| 33 | Rubber Tired Loaders | 199 | 0.36 |
| 34 | Scrapers | 361 | 0.48 |
| 35 | Signal Boards | 6 | 0.82 |
| 36 | Skid Steer Loaders | 64 | 0.37 |
| 37 | Surfacing Equipment | 253 | 0.3 |
| 38 | Sweepers/Scrubbers | 64 | 0.46 |
| 39 | Tractors/Loaders/Backhoes | 97 | 0.37 |
| 40 | Trenchers | 80 | 0.5 |
| 41 | Welders | 46 | 0.45 |

| OFFROAD Equipment Type | 2016 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | TOG | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
| Aerial Lifts | 0.19699 | 0.16550 | 3.20103 | 2.72218 | 0.00490 | 0.11190 | 0.10300 | 506.21130 | 0.15270 |
| Air Compressors | 12.61800 | 0.74400 | 3.80400 | 4.79000 | 0.00600 | 0.39700 | 0.39700 | 568.29900 | 0.06700 |
| Bore/Drill Rigs | 0.22914 | 0.19250 | 1.13299 | 2.90210 | 0.00480 | 0.08520 | 0.07840 | 502.12800 | 0.15150 |
| Cement and Mortar Mixers | 1.07600 | 0.66200 | 3.46900 | 4.15300 | 0.00800 | 0.16700 | 0.16700 | 568.30000 | 0.05900 |
| Concrete/Industrial Saws | 6.23700 | 0.62000 | 3.62000 | 4.43200 | 0.00600 | 0.33300 | 0.33300 | 568.30000 | 0.05500 |
| Cranes | 0.74130 | 0.62290 | 2.58220 | 7.38068 | 0.00490 | 0.33490 | 0.30810 | 507.15520 | 0.15300 |
| Crawler Tractors | 0.53404 | 0.44870 | 1.80295 | 6.04745 | 0.00490 | 0.23320 | 0.21450 | 507.35500 | 0.15300 |
| Crushing/Proc. Equipment | 3.57600 | 0.72000 | 3.82300 | 4.63100 | 0.00600 | 0.37900 | 0.37900 | 568.29900 | 0.06500 |
| Dumpers/Tenders | 0.82500 | 0.69000 | 2.34200 | 4.37800 | 0.00700 | 0.17500 | 0.17500 | 568.29900 | 0.06200 |
| Excavators | 0.42549 | 0.35750 | 3.15771 | 4.08095 | 0.00490 | 0.20080 | 0.18470 | 506.49500 | 0.15280 |
| Forklifts | 0.86028 | 0.72290 | 4.02311 | 6.22192 | 0.00490 | 0.52030 | 0.47860 | 505.58330 | 0.15250 |
| Generator Sets | 11.84000 | 0.58300 | 3.46900 | 4.41000 | 0.00600 | 0.30900 | 0.30900 | 568.29900 | 0.05200 |
| Graders | 0.96357 | 0.80970 | 3.91624 | 8.24966 | 0.00500 | 0.46350 | 0.42640 | 516.13050 | 0.15570 |
| Off-Highway Tractors | 0.46528 | 0.39100 | 3.27806 | 4.51093 | 0.00490 | 0.22900 | 0.21060 | 507.62940 | 0.15310 |
| Off-Highway Trucks | 0.41815 | 0.35140 | 1.88523 | 4.04798 | 0.00490 | 0.15270 | 0.14050 | 509.86040 | 0.15380 |
| Other Construction Equipment | 0.62413 | 0.52440 | 3.35672 | 5.81763 | 0.00480 | 0.30590 | 0.28150 | 503.96410 | 0.15200 |
| Other General Industrial Equipment | 0.55946 | 0.47010 | 3.43665 | 5.05466 | 0.00490 | 0.27580 | 0.25370 | 505.92820 | 0.15260 |
| Other Material Handling Equipment | 0.58169 | 0.48880 | 3.41823 | 5.21152 | 0.00490 | 0.27950 | 0.25710 | 506.32400 | 0.15270 |
| Pavers | 0.51559 | 0.43320 | 3.08023 | 4.87397 | 0.00490 | 0.24220 | 0.22280 | 506.54010 | 0.15280 |
| Paving Equipment | 0.44250 | 0.37180 | 3.08114 | 4.32170 | 0.00490 | 0.21450 | 0.19730 | 504.82010 | 0.15230 |
| Plate Compactors | 0.79000 | 0.66100 | 3.46900 | 4.14200 | 0.00800 | 0.16100 | 0.16100 | 568.29900 | 0.05900 |
| Pressure Washers | 1.98600 | 0.72000 | 3.62200 | 4.97800 | 0.00800 | 0.26400 | 0.26400 | 568.29900 | 0.06500 |
| Pumps | 13.96400 | 0.61000 | 3.52300 | 4.47800 | 0.00600 | 0.32500 | 0.32500 | 568.29900 | 0.05500 |
| Rollers | 0.74763 | 0.62820 | 3.75537 | 5.80563 | 0.00490 | 0.42750 | 0.39330 | 508.19870 | 0.15330 |
| Rough Terrain Forklifts | 0.35893 | 0.30160 | 3.34169 | 3.84005 | 0.00490 | 0.21310 | 0.19610 | 507.06590 | 0.15290 |
| Rubber Tired Dozers | 0.81915 | 0.68830 | 5.82829 | 7.71034 | 0.00490 | 0.35880 | 0.33010 | 513.31090 | 0.15480 |
| Rubber Tired Loaders | 0.46801 | 0.39330 | 1.45212 | 5.11510 | 0.00480 | 0.17450 | 0.16050 | 503.65420 | 0.15190 |
| Scrapers | 0.53834 | 0.45240 | 3.60633 | 5.75749 | 0.00490 | 0.23210 | 0.21350 | 506.35030 | 0.15270 |
| Signal Boards | 1.04000 | 0.66100 | 3.46900 | 4.14200 | 0.00800 | 0.16100 | 0.16100 | 568.29900 | 0.05900 |
| Skid Steer Loaders | 0.32506 | 0.27310 | 3.32767 | 3.53439 | 0.00490 | 0.19740 | 0.18160 | 506.29710 | 0.15270 |
| Surfacing Equipment | 0.25842 | 0.21710 | 1.42484 | 3.46816 | 0.00480 | 0.11110 | 0.10220 | 502.47090 | 0.15160 |
| Sweepers/Scrubbers | 0.93140 | 0.78260 | 4.05916 | 6.45405 | 0.00490 | 0.57070 | 0.52500 | 508.35740 | 0.15330 |
| Tractors/Loaders/Backhoes | 0.64032 | 0.53800 | 3.81146 | 5.14235 | 0.00490 | 0.39590 | 0.36430 | 511.34560 | 0.15420 |
| Trenchers | 0.93774 | 0.78800 | 3.98822 | 6.90219 | 0.00490 | 0.54130 | 0.49800 | 509.90270 | 0.15380 |
| Welders | 16.15500 | 1.54000 | 5.39500 | 4.93600 | 0.00700 | 0.38900 | 0.38900 | 568.29900 | 0.13800 |

| OFFROAD Equipment Type | 2017 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | TOG | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
| Aerial Lifts | 0.16980 | 0.14270 | 3.18429 | 2.36368 | 0.00490 | 0.08340 | 0.07680 | 498.34280 | 0.15270 |
| Air Compressors | 11.38500 | 0.67100 | 3.77200 | 4.41200 | 0.00600 | 0.35000 | 0.35000 | 568.29900 | 0.06000 |
| Bore/Drill Rigs | 0.20647 | 0.17350 | 1.10210 | 2.52150 | 0.00480 | 0.07250 | 0.06670 | 494.13810 | 0.15140 |
| Cement and Mortar Mixers | 1.07500 | 0.66100 | 3.46900 | 4.14500 | 0.00800 | 0.16500 | 0.16500 | 568.29900 | 0.05900 |
| Concrete/Industrial Saws | 5.61000 | 0.55700 | 3.59500 | 4.08600 | 0.00600 | 0.29400 | 0.29400 | 568.29900 | 0.05000 |
| Cranes | 0.66714 | 0.56060 | 2.38452 | 6.65526 | 0.00490 | 0.29670 | 0.27300 | 499.37210 | 0.15300 |
| Crawler Tractors | 0.51114 | 0.42950 | 1.74180 | 5.75969 | 0.00490 | 0.21990 | 0.20230 | 499.83200 | 0.15310 |
| Crushing/Proc. Equipment | 3.21600 | 0.64700 | 3.79100 | 4.24400 | 0.00600 | 0.33000 | 0.33000 | 568.29900 | 0.05800 |
| Dumpers/Tenders | 0.82100 | 0.68700 | 2.34000 | 4.36200 | 0.00700 | 0.17100 | 0.17100 | 568.29900 | 0.06200 |
| Excavators | 0.39703 | 0.33360 | 3.15091 | 3.69967 | 0.00490 | 0.18200 | 0.16750 | 498.52220 | 0.15270 |
| Forklifts | 0.79964 | 0.67190 | 3.97881 | 5.81772 | 0.00490 | 0.48000 | 0.44160 | 497.72450 | 0.15250 |
| Generator Sets | 10.55700 | 0.52000 | 3.44200 | 4.07200 | 0.00600 | 0.27400 | 0.27400 | 568.29900 | 0.04600 |
| Graders | 0.90100 | 0.75710 | 3.84518 | 7.66265 | 0.00490 | 0.43040 | 0.39600 | 506.74780 | 0.15530 |
| Off-Highway Tractors | 0.42350 | 0.35590 | 3.25890 | 4.02594 | 0.00490 | 0.20490 | 0.18850 | 499.24460 | 0.15300 |
| Off-Highway Trucks | 0.38710 | 0.32530 | 1.74773 | 3.66841 | 0.00490 | 0.13620 | 0.12530 | 501.43680 | 0.15360 |
| Other Construction Equipment | 0.59556 | 0.50040 | 3.33767 | 5.49424 | 0.00480 | 0.29030 | 0.26710 | 495.93110 | 0.15200 |
| Other General Industrial Equipment | 0.52016 | 0.43710 | 3.39928 | 4.53359 | 0.00490 | 0.24950 | 0.22960 | 498.06410 | 0.15260 |
| Other Material Handling Equipment | 0.50801 | 0.42690 | 3.35117 | 4.48809 | 0.00490 | 0.23790 | 0.21890 | 498.45370 | 0.15270 |
| Pavers | 0.46282 | 0.38890 | 3.06282 | 4.35312 | 0.00490 | 0.21420 | 0.19710 | 498.96700 | 0.15290 |
| Paving Equipment | 0.40757 | 0.34250 | 3.07321 | 3.89633 | 0.00490 | 0.19460 | 0.17910 | 497.14800 | 0.15230 |
| Plate Compactors | 0.79000 | 0.66100 | 3.46900 | 4.14200 | 0.00800 | 0.16100 | 0.16100 | 568.29900 | 0.05900 |
| Pressure Washers | 1.92700 | 0.69900 | 3.59900 | 4.84700 | 0.00800 | 0.25000 | 0.25000 | 568.29900 | 0.06300 |
| Pumps | 12.49000 | 0.54600 | 3.49500 | 4.13400 | 0.00600 | 0.28700 | 0.28700 | 568.29900 | 0.04900 |
| Rollers | 0.69011 | 0.57990 | 3.71315 | 5.41140 | 0.00490 | 0.39210 | 0.36070 | 500.15250 | 0.15320 |
| Rough Terrain Forklifts | 0.32251 | 0.27100 | 3.31778 | 3.41759 | 0.00490 | 0.18160 | 0.16710 | 499.16820 | 0.15290 |
| Rubber Tired Dozers | 0.78746 | 0.66170 | 5.52569 | 7.33345 | 0.00490 | 0.34070 | 0.31340 | 505.84930 | 0.15500 |
| Rubber Tired Loaders | 0.44353 | 0.37270 | 1.41720 | 4.75473 | 0.00480 | 0.16200 | 0.14900 | 495.94990 | 0.15200 |
| Scrapers | 0.50588 | 0.42510 | 3.33699 | 5.33951 | 0.00490 | 0.21430 | 0.19710 | 498.45710 | 0.15270 |
| Signal Boards | 1.04000 | 0.66100 | 3.46900 | 4.14200 | 0.00800 | 0.16100 | 0.16100 | 568.29900 | 0.05900 |
| Skid Steer Loaders | 0.30377 | 0.25530 | 3.31863 | 3.28618 | 0.00490 | 0.17660 | 0.16250 | 498.32560 | 0.15270 |
| Surfacing Equipment | 0.24244 | 0.20370 | 1.39620 | 3.10636 | 0.00490 | 0.10260 | 0.09440 | 496.88500 | 0.15220 |
| Sweepers/Scrubbers | 0.85744 | 0.72050 | 4.01005 | 6.02020 | 0.00490 | 0.52020 | 0.47860 | 500.45550 | 0.15330 |
| Tractors/Loaders/Backhoes | 0.59560 | 0.50050 | 3.78180 | 4.80870 | 0.00490 | 0.36160 | 0.33270 | 502.79520 | 0.15410 |
| Trenchers | 0.90630 | 0.76150 | 3.96827 | 6.67876 | 0.00490 | 0.52320 | 0.48130 | 501.99160 | 0.15380 |
| Welders | 14.39200 | 1.37200 | 5.23900 | 4.76800 | 0.00700 | 0.35000 | 0.35000 | 568.29900 | 0.12300 |

| OFFROAD Equipment Type | 2018 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | TOG | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
| Aerial Lifts | 0.14509 | 0.12190 | 3.16685 | 2.06360 | 0.00490 | 0.05710 | 0.05250 | 490.47420 | 0.15270 |
| Air Compressors | 10.21800 | 0.60300 | 3.74400 | 4.05000 | 0.00600 | 0.30400 | 0.30400 | 568.30000 | 0.05400 |
| Bore/Drill Rigs | 0.18393 | 0.15450 | 1.07328 | 2.15308 | 0.00480 | 0.06080 | 0.05600 | 484.56050 | 0.15090 |
| Cement and Mortar Mixers | 1.07500 | 0.66100 | 3.46900 | 4.14200 | 0.00800 | 0.16300 | 0.16300 | 568.29900 | 0.05900 |
| Concrete/Industrial Saws | 5.01400 | 0.49800 | 3.57100 | 3.75400 | 0.00600 | 0.25600 | 0.25600 | 568.29900 | 0.04400 |
| Cranes | 0.57488 | 0.48310 | 2.13445 | 5.77298 | 0.00490 | 0.24990 | 0.22990 | 491.40690 | 0.15300 |
| Crawler Tractors | 0.47399 | 0.39830 | 1.65354 | 5.28959 | 0.00490 | 0.20010 | 0.18410 | 491.60600 | 0.15300 |
| Crushing/Proc. Equipment | 2.88100 | 0.58000 | 3.76300 | 3.88100 | 0.00600 | 0.28400 | 0.28400 | 568.29900 | 0.05200 |
| Dumpers/Tenders | 0.82000 | 0.68600 | 2.33900 | 4.35000 | 0.00700 | 0.16900 | 0.16900 | 568.29900 | 0.06100 |
| Excavators | 0.32496 | 0.27310 | 3.09338 | 2.92361 | 0.00490 | 0.14180 | 0.13040 | 490.67250 | 0.15280 |
| Forklifts | 0.67530 | 0.56740 | 3.85819 | 5.01530 | 0.00490 | 0.40020 | 0.36820 | 489.86570 | 0.15250 |
| Generator Sets | 9.35600 | 0.46100 | 3.41800 | 3.75200 | 0.00600 | 0.23900 | 0.23900 | 568.29900 | 0.04100 |
| Graders | 0.78708 | 0.66140 | 3.70957 | 6.60465 | 0.00490 | 0.37130 | 0.34160 | 497.37670 | 0.15480 |
| Off-Highway Tractors | 0.37475 | 0.31490 | 3.21910 | 3.49764 | 0.00490 | 0.17560 | 0.16160 | 491.31280 | 0.15300 |
| Off-Highway Trucks | 0.34159 | 0.28700 | 1.55950 | 3.08995 | 0.00490 | 0.11280 | 0.10380 | 493.50590 | 0.15360 |
| Other Construction Equipment | 0.51940 | 0.43640 | 3.26346 | 4.75499 | 0.00480 | 0.25020 | 0.23020 | 487.98590 | 0.15190 |
| Other General Industrial Equipment | 0.37793 | 0.31760 | 3.23662 | 3.23673 | 0.00490 | 0.17200 | 0.15820 | 490.19990 | 0.15260 |
| Other Material Handling Equipment | 0.38852 | 0.32650 | 3.21803 | 3.33231 | 0.00490 | 0.17250 | 0.15870 | 490.58340 | 0.15270 |
| Pavers | 0.40310 | 0.33870 | 3.03913 | 3.74720 | 0.00490 | 0.18310 | 0.16840 | 491.32200 | 0.15300 |
| Paving Equipment | 0.33762 | 0.28370 | 3.02602 | 3.17208 | 0.00490 | 0.15530 | 0.14290 | 489.20240 | 0.15230 |
| Plate Compactors | 0.79000 | 0.66100 | 3.47000 | 4.14200 | 0.00800 | 0.16100 | 0.16100 | 568.30000 | 0.05900 |
| Pressure Washers | 1.87400 | 0.67900 | 3.58000 | 4.72800 | 0.00800 | 0.23700 | 0.23700 | 568.29900 | 0.06100 |
| Pumps | 11.10700 | 0.48500 | 3.47100 | 3.80800 | 0.00600 | 0.25200 | 0.25200 | 568.29900 | 0.04300 |
| Rollers | 0.57247 | 0.48100 | 3.60981 | 4.65049 | 0.00490 | 0.32000 | 0.29440 | 492.21180 | 0.15320 |
| Rough Terrain Forklifts | 0.26442 | 0.22220 | 3.26976 | 2.84496 | 0.00490 | 0.13600 | 0.12510 | 491.21070 | 0.15290 |
| Rubber Tired Dozers | 0.71175 | 0.59810 | 4.98205 | 6.50184 | 0.00490 | 0.30020 | 0.27620 | 498.18620 | 0.15510 |
| Rubber Tired Loaders | 0.39686 | 0.33350 | 1.34644 | 4.13133 | 0.00480 | 0.14010 | 0.12890 | 487.90230 | 0.15190 |
| Scrapers | 0.43932 | 0.36910 | 2.82811 | 4.56771 | 0.00490 | 0.18000 | 0.16560 | 490.77340 | 0.15280 |
| Signal Boards | 1.04000 | 0.66100 | 3.46900 | 4.14200 | 0.00800 | 0.16100 | 0.16100 | 568.29900 | 0.05900 |
| Skid Steer Loaders | 0.25685 | 0.21580 | 3.28204 | 2.86000 | 0.00490 | 0.13980 | 0.12860 | 490.09350 | 0.15260 |
| Surfacing Equipment | 0.18733 | 0.15740 | 1.22557 | 2.20389 | 0.00490 | 0.07610 | 0.07000 | 487.87220 | 0.15190 |
| Sweepers/Scrubbers | 0.71341 | 0.59950 | 3.88173 | 5.13595 | 0.00490 | 0.42830 | 0.39410 | 492.55360 | 0.15330 |
| Tractors/Loaders/Backhoes | 0.50030 | 0.42040 | 3.69155 | 4.15444 | 0.00490 | 0.29430 | 0.27080 | 494.12370 | 0.15380 |
| Trenchers | 0.78315 | 0.65810 | 3.85487 | 5.91527 | 0.00490 | 0.45000 | 0.41400 | 493.71500 | 0.15370 |
| Welders | 12.69800 | 1.21000 | 5.09200 | 4.60700 | 0.00700 | 0.31100 | 0.31100 | 568.29900 | 0.10900 |

**On Road Vehicle Emission Factors from EMFAC2011**

| | 2016 Emission Factors | | | | 2017 Emission Factors | | | |
|---|---|---|---|---|---|---|---|---|
| | LDT1 | MDV | LHD1 | HHD | LDT1 | MDV | LHD1 | HHD |
| FleetMix | 0.039998 | 0.176598 | 0.051139 | 0.020374 | 0.039911 | 0.176253 | 0.050904 | 0.021019 |
| CH4_IDLEX | 0 | 0 | 0.00117 | 0.024901 | 0 | 0 | 0.001165 | 0.025321 |
| CH4_RUNEX | 0.034903 | 0.036981 | 0.025089 | 0.010901 | 0.031758 | 0.034693 | 0.0237 | 0.010117 |
| CH4_STREX | 0.031877 | 0.036751 | 0.028011 | 0 | 0.028165 | 0.034049 | 0.026752 | 0 |
| CO_IDLEX | 0 | 0 | 0.171833 | 2.934395 | 0 | 0 | 0.171022 | 3.007509 |
| CO_RUNEX | 4.150869 | 2.976565 | 2.280075 | 2.394283 | 3.639246 | 2.777281 | 2.112057 | 2.251351 |
| CO_STREX | 7.451065 | 8.198435 | 5.223146 | 97.27606 | 6.817407 | 7.686446 | 4.970443 | 89.76627 |
| CO2_NBIO_IDLEX | 0 | 0 | 8.620212 | 566.1406 | 0 | 0 | 8.486219 | 557.3913 |
| CO2_NBIO_RUNEX | 360.4793 | 560.7561 | 779.6591 | 1,639.81 | 347.5084 | 544.2701 | 767.3567 | 1,612.01 |
| CO2_NBIO_STREX | 74.42188 | 114.6394 | 37.68721 | 56.74499 | 71.63331 | 111.6627 | 37.22622 | 52.08609 |
| NOX_IDLEX | 0 | 0 | 0.068508 | 4.829136 | 0 | 0 | 0.068495 | 4.479516 |
| NOX_RUNEX | 0.463164 | 0.511921 | 1.790893 | 5.587469 | 0.417751 | 0.473531 | 1.675832 | 4.850926 |
| NOX_STREX | 0.409089 | 0.837267 | 1.438103 | 6.701623 | 0.376654 | 0.784324 | 1.413091 | 6.459717 |
| PM10_IDLEX | 0 | 0 | 0.000784 | 0.017673 | 0 | 0 | 0.000775 | 0.014696 |
| PM10_PMBW | 0.03675 | 0.03675 | 0.051148 | 0.059705 | 0.03675 | 0.03675 | 0.051146 | 0.059725 |
| PM10_PMTW | 0.008 | 0.008 | 0.009451 | 0.034339 | 0.008 | 0.008 | 0.009451 | 0.034361 |
| PM10_RUNEX | 0.005177 | 0.002783 | 0.022215 | 0.091139 | 0.004747 | 0.002715 | 0.021224 | 0.077891 |
| PM10_STREX | 0.00521 | 0.003772 | 0.001156 | 0.003081 | 0.004937 | 0.003774 | 0.001074 | 0.001761 |
| PM25_IDLEX | 0 | 0 | 0.000722 | 0.016259 | 0 | 0 | 0.000713 | 0.01352 |
| PM25_PMBW | 0.01575 | 0.01575 | 0.021921 | 0.025588 | 0.01575 | 0.01575 | 0.02192 | 0.025596 |
| PM25_PMTW | 0.002 | 0.002 | 0.002363 | 0.008585 | 0.002 | 0.002 | 0.002363 | 0.00859 |
| PM25_RUNEX | 0.004702 | 0.00257 | 0.020447 | 0.083848 | 0.004343 | 0.00251 | 0.019535 | 0.07166 |
| PM25_STREX | 0.004743 | 0.003487 | 0.001064 | 0.00265 | 0.004526 | 0.003491 | 0.00099 | 0.001633 |
| ROG_DIURN | 0.098107 | 0.06204 | 0.001654 | 0.002141 | 0.091668 | 0.062316 | 0.001627 | 0.001775 |
| ROG_HTSK | 0.254037 | 0.199519 | 0.059575 | 0.141301 | 0.237265 | 0.202135 | 0.059772 | 0.096896 |
| ROG_IDLEX | 0 | 0 | 0.027071 | 0.536116 | 0 | 0 | 0.026937 | 0.545148 |
| ROG_RESTL | 0.073086 | 0.056116 | 0.000917 | 0.001246 | 0.070053 | 0.05769 | 0.000924 | 0.001075 |
| ROG_RUNEX | 0.176069 | 0.10081 | 0.235446 | 0.279221 | 0.142061 | 0.092044 | 0.21856 | 0.256477 |
| ROG_RUNLS | 0.8951 | 0.680851 | 0.351661 | 0.912557 | 0.839888 | 0.678201 | 0.350363 | 0.687534 |
| ROG_STREX | 0.553689 | 0.64963 | 0.495248 | 4.568699 | 0.49273 | 0.602111 | 0.473212 | 3.861962 |

## Fugitive Dust Emission Factors

### Type = Area

### General Grading and Earth Moving Fugitive Dust

| | Uncontrolled | | | Mitigated | |
|---|---|---|---|---|---|
| PM10 = | 20.0 | lbs/acre | | 7.0 | lbs/acre |
| PM2.5= | 4.16 | lbs/acre | | 1.5 | lbs/acre |

The Midwest Research Instituteidentifed a PM10 fugitive dust emission rate of 0.11 tons/acre/month, which converts to 10 pounds per day. Since the factor includes some watering at sites, it was adjusted assuming 50% control. Sites with best management practices could attain 65% control (with mitigation).

### Type = Pipeline/Trench

### Fugitive Dust from Excavation and Soil Handling

| | pounds PM per ton material | tons material per cubic yard | PM pounds per cubic yard |
|---|---|---|---|
| PM10 = | 0.001292763 | 1.2641662 | 0.001634267 |
| PM2.5= | 0.000195761 | 1.2641662 | 0.000247475 |

Based on AP-42 Emission Factor: EF (lbs/ton) = k (0.0032)(U/5)^1.3 / (M/2)^1.4

Where:

EF = emission rate in pounds PM10 or PM2.5 per ton material handled.

k = particle size multiplier (assumed 0.35 for PM10 and 0.0.053 for PM2.5)

U = mean wind speed (assummed to be 7.1 mph per CalEEMod)

M = material moisture content (assummed 7.9% per CalEEMod for bulldozing).

### Type = Road (unpaved)

### Unpaved Fugitive Dust From Truck Travel

| | Trucks | Workers |
|---|---|---|
| PM10 = | 2.0 | 0.8 |
| PM2.5= | 0.2 | 0.1 |

Based on AP-42 Emission Factor: E (lbs/VMT) = k (s/12)^a (W/3)^b

Where:

E = emission rate in pounds per vehicle mile traveled

k = particle size multiplier (assumed 1.5 lb/VMT for PM10 and 0.15 lb/VMT for PM2.5 per AP-42, Table 13.2.2-2)

a = 0.9

b = 0.45

s = silt content (assumed 6.9% per CalEEMod)

W, truck weight = 80% wiegh 20 tons and 20% weigh 2 tons = 16.4 tons

W, worker vehicle weight = 2 tons

| | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Project Name:** | | **Pure Water Monterey Groundwater Replenishment** | | | | | | | | | | | | | | | |
| **Site Name:** | | **Salinas Pump Station Site** | | | | | | | | | | | | | | | |
| | **See Equipment Type TAB/sheet for type, horsepower and load factor** | | | | | | | | 2016 Computed Emissions (pounds) | | | | | | | | |
| **Qty** | **Description** | **HP** | **Load Factor** | **Hours/day** | **Total Work Days** | **Annual Hours** | **Comments** | | TOG | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
| | **Demolition** | **Start Date:** | **7/15/2016** | | | | | | | | | | | | | | |
| | | **End Date:** | 7/31/2016 | | | | | | | | | | | | | | |
| 1 | Concrete/Industrial Saws | 81 | 0.73 | 8 | 5 | 40 | **Demolition Volume = 10 tons** | | 32.5 | 3.2 | 18.9 | 23.1 | 0.0 | 1.7 | 1.7 | 2960.7 | 0.3 |
| 1 | Excavators | 162 | 0.38 | 8 | 5 | 40 | | | 2.3 | 1.9 | 17.1 | 22.1 | 0.0 | 1.1 | 1.0 | 2747.1 | 0.8 |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 5 | 40 | | | 2.0 | 1.7 | 12.1 | 16.3 | 0.0 | 1.3 | 1.2 | 1616.9 | 0.5 |
| 2 | Dumpers/Tenders | 16 | 0.38 | 8 | 5 | 80 | Assumed in truck traffic calculations | | **Sum=** | 6.9 | | 61.5 | | 4.1 | 3.9 | 7324.7 | 1.6 |
| | | | | | | | | | Per Day = | 1.4 | | 12.3 | | 0.8 | 0.8 | | |
| | **Site Preparation** | **Start Date:** | **7/7/2016** | | | | | | | | | | | | | | |
| | | **End Date:** | 7/15/2016 | | | | | | | | | | | | | | |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 3 | 24 | | | 1.2 | 1.0 | 7.2 | 9.8 | 0.0 | 0.8 | 0.7 | 970.2 | 0.3 |
| 1 | Pumps | 84 | 0.74 | 24 | 7 | 168 | | | 321.2 | 14.0 | 81.0 | 103.0 | 0.1 | 7.5 | 7.5 | 13072.0 | 1.3 |
| | Other Equipment? | 0 | 0 | | | 0 | | | **Sum=** | 15.1 | | 112.8 | | 8.2 | 8.2 | 14042.1 | 1.6 |
| | | | | | | | | | Per Day = | 2.2 | | 16.1 | | 1.2 | 1.2 | | |
| | **Grading / Excavation** | **Start Date:** | **8/1/2016** | | | | | | | | | | | | | | |
| | | **End Date:** | 10/15/2016 | | | | **Soil Hauling Volume** | | | | | | | | | | |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 20 | 160 | Export volume = _100_ cubic yards? | | 8.1 | 6.8 | 48.2 | 65.0 | 0.1 | 5.0 | 4.6 | 6467.7 | 2.0 |
| 1 | Excavators | 162 | 0.38 | 8 | 20 | 160 | Import volume = _30_ cubic yards? | | 9.2 | 7.8 | 68.5 | 88.5 | 0.1 | 4.4 | 4.0 | 10988.5 | 3.3 |
| 2 | Pumps | 84 | 0.74 | 24 | 10 | 480 | | | 917.7 | 40.1 | 231.5 | 294.3 | 0.4 | 21.4 | 21.4 | 37348.5 | 3.6 |
| | Other Equipment? | 0 | 0 | | | 0 | | | **Sum=** | 54.6 | | 447.9 | | 30.7 | 30.0 | 54804.7 | 8.9 |
| | Other Equipment? | 0 | 0 | | | 0 | | | Per Day = | 2.7 | | 22.4 | | 1.5 | 1.5 | | |
| | **Trenching/Pipelines** | **Start Date:** | **9/1/2016** | | | | | | | | | | | | | | |
| | | **End Date:** | 10/15/2016 | | | | **Material Deliveries (all phases)** | | | | | | | | | | |
| 1 | Excavators | 162 | 0.38 | 8 | 10 | 80 | Deliveries by Tractor-Trailer: _2_ | | 4.6 | 3.9 | 34.3 | 44.3 | 0.1 | 2.2 | 2.0 | 5494.2 | 1.7 |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 10 | 80 | Deliveries by smaller trucks: _36_ | | 4.0 | 3.4 | 24.1 | 32.5 | 0.0 | 2.5 | 2.3 | 3233.9 | 1.0 |
| 1 | Plate Compactors | 8 | 0.43 | 8 | 10 | 80 | | | 0.5 | 0.4 | 2.1 | 2.5 | 0.0 | 0.1 | 0.1 | 344.5 | 0.0 |
| 1 | Cement and Mortar Mixers | 9 | 0.56 | 8 | 10 | 80 | | | 1.0 | 0.6 | 3.1 | 3.7 | 0.0 | 0.1 | 0.1 | 504.7 | 0.1 |
| 1 | Welders | 46 | 0.45 | 8 | 10 | 80 | | | 58.9 | 5.6 | 19.7 | 18.0 | 0.0 | 1.4 | 1.4 | 2072.9 | 0.5 |
| | | | | | | | | | **Sum=** | 13.9 | | 101.0 | | 6.3 | 6.0 | 11650.2 | 3.2 |
| | **Building/Facilities** | **Start Date:** | **8/15/2016** | | | | Cement Trucks? _40_ Total Round-Trips(8 CY / truck) | | Per Day = | 1.4 | | 10.1 | | 0.6 | 0.6 | | |
| | | **End Date:** | 11/15/2016 | | | | | | | | | | | | | | |
| 1 | Concrete/Industrial Saws | 81 | 0.73 | 8 | 40 | 320 | Electric? (Y/N) __Y_ Otherwise assumed diesel | | 259.9 | 25.8 | 150.9 | 184.7 | 0.3 | 13.9 | 13.9 | 23685.3 | 2.3 |
| 1 | Cement and Mortar Mixers | 9 | 0.56 | 8 | 20 | 160 | Liquid Propane (LPG)? (Y/N) _N__ Otherwise Assumed diesel | | 1.9 | 1.2 | 6.2 | 7.4 | 0.0 | 0.3 | 0.3 | 1009.4 | 0.1 |
| 1 | Cranes | 226 | 0.29 | 8 | 20 | 160 | Or temporary line power? (Y/N) _Y__ | | 17.1 | 14.4 | 59.6 | 170.5 | 0.1 | 7.7 | 7.1 | 11714.2 | 3.5 |
| 1 | Excavators | 162 | 0.38 | 8 | 40 | 320 | | | 18.5 | 15.5 | 137.0 | 177.1 | 0.2 | 8.7 | 8.0 | 21977.0 | 6.6 |
| 1 | Plate Compactors | 8 | 0.43 | 8 | 20 | 160 | | | 1.0 | 0.8 | 4.2 | 5.0 | 0.0 | 0.2 | 0.2 | 689.0 | 0.1 |
| 2 | Pumps | 84 | 0.74 | 24 | 30 | 1440 | | | 2753.1 | 120.3 | 694.6 | 882.9 | 1.2 | 64.1 | 64.1 | 112045.5 | 10.8 |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 50 | 400 | | | 20.2 | 17.0 | 120.5 | 162.6 | 0.2 | 12.5 | 11.5 | 16169.3 | 4.9 |
| 1 | Welders | 46 | 0.45 | 8 | 50 | 400 | | | 294.6 | 28.1 | 98.4 | 90.0 | 0.1 | 7.1 | 7.1 | 10364.6 | 2.5 |
| 1 | Dumpers/Tenders | 16 | 0.38 | 8 | 40 | 320 | Assumed in truck traffic calculations | | **Sum=** | 223.1 | | 1680.2 | | 114.5 | 112.2 | 197654.3 | 30.9 |
| | Other Equipment? | 0 | 0 | | | 0 | | | Per Day = | 4.5 | | 33.6 | | 2.3 | 2.2 | | |
| | Other Equipment? | 0 | 0 | | | 0 | | | | | | | | | | | |
| | **Paving** | **Start Date:** | **11/1/2016** | | | | | | | | | | | | | | |
| | | **Start Date:** | **11/15/2016** | | | | | | | | | | | | | | |
| 1 | Cement and Mortar Mixers | 9 | 0.56 | 8 | 4 | 32 | | | 0.4 | 0.2 | 1.2 | 1.5 | 0.0 | 0.1 | 0.1 | 201.9 | 0.0 |
| 1 | Graders | 174 | 0.41 | 8 | 4 | 32 | | | 4.8 | 4.1 | 19.7 | 41.5 | 0.0 | 2.3 | 2.1 | 2595.3 | 0.8 |
| 1 | Rollers | 80 | 0.38 | 8 | 4 | 32 | | | 1.6 | 1.3 | 8.0 | 12.4 | 0.0 | 0.9 | 0.8 | 1088.9 | 0.3 |
| 1 | Pavers | 125 | 0.42 | 8 | 4 | 32 | | | 1.9 | 1.6 | 11.4 | 18.0 | 0.0 | 0.9 | 0.8 | 1874.4 | 0.6 |
| 1 | Paving Equipment | 130 | 0.36 | 8 | 4 | 32 | | | 1.5 | 1.2 | 10.2 | 14.3 | 0.0 | 0.7 | 0.7 | 1665.2 | 0.5 |
| 1 | Sweepers/Scrubbers | 64 | 0.46 | 8 | 4 | 32 | | | 1.9 | 1.6 | 8.4 | 13.4 | 0.0 | 1.2 | 1.1 | 1054.9 | 0.3 |
| | | | | | | | | | **Sum=** | 10.1 | | 101.1 | | 6.1 | 5.6 | 8480.6 | 2.5 |
| | | | | | | | | | Per Day = | 2.5 | | 25.3 | | 1.5 | 1.4 | | |
| | | | | | | | | | **Total =** | **323.6** | | **2504.4** | | **170.0** | **165.8** | **293956.8** | **48.7** |
| **Traffic** | | | | | Total | Peak Day | | | | | | | | | | | |
| | **Type** | **Total** | **Peak Day** | **Travel Distance** | **VMT** | **VMT** | | | | | | | | | | | |
| | Worker | 1260 | 34 | 10.8 | 13608 | 367 | | | | 9.5 | | 15.0 | | 1.5 | 0.7 | 10804.9 | 1.0 |
| | Delivery (includes cement trucks) | 72 | 12 | 7.3 | 526 | 88 | | | | 0.4 | | 2.3 | | 0.1 | 0.1 | 902.6 | 0.0 |
| | Large Trucks | 102 | 12 | 20 | 2040 | 240 | | | | 2.5 | | 26.6 | | 0.8 | 0.5 | 7368.3 | 0.0 |
| | | | | | 16174 | 695 | | | | 12.4 | | 43.9 | | 2.4 | 1.3 | 19075.8 | 1.1 |
| | | | | | | 0.0429589 | | Estimated Peak Day | | 0.5 | | 1.8 | | 0.1 | 0.1 | | |

**Project Name:** Pure Water Monterey Groundwater Replenishment

**Site Name:** SIWTF Storage and Recovery

**Includes recovery pump station, pond 3 pump station and on-site gravity lines. Force main is separate sheet.**

See Equipment Type TAB/sheet for type, horsepower and load factor

2016 Computed Emissions (pounds)

| Qty | Description | HP | Load Factor | Hours/day | Total Work Days | Annual Hours | Comments | TOG | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Demolition** | **Start Date:** | NA | | | | | | | | | | | | | |
| | | **End Date:** | | | | | | | | | | | | | | |
| | Concrete/Industrial Saws | 81 | 0.73 | | | 0 | **Demolition Volume** | | | | | | | | | |
| | Other Equipment? | 0 | 0 | | | 0 | Square footage of buildings to be demolished | | | | | | | | | |
| | Other Equipment? | 0 | 0 | | | 0 | (*or* total tons to be hauled) | | | | | | | | | |
| | Other Equipment? | 0 | 0 | | | 0 | _?_ square feet *or* | | | | | | | | | |
| | | | | | | | _0_ Hauling volume (tons) | | | | | | | | | |
| | **Site Preparation** | **Start Date:** | 6/1/2016 | | | | Any pavement demolished and hauled? _0_ tons | | | | | | | | | |
| | | **End Date:** | 6/15/2016 | | | | | | | | | | | | | |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 6 | 5 | 30 | | 1.5 | 1.3 | 9.0 | 12.2 | 0.0 | 0.9 | 0.9 | 1212.7 | 0.4 |
| 1 | Graders | 174 | 0.41 | 6 | 3 | 18 | | 2.7 | 2.3 | 11.1 | 23.3 | 0.0 | 1.3 | 1.2 | 1459.9 | 0.4 |
| 2 | Dumpers/Tenders | 16 | 0.38 | 6 | 5 | 60 | Assumed in truck traffic calculations | | | | | | | | | |
| 1 | Concrete/Industrial Saws | 81 | 0.73 | 8 | 2 | 16 | | 13.0 | 1.3 | 7.5 | 9.2 | 0.0 | 0.7 | 0.7 | 1184.3 | 0.1 |
| | | | | | | | | **Sum=** | 4.9 | | 44.8 | | 2.9 | 2.8 | 3856.8 | 0.9 |
| | **Grading / Excavation** | **Start Date:** | 6/15/2016 | | | | | Per Day = | 1.0 | | 9.0 | | 0.6 | 0.6 | | |
| | Pump Wet Wells | **End Date:** | 8/31/2016 | | | | **Soil Hauling Volume** | | | | | | | | | |
| 1 | Excavators | 162 | 0.38 | 8 | 5 | 40 | Export volume = _1200_ cubic yards? | 2.3 | 1.9 | 17.1 | 22.1 | 0.0 | 1.1 | 1.0 | 2747.1 | 0.8 |
| 2 | Dumpers/Tenders | 16 | 0.38 | 8 | 5 | 80 | mport volume = _50_ cubic yards?, Assumed in truck traffic calculations | | | | | | | | | |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 5 | 40 | | 2.0 | 1.7 | 12.1 | 16.3 | 0.0 | 1.3 | 1.2 | 1616.9 | 0.5 |
| | Other Equipment? | 0 | 0 | | | 0 | | **Sum=** | 3.6 | | 38.4 | | 2.3 | 2.2 | 4364.1 | 1.3 |
| | Other Equipment? | 0 | 0 | | | 0 | | Per Day = | 0.7 | | 7.7 | | 0.5 | 0.4 | | |
| | | | | | | | | | | | | | | | | |
| | **Trenching/Pipelines** | **Start Date:** | 7/15/2016 | | | | | | | | | | | | | |
| | includes manholes | **End Date:** | 8/31/2016 | | | | **Material Deliveries (all phases)** | | | | | | | | | |
| 1 | Excavators | 162 | 0.38 | 8 | 25 | 200 | Deliveries by Tractor-Trailer: _45_ | 11.5 | 9.7 | 85.6 | 110.7 | 0.1 | 5.4 | 5.0 | 13735.6 | 4.1 |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 25 | 200 | Deliveries by smaller trucks: _100_ | 10.1 | 8.5 | 60.3 | 81.3 | 0.1 | 6.3 | 5.8 | 8084.7 | 2.4 |
| 1 | Plate Compactors | 8 | 0.43 | 4 | 25 | 100 | | 0.6 | 0.5 | 2.6 | 3.1 | 0.0 | 0.1 | 0.1 | 430.6 | 0.0 |
| 1 | Rollers | 80 | 0.38 | 4 | 25 | 100 | | 5.0 | 4.2 | 25.1 | 38.9 | 0.0 | 2.9 | 2.6 | 3402.9 | 1.0 |
| 1 | Concrete/Industrial Saws | 81 | 0.73 | 4 | 25 | 100 | | 81.2 | 8.1 | 47.1 | 57.7 | 0.1 | 4.3 | 4.3 | 7401.7 | 0.7 |
| 1 | Welders | 46 | 0.45 | 4 | 25 | 100 | | 73.7 | 7.0 | 24.6 | 22.5 | 0.0 | 1.8 | 1.8 | 2591.1 | 0.6 |
| 1 | Pumps | 84 | 0.74 | 24 | 30 | 720 | | 1376.6 | 60.1 | 347.3 | 441.4 | 0.6 | 32.0 | 32.0 | 56022.8 | 5.4 |
| 1 | Cement and Mortar Mixers | 9 | 0.56 | 8 | 12 | 96 | | 1.1 | 0.7 | 3.7 | 4.4 | 0.0 | 0.2 | 0.2 | 605.7 | 0.1 |
| | | | | | | | | **Sum=** | 98.8 | | 760.1 | | 53.0 | 51.9 | 92275.0 | 14.5 |
| | **Building/Facilities** | **Start Date:** | 7/1/2016 | | | | Cement Trucks? _65_ Total Round-Trips | Per Day = | 3.3 | | 25.3 | | 1.8 | 1.7 | | |
| | Pump Stations | **End Date:** | 9/30/2016 | | | | | | | | | | | | | |
| 1 | Cranes | 226 | 0.29 | 8 | 10 | 80 | Electric? (Y/N) _Y__ Otherwise assumed diesel | 8.6 | 7.2 | 29.8 | 85.2 | 0.1 | 3.9 | 3.6 | 5857.1 | 1.8 |
| 1 | Cement and Mortar Mixers | 9 | 0.56 | 8 | 10 | 80 | Liquid Propane (LPG)? (Y/N) __N_ Otherwise Assumed diesel | 1.0 | 0.6 | 3.1 | 3.7 | 0.0 | 0.1 | 0.1 | 504.7 | 0.1 |
| 1 | Concrete/Industrial Saws | 81 | 0.73 | 4 | 30 | 120 | Or temporary line power? (Y/N) _Y__ | 97.5 | 9.7 | 56.6 | 69.3 | 0.1 | 5.2 | 5.2 | 8882.0 | 0.9 |
| 2 | Dumpers/Tenders | 16 | 0.38 | 6 | 30 | 360 | Assumed in truck traffic calculations | | | | | | | | | |
| 1 | Other Material Handling Equipment | 167 | 0.4 | 8 | 10 | 80 | | 6.8 | 5.8 | 40.2 | 61.3 | 0.1 | 3.3 | 3.0 | 5959.9 | 1.8 |
| 1 | Pumps | 84 | 0.74 | 24 | 10 | 240 | | 458.9 | 20.0 | 115.8 | 147.1 | 0.2 | 10.7 | 10.7 | 18674.3 | 1.8 |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 4 | 30 | 120 | | 6.1 | 5.1 | 36.2 | 48.8 | 0.0 | 3.8 | 3.5 | 4850.8 | 1.5 |
| 1 | Welders | 46 | 0.45 | 4 | 30 | 120 | | 88.4 | 8.4 | 29.5 | 27.0 | 0.0 | 2.1 | 2.1 | 3109.4 | 0.8 |
| | Other Equipment? | 0 | 0 | | | 0 | | **Sum=** | 56.8 | | 442.5 | | 29.1 | 28.2 | 47838.1 | 8.5 |
| | Other Equipment? | 0 | 0 | | | 0 | | Per Day = | 1.9 | | 14.7 | | 1.0 | 0.9 | | |
| | | | | | | | | | | | | | | | | |
| | **Paving** | **Start Date:** | 9/15/2016 | | | | | | | | | | | | | |
| | | **Start Date:** | 10/15/2016 | | | | | | | | | | | | | |
| 1 | Cement and Mortar Mixers | 9 | 0.56 | 8 | 2 | 16 | | 0.2 | 0.1 | 0.6 | 0.7 | 0.0 | 0.0 | 0.0 | 100.9 | 0.0 |
| 1 | Graders | 174 | 0.41 | 8 | 2 | 16 | | 2.4 | 2.0 | 9.8 | 20.7 | 0.0 | 1.2 | 1.1 | 1297.6 | 0.4 |
| 1 | Rollers | 80 | 0.38 | 8 | 2 | 16 | | 0.8 | 0.7 | 4.0 | 6.2 | 0.0 | 0.5 | 0.4 | 544.5 | 0.2 |
| 1 | Pavers | 125 | 0.42 | 8 | 2 | 16 | | 1.0 | 0.8 | 5.7 | 9.0 | 0.0 | 0.4 | 0.4 | 937.2 | 0.3 |
| 1 | Paving Equipment | 130 | 0.36 | 8 | 2 | 16 | | 0.7 | 0.6 | 5.1 | 7.1 | 0.0 | 0.4 | 0.3 | 832.6 | 0.3 |
| | Sweepers/Scrubbers | 64 | 0.46 | | | 0 | | **Sum=** | 4.2 | | 43.8 | | 2.5 | 2.3 | 3712.9 | 1.1 |
| | | | | | | | | Per Day = | 2.1 | | 21.9 | | 1.2 | 1.1 | | |
| | | | | | | | | **Total =** | **168.4** | | **1329.6** | | **89.8** | **87.2** | **152046.9** | **26.3** |

**Traffic**

| Type | Total | Peak Day | Travel Distance | Total VMT | Peak Day VMT | | TOG | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker | 1890 | 24 | 10.8 | 20412 | 259 | | | 14.3 | | 22.5 | | 2.2 | 1.0 | 16207.3 | 1.6 |
| Delivery (includes cement trucks) | 200 | 37 | 7.3 | 1460 | 270 | | | 1.1 | | 6.4 | | 0.3 | 0.1 | 2507.3 | 0.1 |
| Large Trucks | 376 | 70 | 20 | 7520 | 1400 | | | 9.2 | | 98.1 | | 3.1 | 2.0 | 27161.6 | 0.2 |
| | | | | 29392 | 1929 | | | 24.5 | | 127.0 | | 5.6 | 3.1 | 45876.1 | 1.8 |
| | | | | | 0.0656403 | Estimated Peak Day | | 1.0 | | 5.1 | | 0.2 | 0.1 | | |

| Qty | Description | HP | Load Factor | Hours/day | Total Work Days | Annual Hours | Comments | | TOG | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Project Name:** | | **Pure Water Monterey Groundwater Replenishment** | | | | | | | | | | | | | | | |
| **Site Name:** | | **Slip-Lining 33" pipeline** | | | | | | | | | | | | | | | |
| | **See Equipment Type TAB/sheet for type, horsepower and load factor** | | | | | | | | 2016 Computed Emissions (pounds) | | | | | | | | |
| | **Demolition** | **Start Date:** | **7/15/2016** | | | | | | | | | | | | | | |
| | | **End Date:** | 12/15/2016 | | | | | | | | | | | | | | |
| 1 | Concrete/Industrial Saws | 81 | 0.73 | 8 | 4 | 32 | **Demolition Volume** | | 26.0 | 2.6 | 15.1 | 18.5 | 0.0 | 1.4 | 1.4 | 2368.5 | 0.2 |
| 1 | Excavators | 162 | 0.38 | 8 | 4 | 32 | Square footage of buildings to be demolished | | 1.8 | 1.6 | 13.7 | 17.7 | 0.0 | 0.9 | 0.8 | 2197.7 | 0.7 |
| 1 | Dumpers/Tenders | 16 | 0.38 | 8 | 4 | 32 | (*or* total tons to be hauled), Assumed in truck traffic calculations | | | | | | | | | | |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 4 | 32 | _?_ square feet *or* | | 1.6 | 1.4 | 9.6 | 13.0 | 0.0 | 1.0 | 0.9 | 1293.5 | 0.4 |
| | | | | | | | _?_ Hauling volume (tons) | | **Sum=** | 5.5 | | 49.2 | | 3.3 | 3.1 | 5859.8 | 1.3 |
| | **Site Preparation** | **Start Date:** | **7/7/2016** | | | | Any pavement demolished and hauled? _20 tons_ | | Per Day = | 1.4 | | 12.3 | | 0.8 | 0.8 | | |
| | | **End Date:** | 7/15/2016 | | | | | | | | | | | | | | |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 5 | 40 | | | 2.0 | 1.7 | 12.1 | 16.3 | 0.0 | 1.3 | 1.2 | 1616.9 | 0.5 |
| | Other Equipment? | 0 | 0 | | | 0 | | | **Sum=** | 1.7 | | 16.3 | | 1.3 | 1.2 | 1616.9 | 0.5 |
| | Other Equipment? | 0 | 0 | | | 0 | | | Per Day = | 0.3 | | 3.3 | | 0.3 | 0.2 | | |
| | **Grading / Excavation** | **Start Date:** | **7/15/2016** | | | | | | | | | | | | | | |
| | | **End Date:** | 12/15/2016 | | | | **Soil Hauling Volume** | | | | | | | | | | |
| 2 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 40 | 640 | Export volume = _0_ cubic yards? | | 32.4 | 27.2 | 192.8 | 260.2 | 0.2 | 20.0 | 18.4 | 25870.9 | 7.8 |
| 1 | Excavators | 162 | 0.38 | 8 | 40 | 320 | Import volume = _250_ cubic yards? | | 18.5 | 15.5 | 137.0 | 177.1 | 0.2 | 8.7 | 8.0 | 21977.0 | 6.6 |
| 2 | Dumpers/Tenders | 16 | 0.38 | 8 | 40 | 640 | Assumed in truck traffic calculations | | | | | | | | | | |
| 1 | Rubber Tired Loaders | 199 | 0.36 | 8 | 20 | 160 | | | 11.8 | 9.9 | 36.7 | 129.1 | 0.1 | 4.4 | 4.1 | 12716.0 | 3.8 |
| 1 | Plate Compactors | 8 | 0.43 | 8 | 20 | 160 | | | 1.0 | 0.8 | 4.2 | 5.0 | 0.0 | 0.2 | 0.2 | 689.0 | 0.1 |
| 1 | Rollers | 80 | 0.38 | 8 | 20 | 160 | | | 8.0 | 6.7 | 40.2 | 62.2 | 0.1 | 4.6 | 4.2 | 5444.7 | 1.6 |
| 2 | Pumps | 84 | 0.74 | 24 | 40 | 1920 | | | 3670.8 | 160.4 | 926.1 | 1177.2 | 1.6 | 85.4 | 85.4 | 149394.0 | 14.5 |
| | Other Equipment? | 0 | 0 | | | 0 | | | **Sum=** | 220.5 | | 1810.8 | | 123.4 | 120.3 | 216091.6 | 34.4 |
| | | | | | | | | | Per Day = | 5.5 | | 45.3 | | 3.1 | 3.0 | | |
| | **Trenching/Pipelines** | **Start Date:** | **7/15/2016** | | | | | | | | | | | | | | |
| | | **End Date:** | 12/15/2016 | | | | **Material Deliveries (all phases)** | | | | | | | | | | |
| 1 | Excavators | 162 | 0.38 | 8 | 72 | 576 | Deliveries by Tractor-Trailer: _25_ | | 33.2 | 27.9 | 246.6 | 318.7 | 0.4 | 15.7 | 14.4 | 39558.6 | 11.9 |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 72 | 576 | Deliveries by smaller trucks: _50_ | | 29.2 | 24.5 | 173.6 | 234.2 | 0.2 | 18.0 | 16.6 | 23283.8 | 7.0 |
| 1 | Plate Compactors | 8 | 0.43 | 4 | 72 | 288 | | | 1.7 | 1.4 | 7.6 | 9.0 | 0.0 | 0.4 | 0.4 | 1240.1 | 0.1 |
| 2 | Pumps | 84 | 0.74 | 24 | 72 | 3456 | | | 6607.5 | 288.6 | 1667.0 | 2118.9 | 2.8 | 153.8 | 153.8 | 268909.3 | 26.0 |
| 2 | Concrete/Industrial Saws | 81 | 0.73 | 4 | 72 | 576 | | | 467.9 | 46.5 | 271.6 | 332.5 | 0.5 | 25.0 | 25.0 | 42633.6 | 4.1 |
| 1 | Welders | 46 | 0.45 | 4 | 72 | 288 | | | 212.1 | 20.2 | 70.8 | 64.8 | 0.1 | 5.1 | 5.1 | 7462.5 | 1.8 |
| 1 | Truck-Mounted Pump Rig | 84 | 0.74 | 12 | 72 | 864 | | | 1651.9 | 72.2 | 416.8 | 529.7 | 0.7 | 38.4 | 38.4 | 67227.3 | 6.5 |
| 1 | Other Material Handling Equipment | 167 | 0.4 | 8 | 72 | 576 | | | 49.3 | 41.4 | 289.7 | 441.7 | 0.4 | 23.7 | 21.8 | 42911.3 | 12.9 |
| | Other Equipment? | 0 | 0 | | | 0 | | | **Sum=** | 522.8 | | 4049.5 | | 280.1 | 275.5 | 493226.5 | 70.5 |
| | Other Equipment? | 0 | 0 | | | 0 | | | Per Day = | 7.3 | | 56.2 | | 3.9 | 3.8 | | |
| | Other Equipment? | 0 | 0 | | | 0 | | | | | | | | | | | |
| | **Paving** | **Start Date:** | **7/15/2016** | | | | | | | | | | | | | | |
| | | **Start Date:** | 12/15/2016 | | | | | | | | | | | | | | |
| 1 | Cement and Mortar Mixers | 9 | 0.56 | 8 | 5 | 40 | | | 0.5 | 0.3 | 1.5 | 1.8 | 0.0 | 0.1 | 0.1 | 252.4 | 0.0 |
| 1 | Graders | 174 | 0.41 | 8 | 5 | 40 | | | 6.1 | 5.1 | 24.6 | 51.9 | 0.0 | 2.9 | 2.7 | 3244.1 | 1.0 |
| 1 | Rollers | 80 | 0.38 | 8 | 5 | 40 | | | 2.0 | 1.7 | 10.1 | 15.5 | 0.0 | 1.1 | 1.1 | 1361.2 | 0.4 |
| 1 | Pavers | 125 | 0.42 | 8 | 5 | 40 | | | 2.4 | 2.0 | 14.2 | 22.5 | 0.0 | 1.1 | 1.0 | 2343.0 | 0.7 |
| 1 | Paving Equipment | 130 | 0.36 | 8 | 5 | 40 | | | 1.8 | 1.5 | 12.7 | 17.8 | 0.0 | 0.9 | 0.8 | 2081.5 | 0.6 |
| 1 | Sweepers/Scrubbers | 64 | 0.46 | 8 | 5 | 40 | | | 2.4 | 2.0 | 10.5 | 16.7 | 0.0 | 1.5 | 1.4 | 1318.6 | 0.4 |
| Equipment types listed in "Equipment Types" worksheet tab. | | | | | | | | | **Sum=** | 12.6 | | 126.4 | | 7.6 | 7.0 | 10600.8 | 3.1 |
| Equipment listed in this sheet is to provide an example of inputs | | | | | | | | | Per Day = | 2.5 | | 25.3 | | 1.5 | 1.4 | | |
| It is assumed that water trucks would be used during grading | | | | | | | | | **Total =** | **763.2** | | **6052.1** | | **415.6** | **407.1** | **727395.7** | **109.9** |
| **Add or subtract phases and equipment, as appropriate** | | | | | | | | | | | | | | | | | |
| **Modify horepower or load factor, as appropriate** | | | | | | | | | | | | | | | | | |
| **Traffic** | | | | | Total | Peak Day | | | | | | | | | | | |
| | **Type** | **Total** | **Peak Day** | **Travel Distance** | **VMT** | **VMT** | | | | | | | | | | | |
| | Worker | 2205 | 24 | 10.8 | 23814 | 259 | | | | 16.6 | | 26.3 | | 2.6 | 1.2 | 18908.5 | 1.8 |
| | Delivery (includes cement trucks) | 100 | 10 | 7.3 | 730 | 73 | | | | 0.6 | | 3.2 | | 0.1 | 0.1 | 1253.6 | 0.0 |
| | Large Trucks | 109 | 10 | 20 | 2180 | 200 | | | | 2.7 | | 28.4 | | 0.9 | 0.6 | 7874.0 | 0.1 |
| | | | | | 26724 | 532 | | | | 19.8 | | 57.9 | | 3.6 | 1.8 | 28036.1 | 1.9 |
| | | | | | | | | Estimated Peak Day | | 0.8 | | 2.3 | | 0.1 | 0.1 | | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| lame: | Pure Water Monterey Groundwater Replenishment | | | | | | | | | | | | | | | |
| e: | Reclamation Ditch Diversion at Davis Rd | | | | | | | | | | | | | | | |
| See Equipment Type TAB/sheet for type, horsepower and load factor | | | | | | | | 2017 Computed Emissions (pounds) | | | | | | | | |
| **Description** | **HP** | **Load Factor** | **Hours/day** | **Total Work Days** | **Annual Hours** | **Comments** | | TOG | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
| **Demolition** | **Start Date:** | NA | | | | | | | | | | | | | | |
| | **End Date:** | | | | | | | | | | | | | | | |
| Concrete/Industrial Saws | 81 | 0.73 | | | 0 | **Demolition Volume** | | | | | | | | | | |
| Other Equipment? | 0 | 0 | | | 0 | Square footage of buildings to be demolished | | | | | | | | | | |
| Other Equipment? | 0 | 0 | | | 0 | (*or* total tons to be hauled) | | | | | | | | | | |
| Other Equipment? | 0 | 0 | | | 0 | _0_ square feet *or* | | | | | | | | | | |
| | | | | | | _1_ Hauling volume (tons) | | | | | | | | | | |
| **Site Preparation** | **Start Date:** | **5/15/2017** | | | | Any pavement demolished and hauled? _0_ tons | | | | | | | | | | |
| | **End Date:** | 5/31/2017 | | | | | | | | | | | | | | |
| Tractors/Loaders/Backhoes | 97 | 0.37 | 10 | 2 | 20 | | | 0.9 | 0.8 | 6.0 | 7.6 | 0.0 | 0.6 | 0.5 | 794.9 | 0.2 |
| Excavators | 162 | 0.38 | 8 | 1 | 8 | | | 0.4 | 0.4 | 3.4 | 4.0 | 0.0 | 0.2 | 0.2 | 540.8 | 0.2 |
| Pumps | 84 | 0.74 | 24 | 90 | 2160 | By-pass pump operates until in-channel work completed | | 3693.8 | 161.5 | 1033.6 | 1222.6 | 1.8 | 84.9 | 84.9 | 168068.3 | 14.5 |
| | | | | | | | | **Sum=** | 162.6 | | 1234.2 | | 85.6 | 85.6 | 169404.0 | 14.9 |
| **Grading / Excavation** | **Start Date:** | **6/21/2017** | | | | | | Per Day = | 1.8 | | 13.7 | | 1.0 | 1.0 | | |
| | **End Date:** | 8/15/2017 | | | | **Soil Hauling Volume** | | | | | | | | | | |
| Tractors/Loaders/Backhoes | 97 | 0.37 | 10 | 2 | 20 | Export volume = _100_ cubic yards? | | 0.9 | 0.8 | 6.0 | 7.6 | 0.0 | 0.6 | 0.5 | 794.9 | 0.2 |
| Excavators | 162 | 0.38 | 10 | 5 | 50 | Import volume = _20_ cubic yards? | | 2.7 | 2.3 | 21.4 | 25.1 | 0.0 | 1.2 | 1.1 | 3379.8 | 1.0 |
| Other Equipment? | 0 | 0 | | | 0 | | | **Sum=** | 3.1 | | 32.7 | | 1.8 | 1.7 | 4174.8 | 1.3 |
| Other Equipment? | 0 | 0 | | | 0 | | | Per Day = | 0.6 | | 6.5 | | 0.4 | 0.3 | | |
| Other Equipment? | 0 | 0 | | | 0 | | | | | | | | | | | |
| **Trenching/Pipelines** | **Start Date:** | **6/21/2017** | | | | | | | | | | | | | | |
| | **End Date:** | 7/31/2017 | | | | **Material Deliveries (all phases)** | | | | | | | | | | |
| Concrete/Industrial Saws | 81 | 0.73 | 8 | 2 | 16 | Deliveries by Tractor-Trailer: _5_ | | 11.7 | 1.2 | 7.5 | 8.5 | 0.0 | 0.6 | 0.6 | 1184.3 | 0.1 |
| Tractors/Loaders/Backhoes | 97 | 0.37 | 10 | 2 | 20 | Deliveries by smaller trucks: _5_ | | 0.9 | 0.8 | 6.0 | 7.6 | 0.0 | 0.6 | 0.5 | 794.9 | 0.2 |
| Plate Compactors | 8 | 0.43 | 6 | 4 | 24 | | | 0.1 | 0.1 | 0.6 | 0.8 | 0.0 | 0.0 | 0.0 | 103.3 | 0.0 |
| Other Equipment? | 0 | 0 | | | 0 | | | **Sum=** | 2.1 | | 16.9 | | 1.2 | 1.2 | 2082.6 | 0.4 |
| Other Equipment? | 0 | 0 | | | 0 | | | Per Day = | 0.5 | | 4.2 | | 0.3 | 0.3 | | |
| **Building/Facilities** | **Start Date:** | **7/1/2017** | | | | Cement Trucks? _6_ Total Round-Trips | | | | | | | | | | |
| | **End Date:** | 8/31/2017 | | | | | | | | | | | | | | |
| Tractors/Loaders/Backhoes | 97 | 0.37 | 6 | 10 | 60 | Electric? (Y/N) _Y__ Otherwise assumed diesel | | 2.8 | 2.4 | 17.9 | 22.8 | 0.0 | 1.7 | 1.6 | 2384.8 | 0.7 |
| Excavators | 162 | 0.38 | 6 | 5 | 30 | Liquid Propane (LPG)? (Y/N) _N__ Otherwise Assumed diesel | | 1.6 | 1.4 | 12.8 | 15.0 | 0.0 | 0.7 | 0.7 | 2027.9 | 0.6 |
| Cement and Mortar Mixers | 9 | 0.56 | 10 | 2 | 20 | Or temporary line power? (Y/N) _Y__ | | 0.2 | 0.1 | 0.8 | 0.9 | 0.0 | 0.0 | 0.0 | 126.2 | 0.0 |
| Other Equipment? | 0 | 0 | | | 0 | | | **Sum=** | 3.9 | | 38.8 | | 2.5 | 2.3 | 4538.9 | 1.4 |
| Other Equipment? | 0 | 0 | | | 0 | | | Per Day = | 0.4 | | 3.9 | | 0.2 | 0.2 | | |
| Other Equipment? | 0 | 0 | | | 0 | | | | | | | | | | | |
| **Paving** | **Start Date:** | **8/15/2017** | | | | | | | | | | | | | | |
| | **Start Date:** | **8/30/2017** | | | | | | | | | | | | | | |
| Cement and Mortar Mixers | 9 | 0.56 | | | 0 | | | | | | | | | | | |
| Pavers | 125 | 0.42 | 8 | 1 | 8 | | | 0.4 | 0.4 | 2.8 | 4.0 | 0.0 | 0.2 | 0.2 | 461.6 | 0.1 |
| Paving Equipment | 130 | 0.36 | 8 | 1 | 8 | | | 0.3 | 0.3 | 2.5 | 3.2 | 0.0 | 0.2 | 0.1 | 410.0 | 0.1 |
| Rollers | 80 | 0.38 | 8 | 1 | 8 | | | 0.4 | 0.3 | 2.0 | 2.9 | 0.0 | 0.2 | 0.2 | 267.9 | 0.1 |
| Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 1 | 8 | | | 0.4 | 0.3 | 2.4 | 3.0 | 0.0 | 0.2 | 0.2 | 318.0 | 0.1 |
| Sweepers/Scrubbers | 64 | 0.46 | | | 0 | | | **Sum=** | 1.3 | | 13.2 | | 0.8 | 0.7 | 1457.5 | 0.4 |
| | | | | | | | | Per Day = | 1.3 | | 13.2 | | 0.8 | 0.7 | | |
| | | | | | | | | **Total =** | **172.9** | | **1335.7** | | **92.0** | **91.4** | **181657.8** | **18.3** |

| **Type** | **Total** | **Peak Day** | **Travel Distance** | Total **VMT** | Peak Day **VMT** | | | TOG | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker | 1260 | 18 | 10.8 | 13608 | 194 | | | | 4.2 | | 1.1 | | 1.5 | 0.7 | 10804.9 | 1.0 |
| Delivery (includes cement trucks) | 10 | 3 | 7.3 | 73 | 22 | | | | 0.0 | | 0.0 | | 0.0 | 0.0 | 125.4 | 0.0 |
| Large Trucks | 37 | 10 | 20 | 740 | 200 | | | | 0.4 | | 0.5 | | 0.3 | 0.2 | 2672.8 | 0.0 |
| | | | | 14421 | 416 | | | | 4.7 | | 1.7 | | 1.8 | 0.9 | 13603.0 | 1.1 |
| | | | | | 0.0288676 | | | Estimated Peak Day | 0.2 | | 0.1 | | 0.1 | 0.0 | | |

**Project Name:** Pure Water Monterey Groundwater Replenishment

**Site Name:** Tembladero Slough Diversion at Castroville

See Equipment Type TAB/sheet for type, horsepower and load factor

| Qty | Description | HP | Load Factor | Hours/day | Total Work Days | Annual Hours | Comments | | TOG | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 2017 Computed Emissions (pounds) | | | | | | | | |
| | **Demolition** | **Start Date:** | NA | | | | | | | | | | | | | | |
| | | **End Date:** | | | | | | | | | | | | | | | |
| | Concrete/Industrial Saws | 81 | 0.73 | | | 0 | **Demolition Volume** | | | | | | | | | | |
| | Other Equipment? | 0 | 0 | | | 0 | Square footage of buildings to be demolished | | | | | | | | | | |
| | Other Equipment? | 0 | 0 | | | 0 | (*or* total tons to be hauled) | | | | | | | | | | |
| | Other Equipment? | 0 | 0 | | | 0 | _0_ square feet *or* | | | | | | | | | | |
| | | | | | | | _2_ Hauling volume (tons) | | | | | | | | | | |
| | **Site Preparation** | **Start Date:** | 5/15/2017 | | | | Any pavement demolished and hauled? _0_ tons | | | | | | | | | | |
| | | **End Date:** | 5/31/2017 | | | | | | | | | | | | | | |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 10 | 2 | 20 | | | 0.9 | 0.8 | 6.0 | 7.6 | 0.0 | 0.6 | 0.5 | 794.9 | 0.2 |
| 1 | Excavators | 162 | 0.38 | 8 | 2 | 16 | | | 0.9 | 0.7 | 6.8 | 8.0 | 0.0 | 0.4 | 0.4 | 1081.6 | 0.3 |
| 1 | Cranes | 226 | 0.29 | 10 | 4 | 40 | | | 3.9 | 3.2 | 13.8 | 38.4 | 0.0 | 1.7 | 1.6 | 2883.6 | 0.9 |
| 1 | Other Construction Equipment | 171 | 0.42 | 10 | 4 | 40 | sheet driver | | 3.8 | 3.2 | 21.1 | 34.8 | 0.0 | 1.8 | 1.7 | 3138.1 | 1.0 |
| 1 | Pumps | 84 | 0.74 | 24 | 90 | 2160 | Dewatering pump operates until in-channel work completed | | 3693.8 | 161.5 | 1033.6 | 1222.6 | 1.8 | 84.9 | 84.9 | 168068.3 | 14.5 |
| | | | | | | | | | **Sum=** | 169.4 | | 1311.4 | | 89.4 | 89.0 | 175966.5 | 16.9 |
| | **Grading / Excavation** | **Start Date:** | 6/1/2017 | | | | | | Per Day = | 1.9 | | 14.6 | | 1.0 | 1.0 | | |
| | | **End Date:** | 8/15/2017 | | | | **Soil Hauling Volume** | | | | | | | | | | |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 10 | 2 | 20 | Export volume = _100_ cubic yards? | | 0.9 | 0.8 | 6.0 | 7.6 | 0.0 | 0.6 | 0.5 | 794.9 | 0.2 |
| 1 | Excavators | 162 | 0.38 | 10 | 5 | 50 | Import volume = _20_ cubic yards? | | 2.7 | 2.3 | 21.4 | 25.1 | 0.0 | 1.2 | 1.1 | 3379.8 | 1.0 |
| | Other Equipment? | 0 | 0 | | | 0 | | | **Sum=** | 3.1 | | 32.7 | | 1.8 | 1.7 | 4174.8 | 1.3 |
| | Other Equipment? | 0 | 0 | | | 0 | | | Per Day = | 0.6 | | 6.5 | | 0.4 | 0.3 | | |
| | Other Equipment? | 0 | 0 | | | 0 | | | | | | | | | | | |
| | **Trenching/Pipelines** | **Start Date:** | 6/21/2017 | | | | | | | | | | | | | | |
| | | **End Date:** | 7/31/2017 | | | | **Material Deliveries (all phases)** | | | | | | | | | | |
| 1 | Concrete/Industrial Saws | 81 | 0.73 | 8 | 1 | 8 | Deliveries by Tractor-Trailer: _15_ | | 5.8 | 0.6 | 3.7 | 4.3 | 0.0 | 0.3 | 0.3 | 592.1 | 0.1 |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 10 | 5 | 50 | Deliveries by smaller trucks: _10_ | | 2.4 | 2.0 | 14.9 | 19.0 | 0.0 | 1.4 | 1.3 | 1987.4 | 0.6 |
| 1 | Plate Compactors | 8 | 0.43 | 6 | 5 | 30 | | | 0.2 | 0.2 | 0.8 | 0.9 | 0.0 | 0.0 | 0.0 | 129.2 | 0.0 |
| | Other Equipment? | 0 | 0 | | | 0 | | | **Sum=** | 2.7 | | 24.2 | | 1.8 | 1.7 | 2708.7 | 0.7 |
| | Other Equipment? | 0 | 0 | | | 0 | | | Per Day = | 0.5 | | 4.8 | | 0.4 | 0.3 | | |
| | **Building/Facilities** | **Start Date:** | 7/1/2017 | | | | Cement Trucks? _5_ Total Round-Trips | | | | | | | | | | |
| | | **End Date:** | 8/31/2017 | | | | | | | | | | | | | | |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 6 | 10 | 60 | Electric? (Y/N) _Y__ Otherwise assumed diesel | | 2.8 | 2.4 | 17.9 | 22.8 | 0.0 | 1.7 | 1.6 | 2384.8 | 0.7 |
| 1 | Excavators | 162 | 0.38 | 6 | 5 | 30 | Liquid Propane (LPG)? (Y/N) _N__ Otherwise Assumed diesel | | 1.6 | 1.4 | 12.8 | 15.0 | 0.0 | 0.7 | 0.7 | 2027.9 | 0.6 |
| 1 | Cement and Mortar Mixers | 9 | 0.56 | 10 | 5 | 50 | Or temporary line power? (Y/N) _Y__ | | 0.6 | 0.4 | 1.9 | 2.3 | 0.0 | 0.1 | 0.1 | 315.4 | 0.0 |
| | Other Equipment? | 0 | 0 | | | 0 | | | **Sum=** | 4.1 | | 40.2 | | 2.5 | 2.4 | 4728.2 | 1.4 |
| | Other Equipment? | 0 | 0 | | | 0 | | | Per Day = | 0.4 | | 4.0 | | 0.3 | 0.2 | | |
| | Other Equipment? | 0 | 0 | | | 0 | | | | | | | | | | | |
| | **Paving** | **Start Date:** | 8/15/2017 | | | | | | | | | | | | | | |
| | | **Start Date:** | 8/30/2017 | | | | | | | | | | | | | | |
| | Cement and Mortar Mixers | 9 | 0.56 | | | 0 | | | | | | | | | | | |
| 1 | Pavers | 125 | 0.42 | 10 | 2 | 20 | | | 1.1 | 0.9 | 7.1 | 10.1 | 0.0 | 0.5 | 0.5 | 1154.0 | 0.4 |
| 1 | Paving Equipment | 130 | 0.36 | 10 | 2 | 20 | | | 0.8 | 0.7 | 6.3 | 8.0 | 0.0 | 0.4 | 0.4 | 1025.0 | 0.3 |
| 1 | Rollers | 80 | 0.38 | 10 | 2 | 20 | | | 0.9 | 0.8 | 5.0 | 7.2 | 0.0 | 0.5 | 0.5 | 669.8 | 0.2 |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 1 | 8 | | | 0.4 | 0.3 | 2.4 | 3.0 | 0.0 | 0.2 | 0.2 | 318.0 | 0.1 |
| | Sweepers/Scrubbers | 64 | 0.46 | | | 0 | | | **Sum=** | 2.7 | | 28.4 | | 1.7 | 1.5 | 3166.7 | 1.0 |
| | | | | | | | | | Per Day = | 1.3 | | 14.2 | | 0.8 | 0.8 | | |
| | | | | | | | | | **Total =** | **182.0** | | **1436.9** | | **97.2** | **96.2** | **190744.9** | **21.2** |

**Traffic**

| Type | Total | Peak Day | Travel Distance | Total VMT | Peak Day VMT | | TOG | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker | 1260 | 18 | 10.8 | 13608 | 194 | | | 10.0 | | 16.3 | | 1.5 | 0.7 | 10804.9 | 1.0 |
| Delivery (includes cement trucks) | 20 | 4 | 7.3 | 146 | 29 | | | 0.0 | | 0.1 | | 0.0 | 0.0 | 250.7 | 0.0 |
| Large Trucks | 56 | 10 | 20 | 1120 | 200 | | | 0.7 | | 0.8 | | 0.5 | 0.3 | 4045.3 | 0.0 |
| | | | | 14874 | 424 | | | 10.7 | | 17.2 | | 2.0 | 1.0 | 15100.9 | 1.1 |
| | | | | | 0.0284792 | Estimated Peak Day | | 0.4 | | 0.7 | | 0.1 | 0.0 | | |

**Project Name:** Pure Water Monterey Groundwater Replenishment

**Site Name:** Blanco Drain Diversion and Pipeline

See Equipment Type TAB/sheet for type, horsepower and load factor

2017 Computed Emissions (pounds)

| Qty | Description | HP | Load Factor | Hours/day | Total Work Days | Annual Hours | Comments | TOG | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Demolition** | **Start Date:** | NA | | | | | | | | | | | | | |
| | | **End Date:** | | | | | | | | | | | | | | |
| | Concrete/Industrial Saws | 81 | 0.73 | | | 0 | **Demolition Volume** | | | | | | | | | |
| | Other Equipment? | 0 | 0 | | | 0 | Square footage of buildings to be demolished | | | | | | | | | |
| | Other Equipment? | 0 | 0 | | | 0 | (*or* total tons to be hauled) | | | | | | | | | |
| | Other Equipment? | 0 | 0 | | | 0 | _0_ square feet *or* | | | | | | | | | |
| | | | | | | | _1_ Hauling volume (tons) | | | | | | | | | |
| | **Site Preparation** | **Start Date:** | **4/1/2017** | | | | Any pavement demolished and hauled? _20_ tons | | | | | | | | | |
| | | **End Date:** | 4/15/2017 | | | | | | | | | | | | | |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 3 | 24 | | 1.1 | 0.9 | 7.2 | 9.1 | 0.0 | 0.7 | 0.6 | 953.9 | 0.3 |
| 1 | Excavators | 162 | 0.38 | 8 | 1 | 8 | | 0.4 | 0.4 | 3.4 | 4.0 | 0.0 | 0.2 | 0.2 | 540.8 | 0.2 |
| 1 | Pumps | 84 | 0.74 | 24 | 90 | 2160 | By-pass pump operates until in-channel work completed | 3693.8 | 161.5 | 1033.6 | 1222.6 | 1.8 | 84.9 | 84.9 | 168068.3 | 14.5 |
| | | | | | | | | **Sum=** | 162.8 | | 1235.7 | | 85.8 | 85.7 | 169563.0 | 14.9 |
| | **Grading / Excavation** | **Start Date:** | **9/1/2017** | | | | | Per Day = | 1.8 | | 13.7 | | 1.0 | 1.0 | | |
| | | **End Date:** | 11/15/2017 | | | | **Soil Hauling Volume** | | | | | | | | | |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 3 | 24 | Export volume = _2,300_ cubic yards? | 1.1 | 0.9 | 7.2 | 9.1 | 0.0 | 0.7 | 0.6 | 953.9 | 0.3 |
| 1 | Excavators | 162 | 0.38 | 8 | 5 | 40 | Import volume = _60_ cubic yards? | 2.2 | 1.8 | 17.1 | 20.1 | 0.0 | 1.0 | 0.9 | 2703.9 | 0.8 |
| | Other Equipment? | 0 | 0 | | | 0 | | **Sum=** | 2.8 | | 29.2 | | 1.7 | 1.5 | 3657.8 | 1.1 |
| | Other Equipment? | 0 | 0 | | | 0 | | Per Day = | 0.6 | | 5.8 | | 0.3 | 0.3 | | |
| | Other Equipment? | 0 | 0 | | | 0 | | | | | | | | | | |
| | **Trenching/Pipelines** | **Start Date:** | **4/15/2017** | | | | | | | | | | | | | |
| | | **End Date:** | 10/15/2017 | | | | **Material Deliveries (all phases)** | | | | | | | | | |
| 1 | Excavators | 162 | 0.38 | 8 | 50 | 400 | Deliveries by Tractor-Trailer: _15_ | 21.5 | 18.1 | 170.9 | 200.7 | 0.3 | 9.9 | 9.1 | 27038.8 | 8.3 |
| 2 | Plate Compactors | 8 | 0.43 | 8 | 41 | 656 | Deliveries by smaller trucks: _25_ | 3.9 | 3.3 | 17.2 | 20.6 | 0.0 | 0.8 | 0.8 | 2824.8 | 0.3 |
| 2 | Off-Highway Trucks | 400 | 0.38 | 8 | 50 | 800 | Assumed in truck traffic calculations | | | | | | | | | |
| 1 | Graders | 174 | 0.41 | 8 | 10 | 80 | | 11.3 | 9.5 | 48.3 | 96.3 | 0.1 | 5.4 | 5.0 | 6370.3 | 2.0 |
| 1 | Rollers | 80 | 0.38 | 8 | 10 | 80 | | 3.7 | 3.1 | 19.9 | 29.0 | 0.0 | 2.1 | 1.9 | 2679.2 | 0.8 |
| 1 | Concrete/Industrial Saws | 81 | 0.73 | 8 | 50 | 400 | | 292.3 | 29.0 | 187.3 | 212.9 | 0.3 | 15.3 | 15.3 | 29606.6 | 2.6 |
| 1 | Cranes | 226 | 0.29 | 8 | 15 | 120 | | 11.6 | 9.7 | 41.3 | 115.3 | 0.1 | 5.1 | 4.7 | 8650.8 | 2.7 |
| 1 | Bore/Drill Rigs | 205 | 0.5 | 12 | 15 | 180 | | 8.4 | 7.1 | 44.8 | 102.5 | 0.2 | 2.9 | 2.7 | 20081.2 | 6.2 |
| 2 | Pumps | 84 | 0.74 | 24 | 15 | 720 | | 1231.3 | 53.8 | 344.5 | 407.5 | 0.6 | 28.3 | 28.3 | 56022.8 | 4.8 |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 50 | 400 | | 18.8 | 15.8 | 119.6 | 152.1 | 0.2 | 11.4 | 10.5 | 15899.0 | 4.9 |
| 1 | Welders | 46 | 0.45 | 8 | 15 | 120 | | 78.7 | 7.5 | 28.7 | 26.1 | 0.0 | 1.9 | 1.9 | 3109.4 | 0.7 |
| | | | | | | | | **Sum=** | 156.9 | | 1362.9 | | 83.2 | 80.3 | 172282.8 | 33.1 |
| | **Building/Facilities** | **Start Date:** | **9/15/2017** | | | | Cement Trucks? _20_ Total Round-Trips | Per Day = | 3.1 | | 27.3 | | 1.7 | 1.6 | | |
| | | **End Date:** | 11/15/2017 | | | | | | | | | | | | | |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 6 | 10 | 60 | Electric? (Y/N) __Y_ Otherwise assumed diesel | 2.8 | 2.4 | 17.9 | 22.8 | 0.0 | 1.7 | 1.6 | 2384.8 | 0.7 |
| 1 | Excavators | 162 | 0.38 | 6 | 10 | 60 | Liquid Propane (LPG)? (Y/N) _N__ Otherwise Assumed diesel | 3.2 | 2.7 | 25.6 | 30.1 | 0.0 | 1.5 | 1.4 | 4055.8 | 1.2 |
| 1 | Cement and Mortar Mixers | 9 | 0.56 | 8 | 5 | 40 | Or temporary line power? (Y/N) _Y__ | 0.5 | 0.3 | 1.5 | 1.8 | 0.0 | 0.1 | 0.1 | 252.4 | 0.0 |
| | Off-Highway Trucks | 400 | 0.38 | | | 0 | | **Sum=** | 5.4 | | 54.7 | | 3.3 | 3.0 | 6693.0 | 2.0 |
| | Other Equipment? | 0 | 0 | | | 0 | | Per Day = | 0.5 | | 5.5 | | 0.3 | 0.3 | | |
| | Other Equipment? | 0 | 0 | | | 0 | | | | | | | | | | |
| | **Paving** | **Start Date:** | **11/7/2017** | | | | | | | | | | | | | |
| | | **Start Date:** | **11/21/2017** | | | | | | | | | | | | | |
| | Cement and Mortar Mixers | 9 | 0.56 | | | 0 | | | | | | | | | | |
| 1 | Pavers | 125 | 0.42 | 8 | 2 | 16 | | 0.9 | 0.7 | 5.7 | 8.1 | 0.0 | 0.4 | 0.4 | 923.2 | 0.3 |
| 1 | Paving Equipment | 130 | 0.36 | 8 | 2 | 16 | | 0.7 | 0.6 | 5.1 | 6.4 | 0.0 | 0.3 | 0.3 | 820.0 | 0.3 |
| 1 | Rollers | 80 | 0.38 | 8 | 2 | 16 | | 0.7 | 0.6 | 4.0 | 5.8 | 0.0 | 0.4 | 0.4 | 535.8 | 0.2 |
| | Tractors/Loaders/Backhoes | 97 | 0.37 | | | 0 | | **Sum=** | 1.9 | | 20.3 | | 1.1 | 1.0 | 2279.0 | 0.7 |
| | Sweepers/Scrubbers | 64 | 0.46 | | | 0 | | Per Day = | 1.0 | | 10.1 | | 0.6 | 0.5 | | |
| | | | | | | | | **Total =** | **329.8** | | **2702.8** | | **175.1** | **171.6** | **354475.6** | **51.9** |

**Traffic**

| Type | Total | Peak Day | Travel Distance | Total VMT | Peak Day VMT | | ROG | NOX | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker | 3024 | 26 | 10.8 | 32659 | 281 | | 22.8 | 36.0 | 3.6 | 1.6 | 25931.6 | 2.5 |
| Delivery (includes cement trucks) | 50 | 10 | 7.3 | 365 | 73 | | 0.3 | 1.6 | 0.1 | 0.0 | 626.8 | 0.0 |
| Large Trucks | 373 | 40 | 20 | 7460 | 800 | | 9.1 | 97.3 | 3.0 | 1.9 | 26944.9 | 0.2 |
| | | | | 40484 | 1154 | | 32.2 | 135.0 | 6.7 | 3.6 | 53503.3 | 2.7 |
| | | | | | 0.0285 | Estimated Peak Day | 1.3 | 5.4 | 0.3 | 0.1 | | |

**Project Name:** Pure Water Monterey Groundwater Replenishment

**Site Name:** Lake El Estero Stroage Management Site

See Equipment Type TAB/sheet for type, horsepower and load factor

2017 Computed Emissions (pounds)

| Qty | Description | HP | Load Factor | Hours/day | Total Work Days | Annual Hours | Comments | TOG | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Demolition** | **Start Date:** | **8/1/2017** | | | | | | | | | | | | | |
| | | **End Date:** | 8/7/2017 | | | | | | | | | | | | | |
| 1 | Concrete/Industrial Saws | 81 | 0.73 | 6 | 2 | 12 | **Demolition Volume** | 8.8 | 0.9 | 5.6 | 6.4 | 0.0 | 0.5 | 0.5 | 888.2 | 0.1 |
| | Other Equipment? | 0 | 0 | | | 0 | Square footage of buildings to be demolished | **Sum=** | 0.9 | | 6.4 | | 0.5 | 0.5 | 888.2 | 0.1 |
| | Other Equipment? | 0 | 0 | | | 0 | (*or* total tons to be hauled) | Per Day = | 0.4 | | 3.2 | | 0.2 | 0.2 | | |
| | Other Equipment? | 0 | 0 | | | 0 | **_0_** square feet *or* | | | | | | | | | |
| | | | | | | | **_0_** Hauling volume (tons) | | | | | | | | | |
| | **Site Preparation** | **Start Date:** | **8/8/2017** | | | | Any pavement demolished and hauled? **_14_ tons** | | | | | | | | | |
| | | **End Date:** | 8/14/2017 | | | | | | | | | | | | | |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 10 | 2 | 20 | | 0.9 | 0.8 | 6.0 | 7.6 | 0.0 | 0.6 | 0.5 | 794.9 | 0.2 |
| | Other Equipment? | 0 | 0 | | | 0 | | **Sum=** | 0.8 | | 7.6 | | 0.6 | 0.5 | 794.9 | 0.2 |
| | Other Equipment? | 0 | 0 | | | 0 | | Per Day = | 0.4 | | 3.8 | | 0.3 | 0.3 | | |
| | **Grading / Excavation** | **Start Date:** | **8/15/2017** | | | | | | | | | | | | | |
| | | **End Date:** | 9/7/2017 | | | | **Soil Hauling Volume** | | | | | | | | | |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 10 | 2 | 20 | Export volume = **_13_** cubic yards? | 0.9 | 0.8 | 6.0 | 7.6 | 0.0 | 0.6 | 0.5 | 794.9 | 0.2 |
| | Other Equipment? | 0 | 0 | | | 0 | Import volume = **_13_** cubic yards? | **Sum=** | 0.8 | | 7.6 | | 0.6 | 0.5 | 794.9 | 0.2 |
| | Other Equipment? | 0 | 0 | | | 0 | | Per Day = | 0.4 | | 3.8 | | 0.3 | 0.3 | | |
| | Other Equipment? | 0 | 0 | | | 0 | | | | | | | | | | |
| | Other Equipment? | 0 | 0 | | | 0 | | | | | | | | | | |
| | **Trenching/Pipelines** | **Start Date:** | **9/1/2017** | | | | | | | | | | | | | |
| | | **End Date:** | 9/7/2017 | | | | **Material Deliveries (all phases)** | | | | | | | | | |
| 1 | Concrete/Industrial Saws | 81 | 0.73 | 10 | 4 | 40 | Deliveries by Tractor-Trailer: _1_ | 29.2 | 2.9 | 18.7 | 21.3 | 0.0 | 1.5 | 1.5 | 2960.7 | 0.3 |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 10 | 4 | 40 | Deliveries by smaller trucks: _5_ | 1.9 | 1.6 | 12.0 | 15.2 | 0.0 | 1.1 | 1.1 | 1589.9 | 0.5 |
| 1 | Plate Compactors | 8 | 0.43 | 10 | 4 | 40 | | 0.2 | 0.2 | 1.1 | 1.3 | 0.0 | 0.0 | 0.0 | 172.2 | 0.0 |
| | Other Equipment? | 0 | 0 | | | 0 | | **Sum=** | 4.7 | | 37.7 | | 2.7 | 2.6 | 4722.8 | 0.8 |
| | Other Equipment? | 0 | 0 | | | 0 | | Per Day = | 1.2 | | 9.4 | | 0.7 | 0.7 | | |
| | **Building/Facilities** | **Start Date:** | **9/1/2017** | | | | Cement Trucks? **_2_** Total Round-Trips | | | | | | | | | |
| | | **End Date:** | 9/15/2017 | | | | | | | | | | | | | |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 5 | 10 | 50 | Electric? (Y/N) _Y__ Otherwise assumed diesel | 2.4 | 2.0 | 14.9 | 19.0 | 0.0 | 1.4 | 1.3 | 1987.4 | 0.6 |
| 1 | Air Compressors | 78 | 0.48 | 5 | 10 | 50 | Liquid Propane (LPG)? (Y/N) _N__ Otherwise Assumed diesel | 46.9 | 2.8 | 15.6 | 18.2 | 0.0 | 1.4 | 1.4 | 2343.3 | 0.2 |
| | Other Equipment? | 0 | 0 | | | 0 | Or temporary line power? (Y/N) __NO_ | **Sum=** | 4.7 | | 37.2 | | 2.9 | 2.8 | 4330.7 | 0.9 |
| | Other Equipment? | 0 | 0 | | | 0 | | Per Day = | 0.5 | | 3.7 | | 0.3 | 0.3 | | |
| | Other Equipment? | 0 | 0 | | | 0 | | | | | | | | | | |
| | Other Equipment? | 0 | 0 | | | 0 | | | | | | | | | | |
| | **Paving** | **Start Date:** | **9/15/2017** | | | | | | | | | | | | | |
| | | **Start Date:** | **9/21/2017** | | | | | | | | | | | | | |
| | Cement and Mortar Mixers | 9 | 0.56 | | | 0 | | | | | | | | | | |
| 1 | Pavers | 125 | 0.42 | 10 | 2 | 20 | | 1.1 | 0.9 | 7.1 | 10.1 | 0.0 | 0.5 | 0.5 | 1154.0 | 0.4 |
| 1 | Sweepers/Scrubbers | 64 | 0.46 | 2 | 2 | 4 | | 0.2 | 0.2 | 1.0 | 1.6 | 0.0 | 0.1 | 0.1 | 129.8 | 0.0 |
| 1 | Rollers | 80 | 0.38 | 10 | 2 | 20 | | 0.9 | 0.8 | 5.0 | 7.2 | 0.0 | 0.5 | 0.5 | 669.8 | 0.2 |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 10 | 2 | 20 | | 0.9 | 0.8 | 6.0 | 7.6 | 0.0 | 0.6 | 0.5 | 794.9 | 0.2 |
| | Other Equipment? | 0 | 0 | | | 0 | | **Sum=** | 2.7 | | 26.5 | | 1.7 | 1.6 | 2748.6 | 0.8 |
| | | | | | | | | Per Day = | 1.3 | | 13.2 | | 0.9 | 0.8 | | |
| | | | | | | | | **Total =** | **14.5** | | **123.0** | | **8.9** | **8.5** | **14280.1** | **3.0** |

**Traffic**

| Type | Total | Peak Day | Travel Distance | Total VMT | Peak Day VMT | | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker | 378 | 16 | 10.8 | 4082 | 173 | | 2.9 | | 4.5 | | 0.4 | 0.2 | 3241.5 | 0.3 |
| Delivery (includes cement trucks) | 10 | 5 | 7.3 | 73 | 37 | | 0.1 | | 0.3 | | 0.0 | 0.0 | 125.4 | 0.0 |
| Large Trucks | 15 | 5 | 20 | 300 | 100 | | 0.4 | | 3.9 | | 0.1 | 0.1 | 1083.6 | 0.0 |
| | | | | 4455 | 309 | | 3.3 | | 8.7 | | 0.6 | 0.3 | 4450.4 | 0.3 |
| | | | | | 0.0694214 | Estimated Peak Day | 0.1 | | 0.3 | | 0.0 | 0.0 | | |

**Project Name:** Pure Water Monterey Groundwater Replenishment
**Site Name:** Advanced Water Treatment Facility

**Includes AWTF, Diversion Structure and pipeline, and the brine mixing faciltiy. Pump station is on the conveyance tab.**

See Equipment Type TAB/sheet for type, horsepower and load factor

2016 Computed Emissions (pounds)

| Qty | Description | HP | Load Factor | Hours/day | Total Work Days | Annual Hours | Comments | | TOG | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Demolition** | **Start Date:** | **8/15/2016** | | | | | | | | | | | | | | |
| | | **End Date:** | 10/15/2016 | | | | | | | | | | | | | | |
| 1 | Concrete/Industrial Saws | 81 | 0.73 | 4 | 3 | 12 | **Demolition Volume** | | 9.7 | 1.0 | 5.7 | 6.9 | 0.0 | 0.5 | 0.5 | 888.2 | 0.1 |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 6 | 48 | Square footage of buildings to be demolished | | 2.4 | 2.0 | 14.5 | 19.5 | 0.0 | 1.5 | 1.4 | 1940.3 | 0.6 |
| 2 | Dumpers/Tenders | 16 | 0.38 | 8 | 6 | 96 | (*or* total tons to be hauled), Assumed in truck traffic calculations | | | | | | | | | | |
| | Other Equipment? | 0 | 0 | | | 0 | _?_ square feet *or* | | **Sum=** | 3.0 | | 26.4 | | 2.0 | 1.9 | 2828.5 | 0.7 |
| | | | | | | | _10_ Hauling volume (tons) | | Per Day = | 0.5 | | 4.4 | | 0.3 | 0.3 | | |
| | **Site Preparation** | **Start Date:** | **7/1/2016** | | | | Any pavement demolished and hauled? _15_ tons | | | | | | | | | | |
| | | **End Date:** | 8/31/2016 | | | | | | | | | | | | | | |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 20 | 160 | | | 8.1 | 6.8 | 48.2 | 65.0 | 0.1 | 5.0 | 4.6 | 6467.7 | 2.0 |
| 2 | Dumpers/Tenders | 16 | 0.38 | 8 | 5 | 80 | Assumed in truck traffic calculations | | | | | | | | | | |
| 1 | Rubber Tired Dozers | 255 | 0.4 | 8 | 5 | 40 | | | 7.4 | 6.2 | 52.4 | 69.3 | 0.0 | 3.2 | 3.0 | 4613.0 | 1.4 |
| | | | | | | | | | **Sum=** | 13.0 | | 134.3 | | 8.2 | 7.6 | 11080.7 | 3.3 |
| | **Grading / Excavation** | **Start Date:** | **8/15/2016** | | | | | | Per Day = | 0.6 | | 6.7 | | 0.4 | 0.4 | | |
| | | **End Date:** | 11/15/2017 | | | | **Soil Hauling Volume** | | | | | | | | | | |
| 2 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 50 | 800 | Export volume = _510_ cubic yards? | | 40.5 | 34.0 | 241.0 | 325.2 | 0.3 | 25.0 | 23.0 | 32338.7 | 9.8 |
| 1 | Crawler Tractors | 208 | 0.43 | 8 | 30 | 240 | Import volume = _2,100_ cubic yards? | | 25.2 | 21.2 | 85.2 | 285.9 | 0.2 | 11.0 | 10.1 | 23988.3 | 7.2 |
| 2 | Excavators | 162 | 0.38 | 8 | 50 | 800 | | | 46.2 | 38.8 | 342.5 | 442.7 | 0.5 | 21.8 | 20.0 | 54942.4 | 16.6 |
| 1 | Graders | 174 | 0.41 | 8 | 15 | 120 | | | 18.2 | 15.3 | 73.8 | 155.6 | 0.1 | 8.7 | 8.0 | 9732.4 | 2.9 |
| 1 | Rollers | 80 | 0.38 | 8 | 20 | 160 | | | 8.0 | 6.7 | 40.2 | 62.2 | 0.1 | 4.6 | 4.2 | 5444.7 | 1.6 |
| 1 | Rubber Tired Loaders | 199 | 0.36 | 8 | 50 | 400 | | | 29.5 | 24.8 | 91.7 | 322.9 | 0.3 | 11.0 | 10.1 | 31790.1 | 9.6 |
| 1 | Rough Terrain Forklifts | 100 | 0.4 | 8 | 50 | 400 | | | 12.6 | 10.6 | 117.8 | 135.3 | 0.2 | 7.5 | 6.9 | 17870.2 | 5.4 |
| 2 | Dumpers/Tenders | 16 | 0.38 | 8 | 50 | 800 | Assumed in truck traffic calculations | | | | | | | | | | |
| | Other Equipment? | 0 | 0 | | | 0 | | | **Sum=** | 151.5 | | 1729.8 | | 89.7 | 82.5 | 176106.7 | 53.1 |
| | | | | | | | | | Per Day = | 3.0 | | 34.6 | | 1.8 | 1.7 | | |
| | **Trenching/Pipelines** | **Start Date:** | **9/15/2016** | | | | | | | | | | | | | | |
| | | **End Date:** | 8/15/2017 | | | | **Material Deliveries (all phases)** | | | | | | | | | | |
| 1 | Excavators | 162 | 0.38 | 8 | 40 | 320 | Deliveries by Tractor-Trailer: _230_ | | 18.5 | 15.5 | 137.0 | 177.1 | 0.2 | 8.7 | 8.0 | 21977.0 | 6.6 |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 10 | 40 | 400 | Deliveries by smaller trucks: _800_ | | 20.2 | 17.0 | 120.5 | 162.6 | 0.2 | 12.5 | 11.5 | 16169.3 | 4.9 |
| 1 | Plate Compactors | 8 | 0.43 | 8 | 40 | 320 | | | 1.9 | 1.6 | 8.4 | 10.0 | 0.0 | 0.4 | 0.4 | 1377.9 | 0.1 |
| 1 | Concrete/Industrial Saws | 81 | 0.73 | 8 | 40 | 320 | | | 259.9 | 25.8 | 150.9 | 184.7 | 0.3 | 13.9 | 13.9 | 23685.3 | 2.3 |
| 1 | Cement and Mortar Mixers | 9 | 0.56 | 8 | 4 | 32 | | | 0.4 | 0.2 | 1.2 | 1.5 | 0.0 | 0.1 | 0.1 | 201.9 | 0.0 |
| 1 | Welders | 46 | 0.45 | 8 | 40 | 320 | | | 235.7 | 22.5 | 78.7 | 72.0 | 0.1 | 5.7 | 5.7 | 8291.7 | 2.0 |
| 1 | Pumps | 84 | 0.74 | 24 | 14 | 336 | | | 642.4 | 28.1 | 162.1 | 206.0 | 0.3 | 15.0 | 15.0 | 26144.0 | 2.5 |
| | Other Equipment? | 0 | 0 | | | 0 | | | **Sum=** | 110.7 | | 813.9 | | 56.2 | 54.5 | 97847.1 | 18.5 |
| | | | | | | | | | Per Day = | 2.8 | | 20.3 | | 1.4 | 1.4 | | |
| | **Building/Facilities** | **Start Date:** | **9/15/2016** | | | | Cement Trucks? _720_ Total Round-Trips | | | | | | | | | | |
| | | **End Date:** | 12/15/2017 | | | | | | | | | | | | | | |
| 1 | Aerial Lifts | 62 | 0.31 | 8 | 40 | 320 | Electric? (Y/N) _Y_ Otherwise assumed diesel | | 2.7 | 2.2 | 43.4 | 36.9 | 0.1 | 1.5 | 1.4 | 6857.7 | 2.1 |
| 2 | Air Compressors | 78 | 0.48 | 8 | 130 | 2080 | Liquid Propane (LPG)? (Y/N) _N_ Otherwise Assumed diesel | | 2164.4 | 127.6 | 652.5 | 821.6 | 1.0 | 68.1 | 68.1 | 97481.1 | 11.5 |
| 2 | Cement and Mortar Mixers | 9 | 0.56 | 8 | 130 | 2080 | Or temporary line power? (Y/N) _Y_ | | 24.8 | 15.3 | 80.1 | 95.9 | 0.2 | 3.9 | 3.9 | 13122.5 | 1.4 |
| 2 | Concrete/Industrial Saws | 81 | 0.73 | 8 | 52 | 832 | | | 675.9 | 67.2 | 392.3 | 480.3 | 0.7 | 36.1 | 36.1 | 61581.9 | 6.0 |
| 1 | Cranes | 226 | 0.29 | 8 | 104 | 832 | | | 89.0 | 74.8 | 310.1 | 886.5 | 0.6 | 40.2 | 37.0 | 60913.7 | 18.4 |
| 1 | Forklifts | 89 | 0.2 | 8 | 130 | 1040 | | | 35.1 | 29.5 | 164.0 | 253.7 | 0.2 | 21.2 | 19.5 | 20615.3 | 6.2 |
| 1 | Generator Sets | 84 | 0.74 | 8 | 208 | 1664 | | | 2697.5 | 132.8 | 790.3 | 1004.7 | 1.4 | 70.4 | 70.4 | 129474.8 | 11.8 |
| 1 | Graders | 174 | 0.41 | 8 | 32 | 256 | | | 38.8 | 32.6 | 157.5 | 331.9 | 0.2 | 18.6 | 17.2 | 20762.4 | 6.3 |
| 1 | Other Construction Equipment | 171 | 0.42 | 8 | 260 | 2080 | | | 205.4 | 172.6 | 1104.5 | 1914.3 | 1.6 | 100.7 | 92.6 | 165825.9 | 50.0 |
| 1 | Rollers | 80 | 0.38 | 8 | 32 | 256 | | | 12.8 | 10.8 | 64.4 | 99.5 | 0.1 | 7.3 | 6.7 | 8711.5 | 2.6 |
| 1 | Rubber Tired Loaders | 199 | 0.36 | 8 | 104 | 832 | | | 61.4 | 51.6 | 190.6 | 671.5 | 0.6 | 22.9 | 21.1 | 66123.5 | 19.9 |
| 1 | Skid Steer Loaders | 64 | 0.37 | 8 | 208 | 1664 | | | 28.2 | 23.7 | 288.8 | 306.8 | 0.4 | 17.1 | 15.8 | 43942.5 | 13.3 |
| 1 | Surfacing Equipment | 253 | 0.3 | 8 | 32 | 256 | | | 11.1 | 9.3 | 61.0 | 148.4 | 0.2 | 4.8 | 4.4 | 21504.9 | 6.5 |
| 1 | Truck-Mounted Pump Rig | 84 | 0.74 | 8 | 32 | 256 | | | 489.4 | 21.4 | 123.5 | 157.0 | 0.2 | 11.4 | 11.4 | 19919.2 | 1.9 |
| 2 | Welders | 46 | 0.45 | 8 | 208 | 3328 | | | 2451.3 | 233.7 | 818.6 | 749.0 | 1.1 | 59.0 | 59.0 | 86233.2 | 20.9 |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 200 | 1600 | | | 81.0 | 68.0 | 482.1 | 650.4 | 0.6 | 50.1 | 46.1 | 64677.3 | 19.5 |
| 2 | Dumpers/Tenders | 16 | 0.38 | 8 | 104 | 1664 | Assumed in truck traffic calculations | | **Sum=** | 1073.1 | | 8608.3 | | 533.3 | 510.6 | 887747.3 | 198.3 |
| | Other Equipment? | 0 | 0 | | | 0 | | | Per Day = | 4.1 | | 33.1 | | 2.1 | 2.0 | | |
| | **Paving** | **Start Date:** | **6/15/2017** | | | | | | | | | | | | | | |
| | | **Start Date:** | **12/15/2017** | | | | | | | | | | | | | | |
| 1 | Cement and Mortar Mixers | 9 | 0.56 | 8 | 24 | 192 | | | 2.3 | 1.4 | 7.4 | 8.9 | 0.0 | 0.4 | 0.4 | 1211.3 | 0.1 |
| 1 | Graders | 174 | 0.41 | 8 | 24 | 192 | | | 29.1 | 24.4 | 118.2 | 248.9 | 0.2 | 14.0 | 12.9 | 15571.8 | 4.7 |
| 1 | Rollers | 80 | 0.38 | 8 | 24 | 192 | | | 9.6 | 8.1 | 48.3 | 74.6 | 0.1 | 5.5 | 5.1 | 6533.6 | 2.0 |
| 1 | Pavers | 125 | 0.42 | 8 | 24 | 192 | | | 11.4 | 9.6 | 68.4 | 108.2 | 0.1 | 5.4 | 4.9 | 11246.5 | 3.4 |
| 1 | Paving Equipment | 130 | 0.36 | 8 | 24 | 192 | | | 8.8 | 7.4 | 61.0 | 85.5 | 0.1 | 4.2 | 3.9 | 9991.4 | 3.0 |
| 1 | Sweepers/Scrubbers | 64 | 0.46 | 8 | 24 | 192 | | | 11.6 | 9.7 | 50.5 | 80.4 | 0.1 | 7.1 | 6.5 | 6329.3 | 1.9 |
| | | | | | | | | | **Sum=** | 60.6 | | 606.5 | | 36.6 | 33.7 | 50883.9 | 15.1 |
| | | | | | | | | | Per Day = | 2.5 | | 25.3 | | 1.5 | 1.4 | | |
| | | | | | | | | | **Total =** | **1411.9** | | **11919.3** | | **726.0** | **690.7** | **1226494.3** | **289.0** |

## Traffic

| | Type | Total | Peak Day | Travel Distance | Total VMT | Peak Day VMT | | TOG | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Worker | 6048 | 56 | 10.8 | 65318 | 605 | | | 45.6 | | 72.1 | | 7.2 | 3.2 | 51863.3 | 5.0 |
| | Delivery (includes cement trucks) | 1600 | 20 | 7.3 | 11680 | 146 | | | 9.0 | | 51.1 | | 2.1 | 1.2 | 20058.2 | 0.6 |
| | Large Trucks | 2236 | 20 | 20 | 44720 | 400 | | | 54.5 | | 583.4 | | 18.2 | 11.6 | 161524.8 | 1.1 |
| | | | | | 121718 | 1151 | | | 109.1 | | 706.6 | | 27.6 | 16.0 | 233446.2 | 6.7 |
| | | | | | | 0.0094546 | Estimated Peak Day | | 4.4 | | 28.3 | | 1.1 | 0.6 | | |

**Project Name:** Pure Water Monterey Groundwater Replenishment
**Site Name:** SVRP Modification

See Equipment Type TAB/sheet for type, horsepower and load factor

2016 Computed Emissions (pounds)

| Qty | Description | HP | Load Factor | Hours/day | Total Work Days | Annual Hours | Comments | TOG | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Demolition** | **Start Date:** | 11/15/2016 | | | | | | | | | | | | | |
| | | **End Date:** | 12/15/2016 | | | | | | | | | | | | | |
| 2 | Concrete/Industrial Saws | 81 | 0.73 | 8 | 15 | 240 | **Demolition Volume** | 195.0 | 19.4 | 113.2 | 138.5 | 0.2 | 10.4 | 10.4 | 17764.0 | 1.7 |
| 1 | Excavators | 162 | 0.38 | 8 | 15 | 120 | Square footage of buildings to be demolished | 6.9 | 5.8 | 51.4 | 66.4 | 0.1 | 3.3 | 3.0 | 8241.4 | 2.5 |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 15 | 120 | (*or* total tons to be hauled) | 6.1 | 5.1 | 36.2 | 48.8 | 0.0 | 3.8 | 3.5 | 4850.8 | 1.5 |
| | Other Equipment? | 0 | 0 | | | 0 | _?_ square feet *or* | **Sum=** | 30.3 | | 253.7 | | 17.4 | 16.9 | 30856.2 | 5.7 |
| | | | | | | | _8_ Hauling volume (tons) | Per Day = | 2.0 | | 16.9 | | 1.2 | 1.1 | | |
| | **Site Preparation** | **Start Date:** | 10/1/2016 | | | | Any pavement demolished and hauled? _0_ tons | | | | | | | | | |
| | | **End Date:** | 10/15/2016 | | | | | | | | | | | | | |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 10 | 80 | | 4.0 | 3.4 | 24.1 | 32.5 | 0.0 | 2.5 | 2.3 | 3233.9 | 1.0 |
| 1 | Pumps | 84 | 0.74 | 24 | 21 | 504 | | 963.6 | 42.1 | 243.1 | 309.0 | 0.4 | 22.4 | 22.4 | 39215.9 | 3.8 |
| | Other Equipment? | 0 | 0 | | | 0 | | **Sum=** | 45.5 | | 341.5 | | 24.9 | 24.7 | 42449.8 | 4.8 |
| | | | | | | | | Per Day = | 2.2 | | 16.3 | | 1.2 | 1.2 | | |
| | **Grading / Excavation** | **Start Date:** | 10/15/2016 | | | | | | | | | | | | | |
| | | **End Date:** | 1/15/2017 | | | | **Soil Hauling Volume** | | | | | | | | | |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 15 | 120 | Export volume = _150_ cubic yards? | 6.1 | 5.1 | 36.2 | 48.8 | 0.0 | 3.8 | 3.5 | 4850.8 | 1.5 |
| 1 | Excavators | 162 | 0.38 | 8 | 15 | 120 | Import volume = _0_ cubic yards? | 6.9 | 5.8 | 51.4 | 66.4 | 0.1 | 3.3 | 3.0 | 8241.4 | 2.5 |
| | Other Equipment? | 0 | 0 | | | 0 | | **Sum=** | 10.9 | | 115.2 | | 7.0 | 6.5 | 13092.2 | 3.9 |
| | Other Equipment? | 0 | 0 | | | 0 | | Per Day = | 0.7 | | 7.7 | | 0.5 | 0.4 | | |
| | Other Equipment? | 0 | 0 | | | 0 | | | | | | | | | | |
| | **Trenching/Pipelines** | **Start Date:** | 12/1/2016 | | | | | | | | | | | | | |
| | | **End Date:** | 1/15/2017 | | | | **Material Deliveries (all phases)** | | | | | | | | | |
| 1 | Excavators | 162 | 0.38 | 8 | 15 | 120 | Deliveries by Tractor-Trailer: _5_ | 6.9 | 5.8 | 51.4 | 66.4 | 0.1 | 3.3 | 3.0 | 8241.4 | 2.5 |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 15 | 120 | Deliveries by smaller trucks: _25_ | 6.1 | 5.1 | 36.2 | 48.8 | 0.0 | 3.8 | 3.5 | 4850.8 | 1.5 |
| 1 | Plate Compactors | 8 | 0.43 | 8 | 15 | 120 | | 0.7 | 0.6 | 3.2 | 3.8 | 0.0 | 0.1 | 0.1 | 516.7 | 0.1 |
| 1 | Welders | 46 | 0.45 | 8 | 15 | 120 | | 88.4 | 8.4 | 29.5 | 27.0 | 0.0 | 2.1 | 2.1 | 3109.4 | 0.8 |
| 1 | Rollers | 80 | 0.38 | 8 | 15 | 120 | | 6.0 | 5.0 | 30.2 | 46.6 | 0.0 | 3.4 | 3.2 | 4083.5 | 1.2 |
| | | | | | | | | **Sum=** | 25.0 | | 192.6 | | 12.7 | 11.9 | 20801.8 | 6.0 |
| | **Building/Facilities** | **Start Date:** | 12/1/2016 | | | | Cement Trucks? _25_ Total Round-Trips | Per Day = | 1.7 | | 12.8 | | 0.8 | 0.8 | | |
| | | **End Date:** | 7/15/2017 | | | | | | | | | | | | | |
| 1 | Cement and Mortar Mixers | 9 | 0.56 | 8 | 15 | 120 | Electric? (Y/N) _Y__ Otherwise assumed diesel | 1.4 | 0.9 | 4.6 | 5.5 | 0.0 | 0.2 | 0.2 | 757.1 | 0.1 |
| 1 | Concrete/Industrial Saws | 81 | 0.73 | 8 | 20 | 160 | Liquid Propane (LPG)? (Y/N) _Y__ Otherwise Assumed diesel | 130.0 | 12.9 | 75.4 | 92.4 | 0.1 | 6.9 | 6.9 | 11842.7 | 1.1 |
| 1 | Cranes | 226 | 0.29 | 8 | 30 | 240 | Or temporary line power? (Y/N) _Y__ | 25.7 | 21.6 | 89.5 | 255.7 | 0.2 | 11.6 | 10.7 | 17571.3 | 5.3 |
| 1 | Generator Sets | 84 | 0.74 | 8 | 20 | 160 | | 259.4 | 12.8 | 76.0 | 96.6 | 0.1 | 6.8 | 6.8 | 12449.5 | 1.1 |
| 1 | Other Material Handling Equipment | 167 | 0.4 | 8 | 78 | 624 | | 53.4 | 44.9 | 313.8 | 478.5 | 0.4 | 25.7 | 23.6 | 46487.2 | 14.0 |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 25 | 200 | | 10.1 | 8.5 | 60.3 | 81.3 | 0.1 | 6.3 | 5.8 | 8084.7 | 2.4 |
| 1 | Pumps | 84 | 0.74 | 24 | 30 | 720 | | 1376.6 | 60.1 | 347.3 | 441.4 | 0.6 | 32.0 | 32.0 | 56022.8 | 5.4 |
| 1 | Welders | 46 | 0.45 | 8 | 45 | 360 | Pond liner seaming and pipe welding | 265.2 | 25.3 | 88.6 | 81.0 | 0.1 | 6.4 | 6.4 | 9328.1 | 2.3 |
| 1 | Excavators | 162 | 0.38 | 8 | 15 | 120 | | 6.9 | 5.8 | 51.4 | 66.4 | 0.1 | 3.3 | 3.0 | 8241.4 | 2.5 |
| | Other Equipment? | 0 | 0 | | | 0 | | **Sum=** | 192.8 | | 1598.9 | | 99.1 | 95.4 | 170784.6 | 34.3 |
| | | | | | | | | Per Day = | 2.5 | | 20.5 | | 1.3 | 1.2 | | |
| | **Paving** | **Start Date:** | NA | | | | | **Total =** | **304.5** | | **2501.9** | | **161.3** | **155.4** | **277984.5** | **54.7** |
| | | **Start Date:** | | | | | | | | | | | | | | |
| | Cement and Mortar Mixers | 9 | 0.56 | | | 0 | | | | | | | | | | |
| | Graders | 174 | 0.41 | | | 0 | | | | | | | | | | |
| | Rollers | 80 | 0.38 | | | 0 | | | | | | | | | | |
| | Pavers | 125 | 0.42 | | | 0 | | | | | | | | | | |
| | Paving Equipment | 130 | 0.36 | | | 0 | | | | | | | | | | |
| | Sweepers/Scrubbers | 64 | 0.46 | | | 0 | | | | | | | | | | |

### Traffic

| Type | Total | Peak Day | Travel Distance | Total VMT | Peak Day VMT | | ROG | NOX | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker | | 10 | 10.8 | 0 | 108 | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Delivery (includes cement trucks) | 50 | | 7.3 | 365 | 0 | | 0.3 | 1.6 | 0.1 | 0.0 | 626.8 | 0.0 |
| Large Trucks | 82 | | 20 | 1640 | 0 | | 2.0 | 21.4 | 0.7 | 0.4 | 5923.5 | 0.0 |
| | | | | 2005 | 108 | | 2.3 | 23.0 | 0.7 | 0.5 | 6550.4 | 0.1 |
| | | | | | 0.0538653 | Estimated Peak Day | 0.1 | 0.9 | 0.0 | 0.0 | | |

## Product Water Conveyance - Pipelines/Pumps

### Product Water Pipeline - RUWAP AWT to BPS

| Qty | Description | HP | Load Factor | Hours/day | Total Work Days | Annual Hours | 2016 TOG | 2016 ROG | 2016 CO | 2016 NOX | 2016 SO2 | 2016 PM10 | 2016 PM2.5 | 2016 CO2 | 2016 CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Pavers | 160 | 0.42 | 6 | 16 | 96 | 7.3 | 6.2 | 43.8 | 69.3 | 0.1 | 3.4 | 3.2 | 7197.8 | 2.2 |
| 1 | Rollers | 90 | 0.38 | 6 | 110 | 660 | 37.2 | 31.2 | 186.7 | 288.6 | 0.2 | 21.3 | 19.6 | 25266.7 | 7.6 |
| 1 | Backhoe | 150 | 0.37 | 8 | 94 | 752 | 58.9 | 49.5 | 350.4 | 472.7 | 0.5 | 36.4 | 33.5 | 47007.8 | 14.2 |
| 1 | Excavators | 200 | 0.38 | 8 | 94 | 752 | 53.6 | 45.0 | 397.5 | 513.7 | 0.6 | 25.3 | 23.3 | 63760.4 | 19.2 |
| 1 | Cranes | 200 | 0.29 | 6 | 94 | 564 | 53.4 | 44.9 | 186.1 | 531.8 | 0.4 | 24.1 | 22.2 | 36542.0 | 11.0 |
| 1 | Jack-and-Bore Rig | 350 | 0.50 | 8 | 20 | 160 | 14.1 | 11.9 | 69.9 | 179.0 | 0.3 | 5.3 | 4.8 | 30968.2 | 9.3 |
| 1 | Loader | 90 | 0.37 | 8 | 130 | 1040 | 48.8 | 41.0 | 290.7 | 392.3 | 0.4 | 30.2 | 27.8 | 39006.4 | 11.8 |
| 1 | Generator | 200 | 0.74 | 8 | 130 | 1040 | 4014.1 | 197.7 | 1176.1 | 1495.1 | 2.0 | 104.8 | 104.8 | 192670.9 | 17.6 |
| | | | | | | | Sum= | 427.3 | | 3942.5 | | 250.7 | 239.0 | 442420.1 | 93.0 |
| | | | | | | | Per Day = | 2.0 | | 18.8 | | 1.2 | 1.1 | | |

**Notes**: Construction would last 10 months. Jack and bore would occur at two locations for two weeks each: Reservation Rd and Imjin Pkwy. There would be approximately 21 workdays per month.

### Product Water Pipeline - RUWAP: BPS - Injection

| Qty | Description | HP | Load Factor | Hours/day | Total Work Days | Annual Hours | 2016 TOG | 2016 ROG | 2016 CO | 2016 NOX | 2016 SO2 | 2016 PM10 | 2016 PM2.5 | 2016 CO2 | 2016 CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Pavers | 160 | 0.42 | 6 | 16 | 96 | 7.3 | 6.2 | 43.8 | 69.3 | 0.1 | 3.4 | 3.2 | 7197.8 | 2.2 |
| 1 | Rollers | 90 | 0.38 | 6 | 102 | 612 | 34.5 | 29.0 | 173.1 | 267.7 | 0.2 | 19.7 | 18.1 | 23429.1 | 7.1 |
| 1 | Backhoe | 150 | 0.37 | 8 | 86 | 688 | 53.9 | 45.2 | 320.6 | 432.5 | 0.4 | 33.3 | 30.6 | 43007.1 | 13.0 |
| 1 | Excavators | 200 | 0.38 | 8 | 85 | 680 | 48.4 | 40.7 | 359.5 | 464.5 | 0.6 | 22.9 | 21.0 | 57655.6 | 17.4 |
| 1 | Cranes | 200 | 0.29 | 6 | 86 | 516 | 48.9 | 41.1 | 170.2 | 486.5 | 0.3 | 22.1 | 20.3 | 33432.0 | 10.1 |
| 1 | Jack-and-Bore Rig | 350 | 0.50 | 8 | 50 | 400 | 35.3 | 29.7 | 174.7 | 447.5 | 0.7 | 13.1 | 12.1 | 77420.6 | 23.4 |
| 1 | Loader | 90 | 0.37 | 8 | 152 | 1216 | 57.1 | 48.0 | 339.9 | 458.7 | 0.4 | 35.3 | 32.5 | 45607.5 | 13.8 |
| 1 | Generator | 200 | 0.74 | 8 | 150 | 1200 | 4631.7 | 228.1 | 1357.0 | 1725.1 | 2.3 | 120.9 | 120.9 | 222312.6 | 20.3 |
| | | | | | | | Sum= | 467.9 | | 4351.8 | | 270.7 | 258.7 | 510062.3 | 107.1 |
| | | | | | | | Per Day = | 2.2 | | 20.7 | | 1.3 | 1.2 | | |

**Notes**: Construction would last 10 months. Jack and bore would occur at five locations for two weeks each: Divarty St, Gigling Rd, Lightfighter Dr, Normandy Rd, and Eucalyptus Rd. There would be approximately 21 workdays per month.

### AWT Pump Station

| Qty | Description | HP | Load Factor | Hours/day | Total Work Days | Annual Hours | 2016 TOG | 2016 ROG | 2016 CO | 2016 NOX | 2016 SO2 | 2016 PM10 | 2016 PM2.5 | 2016 CO2 | 2016 CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Pavers | 160 | 0.42 | 8 | 3 | 24 | 1.8 | 1.5 | 10.9 | 17.3 | 0.0 | 0.9 | 0.8 | 1799.4 | 0.5 |
| 1 | Rollers | 90 | 0.38 | 8 | 5 | 40 | 2.3 | 1.9 | 11.3 | 17.5 | 0.0 | 1.3 | 1.2 | 1531.3 | 0.5 |
| 1 | Loader | 90 | 0.37 | 8 | 20 | 160 | 7.5 | 6.3 | 44.7 | 60.3 | 0.1 | 4.6 | 4.3 | 6001.0 | 1.8 |
| 1 | Backhoe | 150 | 0.37 | 8 | 15 | 120 | 9.4 | 7.9 | 55.9 | 75.4 | 0.1 | 5.8 | 5.3 | 7501.2 | 2.3 |
| 1 | Cranes | 200 | 0.29 | 8 | 30 | 240 | 22.7 | 19.1 | 79.2 | 226.3 | 0.2 | 10.3 | 9.4 | 15549.8 | 4.7 |
| 1 | Graders | 200 | 0.41 | 8 | 3 | 24 | 4.2 | 3.5 | 17.0 | 35.8 | 0.0 | 2.0 | 1.8 | 2237.3 | 0.7 |
| 1 | Generator | 200 | 0.74 | 8 | 60 | 480 | 1852.7 | 91.2 | 542.8 | 690.1 | 0.9 | 48.4 | 48.4 | 88925.0 | 8.1 |
| | | | | | | | Sum= | 131.5 | | 1122.7 | | 73.2 | 71.2 | 123545.1 | 18.6 |
| | | | | | | | Per Day = | 0.5 | | 4.5 | | 0.3 | 0.3 | | |

**Notes**: Construction would last 12-14 months. Structural work requiring heavy equipment will be completed in 2-3 months.

### Booster Pump Station (RUWAP or Coastal)

2017

| Qty | Description | HP | Load Factor | Hours/day | Total Work Days | Annual Hours | 2017 TOG | 2017 ROG | 2017 CO | 2017 NOX | 2017 SO2 | 2017 PM10 | 2017 PM2.5 | 2017 CO2 | 2017 CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Pavers | 160 | 0.42 | 8 | 3 | 24 | 1.6 | 1.4 | 10.9 | 15.5 | 0.0 | 0.8 | 0.7 | 1772.5 | 0.5 |
| 1 | Rollers | 90 | 0.38 | 8 | 5 | 40 | 2.1 | 1.7 | 11.2 | 16.3 | 0.0 | 1.2 | 1.1 | 1507.1 | 0.5 |
| 1 | Loader | 90 | 0.37 | 8 | 10 | 80 | 3.5 | 2.9 | 22.2 | 28.2 | 0.0 | 2.1 | 2.0 | 2950.3 | 0.9 |
| 1 | Backhoe | 150 | 0.37 | 8 | 10 | 80 | 5.8 | 4.9 | 37.0 | 47.0 | 0.0 | 3.5 | 3.3 | 4917.2 | 1.5 |
| 1 | Cranes | 200 | 0.29 | 8 | 30 | 240 | 20.5 | 17.2 | 73.1 | 204.1 | 0.2 | 9.1 | 8.4 | 15311.1 | 4.7 |
| 1 | Graders | 200 | 0.41 | 8 | 2 | 16 | 2.6 | 2.2 | 11.1 | 22.1 | 0.0 | 1.2 | 1.1 | 1464.4 | 0.4 |
| 1 | Generator | 200 | 0.74 | 8 | 180 | 1440 | 4955.7 | 244.1 | 1615.8 | 1911.5 | 2.8 | 128.6 | 128.6 | 266775.1 | 21.6 |
| | | | | | | | Sum= | 274.4 | | 2244.7 | | 146.6 | 145.1 | 294697.8 | 30.1 |
| | | | | | | | Per Day = | 1.3 | | 10.7 | | 0.7 | 0.7 | | |

**Notes**: Construction would last 10-12 months. Structural work requiring heavy equipment will be completed in 2-3 months.

| | ROG | NOX | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|
| **Total =** | **1301.1** | **11661.7** | **741.2** | **714.1** | **1,370,725** | **248.8** |

### Traffic

| Type | Total | Peak Day | Travel Distance | Total VMT | Peak Day VMT |
|---|---|---|---|---|---|
| Worker | 9828 | 36 | 10.8 | 106142 | 389 |
| Delivery (includes ce | 998 | 12 | 7.3 | 7285 | 88 |
| Large Trucks | 9858 | 12 | 20 | 197160 | 240 |
| | | | | 310588 | 716 |
| | | | | | 0.002307 |

| | ROG | NOx | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|
| | 74.1 | 117.1 | 11.7 | 5.2 | 84277.8 | 8.2 |
| | 4.9 | 31.9 | 1.3 | 0.7 | 12511.3 | 0.4 |
| | 240.3 | 2572.0 | 80.4 | 51.3 | 712124.8 | 4.7 |
| | 319.3 | 2721.0 | 93.4 | 57.2 | 808,914 | 13.3 |
| Estimated Peak Day | 12.8 | 108.8 | 3.7 | 2.3 | | |

## Product Water Conveyance - Pipelines/Pumps

### Product Water Pipeline - Coastal AWT - BPS

2016 Computed Emissions (pounds)

| Qty | Description | HP | Load Factor | Hours/day | Total Work Days | Annual Hours | TOG | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Pavers | 160 | 0.42 | 6 | 3 | 18 | 1.4 | 1.2 | 8.2 | 13.0 | 0.0 | 0.6 | 0.6 | 1349.6 | 0.4 |
| 1 | Rollers | 90 | 0.38 | 6 | 112 | 672 | 37.8 | 31.8 | 190.1 | 293.9 | 0.2 | 21.6 | 19.9 | 25726.0 | 7.8 |
| 1 | Backhoe | 150 | 0.37 | 8 | 109 | 872 | 68.3 | 57.4 | 406.3 | 548.2 | 0.5 | 42.2 | 38.8 | 54509.0 | 16.4 |
| 1 | Excavators | 200 | 0.38 | 8 | 109 | 872 | 62.1 | 52.2 | 460.9 | 595.7 | 0.7 | 29.3 | 27.0 | 73934.9 | 22.3 |
| 1 | Cranes | 200 | 0.29 | 6 | 109 | 654 | 61.9 | 52.0 | 215.7 | 616.7 | 0.4 | 28.0 | 25.7 | 42373.2 | 12.8 |
| 1 | Jack-and-Bore Rig | 350 | 0.50 | 8 | 20 | 160 | 14.1 | 11.9 | 69.9 | 179.0 | 0.3 | 5.3 | 4.8 | 30968.2 | 9.3 |
| 1 | Loader | 90 | 0.37 | 8 | 132 | 1056 | 49.6 | 41.7 | 295.2 | 398.3 | 0.4 | 30.7 | 28.2 | 39606.5 | 11.9 |
| 1 | Generator | 200 | 0.74 | 8 | 132 | 1056 | 4075.9 | 200.7 | 1194.2 | 1518.1 | 2.1 | 106.4 | 106.4 | 195635.1 | 17.9 |
| | | | | | | | Sum= | 448.8 | | 4162.8 | | 264.1 | 251.5 | 464102.5 | 98.9 |
| | | | | | | | Per Day = | 2.1 | | 19.8 | | 1.3 | 1.2 | | |

**Notes**: Construction would last 10 months. Jack and bore would occur at two locations for two weeks each: Reservation Rd. and Divarty St. There would be approximately 21 workdays per month.

### Product Water Pipeline - Coastal: BPS - Injection

| Qty | Description | HP | Load Factor | Hours/day | Total Work Days | Annual Hours | TOG | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Pavers | 160 | 0.42 | 6 | 16 | 96 | 7.3 | 6.2 | 43.8 | 69.3 | 0.1 | 3.4 | 3.2 | 7197.8 | 2.2 |
| 1 | Rollers | 90 | 0.38 | 6 | 69 | 414 | 23.3 | 19.6 | 117.1 | 181.1 | 0.2 | 13.3 | 12.3 | 15849.1 | 4.8 |
| 1 | Backhoe | 150 | 0.37 | 8 | 68 | 544 | 42.6 | 35.8 | 253.5 | 342.0 | 0.3 | 26.3 | 24.2 | 34005.6 | 10.3 |
| 1 | Excavators | 200 | 0.38 | 8 | 68 | 544 | 38.7 | 32.6 | 287.6 | 371.6 | 0.4 | 18.3 | 16.8 | 46124.5 | 13.9 |
| 1 | Cranes | 200 | 0.29 | 6 | 68 | 408 | 38.6 | 32.5 | 134.6 | 384.7 | 0.3 | 17.5 | 16.1 | 26434.6 | 8.0 |
| 1 | Jack-and-Bore Rig | 350 | 0.50 | 8 | 40 | 320 | 28.3 | 23.7 | 139.8 | 358.0 | 0.6 | 10.5 | 9.7 | 61936.5 | 18.7 |
| 1 | Loader | 90 | 0.37 | 8 | 109 | 872 | 41.0 | 34.4 | 243.8 | 328.9 | 0.3 | 25.3 | 23.3 | 32705.4 | 9.9 |
| 1 | Generator | 200 | 0.74 | 8 | 109 | 872 | 3365.7 | 165.7 | 986.1 | 1253.6 | 1.7 | 87.8 | 87.8 | 161547.1 | 14.8 |
| | | | | | | | Sum= | 350.4 | | 3289.1 | | 202.5 | 193.3 | 385800.6 | 82.4 |
| | | | | | | | Per Day = | 1.7 | | 15.7 | | 1.0 | 0.9 | | |

**Notes**: Construction would last 10 months. Jack and bore would occur at four locations for two weeks each: Lightfighter Dr, Gigling Rd, Normandy Rd, and Eucalyptus Rd. There would be approximately 21 workdays per month.

### AWT Pump Station

| Qty | Description | HP | Load Factor | Hours/day | Total Work Days | Annual Hours | TOG | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Pavers | 160 | 0.42 | 8 | 3 | 24 | 1.8 | 1.5 | 10.9 | 17.3 | 0.0 | 0.9 | 0.8 | 1799.4 | 0.5 |
| 1 | Rollers | 90 | 0.38 | 8 | 5 | 40 | 2.3 | 1.9 | 11.3 | 17.5 | 0.0 | 1.3 | 1.2 | 1531.3 | 0.5 |
| 1 | Loader | 90 | 0.37 | 8 | 20 | 160 | 7.5 | 6.3 | 44.7 | 60.3 | 0.1 | 4.6 | 4.3 | 6001.0 | 1.8 |
| 1 | Backhoe | 150 | 0.37 | 8 | 15 | 120 | 9.4 | 7.9 | 55.9 | 75.4 | 0.1 | 5.8 | 5.3 | 7501.2 | 2.3 |
| 1 | Cranes | 200 | 0.29 | 8 | 30 | 240 | 22.7 | 19.1 | 79.2 | 226.3 | 0.2 | 10.3 | 9.4 | 15549.8 | 4.7 |
| 1 | Graders | 200 | 0.41 | 8 | 3 | 24 | 4.2 | 3.5 | 17.0 | 35.8 | 0.0 | 2.0 | 1.8 | 2237.3 | 0.7 |
| 1 | Generator | 200 | 0.74 | 8 | 60 | 480 | 1852.7 | 91.2 | 542.8 | 690.1 | 0.9 | 48.4 | 48.4 | 88925.0 | 8.1 |
| | | | | | | | Sum= | 131.5 | | 1122.7 | | 73.2 | 71.2 | 123545.1 | 18.6 |
| | | | | | | | Per Day = | 0.5 | | 4.5 | | 0.3 | 0.3 | | |

**Notes**: Construction would last 12-14 months. Structural work requiring heavy equipment will be completed in 2-3 months.

### Booster Pump Station (RUWAP or Coastal)

2017

2017 Computed Emissions (pounds)

| Qty | Description | HP | Load Factor | Hours/day | Total Work Days | Annual Hours | TOG | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Pavers | 160 | 0.42 | 8 | 3 | 24 | 1.6 | 1.4 | 10.9 | 15.5 | 0.0 | 0.8 | 0.7 | 1772.5 | 0.5 |
| 1 | Rollers | 90 | 0.38 | 8 | 5 | 40 | 2.1 | 1.7 | 11.2 | 16.3 | 0.0 | 1.2 | 1.1 | 1507.1 | 0.5 |
| 1 | Loader | 90 | 0.37 | 8 | 10 | 80 | 3.5 | 2.9 | 22.2 | 28.2 | 0.0 | 2.1 | 2.0 | 2950.3 | 0.9 |
| 1 | Backhoe | 150 | 0.37 | 8 | 10 | 80 | 5.8 | 4.9 | 37.0 | 47.0 | 0.0 | 3.5 | 3.3 | 4917.2 | 1.5 |
| 1 | Cranes | 200 | 0.29 | 8 | 30 | 240 | 20.5 | 17.2 | 73.1 | 204.1 | 0.2 | 9.1 | 8.4 | 15311.1 | 4.7 |
| 1 | Graders | 200 | 0.41 | 8 | 2 | 16 | 2.6 | 2.2 | 11.1 | 22.1 | 0.0 | 1.2 | 1.1 | 1464.4 | 0.4 |
| 1 | Generator | 200 | 0.74 | 8 | 180 | 1440 | 4955.7 | 244.1 | 1615.8 | 1911.5 | 2.8 | 128.6 | 128.6 | 266775.1 | 21.6 |
| | | | | | | | Sum= | 274.4 | | 2244.7 | | 146.6 | 145.1 | 294697.8 | 30.1 |
| | | | | | | | Per Day = | 1.3 | | 10.7 | | 0.7 | 0.7 | | |

**Notes**: Construction would last 10-12 months. Structural work requiring heavy equipment will be completed in 2-3 months.

| | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|---|---|
| Total = | 1205.1 | | 10819.4 | | 686.4 | 661.2 | 1268146.0 | 230.0 |

### Traffic

| Type | Total | Peak Day | avel Distan | Total VMT | Peak Day VMT | | ROG | NOx | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Worker | 9828 | 36 | 10.8 | 106142 | 389 | | 74.1 | 117.1 | 11.7 | 5.2 | 84278 | 8.2 |
| Delivery (includes cen | 944 | 12 | 7.3 | 6891 | 88 | | 4.7 | 30.2 | 1.3 | 0.7 | 11834 | 0.4 |
| Large Trucks | 6080 | 12 | 20 | 121600 | 240 | | 148.2 | 1586.3 | 49.6 | 31.6 | 439209 | 2.9 |
| | | | | 234634 | 716 | | 227.0 | 1733.6 | 62.5 | 37.5 | 535321 | 11.5 |
| | | | | | 0.003053 | Estimated Peak Day | 9.1 | 69.3 | 2.5 | 1.5 | | |

## Product Water Conveyance - Pipelines/Pumps

*All comments below in these columns were made by T. Gerald Cole, dated 6 Mar 2014*

**Product Water Pipeline - RUWAP AWT to BPS**

| Off-Road Equipment | Approx. HP | Number | Hour/day | Days | | Comment |
|---|---|---|---|---|---|---|
| Pavers | 160 | 1 | 6 | 16 | | 16,000 lf of paving |
| Rollers | 90 | 1 | 6 | 110 | | 16 +94 |
| Backhoe | 150 | 1 | 8 | 94 | | assume 1,000 lf/day |
| Excavators | 200 | 1 | 8 | 94 | | |
| Cranes | 200 | 1 | 6 | 94 | | |
| Jack-and-Bore Rig | 350 | 1 | 8 | 20 | | 2 sites at 2 weeks each |
| Loader | 90 | 1 | 8 | 130 | 94+20+16 | pipe excavation & backfill +bore & jack + paving |
| Generator | 200 | 1 | 8 | 130 | | I assume the generator is for hand tools |

**Notes**: Construction would last 10 months. Jack and bore would occur at two locations for two weeks each: Reservation Rd and Imjin Pkwy. There would be approximately 21 workdays per month. ???

RUWAP Alignment does not cross Hwy One

**Product Water Pipeline - RUWAP: BPS - Injection**

| Off-Road Equipment | Approx. HP | Number | Hour/day | Days | | Comment |
|---|---|---|---|---|---|---|
| Pavers | 160 | 1 | 6 | 16 | | 15,900 lf of paving |
| Rollers | 90 | 1 | 6 | 102 | | 16 + 86 |
| Backhoe | 150 | 1 | 8 | 86 | | |
| Excavators | 200 | 1 | 8 | 85 | | assume 1,000 lf/day |
| Cranes | 200 | 1 | 6 | 86 | | |
| Jack-and-Bore Rig | 350 | 1 | 8 | 50 | | 5 sites at 2 weeks each |
| Loader | 90 | 1 | 8 | 152 | 86+50+16 | pipe excavation & backfill +bore & jack + paving |
| Generator | 200 | 1 | 8 | 150 | | I assume the generator is for hand tools |

**Notes**: Construction would last 10 months. Jack and bore would occur at five locations for two weeks each: Divarty St, Gigling Rd, Lightfighter Dr, Normandy Rd, and Eucalyptus Rd. There would be approximately 21 workdays per month.

**Product Water Pipeline - Coastal AWT - BPS**

| Off-Road Equipment | Approx. HP | Number | Hour/day | Days | | Comment | |
|---|---|---|---|---|---|---|---|
| Pavers | 160 | 1 | 6 | 3 | | 2,000 lf of paving | assume 1,000 lf/day |
| Rollers | 90 | 1 | 6 | 112 | | 109 + 3 | |
| Backhoe | 150 | 1 | 8 | 109 | | | |
| Excavators | 200 | 1 | 8 | 109 | | | |
| Cranes | 200 | 1 | 6 | 109 | | | |
| Jack-and-Bore Rig | 350 | 1 | 8 | 20 | | 2 sites at 2 weeks each | |
| Loader | 90 | 1 | 8 | 132 | 109+20+3 | pipe excavation & backfill +bore & jack + paving | |
| Generator | 200 | 1 | 8 | 132 | | I assume the generator is for hand tools | |

**Notes**: Construction would last 10 months. Jack and bore would occur at two locations for two weeks each: Reservation Rd. and Divarty St. There would be approximately 21 workdays per month.

**Product Water Pipeline - Coastal: BPS - Injection**

| Off-Road Equipment | Approx. HP | Number | Hour/day | Days | | Comment |
|---|---|---|---|---|---|---|
| Pavers | 160 | 1 | 6 | 16 | | 15,900 lf of paving |
| Rollers | 90 | 1 | 6 | 69 | | 68 + 3 |
| Backhoe | 150 | 1 | 8 | 68 | | |
| Excavators | 200 | 1 | 8 | 68 | | assume 1,000 lf/day |
| Cranes | 200 | 1 | 6 | 68 | | |
| Jack-and-Bore Rig | 350 | 1 | 8 | 40 | | 4 sites at 2 weeks each |
| Loader | 90 | 1 | 8 | 109 | 68+40+16 | pipe excavation & backfill +bore & jack + paving |
| Generator | 200 | 1 | 8 | 109 | | I assume the generator is for hand tools |

**Notes**: Construction would last 10 months. Jack and bore would occur at four locations for two weeks each: Lightfighter Dr, Gigling Rd, Normandy Rd, and Eucalyptus Rd. There would be approximately 21 workdays per month.

**AWT Pump Station**

| Off Road Equipment | Approx. HP | Number | Hour/Day | Days | Comment |
|---|---|---|---|---|---|
| Pavers | 160 | 1 | 8 | 3 | Comment: Grading and paving will get taken up by all the rest of the treatment plant site work |
| Rollers | 90 | 1 | 8 | 5 | |
| Loader | 90 | 1 | 8 | 20 | The actual days specifically associated w/ the AWTPS are guesses |
| Backhoe | 150 | 1 | 8 | 15 | |
| Cranes | 200 | 1 | 8 | 30 | Hiatus between structural work and mechanical installation |
| Graders | 200 | 1 | 8 | 3 | |
| Generator | 200 | 1 | 8 | 60 | Power for small tools might be availablel from existing electrical outlets of PCA' RTP |

**Notes**: Construction would last 12-14 months. Structural work requiring heavy equipment will be completed in 2-3 months.

**Booster Pump Station (RUWAP or Coastal)**

| Off Road Equipment | Approx. HP | Number | Hour/Day | Days | Comment |
|---|---|---|---|---|---|
| Pavers | 160 | 1 | 8 | 3 | |
| Rollers | 90 | 1 | 8 | 5 | |
| Loader | 90 | 1 | 8 | 10 | |
| Backhoe | 150 | 1 | 8 | 10 | |
| Cranes | 200 | 1 | 8 | 30 | Hiatus between structural work and mechanical installation |
| Graders | 200 | 1 | 8 | 2 | |
| Generator | 200 | 1 | 8 | 180 | Need for a generator is dependant on whether PG&E will make a temporary electrical "drop" for the contractor's use, before the permanent permanent power supply is available. |

**Notes**: Construction would last 10-12 months. Structural work requiring heavy equipment will be completed in 2-3 months.

**Project Name:** Pure Water Monterey Groundwater Replenishment
**Site Name:** Injection Well Facilities

**Includes injection wells, monitoring wells, backflush basin, connecting pipelines and conduits, road surfacing**

See Equipment Type TAB/sheet for type, horsepower and load factor

2016 Computed Emissions (pounds)

| Qty | Description | HP | Load Factor | Hours/day | Total Work Days | Annual Hours | Comments | TOG | ROG | CO | NOX | SO2 | PM10 | PM2.5 | CO2 | CH4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Demolition** | **Start Date:** | NA | | | | | | | | | | | | | |
| | | **End Date:** | | | | | | | | | | | | | | |
| | Concrete/Industrial Saws | 81 | 0.73 | | | 0 | **Demolition Volume** | | | | | | | | | |
| | Other Equipment? | 0 | 0 | | | 0 | Square footage of buildings to be demolished | | | | | | | | | |
| | Other Equipment? | 0 | 0 | | | 0 | (*or* total tons to be hauled) | | | | | | | | | |
| | Other Equipment? | 0 | 0 | | | 0 | _?_ square feet *or* | | | | | | | | | |
| | | | | | | | _0_ Hauling volume (tons) | | | | | | | | | |
| | **Site Preparation** | **Start Date:** | **8/1/2016** | | | | Any pavement demolished and hauled? **_0_ tons** | | | | | | | | | |
| | Access Road Grading | **End Date:** | 8/31/2016 | | | | | | | | | | | | | |
| 1 | Graders | 174 | 0.41 | 6 | 20 | 120 | | 18.2 | 15.3 | 73.8 | 155.6 | 0.1 | 8.7 | 8.0 | 9,732 | 2.9 |
| 1 | Rubber Tired Dozers | 255 | 0.4 | 6 | 20 | 120 | | 22.1 | 18.6 | 157.1 | 207.9 | 0.1 | 9.7 | 8.9 | 13,839 | 4.2 |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 6 | 20 | 120 | | 6.1 | 5.1 | 36.2 | 48.8 | 0.0 | 3.8 | 3.5 | 4,851 | 1.5 |
| 2 | Dumpers/Tenders | 16 | 0.38 | 6 | 22 | 264 | Assumed in truck traffic calculations | **Sum=** | 38.9 | | 412.2 | | 22.2 | 20.4 | 28,422 | 8.6 |
| | Other Equipment? | 0 | 0 | | | 0 | | Per Day = | 1.8 | | 18.7 | | 1.0 | 0.9 | | |
| | | | | | | | | | | | | | | | | |
| | **Grading / Excavation** | **Start Date:** | **1/15/2017** | | | | | | | | | | | | | |
| | Backflush Basin | **End Date:** | 4/15/2017 | | | | **Soil Hauling Volume** | | | | | | | | | |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 5 | 22 | 110 | Export volume = **_8800_** cubic yards? | 5.6 | 4.7 | 33.1 | 44.7 | 0.0 | 3.4 | 3.2 | 4,447 | 1.3 |
| 1 | Excavators | 162 | 0.38 | 6 | 25 | 150 | Import volume = **_700_** cubic yards? | 8.7 | 7.3 | 64.2 | 83.0 | 0.1 | 4.1 | 3.8 | 10,302 | 3.1 |
| 1 | Graders | 174 | 0.41 | 3 | 20 | 60 | | 9.1 | 7.6 | 36.9 | 77.8 | 0.0 | 4.4 | 4.0 | 4,866 | 1.5 |
| 1 | Crawler Tractors | 208 | 0.43 | 6 | 10 | 60 | | 6.3 | 5.3 | 21.3 | 71.5 | 0.1 | 2.8 | 2.5 | 5,997 | 1.8 |
| 2 | Dumpers/Tenders | 16 | 0.38 | 7 | 22 | 308 | Assumed in truck traffic calculations | | | | | | | | | |
| 1 | Rubber Tired Dozers | 255 | 0.4 | 6 | 15 | 90 | | 16.6 | 13.9 | 117.8 | 155.9 | 0.1 | 7.3 | 6.7 | 10,379 | 3.1 |
| | Other Equipment? | 0 | 0 | | | 0 | | **Sum=** | 38.8 | | 432.9 | | 21.9 | 20.2 | 35,991 | 10.9 |
| | | | | | | | | Per Day = | 1.6 | | 17.3 | | 0.9 | 0.8 | | |
| | **Trenching/Pipelines** | **Start Date:** | **5/1/2017** | | | | | | | | | | | | | |
| | | **End Date:** | 9/30/2017 | | | | **Material Deliveries (pipeline/conduit)** | | | | | | | | | |
| 1 | Excavators | 162 | 0.38 | 8 | 30 | 240 | Deliveries by Tractor-Trailer: _15_ | 13.8 | 11.6 | 102.8 | 132.8 | 0.2 | 6.5 | 6.0 | 16,483 | 5.0 |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 40 | 320 | Deliveries by smaller trucks: _30_ | 16.2 | 13.6 | 96.4 | 130.1 | 0.1 | 10.0 | 9.2 | 12,935 | 3.9 |
| 1 | Plate Compactors | 8 | 0.43 | 6 | 30 | 180 | | 1.1 | 0.9 | 4.7 | 5.6 | 0.0 | 0.2 | 0.2 | 775 | 0.1 |
| 2 | Concrete/Industrial Saws | 81 | 0.73 | 4 | 30 | 240 | | 195.0 | 19.4 | 113.2 | 138.5 | 0.2 | 10.4 | 10.4 | 17,764 | 1.7 |
| 1 | Welders | 46 | 0.45 | 6 | 30 | 180 | | 132.6 | 12.6 | 44.3 | 40.5 | 0.1 | 3.2 | 3.2 | 4,664 | 1.1 |
| 1 | Dumpers/Tenders | 16 | 0.38 | 8 | 30 | 240 | Assumed in truck traffic calculations | | | | | | | | | |
| 1 | Rollers | 80 | 0.38 | 6 | 30 | 180 | | 9.0 | 7.6 | 45.3 | 70.0 | 0.1 | 5.2 | 4.7 | 6,125 | 1.8 |
| | Other Equipment? | 0 | 0 | | | 0 | | **Sum=** | 65.7 | | 517.6 | | 35.5 | 33.8 | 58,747 | 13.7 |
| | | | | | | | | Per Day = | 1.6 | | 12.9 | | 0.9 | 0.8 | | |
| | **Building/Facilities** | **Start Date:** | **10/1/2016** | | | | | | | | | | | | | |
| | **Deep Injection Wells (typ of 4)** | **End Date:** | 2/28/2017 | | | | **Material Deliveries (deep wells, typ of 4)** | | | | | | | | | |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 4 | 20 | 80 | Deliveries by Tractor-Trailer: _8_ | 4.0 | 3.4 | 24.1 | 32.5 | 0.0 | 2.5 | 2.3 | 3,234 | 1.0 |
| 1 | Bucket Auger Drill Rig | 600 | 0.5 | 12 | 4 | 48 | Deliveries by smaller trucks: _25_ | 7.3 | 6.1 | 35.9 | 92.0 | 0.2 | 2.7 | 2.5 | 15,927 | 4.8 |
| 1 | Reverse Rotary Drill Rig | 600 | 0.5 | 24 | 14 | 336 | | 50.9 | 42.7 | 251.6 | 644.3 | 1.1 | 18.9 | 17.4 | 111,486 | 13.1 |
| 1 | Forklifts | 89 | 0.2 | 6 | 14 | 84 | | 2.8 | 2.4 | 13.2 | 20.5 | 0.0 | 1.7 | 1.6 | 1,665 | 0.5 |
| 1 | Truck-Mounted Pump Rig | 84 | 0.74 | 24 | 16 | 384 | | 734.2 | 32.1 | 185.2 | 235.4 | 0.3 | 17.1 | 17.1 | 29,879 | 2.9 |
| 1 | Pumps | 84 | 0.74 | 24 | 2 | 48 | | 91.8 | 4.0 | 23.2 | 29.4 | 0.0 | 2.1 | 2.1 | 3,735 | 0.4 |
| 1 | Generator Sets | 84 | 0.74 | 8 | 20 | 160 | | 259.4 | 12.8 | 76.0 | 96.6 | 0.1 | 6.8 | 6.8 | 12,450 | 1.1 |
| 1 | Welders | 46 | 0.45 | 8 | 10 | 80 | | 58.9 | 5.6 | 19.7 | 18.0 | 0.0 | 1.4 | 1.4 | 2,073 | 0.5 |
| 1 | Cranes | 226 | 0.29 | 10 | 5 | 50 | | 5.4 | 4.5 | 18.6 | 53.3 | 0.0 | 2.4 | 2.2 | 3,661 | 1.1 |
| | | | | | | | | **Sum=** | 113.6 | | 1222.2 | | 55.7 | 53.4 | 184,108 | 25.4 |
| | | | | | | | | Per Day = | 5.7 | | 61.1 | | 2.8 | 2.7 | | |
| | **Building/Facilities** | **Start Date:** | **1/1/2017** | | | | | **All Well Sum** | 454.4 | | 4888.6 | | 222.7 | 213.6 | 736,432 | 101.5 |
| | **Vadose Wells (typ of 4)** | **End Date:** | 5/31/2017 | | | | **Material Deliveries (vadose wells, typ of 4)** | | | | | | | | | |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 4 | 20 | 80 | Deliveries by Tractor-Trailer: _2_ | 4.0 | 3.4 | 24.1 | 32.5 | 0.0 | 2.5 | 2.3 | 3,234 | 1.0 |
| 1 | Bucket Auger Drill Rig | 600 | 0.5 | 12 | 14 | 168 | Deliveries by smaller trucks: _20_ | 25.4 | 21.4 | 125.8 | 322.2 | 0.5 | 9.5 | 8.7 | 55,743 | 16.8 |
| 1 | Forklifts | 89 | 0.2 | 6 | 14 | 84 | | 2.8 | 2.4 | 13.2 | 20.5 | 0.0 | 1.7 | 1.6 | 1,665 | 0.5 |
| 1 | Truck-Mounted Pump Rig | 84 | 0.74 | 24 | 12 | 288 | | 550.6 | 24.1 | 138.9 | 176.6 | 0.2 | 12.8 | 12.8 | 22,409 | 2.2 |
| 1 | Pumps | 84 | 0.74 | 24 | 2 | 48 | | 91.8 | 4.0 | 23.2 | 29.4 | 0.0 | 2.1 | 2.1 | 3,735 | 0.4 |
| 1 | Generator Sets | 84 | 0.74 | 8 | 20 | 160 | | 259.4 | 12.8 | 76.0 | 96.6 | 0.1 | 6.8 | 6.8 | 12,450 | 1.1 |
| 1 | Welders | 46 | 0.45 | 8 | 8 | 64 | | 47.1 | 4.5 | 15.7 | 14.4 | 0.0 | 1.1 | 1.1 | 1,658 | 0.4 |
| | Other Equipment? | 0 | 0 | | | 0 | | **Sum=** | 72.5 | | 692.2 | | 36.5 | 35.4 | 100,894 | 22.4 |
| | | | | | | | | Per Day = | 3.6 | | 34.6 | | 1.8 | 1.8 | | |
| | | | | | | | | **All Well Sum** | 289.9 | | 2768.8 | | 146.1 | 141.8 | 403,574 | 89.5 |
| | **Building/Facilities** | **Start Date:** | **9/1/2016** | | | | | | | | | | | | | |
| | **Monitoring Wells (typ of 6)** | **End Date:** | 5/31/2017 | | | | **Material Deliveries (mon well, typ of 6)** | | | | | | | | | |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 4 | 20 | 80 | Deliveries by Tractor-Trailer: _4_ | 4.0 | 3.4 | 24.1 | 32.5 | 0.0 | 2.5 | 2.3 | 3,234 | 1.0 |
| 1 | Reverse Rotary Drill Rig | 600 | 0.5 | 24 | 28 | 672 | Deliveries by smaller trucks: _30_ | 101.8 | 85.5 | 503.1 | 1288.7 | 2.1 | 37.8 | 34.8 | 222,971 | 67.3 |
| 1 | Forklifts | 89 | 0.2 | 6 | 28 | 168 | | 5.7 | 4.8 | 26.5 | 41.0 | 0.0 | 3.4 | 3.2 | 3,330 | 1.0 |
| 1 | Truck-Mounted Pump Rig | 84 | 0.74 | 24 | 28 | 672 | | 1284.8 | 56.1 | 324.1 | 412.0 | 0.6 | 29.9 | 29.9 | 52,288 | 5.1 |
| 1 | Generator Sets | 84 | 0.74 | 8 | 28 | 224 | | 363.1 | 17.9 | 106.4 | 135.3 | 0.2 | 9.5 | 9.5 | 17,429 | 1.6 |
| 1 | Welders | 46 | 0.45 | 8 | 15 | 120 | | 88.4 | 8.4 | 29.5 | 27.0 | 0.0 | 2.1 | 2.1 | 3,109 | 0.8 |
| | Other Equipment? | 0 | 0 | | | 0 | | **Sum=** | 176.1 | | 1936.5 | | 85.3 | 81.8 | 302,362 | 76.7 |
| | | | | | | | | Per Day = | 6.3 | | 69.2 | | 3.0 | 2.9 | | |
| | | | | | | | | **All Well Sum** | 1056.5 | | 11618.8 | | 511.6 | 490.7 | 1,814,172 | 460.0 |
| | **Building/Facilities** | **Start Date:** | **9/1/2016** | | | | Cement Trucks? **_35_** Total Round-Trips | | | | | | | | | |
| | **Elec. Buildings (typ of 4)** | **End Date:** | 5/31/2017 | | | | | | | | | | | | | |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 4 | 40 | 160 | Electric? (Y/N) _Y__ Otherwise assumed diesel | 8.1 | 6.8 | 48.2 | 65.0 | 0.1 | 5.0 | 4.6 | 6,468 | 2.0 |
| 1 | Welders | 46 | 0.45 | 4 | 10 | 40 | Liquid Propane (LPG)? (Y/N) _N__ Otherwise Assumed diesel | 29.5 | 2.8 | 9.8 | 9.0 | 0.0 | 0.7 | 0.7 | 1,036 | 0.3 |
| 1 | Aerial Lifts | 62 | 0.31 | 8 | 15 | 120 | Or temporary line power? (Y/N) _N__ | 1.0 | 0.8 | 16.3 | 13.8 | 0.0 | 0.6 | 0.5 | 2,572 | 0.8 |
| 1 | Air Compressors | 78 | 0.48 | 8 | 5 | 40 | | 41.6 | 2.5 | 12.5 | 15.8 | 0.0 | 1.3 | 1.3 | 1,875 | 0.2 |
| 1 | Generator Sets | 84 | 0.74 | 8 | 30 | 240 | **Material Deliveries (building, typ of 4)** | 389.1 | 19.2 | 114.0 | 144.9 | 0.2 | 10.2 | 10.2 | 18,674 | 1.7 |
| 1 | Cement and Mortar Mixers | 9 | 0.56 | 8 | 15 | 120 | Deliveries by Tractor-Trailer: _5_ | 1.4 | 0.9 | 4.6 | 5.5 | 0.0 | 0.2 | 0.2 | 757 | 0.1 |
| 1 | Forklifts | 89 | 0.2 | 4 | 15 | 60 | Deliveries by smaller trucks: _30_ | 2.0 | 1.7 | 9.5 | 14.6 | 0.0 | 1.2 | 1.1 | 1,189 | 0.4 |
| 1 | Concrete/Industrial Saws | 81 | 0.73 | 4 | 30 | 120 | | 97.5 | 9.7 | 56.6 | 69.3 | 0.1 | 5.2 | 5.2 | 8,882 | 0.9 |
| 1 | Skid Steer Loaders | 64 | 0.37 | 4 | 15 | 60 | | 1.0 | 0.9 | 10.4 | 11.1 | 0.0 | 0.6 | 0.6 | 1,584 | 0.5 |
| | Other Equipment? | 0 | 0 | | | 0 | | **Sum=** | 45.2 | | 349.1 | | 25.0 | 24.4 | 43,038 | 6.7 |
| | Other Equipment? | 0 | 0 | | | 0 | | Per Day = | 1.1 | | 8.7 | | 0.6 | 0.6 | | |
| | | | | | | | | **All Well Sum** | 180.8 | | 1396.3 | | 100.1 | 97.7 | 172,150 | 26.7 |
| | | | | | | | | | | | | | | | | |
| | **Paving** | **Start Date:** | **10/1/2017** | | | | | | | | | | | | | |
| | | **Start Date:** | **12/31/2017** | | | | | | | | | | | | | |
| 1 | Cement and Mortar Mixers | 9 | 0.56 | 8 | 3 | 24 | | 0.3 | 0.2 | 0.9 | 1.1 | 0.0 | 0.0 | 0.0 | 151 | 0.0 |
| 1 | Graders | 174 | 0.41 | 8 | 14 | 112 | | 17.0 | 14.3 | 68.9 | 145.2 | 0.1 | 8.2 | 7.5 | 9,084 | 2.7 |
| 1 | Rollers | 80 | 0.38 | 8 | 25 | 200 | | 10.0 | 8.4 | 50.3 | 77.7 | 0.1 | 5.7 | 5.3 | 6,806 | 2.1 |
| 1 | Tractors/Loaders/Backhoes | 97 | 0.37 | 8 | 10 | 80 | | 4.0 | 3.4 | 24.1 | 32.5 | 0.0 | 2.5 | 2.3 | 3,234 | 1.0 |
| 2 | Paving Equipment | 130 | 0.36 | 8 | 25 | 400 | | 18.2 | 15.3 | 127.0 | 178.2 | 0.2 | 8.8 | 8.1 | 20,815 | 6.3 |
| 3 | Dumpers/Tenders | 16 | 0.38 | 8 | 25 | 600 | Assumed in truck traffic calculations | **Sum=** | 41.6 | | 434.8 | | 25.3 | 23.3 | 40,090 | 12.1 |
| | | | | | | | | Per Day = | 1.7 | | 17.4 | | 1.0 | 0.9 | | |
| | | | | | | | | **Total =** | **2166.6** | | **22469.9** | | **1085.4** | **1041.4** | **3,289,578** | **722.9** |
| | | | | | | | | | | | | | | | | |
| **Traffic** | | | | | Total | Peak Day | | | | | | | | | | |
| | **Type** | **Total** | **Peak Day** | **Travel Distance** | **VMT** | **VMT** | | | ROG | | NOx | | PM10 | PM2.5 | CO2 | CH4 |
| | Worker | 21420 | 132 | 10.8 | 231336 | 1426 | | | 161.5 | | 255.3 | | 25.4 | 11.4 | 183,682 | 17.8 |
| | Delivery (includes cement trucks) | 1020 | 12 | 7.3 | 7446 | 88 | | | 5.0 | | 32.6 | | 1.4 | 0.7 | 12,787 | 0.4 |
| | Large Trucks | 1456 | 12 | 20 | 29120 | 240 | | | 35.5 | | 379.9 | | 11.9 | 7.6 | 105,179 | 0.7 |
| | | | | | 267902 | 1753 | | | 202.0 | | 667.8 | | 38.7 | 19.7 | 301,648 | 18.9 |
| | | | | | | 0.0065442 | | Estimated Peak Day | 8.1 | | 26.7 | | 1.5 | 0.8 | | |

**AWTF Plant site - concrete take-off**

Curb & Gutter
A = 1.87 SF/LF

| | Length | | Height or Width | | Thick/Depth | Rect. Opening | | Circ Open | | Volume | Volume |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | L1 | L2 | H1 or W1 | H2 or W2 | T1 or D1 | L | W | Diam | | | |
| Element | ft | ft | ft | ft | in | ft | ft | in | | CF | CY |
| 1. Diversion Structure A | | | | | | | | | | | |
| Top | 10 | 10 | 14 | 14 | 12 | 4 | 4 | | | 124.0 | 4.6 |
| Bottom | 10 | 10 | 14 | 14 | 24 | | | | | 280.0 | 10.4 |
| Side 1 | 10 | 10 | 28.6 | 28.6 | 12 | | | 60 | | 266.4 | 9.9 |
| Side 2 | 10 | 10 | 28.6 | 28.6 | 12 | | | 60 | | 266.4 | 9.9 |
| Side 3 | 14 | 14 | 28.6 | 28.6 | 12 | | | 54 | | 384.5 | 14.2 |
| Side 4 | 14 | 14 | 28.6 | 28.6 | 12 | | | | | 400.4 | 14.8 |
| 1. Diversion Structure B | | | | | | | | | | | |
| Top | 10 | 10 | 14 | 14 | 12 | 4 | 4 | | | 124.0 | 4.6 |
| Bottom | 10 | 10 | 14 | 14 | 24 | | | | | 280.0 | 10.4 |
| Side 1 | 10 | 10 | 28.6 | 28.6 | 12 | | | 60 | | 266.4 | 9.9 |
| Side 2 | 10 | 10 | 28.6 | 28.6 | 12 | | | 60 | | 266.4 | 9.9 |
| Side 3 | 14 | 14 | 28.6 | 28.6 | 12 | | | 54 | | 384.5 | 14.2 |
| Side 4 | 14 | 14 | 28.6 | 28.6 | 12 | | | | | 400.4 | 14.8 |
| 1. Diversion Structure C | | | | | | | | | | | |
| Top | 10 | 10 | 14 | 14 | 12 | 4 | 4 | | | 124.0 | 4.6 |
| Bottom | 10 | 10 | 14 | 14 | 24 | | | | | 280.0 | 10.4 |
| Side 1 | 10 | 10 | 28.5 | 28.5 | 12 | | | 60 | | 265.4 | 9.8 |
| Side 2 | 10 | 10 | 28.5 | 28.5 | 12 | | | 60 | | 265.4 | 9.8 |
| Side 3 | 14 | 14 | 28.5 | 28.5 | 12 | | | 54 | | 383.1 | 14.2 |
| Side 4 | 14 | 14 | 28.5 | 28.5 | 12 | | | | | 399.0 | 14.8 |
| 2. Influent Pump Station | | | | | | | | | | | |
| Top | 25 | 25 | 40 | 40 | 12 | | | | | 1000.0 | 37.0 |
| Bottom | 25 | 25 | 40 | 40 | 24 | | | | | 2000.0 | 74.1 |
| Side 1 | 25 | 25 | 28 | 28 | 12 | | | | | 700.0 | 25.9 |
| Side 2 | 25 | 25 | 28 | 28 | 12 | | | | | 700.0 | 25.9 |
| Side 3 | 40 | 40 | 28 | 28 | 12 | | | 54 | | 1104.1 | 40.9 |
| Side 4 | 40 | 40 | 28 | 28 | 12 | | | 36 | | 1112.9 | 41.2 |
| Sidewalk | 4 | 4 | 130 | 130 | 4 | | | | | 173.3 | 6.4 |
| 3. Ozone Generator Bldg | | | | | | | | | | | |
| Slab | 43 | 43 | 39 | 39 | 12 | | | | | 1677.0 | 62.1 |
| Sidewalk | 4 | 4 | 164 | 164 | 4 | | | | | 218.7 | 8.1 |
| 4. Injection Pumps | | | | | | | | | | | |
| Slab | 20 | 20 | 20 | 20 | 12 | | | | | 400.0 | 14.8 |
| 5. Ozone Contactor | from BODR estimate | | | | | | | | | | 351.0 |
| 6. BioFilter Pumps | | | | | | | | | | | |
| Slab | 35 | 35 | 15 | 15 | 18 | | | | | 787.5 | 29.2 |
| 7. BioFilters | from BODR estimate | | | | | | | | | | 1068.0 |
| 8. Brine Mix Structures Meter Vault | | | | | | | | | | | |
| Top | 12 | 12 | 19 | 19 | 12 | 16 | 5 | | | 148.0 | 5.5 |
| Bottom | 12 | 12 | 19 | 19 | 24 | | | | | 456.0 | 16.9 |
| Side 1 | 12 | 12 | 29.5 | 29.5 | 18 | | | | | 531.0 | 19.7 |
| Side 2 | 12 | 12 | 29.5 | 29.5 | 18 | | | | | 531.0 | 19.7 |
| Side 3 | 17 | 17 | 29.5 | 29.5 | 18 | | | 54 | | 728.4 | 27.0 |
| Side 4 | 17 | 17 | 29.5 | 29.5 | 18 | | | 54 | | 728.4 | 27.0 |
| 8. Brine Mix Structures - Mixing Vault | | | | | | | | | | | |
| Top | 20 | 20 | 40 | 40 | 12 | 34 | 6 | | | 596.0 | 22.1 |
| Bottom | 20 | 20 | 40 | 40 | 24 | | | | | 1600.0 | 59.3 |
| Side 1 | 40 | 40 | 28 | 28 | 18 | | | 54 | | 1656.1 | 61.3 |
| Side 2 | 40 | 40 | 28 | 28 | 18 | | | | | 1680.0 | 62.2 |
| Side 3 | 16 | 16 | 28 | 28 | 18 | | | 18 | | 669.3 | 24.8 |
| Side 4 | 16 | 16 | 28 | 28 | 18 | | | 60 | | 642.5 | 23.8 |
| Side 5 | 16 | 16 | 28 | 28 | 18 | | | 60 | | 642.5 | 23.8 |
| 8. Brine Mix Structures Meter Vault 2 | | | | | | | | | | | |
| Top | 12 | 12 | 19 | 19 | 12 | 16 | 5 | | | 148.0 | 5.5 |
| Bottom | 12 | 12 | 19 | 19 | 24 | | | | | 456.0 | 16.9 |
| Side 1 | 12 | 12 | 29.5 | 29.5 | 18 | | | | | 531.0 | 19.7 |
| Side 2 | 12 | 12 | 29.5 | 29.5 | 18 | | | | | 531.0 | 19.7 |
| Side 3 | 17 | 17 | 29.5 | 29.5 | 18 | | | 54 | | 728.4 | 27.0 |
| Side 4 | 17 | 17 | 29.5 | 29.5 | 18 | | | 54 | | 728.4 | 27.0 |
| 9. Lab and Control Bldg | | | | | | | | | | | |
| Slab | 16 | 16 | 25 | 25 | 18 | | | | | 600.0 | 22.2 |
| Sidewalk | 4 | 4 | 82 | 82 | | | | | | 0.0 | 0.0 |
| 10. Backwash Tank | | | | | | | | | | | |
| Slab | 55 | 55 | 55 | 55 | 24 | | | 18 | | 6046.5 | 223.9 |
| Wall | 188.5 | 188.5 | 16 | 16 | 18 | | | | | 4524.0 | 167.6 |
| Sidewalk | 5 | 5 | 190 | 190 | 4 | | | | | 316.7 | 11.7 |
| 11. RO Bldg - Main Room | | | | | | | | | | | |
| Slab | 130 | 130 | 111 | 111 | 12 | | | | | 14430.0 | 534.4 |
| Sidewalk | 4 | 4 | 371 | 371 | 4 | | | | | 494.7 | 18.3 |
| 11. RO Bldg - Electrical Room | | | | | | | | | | | |
| Slab | 30 | 30 | 55 | 55 | 12 | | | | | 1650.0 | 61.1 |
| Sidewalk | 5 | 5 | 85 | 85 | 4 | | | | | 141.7 | 5.2 |
| 11. RO Bldg - Pump Room | | | | | | | | | | | |
| Slab | 25 | 25 | 25 | 25 | 12 | | | | | 625.0 | 23.1 |
| Sidewalk | 5 | 5 | 50 | 50 | 4 | | | | | 83.3 | 3.1 |
| 12. Chemicals Bldg | | | | | | | | | | | |
| Slab | 82 | 82 | 216 | 216 | 18 | | | | | 26568.0 | 984.0 |
| | | 0 | | 0 | | | | | | 0.0 | 0.0 |
| Curbs | 2960 | 2960 | 1.87 | 1.87 | 12 | | | | | 5535.2 | 205.0 |

Converted R=30 to equivalent square

**SVRP Modifications**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 80AF Pond - Inlet | | | | | | | | | | | |
| Top | 10 | 10 | 14 | 14 | 12 | 4 | 4 | | | 124.0 | 4.6 |
| Bottom | 10 | 10 | 14 | 14 | 24 | | | | | 280.0 | 10.4 |
| Side 1 | 10 | 10 | 30 | 30 | 12 | | | 60 | | 280.4 | 10.4 |
| Side 2 | 10 | 10 | 30 | 30 | 12 | | | 60 | | 280.4 | 10.4 |
| Side 3 | 14 | 14 | 30 | 30 | 12 | | | | | 420.0 | 15.6 |
| Side 4 | 14 | 14 | 30 | 30 | 12 | | | | | 420.0 | 15.6 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 80AF Pond - Outlet | | | | | | | | | | | |
| Top | 10 | 10 | 14 | 14 | 12 | 4 | 4 | | | 124.0 | 4.6 |
| Bottom | 10 | 10 | 14 | 14 | 24 | | | | | 280.0 | 10.4 |
| Side 1 | 10 | 10 | 30 | 30 | 12 | | | 60 | | 280.4 | 10.4 |
| Side 2 | 10 | 10 | 30 | 30 | 12 | | | 60 | | 280.4 | 10.4 |
| Side 3 | 14 | 14 | 30 | 30 | 12 | | | | | 420.0 | 15.6 |
| Side 4 | 14 | 14 | 30 | 30 | 12 | | | | | 420.0 | 15.6 |
| | | 0 | | 0 | | | | | | 0.0 | 0.0 |

**Blanco Drain F.M. - Receiving Manhole (Cast Around)**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Top | | 0 | | 0 | | | | | | 0.0 | 0.0 |
| Bottom | 10 | 10 | 10 | 10 | 24 | | | | | 200.0 | 7.4 |
| Side 1 | 10 | 10 | 15 | 15 | 12 | | | | | 150.0 | 5.6 |
| Side 2 | 10 | 10 | 15 | 15 | 12 | | | 30 | | 145.1 | 5.4 |
| Side 3 | 10 | 10 | 15 | 15 | 12 | | | 72 | | 121.7 | 4.5 |
| Side 4 | 10 | 10 | 15 | 15 | 12 | | | 72 | | 121.7 | 4.5 |
| | | 0 | | 0 | | | | | | 0.0 | 0.0 |
| | | 0 | | 0 | | | | | | 0.0 | 0.0 |
| | | 0 | | 0 | | | | | | 0.0 | 0.0 |
| | | 0 | | 0 | | | | | | 0.0 | 0.0 |
| | | 0 | | 0 | | | | | | 0.0 | 0.0 |
| | | 0 | | 0 | | | | | | 0.0 | 0.0 |
| | | 0 | | 0 | | | | | | 0.0 | 0.0 |
| | | 0 | | 0 | | | | | | 0.0 | 0.0 |
| | | 0 | | 0 | | | | | | 0.0 | 0.0 |

END OF FORMULA RANGE

| | | | AWTF Only | SVRP Only |
|---|---|---|---|---|
| SUM | 94,129 | 4,905 | 4,744 | 133.7 |
| Add 5% for misc. sites | | 5,150.51 | 4,981 | 140 |
| Add 15% for losses/partial trucks | | 5,923.09 | 5,729 | 161 |
| Estimated truckloads | | 741 | 717 | 21 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SAPS Diversion Structure - Assumed typical of 4 | | | | | | | | | | | |
| Top | 10 | 10 | 14 | 14 | 12 | 4 | 4 | | | 124.0 | 4.6 |
| Bottom | 10 | 10 | 14 | 14 | 24 | | | | | 280.0 | 10.4 |
| Side 1 | 10 | 10 | 20 | 20 | 12 | | | 72 | | 171.7 | 6.4 |
| Side 2 | 10 | 10 | 20 | 20 | 12 | | | 72 | | 171.7 | 6.4 |
| Side 3 | 14 | 14 | 20 | 20 | 12 | | | 60 | | 260.4 | 9.6 |
| Side 4 | 14 | 14 | 20 | 20 | 12 | | | | | 280.0 | 10.4 |
| | | 0 | | 0 | | | | | | 0.0 | 0.0 |

47.7 4 190.8

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Parshall Flume - 42" pipe | | | | | | | | | | | |
| Top | 8 | 8 | 14 | 14 | 12 | 4 | 4 | | | 96.0 | 3.6 |
| Bottom | 8 | 8 | 14 | 14 | 24 | | | | | 224.0 | 8.3 |
| Side 1 | 8 | 8 | 8 | 8 | 12 | | | 42 | | 54.4 | 2.0 |
| Side 2 | 8 | 8 | 8 | 8 | 12 | | | 42 | | 54.4 | 2.0 |
| Side 3 | 14 | 14 | 8 | 8 | 12 | | | | | 112.0 | 4.1 |
| Side 4 | 14 | 14 | 8 | 8 | 12 | | | | | 112.0 | 4.1 |

24.2 1 24.2

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Parshall Flume - 30" pipe | | | | | | | | | | | |
| Top | 8 | 8 | 14 | 14 | 12 | 4 | 4 | | | 96.0 | 3.6 |
| Bottom | 8 | 8 | 14 | 14 | 24 | | | | | 224.0 | 8.3 |
| Side 1 | 8 | 8 | 8 | 8 | 12 | | | 30 | | 59.1 | 2.2 |
| Side 2 | 8 | 8 | 8 | 8 | 12 | | | 30 | | 59.1 | 2.2 |
| Side 3 | 14 | 14 | 8 | 8 | 12 | | | | | 112.0 | 4.1 |
| Side 4 | 14 | 14 | 8 | 8 | 12 | | | | | 112.0 | 4.1 |

24.5 1 24.5

sums for SAPS 239.5

| | |
|---|---|
| Add 5% for misc. sites | 251 |
| Add 15% for losses/partial trucks | 289 |
| Estimated truckloads | 37 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Injection well site - Assumed typical of 4 | | | | | | | | | | | |
| Slab | 16 | 16 | 24 | 24 | 18 | | | | | 576.0 | 21.3 |
| Sidewalk | 4 | 4 | 56 | 56 | 4 | | | | | 74.7 | 2.8 |
| Wellhead | 8 | 8 | 8 | 8 | 36 | | | 24 | | 182.6 | 6.8 |
| Wellhead | 8 | 8 | 8 | 8 | 36 | | | 18 | | 186.7 | 6.9 |
| Pedestal | 2 | 2 | 2 | 2 | 24 | | | | | 8.0 | 0.3 |
| Pedestal | 2 | 2 | 2 | 2 | 24 | | | | | 8.0 | 0.3 |
| Pedestal | 2 | 2 | 2 | 2 | 24 | | | | | 8.0 | 0.3 |
| Pedestal | 2 | 2 | 2 | 2 | 24 | | | | | 8.0 | 0.3 |
| Pedestal | 2 | 2 | 2 | 2 | 24 | | | | | 8.0 | 0.3 |
| Pedestal | 2 | 2 | 2 | 2 | 24 | | | | | 8.0 | 0.3 |
| Pedestal | 2 | 2 | 2 | 2 | 24 | | | | | 8.0 | 0.3 |

39.8 4 159.4

| | |
|---|---|
| Add 5% for misc. sites | 167 |
| Add 15% for losses/partial trucks | 192 |
| Estimated truckloads | 25 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Perimeter of backwash basin | | | | | | | | | | | |
| Liner anch | 460 | 460 | 2.5 | 2.5 | 12 | | | | | 1150.0 | 42.6 |
| | | 0 | | 0 | | | | | | 0.0 | 0.0 |
| | | 0 | | 0 | | | | | | 0.0 | 0.0 |

**OPERATIONAL AIR QUALITY ANALYSIS**

**Illingworth & Rodkin, Inc.**

**December 2014**

Table 2-11

## Overview of Electricity Demand (all in megawatt-hours per year)

| | Proposed Project Electricity Demand | Applicant-proposed electricity use reductions: Use of VFD motors on AWT and Product Water Pumps |
|---|---|---|
| **<u>Source Water Diversion Sites</u>**<br>(Source: Vinod Badani, E2 Consulting, October 2014, except as noted) | | |
| Existing MRWPCA Wastewater Collection System Pump Stations<br>(increased pumping for source water collection) (Source: Bob Holden, MRWPCA, October 2014) | 1,100 | |
| Proposed Salinas Pump Station Diversions<br>(lighting, SCADA, misc. electricity) | 10 | |
| Proposed Salinas Industrial Wastewater Treatment Plant Storage and Recovery Component<br>(pumping, lighting, SCADA, misc. electricity) | 224 | |
| Existing Salinas Treatment Facility and Stormwater Operations<br>(reduction of pumping) (Source: Ron Cole, February 2014 modified by MRWPCA staff October 2014) | (1,875) | |
| Proposed Reclamation Ditch Diversion<br>(pumping, lighting, SCADA, misc. electricity) | 250 | |
| Proposed Tembladero Slough Diversion<br>(pumping, lighting, SCADA, misc. electricity) | 461 | |
| Proposed Blanco Drain Diversion<br>(pumping, lighting, SCADA, misc. electricity) | 731 | |
| Proposed Lake El Estero Diversion<br>(lighting, SCADA, misc. electricity) | 10 | |
| **<u>Treatment Facilities at Regional Treatment Plant</u>**<br>(Sources: Bob Holden, MRWCPA, and Alex Wesner, SPI, personal communication, October 2014) | | |
| **Existing Primary and Secondary Processes**<br>(existing on-site cogeneration facility would provide a reduction in this value)<br>(9,900 AFY more wastewater flows through treatment processes) | 3,673 | |
| **Salinas Valley Reclamation Plant**<br>(4,260 AFY more crop irrigation produced) | 1,300 | |
| **AWT Facility**<br>New treatment facilities, not including product water pumping (assumes 3,700 AFY of water production to build drought reserve; demand will be less when Drought Reserve is at full capacity and when Drought Reserve is being used by CSIP) | 7,007 | 793 |
| **<u>Castroville Seawater Intrusion Project Supplemental Wells</u>**<br>(Source: Bob Holden, MRWPCA, October 2014) | | |
| Reduction of use of CSIP Supplemental Wells by 4,260 AFY | (1,900) | |
| **<u>Product Water Conveyance</u>**<br>(Source: TG Cole, October 2014) | | |
| Pumping of product water to Injection Well Facilities under either option (RUWAP or Coastal) | 1,912 | 18 |
| **<u>Injection Well Facilities</u>**<br>(Source: Vinod Badani, E2 Consulting Engineers, October 2014) | | |
| Back-flush of four (4) deep injection wells, lighting, HVAC, meters, instruments, SCADA | 147 | |
| **<u>CalAm Distribution System Changes</u>**<br>(Source: CalAm, 2014) | | |
| Increase by moving 3,500 afy extractions from Carmel River to Seaside Basin wells | 630 | |
| **TOTAL PROPOSED NEW ELECTRICITY DEMAND** | **13,678** | **811** |
| **Proposed New Electricvity Generation without Cogeneration or VSD** | **14,489** | |
| **Proposed New Electricity Generation at Existing Cogen Facility** | **2,726** | |
| **Net Proposed New Electricity Demand (in megawatt-hours per year)** | **10,952** | |

910

11,980

## Net Change in CalAm System Operations

| | | |
|---|---|---|
| less carmel river well extractions | 462 | kWh/af |
| more seaside GW basin well extractions | 642 | kWh/af |
| **net increase in electricity by switching the source** | **180** | **kWh/af** |
| Increase by moving 3,500 afy extractions from Carmel River to Seaside Basin | 630,000 | kwh/yr |

630 mWh/yr

Source: California American Water Company (CalAm), 2014. Proposed Water Portfolio Data plus energy spreadsheet provided to CPUC by John T. Kilpatrick on March 12, 2014.

## GHG OPERATIONAL EMISSIONS

| Indirect Emissions from Net New Electricity Consumption (including new cogeneration capabilities enabled by source water carbon content) | | | |
|---|---|---|---|
| GHGs from Electricity Consumption | | | |
| GHG | Emission Factor (lb/kWh) | Electricity Consumption kWhr | CO2e* (metric tons) |
| CO2 | 0.32800 | 10,952,043 | 1,629.44 |
| CH4 | 0.00003 | 10,952,043 | 3.01 |
| N20 | 0.00001 | 10,952,043 | 9.50 |
| | | **Total =** | **1,642** |

| Indirect Emissions from Project Electricity Consumption (assuming no energy efficiency measures) | | | |
|---|---|---|---|
| GHGs from Electricity Consumption | | | |
| GHG | Emission Factor (lb/kWh) | Electricity Consumption kWhr | CO2e* (metric tons) |
| CO2 | 0.32800 | 14,488,600 | 2,155.61 |
| CH4 | 0.00003 | 14,488,600 | 3.99 |
| N20 | 0.00001 | 14,488,600 | 12.57 |
| | | **Total =** | **2,172** |

Notes: The emission factor for CO2 was obtained from PG&E, 2013. Emission factors for CH4 and N2O are from USEPA, 2012b.
Project baseline and proposed electricity consumption estimates provided by MRWPCA, October 2014.
*Global Warming Potential for CH4 = 21; GWP for N2O = 310 (CCAR, 2009).

California Climate Action Registry (CCAR), 2009. General Reporting Protocol, Reporting Entity-Wide Greenhouse Gas Emissions, Version 3.1, January 2009. Tables C.3 and C.6.
Pacific Gas and Electric Company (PG&E), 2013. Greenhouse Gas Emission Factors Info Sheet **for the year 2017**, last revised April, 2013.
USEPA, 2012b. eGRID2012 Version 1.0 Year 2009 GHG Annual Output Emission Rates, 2012.

**Project Mobile Sources**

| On-road Sources | Miles/trip | One way Trips per year | Running Exhaust Emission Factor (pound/mile) $CO_2$ | $CH_4$ | N2O | Total Emissions (Metric tons) $CO_2$ | $CH_4$ | N2O | $CO_2e$ | Fuel efficiency mpg | Fuel use gal/year |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Light duty truck (gas) | 10 | 8,030 | 0.79 | 9.96E-05 | 1.92E-04 | 28.88 | 0.00 | 0.006994084 | 31.13 | 15 | 5,353 |
| Heavy duty truck | 25 | 624 | 3.61 | 1.12E-05 | 1.06E-05 | 25.54 | 0.00 | 7.48795E-05 | 25.57 | 5 | 3,120 |
| | | | | | **Totals =** | **54.43** | **0.00** | **0.007068964** | **56.70** | | **8,473** |

Notes: Emission factors for mobile sources were derived from EMFAC2011 for the year 2018 (see CalEEMod Emfac 2011 Onroad Emission Factors). It is assumed that 11 employees would each generate two light duty truck trips each per day (22 total one way); 7 days per week (365 days per year), and that there would be six (6) weekly heavy duty truck deliveries or 12 one way trips per week (52 weeks per year).

| | |
|---|---|
| Total GHG Emissions (metric tons per year of CO2e) = | 1,699 |
| Total GHG Emission (based on 2003) = | 2,229 |
| **% GHG reduction =** | **24%** |

**NOTES:**

Treatment of the Agricultural Washwater at the Regional Treatment Plant (where methane is captured) rather than at the Salinas Industrial Wastewater Treatment Facility (where decomposition of organic matter in the wastewater occurs but it is not captured) would also reduce GHG emissions of the project. The project proposes storage and recovery of the water at the SIWTF, and thus some decomposition of organic matter in the ag wash water would still occur at the SIWTF in those waters stored. For this reason, this analysis conservatively does not account for this benefit.

## ON-ROAD OPERATIONAL CRITERIA POLLUTANT EMISSIONS

### Emission Factors

| Vehicle Type | Running Exhaust Emission Factors (pounds/mile) | | | | |
|---|---|---|---|---|---|
| | ROG | NOx | PM10 | PM2.5 | CO |
| Light duty truck | 0.0004 | 0.0010 | 1.1E-04 | 4.9E-05 | 0.0096 |
| Heavy duty truck | 0.0006 | 0.0207 | 5.0E-04 | 3.4E-04 | 0.0024 |

Note: derived from EMFAC 2011.

PM10 and PM2.5 emission factors include break and tire wear factors.

### Daily Operational Emissions (pounds/day)

**Proposed Project***

| Vehicle Type | Avg Trips/day | miles/trip | ROG | NOx | PM10 | PM2.5 | CO |
|---|---|---|---|---|---|---|---|
| Light duty truck | 22 | 10 | 0.10 | 0.22 | 0.02 | 0.01 | 2.11 |
| Heavy duty truck | 2 | 25 | 0.02 | 0.88 | 0.02 | 0.01 | 0.10 |
| *Total* | *24* | | *0.12* | *1.11* | *0.05* | *0.03* | *2.21* |

Notes: Trips are one-way; assumes 11 employees and 10 truck trips would require 2 trips per day.

Average truck trip length represents from the Santa Clara/San Benito County line (south of Gilroy) down to Seaside.

Daily trip amounts obtained from Bob Holden, MRWPCA, November 2014.

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# Appendix F rev

# Memorandum Regarding Steelhead Habitat and Passage Effects Assessment: Salinas River

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# Pure Water Monterey Groundwater Replenishment Project

# Steelhead Habitat and Passage Effects Assessment Technical Memorandum

January 2015


**Prepared by:**

HDR Engineering, Inc.
2365 Iron Point Road, Folsom, CA 95630

**Prepared for:**

Denise Duffy and Associates
947 Cass Street, Monterey, CA 93940

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# 1 INTRODUCTION

The Pure Water Monterey Groundwater Replenishment Project is a water supply project that will serve northern Monterey County. The project will provide purified water for recharge of a groundwater basin that serves as drinking water supply, and recycled water to augment the existing Castroville Seawater Intrusion Project's crop irrigation supply. The project is jointly sponsored by the Monterey Regional Water Pollution Control Agency (MRWPCA) and the Monterey Peninsula Water Management District (Water Management District), and also includes participation by the City of Salinas, the Marina Coast Water District, and the Monterey County Water Resources Agency.

The project includes the collection of a variety of new source waters for conveyance to the Regional Wastewater Treatment Plant (Regional Plant) for treatment and recycling. The water will then be used for two primary purposes: replenishment of the Seaside Groundwater Basin and additional recycled water supply for agricultural irrigation in northern Salinas Valley (both described below).

The new source waters would supplement the existing incoming wastewater flows, and would include the following:

1. Water from the City of Salinas agricultural wash water system that currently flows to the Salinas Industrial Wastewater Treatment Facility (Salinas Treatment Facility)
2. Stormwater flows from the southern part of Salinas and the Lake El Estero facility in Monterey,
3. Surface water and agricultural tile drain water that is captured in the Reclamation Ditch and Tembladero Slough, and
4. Surface water and agricultural tile drain water that flows in the Blanco Drain.

Most of these new source waters would be combined within the existing wastewater collection system before arriving at the Regional Plant; water from Blanco Drain would be conveyed on its own directly to the Regional Plant. The combined flow would be treated using the existing Regional Plant processes and then further treated to recycle it for replenishment of the Seaside Groundwater Basin and to provide additional recycled water for agricultural irrigation in the northern Salinas Valley.

HDR, Inc. (HDR) has reviewed the potential effects of the Seaside Groundwater Replenishment Project (GWR Project) on flows in the Salinas River and assessed the potential resulting effects on the river's steelhead population. Results reported by Schaaf & Wheeler Consulting Civil Engineers (Schaaf & Wheeler) on the proposed project's effects on river surface flow show that the GWR Project would reduce the volume of water entering the Salinas River from the vicinity of Davis Road, and potentially reduce Salinas River in-stream flows. Schaaf & Wheeler provided simulated river flows resulting from the each of the diversion scenarios, as well as the baseline condition near Spreckles (USGS Gage 11152500) (RM 13.2), upstream of the Salinas Treatment Facility (RM 11.2). Based on the estimated changes in instream-flow and water quality, HDR, Inc. evaluated potential effects to the Salinas River steelhead population.

## 2 Aquatic Biological Resources

This section describes the aquatic (fishery) resources in the area and potential direct and indirect impacts to those resources resulting from implementation of the diversion actions of the GWR Project.

Aquatic biological resources, including native fish species and federally-listed species, specifically South- Central California Coastal (S-CCC) steelhead (*Oncorhynchus mykiss*) Distinct Population Segment (DPS) is known to occur within and adjacent to areas that could be affected by the Salinas River GWR Project. and tidewater goby (*Eucyclogobius newberryi*), are The following analysis is based on a review of the most current program description, previous biological investigations and reports, and literature from federal, state and local agencies. It provides the existing setting (baseline) and identifies potential adverse effects resulting from implementation of the GWR Project.

## 3 Environmental Setting

The study area includes the immediate project vicinity (i.e., adjacent to the stormwater and Salinas Treatment Facility outflow locations at RM 11.2 and the Blanco Drain confluence with the Salinas River at RM 5.1) and upstream and downstream areas that could be influenced by diversion actions associated with the GWR Project. Areas upstream of the immediate project vicinity that could be influenced by GWR Project diversion actions are the Arroyo Seco (RM 50), San Antonio (RM 105), and Nacimiento (RM 108) rivers. The Salinas River Lagoon is downstream of the immediate project vicinity and could potentially be affected by actions associated with the GWR Project.

Unless otherwise noted, much of the discussion in the Environmental Setting Section, below is provided from MCWRA 2013b.

### 3.0.1 Salinas River Basin

#### 3.0.1.1 *Salinas River*

The Salinas River flows approximately 184 miles north/northwest from its headwaters in the Santa Lucia and La Panza Mountain Ranges in San Luis Obispo County, through the Salinas Valley and reaches the Monterey Bay near Castroville. With a drainage area of approximately 4,240 square miles, the Salinas River watershed is the largest in the central California coast area. Minor tributaries to the Salinas River include Santa Margarita Creek, Trout Creek, Tassajero Creek, Atascadero Creek, Santa Rita Creek, Paso Robles Creek, Jack Creek, Huerhuero Creek, San Juan Creek, and Big Sandy Creek. Major tributaries include the Estrella River, the Nacimiento River, the San Antonio River, San Lorenzo Creek, and the Arroyo Seco River.

The Salinas River is a managed river system, influenced by flow regulation from upstream dams, levees, and land use on the adjacent floodplains. Construction of Nacimiento and San Antonio dams in 1957 and 1965, respectively, altered the natural hydrology of the Salinas River to provide flood protection and aquifer recharge (and recreation, although this was not a primary purpose of the dams) (MCWRA 2001, California Division of Dam Safety 2010). Additionally, the upper 110 mi2 of the Salinas River are controlled by the Santa Margarita Dam

(RM 154, constructed in 1942), which impounds 4,000 acre-feet and forms Santa Margarita Lake (FISHBIO 2011a in MCWRA 2013).

The Salinas River is roughly divided into two reaches based on the channel morphology. The lower 21 miles of river generally has a more narrow channel top width, typically about 500 to 1,000 feet (ft), than the upper 73 miles of river. The Salinas River channel bed and banks are sand dominated along both reaches. The bed-form is usually plane-bed (i.e., relatively flat with little vertical oscillation in the bed topography) or low amplitude dune-ripples. Channel banks are usually well-vegetated, with widely varying amounts of vegetation growing on bars and the channel bottom.

The Salinas River Diversion Facility (SRDF) located at river mile 4.8 is a diversion to supply surface waters to the Castroville Seawater Intrusion Project's non-potable agricultural irrigation system. The SRDF operates April 1-October 31. The dam has pneumatically controlled interlocking steel gates that span the width of the river, the height of the spillway gate is controlled by inflatable bladders (NMS 2007). When in operation the dam will maintain upstream water surface elevation of the impoundment and a total operational storage volume of the impoundment is within 108 acre feet (AF). The SRDF includes a fish passage system with intake screens and fish ladders that comply with National Marine Fisheries Service (NMFS) and California Department of Fish and Wildlife (CDFW) criteria (NMFS 2007).

Non-native species have been spreading pervasively in the Salinas River Watershed. The watershed has an infestation of Arundo donax(Giant reed) which provides little shading in the stream, and can lead to increased water temperatures and reduced habitat quality for aquatic wildlife(MCWRA 2013b).

Habitat conditions in the Lower Salinas River are generally not suitable for steelhead spawning or rearing. The substrate is primarily sand throughout and gravel is only a minor component, primarily upstream of King City. Before Nacimiento and San Antonio Reservoirs were constructed, the Salinas River had little or no flow during most years (NMFS 2007). Even with present operations and release of water from the reservoirs throughout the summer, water temperature is reportedly too high for rearing juveniles (MCWRA 2001 Appendix C). Steelhead populations spawning in the Arroyo Seco or in other tributaries to the Salinas River use the lower Salinas River as a migration corridor only. Low stream flow in the Salinas River may result in areas that are too shallow for fish to pass. Based on an assessment conducted by Dettman (1988), NMFS (2007) reported the Arroyo Seco River had the potential to support an estimated run of a few thousand steelhead.

***Flow Considerations***

Within the Salinas River watershed, the wet season is considered to occur from November- May while the dry season is defined as June-October.

MCWRA (2001) estimated passage flow requirements using field measurement of channel and flow characteristics and the application of objective criteria for conditions suitable for upstream steelhead migration. The study involved development of criteria for passage based procedures developed by Thompson (1972) and CDFW (2012) using water depth transects at critical passage sites. Specifically, the minimum flow for steelhead migration occurs when, at the shallowest cross-sections, there is a depth of at least 0.6 feet across 25% of the channel width and there is a continuous section this deep across at least 10% of the channel width.

Based on the evaluation conducted by MCWRA (2001), a flow of about 72 cubic feet per second (cfs) would meet the minimum migration needs for steelhead in the Lower Salinas River downstream of Spreckels and a flow of 154 cfs would meet the minimum migration criteria upstream of Spreckels. Less flow is required downstream of Spreckels since the channel is narrower and more confined in this reach.

Under some situations the 0.6 foot depth over 25% channel width criteria have been considered to be overly restrictive and less conservative criteria have been applied (USBR 1999 in MCWRA 2001). Using a less restrictive width criterion MCWRA (2001) estimated that passage flows for adult steelhead in the Salinas River would be 94 cfs upstream of Spreckels and 60 cfs downstream of Spreckels (**Table 1**).

**Table 1. Threshold Flows for Maintenance of Steelhead Migration**

| Life stage | Required Flow Depth | Channel Width | Threshold Flow |
|---|---|---|---|
| Adult Immigration | 0.6 feet | 25% of channel | 72 cfs |
| Adult immigration | 0.6 feet | 8 feet (min) | 60 cfs |
| Juvenile and Smolt Emigration | 0.4 feet | 25% of channel | 56 cfs |
| Juvenile and Smolt Emigration | 0.4 feet | 8 feet (min) | 50 cfs |

Flow criteria for downstream migration of post-spawning adults and immature fish have not been widely developed. However, it was assumed by MCWRA (2001) that post-spawning adult steelhead and emigrating juvenile steelhead can migrate downstream over riffle areas at shallower depths than those needed by adults migrating upstream. If a depth criterion of 0.4 feet is substituted in the analysis of passage transects in the Salinas River the resulting minimum passage flow estimates for downstream migration of post-spawning adults and smolts would be 112 cfs upstream of Spreckels and 56 cfs downstream of Spreckels (MCWRA 2001). If it is also assumed that the 0.4 foot depth criteria were achieved over a continuous 8 foot channel width rather than 10% of the channel width, the minimum passage flow estimate would be further reduced to 59 cfs upstream of Spreckels and 50 cfs downstream of Spreckels (MCWRA 2001).

In addition to flow considerations provided by MCWRA (2001), NMFS (2007) set up guidelines regarding steelhead upstream and downstream migration as permit conditions associated with operating the Salinas River Diversion Facility (SRDF). Adult steelhead upstream migration triggers will be in effect from February 1 through March 31 (NMFS 2007). When flow triggers occur, flows of 260 cfs at the USGS gage near Chualar (USGS gage 11152300) will be provided to facilitate adult steelhead upstream migration of adult steelhead. To insure this minimum flow and duration, MCWRA will provide reservoir releases when necessary to augment natural flows. The number of passage days targeted for dry-normal, normal-normal, and wet-normal years are 16, 47, and 73 days, respectively (NMFS 2007).

Based on specific flow triggers that consider reservoir storage, flow, and hydrologic conditions NMFS (2007) further recommended flows to facilitate the downstream migration of smolts and rearing juvenile steelhead in the Salinas River. In some years, flow releases for smolt migration may not occur because triggers for those releases are not met. However, in those years, NMFS (2007) required MCWRA to provide reservoir releases and SRDF bypass flows to enhance migration opportunities for juvenile steelhead and post-spawn adult steelhead (kelts) (NMFS 2007).

In April 2010 the MCWRA began operation of the SRDF as part of the Salinas Valley Water Project (SVWP) (MCWRA 2011). Operation of the SRDF involves release of water from Nacimiento Reservoir to the Salinas River throughout the irrigation season with impoundment and diversion at the SRDF located at about river mile 4.8 near the upper part of the Salinas River Lagoon (MCWRA 2011). The SRDF operates seasonally between April 1 and October 31. Beginning April 1, MCWRA provides bypass flows to the lagoon under the following circumstances. For dry year-types, MCWRA provides 2 cfs to the lagoon when the SRDF is operating or during aquifer conservation releases. For non-dry year-types, and if the combined reservoir storage is 220,000 AF or more, MCWRA provides additional supplemental bypass flows (MCWRA 2011). If the lagoon is open to the ocean, then MCWRA provides 45 cfs to the lagoon for 10 days or until the lagoon closes to the ocean, whichever occurs first, then 15 cfs to the lagoon through June 30th, then 2 cfs as long as the SRDF is operating or during aquifer conservation releases (MCWRA 2011). If the lagoon is not open to the ocean, then MCWRA will provide 15 cfs to the lagoon through June 30th, then 2 cfs as long as the SRDF is operating or during aquifer conservation releases. These bypass flows influence water quality conditions in the lagoon during the dry season. Previous to implementation of the SVWP there was no requirement for provision of flow to the lagoon and there was generally no flow to the lagoon after storm flows ceased in the spring. This was likely consistent with natural river flow patterns before development of the Salinas Valley for agriculture (MCWRA 2011).

***Temperature Considerations***

Water temperature is measured at two locations in the Salinas River, at the Blanco Road Bridge, three miles upstream of the SRDF, and at the SRDF. Data collected during 2011 indicate that the general trend within the monitoring period showed increasing water temperatures from spring to summer and decreasing temperatures from summer to fall. Sullivan et al. (2000) was reported in RWQCB (2008) as stating that for the protection of steelhead, the maximum weekly average temperatures are 67 °F. Temperatures recorded at the Spreckels Gage range from 50 to 82 °F, with an average of 63 °F (RWQCB 2008).

Water temperatures in this stream are highly variable and dependent on reservoir releases, air temperature, and reservoir storage. In general, water released through the reservoir outlet is at a relatively constant temperature of 52°F to 54°F (NMFS 2001). The water warms rapidly as it moves downstream, generally in proportion to fluctuation in daily air temperature. At minimum release levels (25 to 30 cfs), water temperature can increase to as much as 73°F within 5 miles of the Nacimiento dam, and 75°F within 10 miles of the dam. During the summer conservation release period (with flows of 300 cfs or more), water temperature is generally maintained at less than 64°F within 5 miles of the dam, and 68°F or less within 10 miles of the dam (MCWRA 2001).

In addition, diurnal water temperature fluctuations are common. Data collected at the Chualar gage indicate an average difference of 4.5°F and a maximum difference of 8°F between maximum and minimum daily temperature in April (MCWRA 2001). In May there is as much as a 22°F daily swing in temperature and the average change is 16°F (MCWRA 2001).

***City of Salinas Wastewater Facility***

Three miles southwest of the City of Salinas, the Salinas Industrial Wastewater Treatment Facility (Salinas Treatment Facility) is located on the bank of the Salinas River. The City of Salinas owns and operates the plant to treat and dispose of water used to wash and prepare vegetable crops at 24 industrial food processing facilities in Salinas. The Salinas Treatment Facility consists of an aeration pond for treatment of incoming water and three large percolation ponds that dispose of water by percolation and evaporation. Additional disposal capacity during the high-inflow season (May-October) is provided by drying beds and by temporary Rapid Infiltration Basins (RIBs) between the main ponds and the adjacent Salinas River channel.

Water that percolates from the ponds either flows a short distance through the subsurface and emerges as seepage into the Salinas River or accrues to the regionally extensive shallow aquifer. The shallow aquifer is not used directly as a source of water supply, but downward percolation from the shallow aquifer is a source of recharge to the 180-Foot aquifer, which is used for water supply in the agricultural area surrounding the Salinas Treatment Facility.

#### 3.0.1.2 *Salinas River Lagoon*

The mouth of the river is a seasonal lagoon controlled by the presence of a sandbar that forms in response to changes in outflow and tidal cycles. Lagoons form in response to seasonal rainfall and water patterns, and tidal influences, with sandbar closure during dry periods (spring and summer) and breaching during wet periods (fall and winter). During wet months, high energy waves erode and breach sandbars, while high stream flows widen and deepen the estuary mouth (Capelli 1997, Smith 1990 in MCWRA 2013b). In dry months, low energy waves deposit sand and build up sandbars. After sandbar formation, water surface elevation rises as the impounded lagoon fills with freshwater streamflow. The fresh water interacts with already present salt water, occasional surf wash, and salt water that has percolated through the sandbar to create a brackish environment or even a freshwater environment if inflow is sufficient (Capelli 1997, Smith 1990 in MCWRA 2013b). Sandbars generally breach at the onset of fall and winter storms, converting the estuaries to freshwater during high flows and brackish estuaries during low inflows if there is still a substantial area of impounded water despite removal of all or most of the sandbar. In the Salinas River flooding of agricultural lands can precede the natural breaching (MCWRA 2013b).

In general, estuaries provide important habitat for juvenile steelhead and are used for rearing/feeding, freshwater to saltwater acclimation, and migration (Simenstad et al. 1982). Similarly, lagoons located at the interface of river mouths and the ocean may be a valuable habitat component for juvenile steelhead, providing abundant feeding opportunities for rearing fish and saltwater transition zones for outmigrating smolts. Preferred rearing conditions in lagoons exist when sandbars cut off ocean access which reduces salinity and promotes mixing of the lagoon water (Smith 1990), which prevents water stratification and high temperatures, thus supporting food production and appropriate dissolved oxygen concentrations.

Historical information (i.e., late 1800s) reported by the Habitat Restoration Group et al. (1992 in NMFS 2007) indicates that the floodplain adjacent to the Salinas River and the lagoon appeared to support extensive areas of wetland-type vegetation, with riparian woodland vegetation bordering the channel in the vicinity of the present river mouth. This freshwater marsh ecosystem, including the lower Salinas River was likely an integral component of a larger wetland complex that included Elkhorn Slough and the Pajaro River mouth (NMFS 2007).Currently, the Salinas Lagoon is around 2 miles long and located in low-lying, open agriculture setting (Casagrande et al. 2003). The banks are defined leading to a stable surface area during the summer months. The northern bank is vegetated with riparian and phreatophytic vegetation with large woody debris scattered around the lagoon (Casagrande et al. 2003). A seasonal sandbar forms in the lagoon in response to the changes in outflow and tidal cycles (MCWRA 2011) and currently is reported to be utilized primarily as a migration corridor by adult and juvenile steelhead (MCWRA 2013b).

The lagoon supports a mixture of marine and freshwater fishes. Over 24 species (**Table 2**) were observed during lagoon fishery surveys conducted during the past 12 years (2002-2013). Some species appear to occur in the lagoon year round while others are seasonally present. (HES 2012, MCWRA 2013a). Steelhead and tidewater goby have been rarely observed in the lagoon surveys. Only three steelhead were observed: two in 2011 and one in 2013. Tidewater goby were recently observed for the first time during the 12 years of the lagoon survey and for the first time since 1951, when two gobies were observed during fall 2013 surveys. The tidewater goby was presumed lost from the lagoon due to levee construction and channelization (USFWS 2013). It is likely that the gobies observed in 2013 had dispersed from nearby Bennett Slough or Moro Cojo Slough (MCWRA 2013b).

**Table 2. Fish species observed in Salinas River Lagoon during lagoon fishery surveys conducted during spring, summer and fall (2002-2013)**

| Species | Scientific name | Season observed | | |
|---|---|---|---|---|
| | | Spring | Summer | Fall |
| Arrow goby | *Clevelandia ios* | No | No | Yes |
| Carp | *Cyprinus carpio* | No | Yes | Yes |
| Chinook Salmon | *Oncorhynchus tshawystcha* | No | No | Yes |
| Hitch | *Lavinia exilicauda* | No | Yes | x |
| Largemouth bass | *Micropterus salmoides* | No | Yes | Yes |
| Mosquitofish | *Gambusia affinis* | No | Yes | Yes |
| Pacific herring | *Clupea pallasii* | No | Yes | Yes |
| Pacific lamprey | *Lampetra tridentata* | Yes | No | Yes |
| Pacific sardine | *Sardinops sagax* | No | Yes | No |
| Pacific staghorn sculpin | *Leptocottus armatus* | Yes | Yes | Yes |
| Prickly sculpin | *Cottus asper* | Yes | Yes | Yes |
| Rockfish | *Sebastoides spps* | No | Yes | No |

| | | | | |
|---|---|---|---|---|
| Sacramento blackfish | *Orthodon microlepidotus* | Yes | Yes | Yes |
| Sacramento pikeminnow | *Ptychocheilus grandis* | Yes | Yes | Yes |
| Sacramento sucker | *Catostomus occidentalis* | Yes | Yes | Yes |
| Shiner surfperch | *Cymatogaster aggregata* | Yes | Yes | Yes |
| Starry flounder | *Platichthys stellatus* | Yes | Yes | Yes |
| Steelhead | *Oncorhynchus mykiss* | Yes | Yes | Yes |
| Striped bass | *Morone saxatilis* | Yes | Yes | Yes |
| Threadfin shad | *Dorosoma patenense* | Yes | No | Yes |
| Threespine stickleback | *Gasterosteus aculeatus* | Yes | Yes | Yes |
| Tidewater goby | *Eucyclogobius newberryi* | No | No | Yes |
| Topsmelt | *Atherinops affinis* | No | Yes | Yes |
| Yellowfin goby | *Acanthogobius flavimanus* | Yes | Yes | No |

The lagoon is brackish in the fall due to the freshwater from the inflowing river and salt water form the high ocean waves (Casagrande et al. 2003). During major runoff events, water elevations in the lagoons rise and breaching events occur. During breaching events, which can be natural or artificial, anadromous fish such as steelhead and Pacific lamprey are able to migrate into the river (Casagrande et al. 2003). The Monterey County Water Resources Agency intervenes in the breaching of Salinas Lagoon as needed to prevent flooding of nearby properties ~~each year~~ by using equipment to either cause or assist the breach (Casagrande et al. 2003). The MCWRA also manages the lagoon water levels as part of flood control activities (MCWRA 2011).

Monterey County Water Resources Agency intermittently evaluates water quality of the lagoons and analyzes fish population and response to any changing conditions. Since 2002 MCWRA has conducted the Lagoon Monitoring Program, which in 2010 was modified to be consistent with the NMFS 2009 Biological Opinion for sandbar management at the mouth of the Salinas River. Fall sampling was expanded to include spring and summer surveys.

***Flow Considerations***

Water levels in the lagoon are monitored by a county gage and staff plate located at the Old Salinas River outlet gate, which is located in the northwestern corner of the lagoon (Casagrande et al. 2003). During non-event periods the majority of fresh or brackish water entering the lagoon comes from the Blanco Drain, located 8 km upstream from the lagoon, which is an agricultural runoff canal (Casagrande et al. 2003). There are also a number of small agricultural tile drainage systems discharging directly into the lagoon. The flow at which the Salinas River lagoon will remain open to the ocean is expected to generally range from 80 to 150 cfs (MCWRA 2005).

#### 3.0.1.3 *Arroyo Seco River*

The Arroyo Seco River enters the Salinas River at RM 50, and drains a watershed area of 303 mi2. The river extends approximately 37 miles from it is headwaters within forest and wilderness area to its confluence with the Salinas River. The river is unregulated with surface flow interrupted during dry summer months as it flows across the Salinas Valley en route to the

Salinas River. The Arroyo Seco River contains a majority of the steelhead spawning habitat and half the steelhead rearing habitat within the Salinas River basin. It is the closest major tributary to the Pacific Ocean, which increases the likelihood of steelhead utilization over upstream tributaries (MCWRA 2013b).

#### 3.0.1.4 *San Antonio River*

The San Antonio River enters the Salinas River at RM 105 and drains 344 mi2. The river flows 58 miles from its headwaters in the Los Padres National Forest to the Salinas River. The San Antonio River is regulated by the San Antonio Dam (RM 5), which impounds <u>335,000</u> ~~350,000~~ acre-feet. The dam was constructed in 1965 and is used for flood protection, aquifer recharge, and recreation. Prior to construction of San Antonio Dam, the San Antonio River normally did not reach the Salinas River in late summer (Monterey County Flood and Water Conservation District, 1989, as cited in MCWRA 2001). Flow prescriptions are used to maintain steelhead rearing habitat on the San Antonio River below the dam. Prior to construction of the San Antonio Dam, the San Antonio River normally did not reach the Salinas River in late summer. Aquatic habitat below the dam consists primarily of shallow-run habitat, and lesser amounts of pool and riffle habitat. The channel substrate is primarily composed of equal parts of sand and gravel with lesser amounts of cobble and silt (Nacitone Watersheds Steering Committee and Central Coast Salmon Enhancement, Inc., 2008).

#### 3.0.1.5 *Nacimiento River*

The Nacimiento River enters the Salinas River at RM 108 and drains 362 mi2. The river flows 53 miles from its headwaters in the Santa Lucia Mountains within the Los Padres National Forest to the confluence with the Salinas River. Under natural conditions, flow in the river is intermittent, drying during the summer months. The river is regulated by the Nacimiento Dam, located 10 miles upstream from the confluence with the Salinas River. The dam, constructed in 1957 impounds 350,000 acre-feet, and provides flood protection and aquifer recharge to the Salinas Valley (MCWRA 2001). Before Nacimiento Reservoir was constructed, the Nacimiento River regularly experienced levels of little or no flow in the reach currently inundated by the reservoir and in the section of river downstream of the dam (MCWRA 2001). The dam also blocks passage of steelhead to the upper portion of the basin. Dam operation and flow releases on the Nacimiento River are managed to facilitate and enhance passage for upstream migrating adult steelhead on the Salinas River, to facilitate and enhance passage for downstream migrating steelhead smolts and juveniles on the Salinas River, to maintain the Salinas River Lagoon, to provide water for Salinas River Diversion Facility (RM 4.8) and to maintain steelhead rearing habitat below the dam (MCWRA 2005). Below the dam, the Nacimiento River is characterized by a low gradient and long, wide sections with sparse riparian vegetation. Typical substrate consists of gravel with lesser amounts of sand and cobble. Water temperatures below the dam generally range from 64-69 °F, but can reach as high as 73-75°F (MCWRA 2013b).

#### 3.0.1.6 *Salinas Valley Water Project*

The Salinas Valley Water Project (SVWP) was completed in 2010 with the goals to halt seawater intrusion to aquifers, to provide water for current and future needs, and to improve the hydrologic balance of groundwater within the basin. Groundwater is the source for most urban and agricultural water needs in the Salinas River Valley (NMFS 2007). A long-known and continual imbalance between groundwater withdrawal and recharge caused overdraft conditions and seawater intrusion into the aquifer. To address (in part) overdraft in the basin, the San Antonio and Nacimiento reservoirs were constructed in 1965 and 1957, (NMFS 2007).

The SVWP is a combination of structural and operational changes to provide surface water deliveries and aquifer replenishment. The project includes the Salinas River Diversion Facility (SRDF) located at RM 4.8 on the Salinas River, which consists of a bladder dam to impound spring, summer and early-fall reservoir releases, and a pump station to deliver surface water and reduce the need for groundwater pumping. The SVWP also includes re-operation of the San Antonio and Nacimiento dam releases as the source of surface water. The project does not provide new water sources for the basin, rather more water is released from the San Antonio and Nacimiento dams in the spring, summer, and early-fall for diversion by the SRDF to offset groundwater pumping (NMFS 2007).

As part of the SVWP goals and to minimize impacts to federally threatened S-CCC steelhead and its Critical Habitat, the MCWRA developed flow prescriptions to facilitate and enhance adult steelhead upstream migration, downstream migration of juveniles, smolts, and kelts (post-spawn adult steelhead), and spawning and rearing habitat within the San Antonio and Nacimiento rivers below the dams (MCWRA 2005). Additionally, MCWRA releases lagoon maintenance flows in conjunction with lagoon opening and closure, juvenile passage flows released from the San Antonio and Nacimiento dams, and passage conditions within the Arroyo Seco River (MCWRA 2005). The flow prescriptions and timing are tied to the S-CCC steelhead life cycle within the Salinas River (MCWRA 2005).

### 3.0.2 Species Evaluated

#### 3.0.2.1 *Native Species*

Snyder (1913) described 12 fish species within the Salinas River basin including steelhead, Pacific lamprey (*Lampetra tridentata,* new *Entosphenus tridentatus*), threespine stickleback (*Gasterosteus aculeatus*), coast range sculpin (*Cottus aleuticus*), hitch (*Lavinia exilicauda*), Sacramento pikeminnow (*Ptychocheilus grandis*), prickly sculpin (*Cottus asper*), riffle sculpin (*Cottus gulosus*) , Sacramento sucker (*Catostomus occidentalis*), Monterey roach (*Hesperoleucus symmerticus*, new *Lavinia symmetricus subditus*), tule perch (*Hysterocarpus traski*), and speckled dace (*Rhinichthys osculus*). MCWRA (2001) reported that 8 of the species recorded by Snyder (1913), including tule perch, riffle sculpin, and coast range sculpin, were not collected. Moyle (2002) believes that the riffle sculpin may have been misidentified and that the roach collected is a Monterey Roach subspecies (*Lavinia symmetricus subditusi*).

Casagrande et al. (2003) described the Sucker-Hardhead-Pikeminnow Assemblage as occurring in large rivers, reservoirs, with warm temperatures, and along sand or bedrock substrate, such as occurs in the lower Salinas River. Hitch, Monterey roach, and non-native species including redear sunfish and green sunfish, bluegill and black bass can also be found within this assemblage (Casagrande et al. 2003). This fish assemblage occurs in the low-elevation reaches of the western and north Salinas River watershed, including the Salinas River main-stem, the lower reaches of the Arroyo Seco River and lower Gabilan Creek (MCWRA 2013a). The Roach assemblage is associated with small tributary streams with low to moderate gradients and rocky substrate, and the Rainbow Trout-Speckled Dace Assemblage, which typically occurs in cool headwater streams are also represented within the Salinas River watershed. The most abundant native fishes observed in the Salinas River watershed during recent years include hitch, Sacramento blackfish, speckled dace, starry flounder, and threespine stickleback (MCWRA 2011). FISHBIO (2011). **Table 3** lists native fish species known to occur in the Salinas River watershed.

**Table 3. Native Fish Species Known to Occur in the Salinas River Watershed (Source MCWRA 2013b)**

| Common name | Scientific name | Special Status | Distribution |
|---|---|---|---|
| Hitch | *Lavinia exilicauda* | None | Mainstem Salinas |
| Monterey roach | *Lavinia symmetricus subditus* | California Species of Special Concern | Mainstem Salinas tributaries |
| Pacific herring | *Clupea pallasi* | None | Salinas Lagoon |
| Pacific lamprey | *Entosphenus tridentatus* | None | Mainstem Salinas tributaries |
| Prickly sculpin | *Cottus asper* | None | Mainstem Salinas, tributaries |
| Sacramento blackfish | *Orthodon microlepidotus* | None | Mainstem Salinas |
| Sacramento pikeminnow | *Ptychocheilus grandis* | None | Mainstem Salinas |
| Sacramento sucker | *Catostomus occidentalis* | None | Mainstem, Salinas/Reservoir |
| Shiner surfperch | *Cymatogaster aggregata* | None | Salinas Lagoon |
| Speckled dace | *Rhinichthys osculus* | None | Upper tributaries |
| Staghorn sculpin | *Leptocottus armatus* | None | Salinas Lagoon |
| Starry flounder | *Platichthys stellatus* | None | Salinas Lagoon |
| South Central California Coast steelhead | *Oncorhynchus mykiss* | Federally-listed Threatened | Mainstem Salinas tributaries |
| threespine stickleback | *Gasterosteus aculeatus* | None | Mainstem Salinas tributaries |
| Tidewater Goby | *Eucyclogobius newberryi* | Federally Endangered. | Salinas Lagoon |
| topsmelt | *Atherinops affinis* | None | Salinas Lagoon |

#### 3.0.2.2 *Special Status Species*

**Table 3** also lists the special status species in the Salinas River and Salinas Lagoon. Of the species identified as occurring within the Salinas River and could be affected by ongoing operations and subject to regulation by NMFS or USFWS, SCCC steelhead and tidewater goby were identified as occurring in the Salinas River and are the only listed species addressed in this Analysis. Monterey roach is a special status species identified by CDFW as a Species of Special Concern and is also addressed in this Analysis.

### 3.0.3 Species Considered and Eliminated from the Analysis

In 2011, Skiles et al. (2013) reported pink salmon (*O. gorbuscha*) in the Salinas River. Although pink salmon were historically distributed in coastal streams, the Puget Sound region is regarded as the southernmost extent of recent spawning habitat. Pink Salmon have been known to occur within California (Jordan and Evermann 1896, Moyle 2002, Moyle et al. 2008) and have even been reported south of the San Francisco Bay in the San Lorenzo River (Scofield 1916). However, the four pink salmon do not suggest a population within Salinas River (Skiles et al. 2013). Therefore, the species is not considered further in this analysis.

### 3.0.4 Special Species Status Species

#### 3.0.4.1 *South-Central California Coastal Steelhead Distinct Population Segment*

***ESA Listing Status***

In 1996, NMFS and USFWS adopted a joint policy for recognizing Distinct Population Segments (DPS) under the Endangered Species Act (ESA) (DPS Policy; 61 FR 4722; February 7, 1996). On August 9, 1996, NMFS identified 15 Evolutionarily Significant Units (ESU), with the South-Central California Coast (SCCC) steelhead ESU listed as a threatened species (62 FR 43937). During 2006 the SCCC steelhead status as Threatened was re-affirmed (71 FR 834).

The SCCC DPS includes all naturally spawned anadromous populations of *O. mykiss* in coastal river basins from the Pajaro River in Monterey County southward to but not including the Santa Maria River in San Luis Obispo County (65 FR 36074, 71 FR 834).

The ESA requires that NMFS review the status of listed species under its authority at least every five years and determine whether any species should be removed from the list or have its listing status changed. In September 2012, NMFS completed a 5-year status review of the SCCC steelhead DPS. Based upon a review of available information, NMFS (2012) recommended that the SCCC steelhead DPS remain classified as a threatened species.

Although *O. mykiss* exhibits both resident and anadromous life history characteristics, the SCCC steelhead DPS includes only the anadromous life form of *O. mykiss*.

***Critical Habitat Designation***

Critical Habitat for SCCC steelhead was designated in February 2000 (65 FR 7764) and was reaffirmed in 2005 (70 FR 52488). Section 3 of the ESA (16 U.S.C. 1532(5)) defines critical habitat as ‘‘(i) the specific areas within the geographical area occupied by the species, at the time it is listed on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed”. The freshwater primary constituent elements of critical habitat include: 1) spawning habitat, including spawning substrate, and adequate water quantity and quality; 2) freshwater rearing habitat including floodplain connectivity, and natural escape and velocity cover; and 3) freshwater migration corridors free of obstructions, with water quantity and quality conditions that allow movement (NMFS 2005, MCWRA 2013b).

Critical Habitat on the Salinas River watershed is designated from the mouth upstream to 7.5 miles below the Santa Margarita Lake, Arroyo Seco River, Nacimiento River (below the dam), San Antonio River (below the dam), and the upper Salinas River tributaries (NMFS 2005, MCWRA 2013b). The primary constituent element of critical habitat that could potentially be affected by the Proposed Project includes migration habitat in the Salinas River.

### *Taxonomy*

The taxonomic history and nomenclature of steelhead is complex and difficult to reconcile. The species has been described with at least 22 scientific names in five genera and is known by many common or colloquial names (Scott and Crossman 1973; Healey and Jordan 1982). Until 1989, the primary scientific name used for steelhead from western North America was *Salmo gairdneri*. However, Smith and Stearley (1989) presented evidence that Salmo gairdneri was the same species as the previously described Salmo mykiss, and was more similar to Pacific salmon (*Oncorhynchus*) than to Atlantic salmon (*Salmo*). Thus, the scientific name *Oncorhynchus mykiss* was adopted for steelhead and rainbow trout in 1989.

Based on genetic and distributional information, Boughton et al. (2006) identified 41 historically independent populations of SCC steelhead in the DPS, including three populations in the Salinas River (Moyle 2008). Three populations are recognized in the Salinas River due to its large size, which likely allows sufficient geographic isolation to maintain multiple populations (Boughton et al. 2006). These 41 populations are divided into four biogeographical regions including (from north to south): Interior coast range, Carmel Basin, Big Sur Coast, and San Luis Obispo Terrace (Boughton et al. 2007 as cited in Moyle 2008). The Salinas River occurs within the Interior Coast Range Biogeographic Population Group (BPG; NMFS 2012 in MCWRA 2013).

### *Population Trends*

The limited documentation on current abundance suggests the overall population in the SCCC steelhead DPS is extremely small. Estimating the magnitude of the departure of the population from historical conditions is further hampered because the run size for most watersheds continues to be poorly characterized and major impacts leading to subsequent declines occurred prior to most modern fish investigations in the SCCC steelhead DPS. The sporadic presence of steelhead in many watersheds in the SCCC steelhead DPS further confounds assessment efforts. Nonetheless, investigations conducted since 1996 (Busby et al. 1996, Boughton et al 2006) indicate that of the 39 watersheds that historically supported anadromous runs, virtually all continue to be occupied by native O. mykiss, though most of the populations are at historically low levels(NMFS 2013).

Recent status reviews conducted by Busby (1996), Good et al. (2005), and Williams et al. (2011) indicated that steelhead populations in the region declined dramatically from the 27,000 estimated at the turn of the century.

### *Life History Overview*

Much of the following discussion is derived from MCWRA 2013b.

Steelhead are a form of rainbow trout that migrate to the ocean as juveniles and return to inland waters as adults to spawn in a process known as anadromy. All steelhead within the SCCC steelhead DPS are considered "winter steelhead" based on their migratory timing and behavior; ascending streams during the winter when winter rainfall results in suitable flow and temperature (Busby 1996, Moyle 2002). SCCC steelhead require pools with low velocities in association with instream and near stream cover such as large woody debris, undercut banks, or submerged or overhanging vegetation, can provide desirable resting areas for migrating adult steelhead. The migration of adult SCCC steelhead is strongly associated with high winter and spring flows that provide a continuous hydrological connection between the ocean and upstream habitat (NMFS 2012). The pulse of upstream migration is believed to coincide during storm runoff conditions when flows are elevated. Adult upstream migration times vary according to life history type (e.g., winter run versus spring-run) and climatic conditions (i.e., the timing of higher winter and spring flows) (MCWRA 2013b).

Winter steelhead fish are reported to enter freshwater to spawn between November 1 and April 30 (Barnhart 1986), with peak numbers occurring in January and February (Moyle 2002). NMFS (2007) states that SCCC steelhead primarily migrate from December through April in the Salinas Region. Steelhead spawn in cool, clear, well-oxygenated streams with suitable depth, current velocity, and gravel size (Reiser and Bjornn 1979, Barnhart 1986). Steelhead typically select spawning areas at the downstream end of pools, in gravels ranging from approximately 0.5 to 4.5 inches in diameter (Pauley et al. 1986). Once they reach their spawning grounds, females use their caudal fin to excavate a nest (redd) in streambed gravels where they deposit their eggs. Steelhead are unique among Pacific salmonids in that they can be iteroparous (may be able to return the ocean and then spawn again in one or more subsequent years). Eggs incubate for 25–30 days, depending on water temperatures (warmer temperature will decrease incubation time, which is reported to occur in the Salinas River watershed), then hatch into alevins (larval stage). The alevins remain in the gravel for an additional 2–5 weeks after hatching, depending on temperature, before emerging in spring or early summer as fry (Shapovalov and Taft 1954, Barnhart 1986). Following emergence, steelhead juveniles (fry) feed in shallow, low-velocity areas such as stream margins and low-gradient riffles, then move to faster, deeper water as they increase in size (Bjorkstedt et al. 2005). In the summer and late-fall, as flows lessen and riffle area decreases, juvenile steelhead may move into pools (Barnhart 1986). During winter as water temperatures decrease and flows increase, juveniles seek hydraulic refuge within pools, interstitial spaces in cobble and boulder substrates, or near large woody debris (MCWRA 2013b).

As fry grow they develop marks on their sides and become known as "parr", which is the juvenile life stage (Moyle, 2002). After 1 to 3 years of rearing in freshwater, most juvenile steelhead begin the process of smoltification and proceed to migrate downstream toward the ocean. Young steelhead feed on a wide variety of aquatic and terrestrial insects, and emerging fry are sometimes preyed upon by older juveniles (NMFS 2007). Steelhead smolts may immigrate to the ocean from January through June on the receding limb of the winter hydrograph. NMFS (2012) states that outmigration usually occurs in the late winter and spring. These fish may reside in the ocean for between 2 and 4 years (Barnhart 1986; Moyle 2002) prior to returning to spawn. Habitat needs in the Salinas River for emigrating steelhead (smolts) likely are similar to those for rearing juvenile steelhead. Migrating smolts are particularly vulnerable to predation, and physical structure and cover (refugia) are important for survival of this life stage. Similar to rearing juveniles, outmigrants rely on the presence of adequate food and suitable resting pools. Lagoons and estuaries at the river mouth are often very important for the rearing of larger juveniles and may provide essential feeding opportunities for smolts prior to entering the ocean (Smith 1990, MCWRA 2013b).

Densities of juvenile steelhead in streams are greatest where in-stream cover and their invertebrate food source are diverse and abundant. The distribution and abundance of rearing juveniles is influenced by food availability, predation and competition, and the quantity and quality of suitable habitat (Bjornn and Reiser 1991). Temperature is also an important factor for juvenile rearing conditions. In general, water temperatures less than 59°F are suitable for summer rearing of juvenile steelhead, while temperatures greater than 77°F are potentially lethal, and temperatures above 72°F may affect feeding and fitness (Bjornn and Reiser 1991, NMFS 2011, MCWRA 2013b).

Downstream migrating steelhead exhibit three possible life history strategies based upon usage of lagoon and stream rearing habitat: stream rearing, lagoon rearing, and combination stream and lagoon rearing (Hayes et al 2008). Stream-reared steelhead spend one–three years in the stream, and then migrate to the ocean with minimal lagoon residence. Lagoon-reared steelhead spend only a few months in the stream before migrating to the lagoon where they will rear for typically one year. The combination stream and lagoon strategy will rear for 1–2 years in the stream and 1–10 months in the lagoon before immigrating to the ocean. Conditions for growth can be very good in lagoons relative to stream habitat, and thus fish in lagoons tend to achieve a larger size-at-age then their stream-reared counterparts (Smith 1990, Hayes et al. 2008). Since larger smolts tend to have higher ocean survival, growth during lagoon rearing may increase ocean survival of steelhead smolts (MCWRA 2013b).

***Steelhead Habitat in the Salinas River***

Much of the following discussion is derived from MCWRA 2013b.

The mainstem Salinas River is a migration corridor for adult steelhead migrating from the ocean to spawn in tributaries (NMFS 2007). Kelts, smolts, and juveniles use the river to migrate downstream to the ocean or lagoon. The lower Salinas River has a sandy substrate with a broad channel with no spawning or rearing habitat present, (NMFS 2003). Most spawning and rearing that does occur in the Salinas River Basin occurs in tributary streams (NMFS 2003, NMFS 2007). The Salinas River between the confluence with the Pacific Ocean and below the upstream dams is characteristic of a depositional environment where transverse, lateral, and point bars form the predominant channel pattern. The substrate is primarily sand throughout, and coarser gravel is only a minor component, primarily upstream of King City. Before Nacimiento and San Antonio Reservoirs were constructed, the Salinas River had little or no summertime flow in most years due to groundwater pumping (NMFS 2003). Even with present operations and release of cooler water from the reservoirs throughout the summer, water temperatures are too high for rearing juveniles (MCWRA 2001 Appendix C). As such, steelhead use of upper Salinas River tributaries depends upon maintaining a migration corridor in the mainstem Salinas River. The current migration corridor of the lower Salinas River is limited by the availability of adequate flows to provide passage over long distances to suitable spawning and rearing habitat (NMFS 2007). Adequate migration flows are highly annually variable. Groundwater pumping has also affected these flows, and levees, channel maintenance, road crossings, and removal of riparian vegetation have reduced the availability and quality of migration habitat for steelhead (NMFS 2007, MCWRA 2013b).

### *Steelhead in the Salinas River Lagoon*

Habitat conditions in the Salinas River Lagoon are generally not suitable for steelhead spawning or egg incubation, but could potentially support rearing. When the river mouth is open, the lagoon is tidally influenced and sustains saltwater conditions. When the river mouth is closed, the lagoon is typically fresh with good water quality conditions, specifically when Salinas River inflow is adequate and no saltwater intrusions occur. The transition period between saltwater and freshwater conditions may result in salinity stratification that can contribute to elevated temperatures and low dissolved oxygen levels, conditions not suitable for rearing juveniles. Thus, the lagoon is believed to be utilized primarily as a migration corridor by adult and juvenile steelhead.

### *Current and Ongoing Studies in the Salinas River Watershed*

MCWRA has conducted fisheries studies on the Salinas River Watershed including the Nacimiento, Arroyo Seco, and Salinas Rivers and the Salinas River Lagoon (MCWRA 2011, 2012, 2013a). Studies focused primarily on these tributaries to the Salinas River because the tributaries historically provided the best spawning and rearing habitats in the watershed. Additionally, MCWRA (2011, 2012) measured conductivity, dissolved oxygen, and water temperature on the Salinas River and Lagoon and conducted an impoundment survey at the SRDF.

During 2010 MCWRA developed and implemented a Juvenile Outmigration Monitoring Program to: (1) determine the abundance of downstream migrating steelhead smolts in the Salinas River Basin; (2) determine the relative contribution of the tributaries on smolt abundances to the overall Salinas River Basin abundance; (3) characterize the migration timing of steelhead smolts; and (4) evaluate potential relationships to environmental factors. A set of three rotary screw traps (RST) was installed and operated in the Salinas River Watershed at three locations, one each on the Arroyo Seco River, Nacimiento River and Salinas River. Sampling was conducted from March 12 through May 28 during 2010 (MCWRA 2011) and during the same time period in 2011 (MCWRA 2012)

During the November 16, 2010 impoundment survey, no *O. mykiss* were observed (MCWRA 2011). However, electrofishing and seining surveys conducted on the Nacimiento and Arroyo Seco rivers during 2010 resulted in capture of *O. mykiss* on the Arroyo Seco River (MCWRA 2011). During the 2010 juvenile outmigration survey period, a total of 140 *O. mykiss* were captured in the Arroyo Seco River, which led to an abundance estimate of 480 juvenile *O. mykiss*. No *O. mykiss* were captured in the Nacimiento River and only two *O. mykiss* were captured on the Salinas River, so no abundance estimates could be generated (MCWRA 2011).

The impoundment survey was also conducted during 2011, but was not completed due to unforeseen environmental conditions not allowing efficient sampling to occur (MCWRA 2012). Electrofishing and seining was also conducted during 2011 in the Nacimiento and Arroyo Seco rivers. Twenty eight *O. mykiss* were captured in the Arroyo Seco River and no *O. mykiss* were captured in the Nacimiento River. The Salinas Basin Juvenile *O. mykiss* Outmigration Monitoring report published in September 2011 (Appendix A of MCWRA 2012) documented the second year of outmigration monitoring in the Salinas River watershed. A total of 64 *O.*

*mykiss* were captured in the Arroyo Seco River, resulting in an abundance estimate of 332 *O. mykiss* for the sampling season. No *O. mykiss* were captured in the Nacimiento River and only two *O. mykiss* were captured on the Salinas River, so no abundance estimates could be generated (MCWRA 2012).

The 2011 study concluded that similar to 2010 there were no apparent overall relationships between downstream migration timing, water temperature, or dissolved oxygen (MCWRA 2012). The report further suggested that that migration timing may be affected by turbidity, with small peaks in migration occurring during small changes in turbidity. However, because turbidity and flow covary, it is difficult to identify the influences of turbidity and flow independently (MCWRA 2012).

Non-salmonid species captured during the 2010 and 2011 surveys conducted by MCWRA (2011, 2012) are presented in those reports.

MCWRA conducts sandbar management at the mouth of the Salinas River as part of its flood control activity (MCWRA 2013a). The Lagoon Monitoring Program, conducted by MCWRA since 2002 was altered in 2010 to be consistent with the NMFS 2009 Biological Opinion for sandbar management at the mouth of the Salinas River (MCWRA 2011). The Biological Opinion (NMFS 2009) calls for fish population sampling in the Salinas River Lagoon during spring (April/May), summer (June-August), and fall (October or early November) (MCWRA 2013a). Sampling is focused on capturing rearing juvenile steelhead that may be present in the lagoon (MCWRA 2013a). The objective of the sampling is to determine whether steelhead are present, and evaluate steelhead distribution, relative abundance (catch per unit effort), and condition (MCWRA 2013a). Sampling is conducted at accessible and appropriate stations from the mouth upstream past Highway 1 to approximately river mile 3. Fish are captured using large beach seines (MCWRA 2013a).

The lagoon monitoring in 2011 began in April with high flows from the Salinas River and an open lagoon (MCWRA 2012). The lagoon was closed for the October sampling. The fish population sampling was conducted May10-11, August 23-24, and October 25-26, with sampling occurring at standard locations. Fish sampling occurred using large beach seines. For the first time since 2002, juvenile steelhead were captured during each of the three sampling periods (MCWRA 2012). However, only one individual was captured during each of the three surveys. The winter conditions of 2010-2011 led to good migration conditions and the flow at Spreckles remaining high through late-May, led to conditions at Arroyo Seco that would support adult steelhead migration (MCWRA 2012), which is in agreement with the smolt trapping conducted during 2011 that documented migration of juvenile steelhead from the Arroyo Seco River with the majority of migrating juveniles being smolts and silvery parr. Smolts would pass quickly through the estuary while parr and young-of-year may spend time rearing in the estuary (MCWRA 2012). The low number of parr and young-of-year migrating from the Arroyo Seco River is consistent with the lack of observed steelhead rearing in the Salinas River lagoon (MCWRA 2012).

The water conditions in 2012 were dry and resulted in low flows during migration periods for adult steelhead in the Salinas River system, but adequate flows for migrating smolts (MCWRA

2012). The late season rain in March and April also led to high flows likely beneficial for smolts (MCWRA 2013a). In 2012, the diversion gates were raised on April 2, 2012 and lowered on April 14, 2012 (due to lack of demand) then raised on May 1, 2012 for the rest of the season (MCWRA 2013a). With a full impoundment behind the inflatable dam, a minimum of 2 cfs was bypassed to the Salinas River Lagoon for 27 days (October 20th thru November 15th) (MCWRA 2013a). Impoundment of water at the SRDF ended on November 15, 2012 and the gates were completely lowered (MCWRA 2013a). During the irrigation season flows were bypassed through the fish ladder and the regulating weir at the SRDF (MCWRA 2013a). Bypass flows averaged 10-22 cfs throughout the season (MCWRA 2013a).

The 2007 NMFS Biological Opinion stated that one of the terms and conditions of the Biological Opinion requested that adult steelhead escapement monitoring be conducted using a Dual Frequency Identification Sonar (DIDSON; Lake Forest Park, Washington, USA). The escapement-monitoring program was to be conducted for a minimum of 10 years, unless NMFS and MCWRA agree to an alternative timeframe. In 2011 an adult steelhead escapement Monitoring program was set up with a combined resistance board weir and VAKI Riverwatcher fish counting system, when the weir became inoperable, a Dual Frequency Identification Sonar was installed and used (MCWRA 2012). Due to multiple factors, monitoring was not conducted during the entire timeframe outlined in the Biological Opinion (December 1 to March 31) (MCWRA 2012). Between January 19, 2011 and February 17, 2011, 23 steelhead passage events were detected by the VAKI Riverwatcher system at the Salinas River Weir, 18 upstream passages, and 5 downstream passages, with a total of 13 adult steelhead documented (MCWRA 2012). Although steelhead cannot be distinguishable from salmon with silhouettes alone, based on passage timings and the fact that the Salinas is not known to support any salmon species, the assumption was made that silhouettes observed were steelhead (Cassagrande et al. 2003, MCWRA 2011).

During the 2012 period monitoring protocols were amended regarding the weir and flow events. Unlike the previous season, the weir was operated during the entire monitoring period (December 1 through March 31) established by the Biological Opinion (NMFS 2007). Weir monitoring was initiated on November 30, 2011 and terminated on April 2, 2012.

From November 30, 2011, through April 2, 2012, the Riverwatcher system recorded a net upstream passage of 17 adult steelhead (19 recorded passing upstream and 2 recorded passing downstream), which was an increase of four adult steelhead net upstream passages during the previous monitoring season (MCWRA 2013a). No apparent relationships between migration timing, flow, water temperature, turbidity, and dissolved oxygen were identified during the 2012 migratory period for steelhead. However, failure to detect such trends and relationship is (at least partially) attributable to a very small population size of steelhead in the Salinas basin (MCWRA 2012). Furthermore, the 2011/2012 winter was relatively "dry" that resulted in only two very small peaks in flow at the weir (MCWRA 2013a). Future monitoring efforts may yield additional information and elucidate relationships between upstream migration of steelhead and environmental variables.

### 3.0.4.2 *Tidewater Goby*

***Status and Distribution***

The tidewater goby (*Eucyclogobius newberryi*) is listed as threatened. It is a small fish that inhabits coastal brackish water habitats entirely within California, ranging from Tillas Slough (mouth of the Smith River, Del Norte County) near the Oregon border south to Agua Hedionda Lagoon (northern San Diego County). The tidewater goby is known to have formerly inhabited at least 134 localities, including the Salinas River. Presently 23 (17 percent) of the 134 documented localities are considered extirpated and 55 to 70 (41 to 52 percent) of the localities are naturally so small or have been degraded over time that long-term persistence is uncertain.

This species was listed by the U.S. Fish & Wildlife Service (USFWS) as endangered in 1994 (USFWS 1994). The 5-year review conducted in 2007 recommended down-listing to threatened status (USFWS 2007). The USFWS has determined that reclassifying the tidewater goby as threatened is warranted, and, has proposed to reclassify tidewater goby as threatened (Federal Register: March 13, 2014; Volume 79, Number 49).

Snyder (1913) did not find tidewater goby in his survey of the Salinas River; however, Hubbs (1947) collected tidewater goby in low to moderate abundance at three locations in the Salinas River Lagoon in August 1946. Tidewater gobies were recently collected again in the Salinas Lagoon in 2013 (HES 2014). Tidewater goby have also been found in Bennett Slough (northern end of Elkhorn Slough) (USFWS 2005). The critical habitat designation for tidewater goby includes Bennett Slough (north of the project area) and the Salinas River (USFWS 2013). The Salinas River however, does not include any special management considerations or protection of the essential physical or biological features, which include water diversions, alterations of water flows, and groundwater overdrafting because location is outside the geographical area occupied by the species at the time of listing.

The following life history and habitat discussion are primarily summarized from the Tidewater Goby Recovery Plan (USFWS 2005) and HES (2014).

***Life History***

Tidewater goby generally live for only 1 year, with few individuals living longer than a year. Reproduction occurs at all times of the year. Spawning activity peaks twice, once during the spring and again in the late-summer. Fluctuations in reproduction are probably due to death of breeding adults in early summer and colder temperatures or hydrologic disruptions in winter. Male tidewater gobies begin digging breeding burrows in relatively unconsolidated, clean, coarse sand, in April or May after lagoons close to the ocean. After hatching, the larval tidewater gobies emerge from the burrow and swim upward to feed on plankton. Juvenile tidewater gobies become benthic dwellers at 16 to 18 mm SL. Tidewater gobies are known to be preyed upon by native species such as small steelhead, prickly sculpin, and staghorn sculpin.

The USFWS characterizes tidewater goby populations (i.e., localities) along the California coast as metapopulations (a group of distinct populations that are genetically interconnected through occasional exchange of animals) (USFWS 2007). While individual populations may be periodically extirpated under natural conditions, a metapopulation is likely to persist through colonization or re-colonization events that establish new populations (USFWS 2007). Local populations of tidewater gobies occupy coastal lagoons and estuaries that, in most cases, are separated from each other by the open ocean. Very few tidewater gobies have ever been captured in the marine environment (Swift et al. 1989), which suggests this species rarely occurs in the open ocean (USFWS 2007). Some tidewater goby populations persist on a consistent basis (potential sources of individuals for re-colonization), while other tidewater goby populations appear to experience intermittent extirpations. Local extirpations may result from one or a series of factors, such as the drying up of some small streams during prolonged droughts, water diversions, and estuarine habitat modifications (USFWS 2007). Some localities where tidewater gobies have been extirpated apparently have been re-colonized when extant populations were present within a relatively short distance of the extirpated population (i.e., less than 6 miles (10 kilometers)). More recently, another tidewater goby researcher has suggested that re-colonizations have typically been between populations separated by no more than 10 miles (16 kilometers). Flooding during winter rains can contribute to re-colonization of estuarine habitats where tidewater goby populations have previously been extirpated. The closest known populations that could recolonize the Salinas River Lagoon is in the Elkhorn Slough. The mouth of Elkhorn Slough is connected to the Salinas River Lagoon through the Old Salinas River. The mouth of Elkhorn Slough is about 7 miles (11 kilometers) north of the Salinas River Lagoon.

***Habitat Characteristics***

The tidewater goby favors the calm conditions that prevail when the lagoons are cut off from the ocean by beach sandbars. They are bottom dwellers and are typically found at water depths of less than 3 feet. Tidewater gobies typically inhabit areas of slow-moving water, avoiding strong wave action or currents. Particularly important to the persistence of the species in lagoons is the presence of backwater, marshy habitats, which provide refuge habitat during winter flood flows. Optimal lagoon habitats are shallow, sandy-bottomed areas, surrounded by beds of emergent vegetation. Open areas are critical for breeding, while vegetation is critical for overwintering survival (providing refuge from high flows) and probably for feeding.

USFWS (2005) identify several criteria for lagoon conditions that favor tidewater gobies. These include: little or no channelization; allowing closure to the ocean for much of the year so that tidal fluctuation is absent or minimal; fresh unconsolidated sand is optimal for reproduction; high quality of inflowing water to increase habitable area of a lagoon in summer. Nutrient enrichment can stimulate algal blooms, deplete oxygen, and lead to hydrogen sulfide formation. Most fish species are intolerant of low dissolved oxygen and high hydrogen sulfide concentrations. Non-native predatory fish should be excluded. Centrarchid fish (sunfish and bass) and tidewater gobies are not usually found together and may not be able to coexist.

Gobies may move upstream during winter rains and high flows of inlet streams as well as during the summer when algal blooms and hydrogen sulfide forms in the substrate and enters the water column. During this period most fish are found at the upper end of lagoons where freshwater inflow occurs or at the seaward end where occasional waves wash into the lagoon.

### 3.0.4.3 *Monterey Roach*

***General Information on the Monterey Roach (Lavinia symmetricus subditus)***

Monterey Roach (*Lavinia symmetricus subditus*) is designated as a California Species of Special Concern (CSC), which is a designation conferred by the CDFW for those species that are considered to be indicators of regional habitat changes or are considered to be potential future protected species. Species of special concern are not necessarily afforded protection under the Fish and Game Code unless they are also identified in the code as California Fully Protected Species. The CSC designation is intended by the CDFW for use as a management tool to take these species into special consideration when decisions are made concerning the development of natural lands.

The Monterey form of California Roach formerly were widely distributed throughout streams in the Monterey Bay drainage, however, they are currently less widely distributed due to habitat loss and interspecific competition (Moyle 2002, MCWRA 2013b). They tend to be most abundant when found by themselves or with just one or two other species (Moyle 2002, MCWRA 2013b). In the absence of predatory fish species, roach will utilize the open waters of pools; otherwise they often stay within pool margins and amongst shallow water areas. Roach are omnivorous, mainly feeding on the bottom, but they can also feed on drift organisms such as terrestrial insects (Moyle 2002, MCWRA 2013b).

Little is known regarding the current status and distribution of Monterey roach in the Salinas River watershed. Monterey roach were collected on the Salinas River at RM 109 during recent rotary screw trap surveys (MCWRA 2013a). However, roach have not been reported to occur in the lower Salinas River, downstream of the Project. Roach have been reported to occur in the warmwater reaches of neighboring watersheds, including lower Natividad Creek/Laurel Pond, the lower Santa Rita Creek drainage, the Reclamation Ditch, Tembladero Slough, and the Old Salinas River.

# 4 IMPACT ANALYSIS METHODS

### 4.0.1 Impact Analysis Approach

The impact assessment addresses impacts on SCCC steelhead, tidewater goby and Monterey roach in the Salinas River by considering the proposed project long-term hydrologic changes associated with each of three diversion scenarios associated with the Groundwater Replenishment Project.

Each scenario is evaluated relative to a baseline condition that is defined as historic flow in the Salinas River near Spreckels plus the Salinas Industrial Wastewater Treatment Facility (Salinas Treatment Facility) outflow plus Salinas stormwater outfall. The baseline condition is also referred to as the Existing Condition scenario. The diversion scenarios are broadly defined as follows:

- Scenario A includes diverting Salinas stormwater outfall and Salinas Treatment Facility outflow, with no diversions from Blanco Drain
- Scenario B includes diverting Salinas stormwater outfall and Salinas Treatment Facility outflow, in addition to 2.99 cfs from Blanco Drain
- Scenario C includes diverting Salinas stormwater outfall and Salinas Treatment Facility outflow, in addition to up to 6 cfs (typically only up to 4.6 cfs) from Blanco Drain

Detailed assumptions associated with each of these scenarios are provided by Schaaf and Wheeler (2014).

The requirements for conducting analyses under CEQA include utilizing the best available information to conduct impact assessments. In the absence of final design specifications associated with all of the project components, environmental documents often rely of the use of qualitative analyses, which rely on an understanding of potential impact mechanisms and understanding of species habitat utilization and life history characteristics. These analyses focus on the types of impacts that could occur on a species that could be present at a general location during a general time of year. For each of the scenarios identified above, the impact mechanism with the highest potential for affecting SCCC steelhead in the Salinas River is a reduction in flow during adult immigration and juvenile outmigration (including smolt outmigration).

Because the diversion scenarios may result in reductions in river flows, the impact assessment focuses on these and other habitat based elements (e.g., water quality). The analytical framework used to assess these potential impacts is described below.

#### 4.0.1.1 *Analytical Tools*

The SCCC steelhead impact assessment relies on historic hydrologic data obtained from the Spreckels gage that has been conditioned based on assumptions regarding stormwater outfall and Salinas Treatment Facility outflow. By conditioning the data based on these assumptions, the historical data effectively became a baseline hydrologic modeling output against which potential alterations in flow associated with implementation of each of the diversion scenarios could be compared. Specifically, the diversion assumptions are applied to the estimated (modeled) baseline flows to obtain a specific set of estimated (modeled) flows associated with each of the diversion scenarios. These "modeled flows" provide a quantitative basis from which to assess the potential impacts of the three diversion scenarios on SCCC steelhead passage in the Salinas River at the Spreckels gage. Detailed discussion of development of the modeled flows is presented in Schaaf and Wheeler (2014).

#### 4.0.1.2 *Model Uncertainty*

The modeled flows used in these analyses, although mathematically precise, should be viewed as having inherent uncertainty. Nonetheless, for planning and impact assessment purposes this approach represents the best available information with which to conduct evaluations of proposed changes in flow diversion, and resulting Salinas River flows. Detailed discussion of specific assumptions used to develop the "modeled" flows is presented in Schaaf and Wheeler (2014).

### 4.0.2 Application of Model Output

Modeled flow results are used for comparative purposes, rather than for absolute predictions, and the focus of the analysis is on differences in the results among comparative scenarios (e.g., a comparison of estimated conditions under Scenario A, relative to the Existing Condition scenario [estimated without-project conditions]). All of the assumptions (e.g., hydrologic conditions, climatic conditions, upstream storage conditions, Salinas Lagoon conditions, etc.) are the same for the baseline, or existing conditions scenario and the diversion scenarios flow estimates, except assumptions associated with the diversion scenario itself, and the focus of the analysis is based primarily on the differences in modeled flow conditions among the three scenarios and the existing condition scenarios.

Raw model output included estimated daily flow for an 82-year period of record, which were conditioned to aggregate data in meaningful ways for the SCCC steelhead evaluation. Daily estimated flow data were used to develop exceedance probability distributions (exceedance curves) by month. These exceedance probability distributions were developed from ranked and sorted data, and show the percentage of time (probability) that a given value is exceeded. These curves show the general long-term differences in flow between an evaluated diversion scenario and the baseline scenario.

### 4.0.3 Impact Indicators

Impact indicators were developed to assess potential Project effects on steelhead life stages and related habitat conditions that are likely to be present in the affected reach of the Salinas River. Migration, both upstream for adults and downstream for adults and juveniles (smolts) are the potentially affected life stages. Potential project affects to these life stages are related to changes in flows. As such, impact indicators were developed as a means to assess potential effects on steelhead passage and migration resulting from each of the different Diversion Scenarios. Specifically, relative changes in modeled flow due to the Diversion Scenario and, predicted changes in frequency of the occurrence of migratory conditions, based on flow-based passage criteria, were used as quantitative indicators of potential effects to steelhead, as discussed in the following sections.

#### 4.0.3.1 *Stream Flow Changes*

Stream flow magnitude and timing are critical components of water supply, water quality, and the ecological integrity of river systems (Poff et al. 1997). Stream flow, which is strongly correlated with many critical physicochemical characteristics of rivers, can be considered a master variable that limits the distribution and abundance of riverine species (Power et al. 1995 and Resh et al. 1988 in Poff et al. 1997).

In order to identify potential effects of the Project's Diversion Scenarios on stream flow, a 10 percent decrease in flow relative to existing conditions was defined as the impact indicator. A decrease in monthly flow of 10 percent or greater has been previously identified by various environmental documents as an appropriate criterion to evaluate flow changes. For example, in the Trinity River Mainstem Fishery Restoration Draft EIS/EIR (USFWS et al. 1999), the USFWS identified reductions in flow of 10 percent or greater as changes that could be sufficient to reduce habitat quantity or quality to an extent that could significantly affect fish. The Trinity River EIS/EIR further states, "…[t]his assumption [is] very conservative…[i]t is likely that reductions in streamflows much greater than 10 percent would be necessary to significantly (and quantifiably) reduce habitat quality and quantity to an extent detrimental to fishery resources." Conversely, the Trinity River EIS/EIR considers increases in streamflow of 10 percent or greater, relative to the basis of comparison, to be "beneficial" to fish species.

In addition to the USFWS et al. (1999) criteria, the San Joaquin River Agreement EIS/EIR (USDOI et al. 1999) used USGS 1977 criteria thresholds, which were derived based on the ability to accurately measure stream flow discharges to ±10 percent. The criterion used to determine impacts associated with implementation of the San Joaquin Agreement was based on average percentage changes to stream flow relative to the basis of comparison. The San Joaquin River Agreement EIS/EIR considered flow changes of less than ±10 percent to be insignificant (USDOI et al. 1999).

The Freeport Regional Water Project Draft EIS/EIR (JSA 2003) used a similar rationale as the USGS documentation for selecting criteria to evaluate changes in flow. The Freeport EIS/EIR states: "Relative to the base case, a meaningful change in habitat is assumed to occur when the change in flow equals or exceeds approximately 10 percent. The 10 percent criterion is based on the assumption that changes in flow less than 10 percent are generally not within the accuracy of flow measurements, and will not result in measurable changes to fish habitat area."

Although the environmental documents listed above have been legally certified (i.e., Trinity River Mainstem Fishery Restoration Record of Decision December 19, 2000; San Joaquin River Agreement Record of Decision in March 1999; Freeport Regional Water Project Record of Decision January 4, 2005), biological justifications specific to using a 10 percent change as a criterion for a meaningful change in habitat affecting fisheries resources in a particular river have not been provided. Nevertheless, these documents apparently have resulted in consensus in the use of 10 percent when evaluating the potential effects of flow changes on fish and aquatic habitat.

Accordingly, this impact assessment relies on previously established information and, therefore, evaluates changes in monthly flow based on differences in frequency of daily flow changes of

10 percent or greater under the diversion versus baseline scenario. Specifically, a change of 10 percent or greater in long term flow, as expressed by flow exceedance probabilities is considered an indicator of potential impact on SCCC steelhead.

#### 4.0.3.2 *Temporal Considerations*

As discussed below, duration and timing are important components of a flow regime (Poff et al. 1997). Therefore, simply evaluating quantitative changes in flow magnitude during an analytical period (i.e., migration periods) could artificially overstate or understate impacts. However, a paucity of information exists regarding site specific effects of changes in flow over specific durations. Thus, utilizing a change in flow that occurs 10% of the time during an analytical evaluation period was used as an indicator of a duration and timing of flow change that could result in an impact on migrating steelhead.

#### 4.0.3.3 *Passage Thresholds*

In addition to the general assessment of the Diversion Scenario's potential effects on flow, specific, potential direct effects on upstream and downstream migration (passage impediments) were identified and evaluated. Specifically, flow levels that provide suitable conditions for upstream and downstream passage were established based on available literature and onsite evaluation at potential passage impediments. These flow values are treated as thresholds, below which passage is impaired, and serve as indicators of potential impact to passage for upstream migrating adults and downstream migrating juveniles and smolts. Specific passage thresholds are described below.

#### 4.0.3.4 *Qualitative Environmental Considerations*

Conducting fully quantitative analyses of potential impacts on steelhead requires information more detailed than is currently available. As such, impact analyses included qualitative assessment of unquantified components of the flow regime that can be used to characterize the entire range of flows and specific hydrologic phenomena (e.g., floods and low flows) that are vital to the integrity of river ecosystems, thus fish species. These components of the flow regime include: (1) magnitude; (2) frequency; (3) duration; (4) timing; and (5) rate of change of hydrologic conditions (Poff et al. 1997). Furthermore, Poff et al. (1997) report that by defining flow regimes in these terms, the ecological consequences of particular human activities that modify one or more components of the flow regime can be considered explicitly. Therefore, while modeled flows are evaluated using specific values as impact indicators (changes in flow of 10% or more, specific flow thresholds); other flow conditions are considered qualitatively in conjunction with quantitative evaluations. That is, the relative changes in magnitude, timing, etc. that are not quantitatively assessed are surrogate for potential change in habitat that conditions, such as rearing and migration associated with flood or high flows.

The requirements for conducting analyses under CEQA include utilizing the best available information to conduct impact assessments. In the absence of final design specifications or other site-specific information (e.g., flow-habitat relationships) environmental documents often rely of the use of qualitative analyses, which rely on an understanding of potential impact mechanisms and a detailed understanding of species habitat utilization and life history characteristics. Therefore, qualitative consideration of general habitat conditions in the potentially affected reaches also is included in the analyses of impacts on steelhead migration.

4.0.3.5 *Water Quality*

The Central Coast Regional Water Quality Control Board (CCRWQCB) Water Quality Control Plan for the Central Coast Basin (Basin Plan) designates beneficial uses of the Salinas River below Spreckels as including municipal and domestic supply, agricultural supply, non-contact water recreation, wildlife habitat, warm and cold water fish habitat, freshwater replenishment (of the Salinas Lagoon) and commercial or sport fishing. The Salinas River is listed as an impaired water body pursuant to Section 303(d) of the Clean Water Act for chlorides, pesticides, Escherichia coli, fecal coliform, nitrate, total dissolved solids, turbidity and other factors. Diversion related impacts that could further degrade water quality conditions and impair associated beneficial uses would be considered an impact indicator.

### 4.0.4 Species Specific Analytical Approach

The potential for changes in flows resulting from implementation of any of the three diversion scenarios to impact SCCC steelhead in the Salinas River is dependent on the ability of the species to use the affected reaches as a migratory corridor.

In addition to evaluating long-term flows, daily exceedance of specific flow thresholds identified in the literature as important for steelhead passage also was evaluated. The number of days when modeled flow in the Salinas River exceeds a specified flow threshold under the baseline scenario and does not exceed the same specified flow under a diversion scenario on the same day represents the number of days under each scenario when the diversion scenario caused modeled flows to be reduced below the threshold.

**Table 4** provides the timing of adult and juvenile presence in the Salinas River identified in various literature sources, as well as flow thresholds important for passage upstream (adults) and downstream (outmigrating juveniles and smolts).

**Table 4 – SCCC Steelhead life history periodicity and flow thresholds required for migratory passage in the Salinas River identified from various literature sources.**

| Life stage | Time Period* | Flow (in cfs) Required Downstream of Spreckles Gage for Steelhead Migratory Passage | Source Document | Notes** |
|---|---|---|---|---|
| Smolt Outmigration | March through June | N/A | NMFS 2007, Page 23 | In California, the outmigration of steelhead smolts typically begins in March and ends in late May or June (Titus *et al.* 2002). |
| | April through June | N/A | NMFS 2007, Page 23 | Snider (1983) states that in the Carmel River, most juvenile steelhead migrate to the ocean between April and June. |

| | | | | |
|---|---|---|---|---|
| | March through June | N/A | NMFS 2007, Page 74 | However, to assist our assessment of the project's effects on flows for smolt outmigration, we have assumed that properly functioning habitat conditions for this phase of the steelhead life history include substantial sustained flows for several weeks during the period of migration (late March through early June). |
| | Year-Round with peak emigration from April through June | 56 | MCWRA 2001, Section 5.6 | If a depth criteria of 0.4 feet is substituted in the analysis of passage transects in the Salinas River the resulting minimum passage flow estimates for downstream migration of post-spawning adults and smolts would be 112 cfs upstream of Spreckels and 56 cfs downstream of Spreckels. |
| | | 50 | | If it is also assumed that the 0.4 foot depth criteria were achieved over a continuous 8 foot channel width rather than 10% of the channel width, the minimum passage flow estimate would be further reduced to 59 cfs upstream of Spreckels and 50 cfs downstream of Spreckels. |
| | January through June | N/A | MCWRA 2013b, Page 3-118 | Steelhead smolts may immigrate to the ocean from January through June on the receding limb of the winter hydrograph. |
| | December 15 through March 31 | N/A | MCWRA 2013b, Page 3-119 | Seaward migration of juveniles may end earlier as compared to the other coastal drainages, because a greater amount of flow is required to provide safe passage conditions in the broad, sandy Salinas riverbed and the migration from rearing habitat in the tributaries is greater than 50 miles. NMFS (2003, p. 24) noted December 15 to March 31 as the juvenile steelhead migration season, which likely considers the above factors. |
| | March through June | N/A | MCWRA 2013b, Page 3-128-129 | … and steelhead smolt migration typically begins in March and ends in late-May or June, depending on flow and passage conditions. |
| | Jan 15 through May | N/A | MCWRA 2013b, Page 3-134 | …and downstream juvenile/kelt migration (mid-January through the end of May). |
| **Adult Immigration** | December 1 through April 15 | 72 | MCWRA 2001, Section 5.6 | Based on the Thompson criteria, a flow of about 72 cfs would meet the minimum migration needs for steelhead in the Lower Salinas downstream of Spreckels and a flow of 154 cfs would meet the minimum migration criteria upstream of Spreckels. Less flow is required downstream of Spreckels since the channel is narrower and more confined in this reach. |
| | | 60 | | Using the less restrictive width criterion of 8 feet instead of 25%, minimum passage flow estimates for adult steelhead in the Salinas River would be 94 cfs upstream of Spreckels and 60 cfs downstream of Spreckels. |
| | January through May | N/A | Moyle 2008, Page 80 | Adult steelhead return from the ocean to enter watersheds to spawn in SCC stream between January and May (Boughton et al. 2006) |
| | December | N/A | MCWRA 2013b, | NMFS indicates that adult steelhead in |

| | | | | |
|---|---|---|---|---|
| | through April | | Page 3-118 | this region migrate upstream primarily from December to April (NMFS 2007) |
| | November through June | N/A | NMFS 2007, Page 23 | Adult steelhead migrate to fresh water between November and June, peaking in March. |
| | December through April | N/A | NMFS 2007, Page 69 - 70 | Although the exact timing of adult upstream migration in the Salinas River is not known, data from other Central California coastal streams indicate that adult steelhead in this area migrate upstream primarily from December through April (Figure 11) |
| * Time periods provided represent the widest range indicated by the source document. For example, if a source document indicates a time period beginning sometime in March and ending in late May or June, the time period selected includes March through June | | | | |
| ** Time periods are selected based on source documents evaluated (e.g., NMFS 2007, MCWRA 2013b), although the source documents may cite additional sources. | | | | |

#### 4.0.4.1 *Analytical Time Periods*

Based on information presented in Table 4 comparisons of modeled flows for the three diversion scenarios, relative to the baseline scenario (the Existing Condition scenario), are conducted for the following life stages and life history periodicities:

- Adult Immigration (December through April)
- Juvenile and Smolt Emigration (March through June)

These time periods were selected for evaluation in this analysis to evaluate the bulk of the upstream migration and downstream emigration periods. The evaluation is intended to encompass the majority of steelhead migration in the Salinas River, including the peak migration periods, without potentially overestimating impacts.

#### 4.0.4.2 *Analytical Passage Threshold Flow Indicator Values*

Two sets of passage flow indicator values were evaluated to assess passage potential of upstream migrating adult steelhead and downstream migrating juveniles. As described in MCWRA (2001), these thresholds were based on evaluation of stream conditions as part of the Salinas Valley Water Project Draft Master EIR. MCWRA estimated passage flow requirements using field measurement of channel and flow characteristics and the application of objective criteria for conditions suitable for adult steelhead upstream migration based on water depth transects at critical passage sites using a method developed by Thompson (1972). MCWRA (2001) further states that the minimum flow for steelhead adult immigration occurs when, at the shallowest cross-sections, there is a depth of at least 0.6 feet across 25% of the channel width and there is a continuous section this deep across at least 10% of the channel width. Based on these criteria, a flow of about 72 cfs would meet the minimum migration needs for steelhead in the Lower Salinas downstream of the Spreckels gage. However, MCWRA (2001) noted that under some situations the 0.6 foot depth over 25% channel width criteria have been considered to be overly restrictive and less conservative criteria have been applied. Using a less restrictive width criterion of 8 feet instead of 25%, minimum passage flow estimates for adult steelhead in the Salinas River would be 60 cfs downstream of Spreckels (RM 13.2).

Because juvenile passage criteria have not been widely developed, MCWRA (2001) modified the adult upstream passage criteria to accommodate downstream migrating juveniles based on the assumption that emigrating juvenile steelhead can migrate downstream over riffle areas at shallower depths than those needed by adults migrating upstream. If a depth criterion of 0.4 feet is substituted in the analysis of passage transects in the Salinas River the resulting minimum passage flow estimates for downstream migration of smolts would be 56 cfs downstream of Spreckels. If it is also assumed that the 0.4 foot depth criteria were achieved over a continuous 8 foot channel width rather than 10% of the channel width, the minimum passage flow estimate would be further reduced to 50 cfs downstream of Spreckels (MCWRA 2001).

Therefore, the following passage flow indicator values were evaluated:

- Adult Immigration – 60 cfs and 72 cfs at Spreckels
- Juvenile and Smolt Emigration – 50 cfs and 56 cfs at Spreckels

### 4.0.5 Evaluation Criteria and Significance Thresholds

As described above, a 10 percent scenario-induced change in existing flow, as well as 10 percent scenario-induced changes in flows that occur 10 percent or more of the time, are used as impact indicators, but are not meant to serve as a significance thresholds for CEQA purposes. Instead, these impact indicators serve as mechanisms to compare a Diversion Scenario to a baseline condition. Additionally, site-specific flow thresholds and qualitative consideration of general habitat and flow conditions also are utilized in conducting the evaluation of flow-related impacts on steelhead. Impact determinations will be based on consideration of all evaluated impact indicators for all life stages for a particular species.

The California Environmental Quality Act (CEQA) Guidelines provide a discussion of significance criteria for evaluation of environmental effects of a project. Specifically, significance criteria represent the thresholds that were used to identify whether an impact would be considered significant under CEQA. However, these significance criteria do not provide quantitative thresholds against which simulated hydrologic data can be compared to identify potential impacts. Appendix G of the CEQA Guidelines suggests the following evaluation criteria for biological resources:

Would the project:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service;
- Conflict with any local policies or ordinances protecting fishery resources; or

- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Conservation Community Plan, or other approved local, regional, or state habitat conservation plan?

The evaluation criteria used for impact analysis represent a combination of the Appendix G criteria and professional judgment that considers current regulations, standards, and/or consultation with agencies, knowledge of the area, and consideration of the context and intensity of the environmental effects. Specifically, for the SCCC steelhead impact assessment, significance determinations are based on consideration of all evaluated impact indicators (e.g., 10 percent change in long-term flow, differences in exceedance of flow thresholds). An impact is considered significant if implementation of the Diversion Scenario would substantially adversely affect steelhead based on evaluation of the changes in flows. For the purposes of this analysis, the effect of a Diversion Scenario would be considered less than significant if it would result in any of the following:

- A change in average monthly stream flow of less than 10%.
- A change in flow of less than 10%, relative to specific flow thresholds during steelhead adult or smolt migration periods.
- Changes in flow that occur less than 10% of the time during the analytical period

Furthermore, for an impact to be considered less than significant, implementation of a Diversion Scenario will not cause creation of an obstacle or hazard to migrating steelhead (adults, juveniles or smolts).

Therefore, for the purposes of this analysis, a diversion Case scenario would result in a significant impact to aquatic biological resources if it would result in the following:

- A substantial adverse effect (directly, through habitat modifications, by interfering with the movement of native fish species, or by impeding the use of native fish nursery/rearing sites) on SCCC steelhead.

# 5 IMPACT ANALYSIS

The impact assessment of aquatic biological resources consisted of a comparative evaluation of hydrologic conditions (i.e., change in flow frequency, change in flow based habitat availability) between current conditions and each of the diversion scenarios.

The quantitative assessment of potential flow-related impacts included evaluation of: (1) changes in monthly long-term flows (exceedance probability distributions based on hydrologic record of 82 years) using occurrence (> 10 percent of the time) of a 10 percent or more reduction in simulated diversion scenario flow conditions, relative to a baseline condition as indicators of impact; and (2) differences in occurrence of suitable fish passage conditions using percent reduction in current daily flows from suitable to unsuitable relative to meeting specified passage thresholds (Table 4). Qualitative interpretation of flow changes, relative to general habitat conditions and water quality is also considered in the analysis.

Implication of effects on aquatic resources using an analysis of flow exceedance is complicated by the runoff patterns in coastal streams, like the Salinas River; coastal, rain dominated streams display substantial variation in flows during most months, as clearly depicted in the nearly vertical portion of the exceedance curves with the Y-axis scaled to 100 cfs (**Figure 1b**). These curves suggest that exceedance probability between 10 cfs and 100 cfs is typically less than 15 percent, which means that when flows reach 10 cfs they are likely to reach 100 cfs and that flows greater than 10 cfs are infrequent. Furthermore, evaluation of the exceedance probability distributions indicates that, while flows can get very high in any month, flows generally are substantially less than 80 percent of the maximum flow over 80 percent of the time. For example, during December the maximum modeled flow under the baseline condition (the Existing Condition scenario) is over 39,000 cfs. However, modeled flows are below approximately 55 cfs for 80 percent of the time and are below approximately 15 cfs for 50 percent of the time. Therefore, substantial flow reductions, as indicated by reductions of 10 percent or more, occur more frequently at lower flows simply because small reductions in flow represent a large percentage of the total flow. As such, evaluating only the percentage of time when flow reductions of 10 percent or more occur may be misleading when considered as an indicator of impacts on biological resources and their habitats because a 10 percent reduction in flow would not necessarily result in a substantial loss of migratory habitat or a substantial reduction in passage potential, as summarized below. In such cases, best professional judgment is used to determine whether impacts associated with these reductions would be considered substantial.

### 5.0.1 Scenario A Analysis

As described by Schaaf and Wheeler (2014), Scenario A reduces flow in the Salinas River by diverting City of Salinas stormwater (RM 11.2) and Salinas Treatment Facility inflow (RM 9.2-10.7). Scenario A does not include Blanco Drain diversions. The effect of Scenario A on Salinas River flow was analyzed at RM 4.7.

Overall, Scenario A diverts less than 1 percent of the baseline mean annual flow (Schaaf and Wheeler 2014). However, due to the flashy nature of runoff in the Salinas River, the majority of flow occurs during a very brief period, which means that the likelihood of Scenario A (diversion rate of 3 cfs) to incur a 10 percent or greater reduction in flow (i.e., when flow is 30 cfs or less), is high. The probability of exceeding 30 cfs (i.e., exceedance probability) ranges from the highest probability of exceedance of 66 percent in February to less than 16 percent in June. As such, exceedance probability distributions of modeled daily flows aggregated by month from December through June (encompassing both the adult immigration and juvenile outmigration periods) indicate that flows under Scenario A are generally similar (slightly reduced), relative to the baseline scenario (the Existing Condition scenario) when flows are above 30 cfs during all months evaluated (**Figure 1**). However, flow reductions range from occurring approximately 34 percent of the time during February to approximately 84 percent of the time during June. **Table 5** displays the percentage of time when reductions in flow attributable to Scenario A diversion occur in the December through June period. Further, as flow decreases below 30 cfs, relatively small flow reductions resulting from increased diversions under Scenario A become proportionately greater, which occurs during all months evaluated. Therefore, reductions in flow of 10 percent or more occur during all months of the SCCC steelhead adult immigration and juvenile outmigration periods under Scenario A.

A more direct assessment of diversion effects on steelhead evaluates the reduction in suitable fish passage conditions under Scenario A. Therefore, each of the identified passage flow indicator values was evaluated. Specifically, the number and percentage of days in each month (over the entire 82-year period of record) was identified when Scenario A resulted in reducing flow from above to below a migratory flow threshold (**Table 6**). Suitable migration flows were reduced below each of the passage flow indicator values less than 1 percent of the time under Scenario A, relative to the Existing Condition scenario (Table 6).

Overall occurrence of suitable adult steelhead migration conditions (i.e., occurrence of threshold flows) were reduced about 1 percent for both the 60 cfs and 72 cfs thresholds (Table 6). The 60 cfs threshold was reduced a total of 58 days out of the 12,434 days modeled during the upstream migration period (December-April). In comparison to existing conditions, the percent occurrence of 60 cfs or greater flows during the upstream migration period was reduced 0.5 percent, from 46.5 to 46.0 percent. Percent reductions ranged from 0.1 percent in April to 0.7 percent in December and January. The net change in days meeting the 60 cfs threshold (i.e., reduction in days meeting the threshold under existing conditions) was 1 percent overall (58 out of 5,773 days). Net reduction ranged from 0.3 percent in April to 3.5 percent in December.

Similarly, the 72 cfs threshold was reduced 54 days out of the 12,434 days modeled during the upstream migration period (December-April). The percent occurrence of 72 cfs or greater flows during the upstream migration period was reduced 0.4 percent, from 45.0 to 44.6 percent. Percent reductions ranged from 0.3 percent in March to 0.6 percent in December. The net change in days meeting the 72 cfs threshold was less than 1 percent overall (54 out of 5,598 days). Net reduction ranged from 0.5 percent in April to 3.2 percent in December.

Overall occurrence of suitable juvenile steelhead migration conditions (i.e., occurrence of threshold flows) were reduced less than 1 percent for both the 50 cfs and the 56 cfs thresholds (Table 6). The 50 cfs threshold was reduced a total of 51 days out of the 10,004 days modeled during the downstream migration period (March-June). In comparison to existing conditions, the percent occurrence of 50 cfs or greater flows during the upstream migration period was reduced 0.5 percent, from 37.8 to 37.3 percent. Percent reductions ranged from 0.2 percent in June to 0.9 percent in May. The net change in days meeting the 50 cfs threshold (i.e., reduction in days meeting the threshold under existing conditions) was 1.3 percent overall (51 out of 3,780 days). Net reduction ranged from 0.8 percent in March to 3.1 percent in May.

Similarly, the 56 cfs threshold was reduced 43 days out of the 10,004 days modeled. The percent occurrence of 56 cfs or greater flows during the upstream migration period was reduced 0.4 percent, from 37.0 to 36.6 percent. Percent reductions ranged from 0.2 percent in June to 0.6 percent in May. The net change in days meeting the 56 cfs threshold was 1.2 percent overall (43 out of 3,700 days). Net reduction ranged from 0.8 percent in March to 2.1 percent in May.

Schaff and Wheeler (2014) report that the stormwater runoff is generally of equal or better quality than the Salinas River, which receives it. Stormwater runoff meets the Central Coast RWQCB Basin Plan objectives in most categories. In the categories of turbidity and orthophosphate, it exceeds the basin plan objectives but is below the average concentration in the receiving stream. Diverting stormwater runoff to the Proposed Project should, therefore, have no appreciable effect on water quality within the Salinas River.

Effluent from the SIWTF is also generally of equal or better quality than the Salinas River. The exception in this case is Total Dissolved Solids (TDS), which exceeds both the Basin Plan objective and the quality of the receiving stream. Diverting Industrial Wastewater to the Proposed Project may result in reduced TDS levels in the river, particularly in summer months during low flow periods, outside the steelhead migration periods.

#### 5.0.1.1 *Scenario A Conclusion*

In general, modeled flows were reduced under Scenario A, relative to the Existing Condition scenario. Implementation of Scenario A is anticipated to reduce flows in the Salinas River during the SCCC steelhead adult immigration period by 1 percent and during the juvenile outmigration period by about 1.3 percent, relative to existing conditions. However, the effect of Scenario A on occurrence of suitable fish passage conditions (passage thresholds) is very infrequent (monthly reductions in flows meeting passage thresholds, relative to existing conditions occur from less than 1% of the time to no more than just over 3 percent of the time during juvenile and adult migration periods). Furthermore, flow reductions which seem disproportionately high during the lowest flow periods, are likely to have relatively little effect on steelhead migration. Implementation of Scenario A would not have an effect on the occurrence of high flows, flows greater than 100 cfs, which are more closely associated with steelhead migration than the threshold flows used in this evaluation, nor on availability of potential rearing habitat associated with side channel and flood plain inundation. Therefore, in consideration of the timing, frequency, magnitude, and duration of flow changes that could occur associated with implementing Scenario A, these flow changes are not considered to be substantial impacts on SCCC Steelhead.

There is a limited potential for tidewater goby and Monterey roach to occur downstream of the project site. Since these species prefer quiescent conditions, flow reductions would not be expected to have a detrimental effect on them, should they be present

Additionally, removing stormwater runoff and Salinas Treatment Facility effluent should have no appreciable effect on water quality within the Salinas River.

Overall, flow reductions associated with implementation of Scenario A, relative to the Existing Condition is considered to be ***Less than Significant*** on SCCC Steelhead, Monterey roach, and tidewater goby.

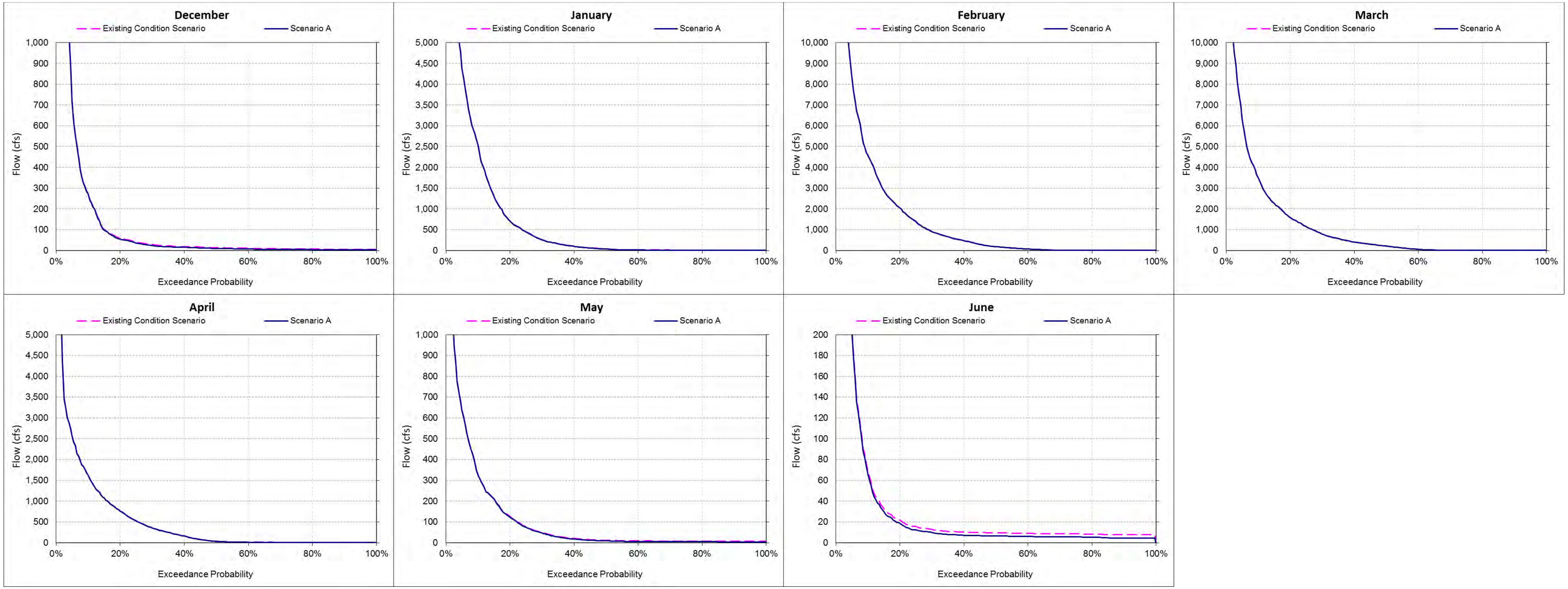


**Figure 1a – Monthly exceedance probability distributions of modeled daily flows for Scenario A and the Existing Condition scenario.**

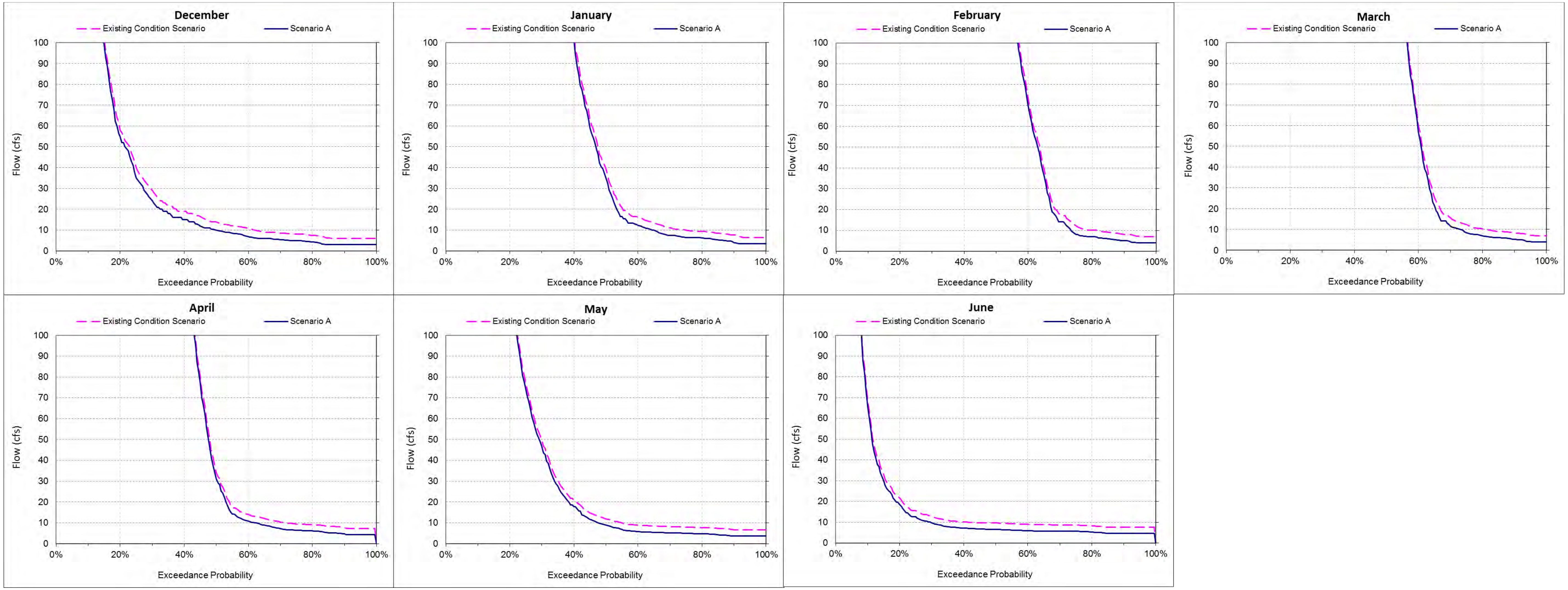


**Figure 1b – Monthly exceedance probability distributions of modeled daily flows for Scenario A and the Existing Condition scenario (y-axis scale restricted to 100 cfs).**

**Table 5 – Percentages of time that modeled flows under Scenario A are less than modeled flows under the baseline condition (the Existing Condition scenario) during both the SCCC steelhead adult immigration period (December through April) and juvenile outmigration period (March through June).**

| Analytical Scenario | December | January | February | March | April | May | June |
|---|---|---|---|---|---|---|---|
| **Percent of time Scenario A has less flow than the Existing Condition Scenario** | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| **Percent of time Scenario A has slightly less flow than the Existing Condition Scenario (1% < X <10%)** | 16.6% | 22.9% | 22.3% | 20.2% | 20.2% | 24.4% | 12.3% |
| **Percent of time Scenario A has substantially less flow than the Existing Condition Scenario (X > 10% )** | 75.6% | 50.2% | 34.4% | 37.3% | 48.7% | 64.9% | 84.3% |
| **Total Days Modeled** | 2,573 | 2,542 | 2,317 | 2,542 | 2,460 | 2,542 | 2,460 |

**Table 6 – Model results estimates of the number of days and percentage of time represented by those days that diversions under Scenario A caused flows in the Salinas River to be reduced below the adult and juvenile passage thresholds relative to potential number of passage days and baseline conditions.**

| Life stage/ Period | Number of days meeting threshold | | Percent of potential migration period meeting threshold | | Change in percentage of potential migration period meeting threshold (%) | Reduction in number of days meeting threshold relative to baseline | Reduction in threshold occurrence relative to baseline (%) |
|---|---|---|---|---|---|---|---|
| | Baseline | Scenario A | Baseline | Scenario A | | | |
| **Adult upstream Migration** | | | | | | | |
| **60 cfs threshold** | | | | | | | |
| **Dec** | 508 | 490 | 19.7 | 19.0 | 0.7 | 18 | 3.5 |
| **Jan** | 1,160 | 1,142 | 45.6 | 44.9 | 0.7 | 18 | 1.6 |
| **Feb** | 1,430 | 1,420 | 61.7 | 61.3 | 0.4 | 10 | 0.7 |
| **Mar** | 1,524 | 1,515 | 60.0 | 59.6 | 0.4 | 9 | 0.6 |
| **Apr** | 1,151 | 1,148 | 45.3 | 45.2 | 0.1 | 3 | 0.3 |
| **All** | 5,773 | 5,715 | 46.5 | 46.0 | 0.5 | 58 | 1.0 |
| **72 cfs threshold** | | | | | | | |
| **Dec** | 467 | 452 | 18.2 | 17.6 | 0.6 | 15 | 3.2 |
| **Jan** | 1,111 | 1,099 | 43.2 | 43.2 | 0.5 | 12 | 1.0 |
| **Feb** | 1,397 | 1,387 | 59.9 | 59.9 | 0.4 | 10 | 0.7 |
| **Mar** | 1,498 | 1,490 | 58.6 | 58.6 | 0.3 | 8 | 0.5 |
| **Apr** | 1,125 | 1,116 | 43.9 | 43.9 | 0.4 | 9 | 0.8 |
| **All** | 5,598 | 5,598 | 45.0 | 44.6 | 0.4 | 54 | 1.0 |
| **Juvenile Downstream Migration** | | | | | | | |
| **50 cfs threshold** | | | | | | | |
| **Mar** | 1,555 | 1,542 | 61.2 | 60.7 | 0.5 | 13 | 0.8 |
| **Apr** | 1,179 | 1,171 | 46.4 | 46.1 | 0.3 | 8 | 0.7 |
| **May** | 762 | 738 | 30.0 | 29.0 | 0.9 | 24 | 3.1 |
| **Jun** | 284 | 278 | 11.5 | 11.3 | 0.2 | 6 | 2.1 |
| **All** | 3,780 | 3,729 | 37.8 | 37.3 | 0.5 | 51 | 1.3 |
| **56 cfs threshold** | | | | | | | |
| **Mar** | 1,539 | 1,526 | 60.5 | 60.0 | 0.5 | 13 | 0.8 |
| **Apr** | 1,166 | 1,156 | 45.9 | 45.5 | 0.4 | 10 | 0.9 |
| **May** | 720 | 705 | 28.3 | 27.7 | 0.6 | 15 | 2.1 |
| **Jun** | 275 | 270 | 11.2 | 11.0 | 0.2 | 5 | 1.8 |
| **All** | 3,700 | 3,657 | 37.0 | 36.6 | 0.4 | 43 | 1.2 |

### 5.0.2 Scenario B Analysis

As described by Schaaf and Wheeler (2014), Scenario B reduces flow in the Salinas River by diverting City of Salinas stormwater (RM 11.2) and Salinas Treatment Facility inflow (RM 9.2-10.7) as well as 2.99 cfs from Blanco Drain (RM 5.1). The effect of Scenario B on Salinas River flow was analyzed at RM 4.7.

Overall, Scenario B diverts less than 1.5 percent of the baseline mean annual flow (Schaaf and Wheeler 2014). However, as discussed above, due to the flashy nature of runoff in the Salinas River, the majority of flow occurs during a very brief period, which means that the likelihood of Scenario B (diversion rate of 5.99 cfs) to incur a 10 percent or greater reduction in flow (i.e., when flow is 60 cfs or less), is high. The probability of exceeding 60 cfs ranges from the highest probability of exceedance of 62 percent in February to less than 11 percent in June. As such, exceedance probability distributions of modeled daily flows aggregated by month from December through June (encompassing both the adult immigration and juvenile outmigration periods) indicate that flows under Scenario B are generally similar (slightly reduced), relative to the baseline scenario (the Existing Condition scenario) when flows are above 60 cfs during all months evaluated (**Figure 2**). However, flow reductions range from occurring approximately 39 percent of the time during February to approximately 89 percent of the time during June. **Table 7** displays the percentage of time when reductions in flow attributable to Scenario B diversion occur in the December through June period. Further, as flow decreases below 60 cfs, relatively small flow reductions resulting from increased diversions under Scenario B become proportionately greater, which occurs during all months evaluated. Therefore, reductions in flow of 10 percent or more occur during all months of the SCCC steelhead adult immigration and juvenile outmigration periods under Scenario B.

However, as previously described for Scenario A, substantial flow reductions, as indicated by reductions of 10 percent or more, occur more frequently at lower flows simply because small reductions in flow represent a large percentage of the total flow when a 10 percent reduction in flow would not necessarily result in a substantial loss of migratory habitat or a substantial reduction in passage potential. Therefore, as discussed above, evaluating only the percentage of time when flow reductions of 10 percent or more occur may confound the analysis.

A more direct assessment of diversion effects on steelhead evaluates the reduction in suitable fish passage conditions due to Scenario B. Therefore, each of the identified passage flow indicator values was evaluated. Specifically, the number and percentage of days in each month (over the entire 82-year period of record) was identified when Scenario B resulted in reducing flow from above to below a migratory flow threshold (**Table 8**).

Overall occurrence of suitable adult steelhead migration conditions (i.e., occurrence of threshold flows) were reduced less than 2 percent for both the 60 cfs and 72 cfs thresholds (Table 8). The 60 cfs threshold was reduced a total of 104 days out of the 12,434 days modeled during the upstream migration period (December-April). In comparison to existing conditions, the percent occurrence of 60 cfs or greater flows during the upstream migration period was reduced 0.9 percent, from 46.5 to 45.6 percent. Percent reductions ranged from 0.4 percent in March and April to 1.2 percent in December. The net change in days meeting the 60 cfs threshold (i.e., reduction in days meeting the threshold under existing conditions) was 1.8 percent overall (104 out of 5,773 days). Net reduction ranged from 0.7 percent in March to 6.3 percent in December.

Similarly, the 72 cfs threshold was reduced 84 days out of the 12,434 days modeled during the upstream migration period (December-April). The percent occurrence of 72 cfs or greater flows during the upstream migration period was reduced 0.6 percent, from 45.0 to 44.4 percent. Percent reductions ranged from 0.4 percent in March to 0.9 percent in December. The net change in days meeting the 72 cfs threshold was 1.5 percent overall (104 out of 5,598 days). Net reduction ranged from 0.7 percent in March to 4.9 percent in December.

Overall occurrence of suitable juvenile steelhead migration conditions (i.e., occurrence of threshold flows) were reduced about 2 percent for both the 50 cfs and the 56 cfs thresholds (Table 8). The 50 cfs threshold was reduced a total of 80 days out of the 10,004 days modeled during the downstream migration period (March-June). In comparison to existing conditions, the percent occurrence of 50 cfs or greater flows during the upstream migration period was reduced 0.8 percent, from 37.8 to 37.0 percent. Percent reductions ranged from 0.4 percent in June to 1.7 percent in May. The net change in days meeting the 50 cfs threshold (i.e., reduction in days meeting the threshold under existing conditions) was 2.1 percent overall (80 out of 3,780 days). Net reduction ranged from 1.0 percent in March to 5.5 percent in May.

Similarly, the 56 cfs threshold was reduced 73 days out of the 10,004 days modeled. The percent occurrence of 56 cfs or greater flows during the upstream migration period was reduced 0.7 percent, from 37.0 to 36.3 percent. Percent reductions ranged from 0.6 percent in June to 0.9 percent in May. The net change in days meeting the 56 cfs threshold was 2.0 percent overall (73 out of 3,700 days). Net reduction ranged from 1.2 percent in March to 5.5 percent in May.

Effects on water quality are as described above, for Scenario A.

### 5.0.3 Scenario B Conclusion

In general, modeled flows were reduced under Scenario B, relative to the Existing Condition scenario. Implementation of Scenario B is anticipated to reduce flows in the Salinas River during the SCCC steelhead adult immigration period by 1.8 percent and during the juvenile outmigration period by about 2.1 percent relative to existing conditions. However, the effect of Scenario B on occurrence of suitable fish passage conditions (passage thresholds) is very infrequent (monthly reductions in flows meeting passage thresholds relative to existing conditions occur from less than 1% of the time to no more than 5.5 percent of the time during juvenile and adult migration periods). Furthermore, flow reductions would be disproportionately high during the lowest flow periods. Implementation of Scenario B would not have an effect on the occurrence of high flows, flows greater than 100 cfs, which are more closely associated with steelhead migration than the threshold flows used in this evaluation, nor on availability of potential rearing habitat associated with side channel and flood plain inundation. Therefore, in consideration of the timing, frequency, magnitude, and duration of flow changes that could occur associated with implementing Scenario B, these flow changes are not considered to be substantial impacts on SCCC Steelhead.

There is a limited potential for tidewater goby and Monterey roach downstream of the project site. Since these species prefer quiescent conditions, flow reductions would not be expected to have a detrimental effect on them, should they be present

Additionally, removing stormwater runoff and Salinas Treatment Facility effluent should have no appreciable effect on water quality within the Salinas River.

Overall, flow reductions associated with implementation of Scenario B, relative to the Existing Condition is considered to be ***Less than Significant*** on SCCC Steelhead, Monterey roach, and tidewater goby.

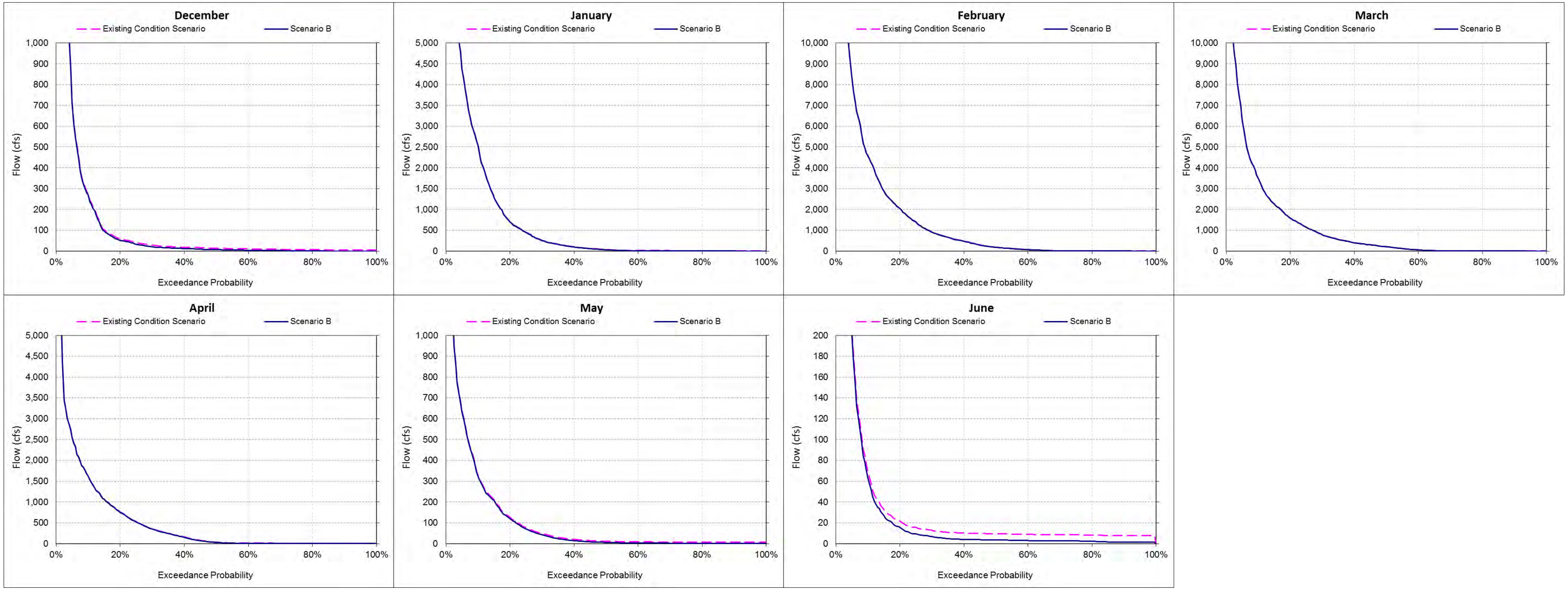


**Figure 2a – Monthly exceedance probability distributions of modeled daily flows for Scenario B, relative to the Existing Condition scenario.**

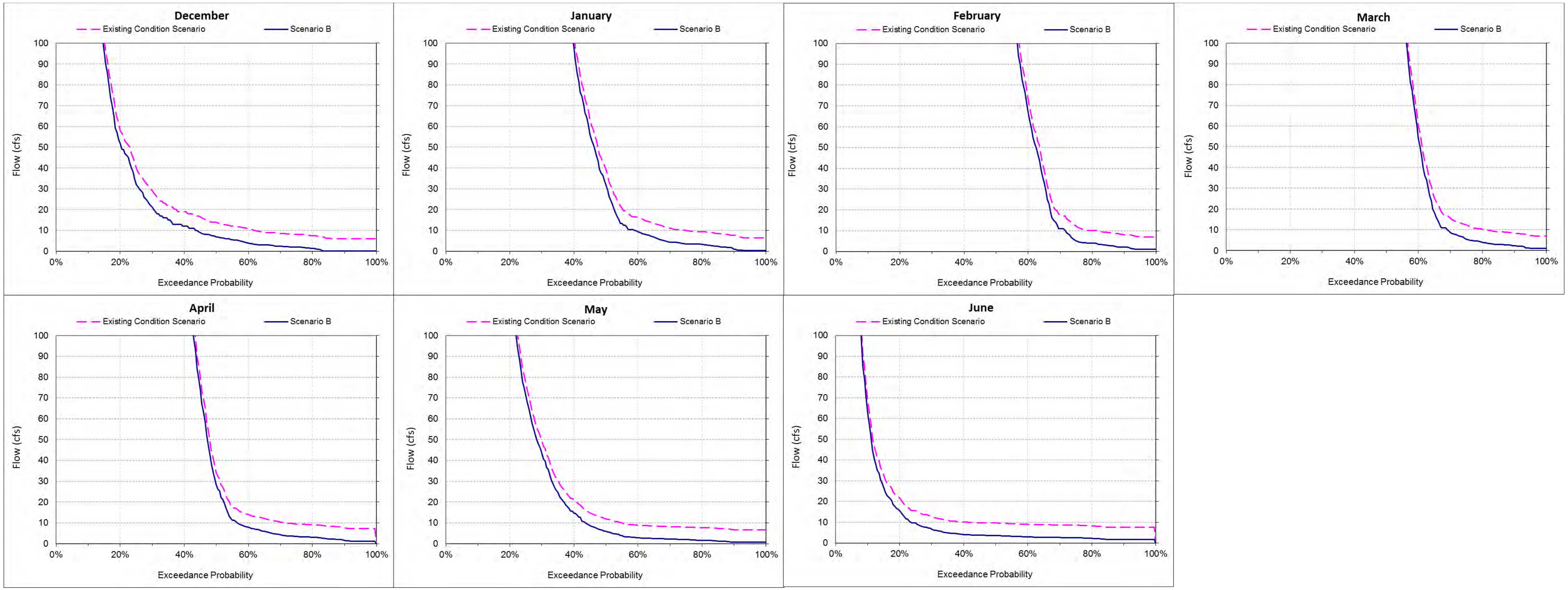


**Figure 2b – Monthly exceedance probability distributions of modeled daily flows for Scenario B, relative to the Existing Condition scenario (y-axis restricted to 100 cfs).**

**Table 7 – Percentages of time that modeled flows under Scenario B are less than modeled flows under the baseline condition (the Existing Condition scenario) during both the SCCC steelhead adult immigration period (December through April) and juvenile outmigration period (March through June).**

| Analytical Scenario | December | January | February | March | April | May | June |
|---|---|---|---|---|---|---|---|
| **Percent of time Scenario B has less flow than the Existing Condition Scenario** | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| **Percent of time Scenario B has slightly less flow than the Existing Condition Scenario (1% < X <10%)** | 12.6% | 24.0% | 26.5% | 27.2% | 24.0% | 22.0% | 10.1% |
| **Percent of time Scenario B has substantially less flow than the Existing Condition Scenario (X > 10% )** | 82.2% | 55.6% | 38.5% | 40.1% | 53.4% | 72.3% | 89.2% |
| **Total Days Modeled** | 2,573 | 2,542 | 2,317 | 2,542 | 2,460 | 2,542 | 2,460 |

**Table 8 – Model results estimates of the number of days and percentage of time represented by those days that diversions under Scenario B caused flows in the Salinas River to be reduced below the adult and juvenile passage thresholds relative to potential number of passage days and baseline conditions.**

| Life stage/ Period | Number of days meeting threshold | | Percent of potential migration period meeting threshold | | Change in potential migration period meeting threshold (%) | Reduction in number of days meeting threshold relative to baseline | Reduction in threshold occurrence relative to baseline (%) |
|---|---|---|---|---|---|---|---|
| | Baseline | Scenario B | Baseline | Scenario B | | | |
| **Adult upstream Migration** | | | | | | | |
| **60 cfs threshold** | | | | | | | |
| **Dec** | 508 | 476 | 19.7 | 18.5 | 1.2 | 32 | 6.3 |
| **Jan** | 1,160 | 1,133 | 45.6 | 44.6 | 1.1 | 27 | 2.3 |
| **Feb** | 1,430 | 1,407 | 61.7 | 60.7 | 1.0 | 23 | 1.6 |
| **Mar** | 1,524 | 1,513 | 60.0 | 59.5 | 0.4 | 11 | 0.7 |
| **Apr** | 1,151 | 1,140 | 46.8 | 46.3 | 0.4 | 11 | 1.0 |
| **All** | 5,773 | 5,669 | 46.5 | 45.6 | 0.9 | 104 | 1.8 |
| **72 cfs threshold** | | | | | | | |
| **Dec** | 467 | 444 | 18.2 | 17.3 | 0.9 | 23 | 4.9 |
| **Jan** | 1,111 | 1,099 | 43.7 | 43.2 | 0.5 | 12 | 1.1 |
| **Feb** | 1,397 | 1,376 | 60.3 | 59.4 | 0.9 | 21 | 1.5 |
| **Mar** | 1,498 | 1,487 | 58.9 | 58.5 | 0.4 | 11 | 0.7 |
| **Apr** | 1,125 | 1,108 | 45.7 | 45.0 | 0.7 | 17 | 1.5 |
| **All** | 5,598 | 5,514 | 45.0 | 44.4 | 0.6 | 84 | 1.5 |
| **Juvenile downstream migration** | | | | | | | |
| **50 cfs threshold** | | | | | | | |
| **Mar** | 1,555 | 1,540 | 61.2 | 60.6 | 0.6 | 15 | 1.0 |
| **Apr** | 1,179 | 1,165 | 47.9 | 47.4 | 0.6 | 14 | 1.2 |
| **May** | 762 | 720 | 30.0 | 28.3 | 1.7 | 42 | 5.5 |
| **Jun** | 284 | 275 | 11.5 | 11.2 | 0.4 | 9 | 3.2 |
| **All** | 3,780 | 3,700 | 37.8 | 37.0 | 0.8 | 80 | 2.1 |
| **56 cfs threshold** | | | | | | | |
| **Mar** | 1,539 | 1,520 | 60.5 | 59.8 | 0.7 | 19 | 1.2 |
| **Apr** | 1,166 | 1,150 | 47.4 | 46.7 | 0.7 | 16 | 1.4 |
| **May** | 720 | 697 | 28.3 | 27.4 | 0.9 | 23 | 3.2 |
| **Jun** | 275 | 260 | 11.2 | 10.6 | 0.6 | 15 | 5.5 |
| **All** | 3,700 | 3,627 | 37.0 | 36.3 | 0.7 | 73 | 2.0 |

### 5.0.4 Scenario C Analysis

As described by Schaaf and Wheeler (2014), Scenario C, similar to Scenario B, reduces flow in the Salinas River by diverting City of Salinas stormwater (RM 11.2) and Salinas Treatment Facility inflow (RM 9.2-10.7) as well as from Blanco Drain (RM 5.1). Under Scenario C, diversion from Blanco Drain is 6 cfs (rather than 2.99 cfs under Scenario B). The effect of Scenario C on Salinas River flow was analyzed at RM 4.7.

Overall, Scenario C diverts less than 2 percent of the baseline mean annual flow (Schaaf and Wheeler 2014). However, as discussed above, due to the flashy nature of runoff in the Salinas River, the majority of flow occurs during a very brief period, which means that the likelihood of Scenario C (diversion rate of 8.99 cfs) to incur a 10 percent or greater reduction in flow (i.e., when flow is 90 cfs or less), is high. The probability of exceeding 90 cfs ranges from the highest probability of exceedance of 60 percent in February to less than 10 percent in June. As such, exceedance probability distributions of modeled daily flows aggregated by month from December through June (encompassing both the adult immigration and juvenile outmigration periods) indicate that flows under Scenario C are generally similar (slightly reduced), relative to the baseline scenario (the Existing Condition scenario) when flows are above 90 cfs during all months evaluated (**Figure 3**). However, flow reductions ranges from occurring approximately 40 percent of the time during February to approximately 90 percent of the time during June. **Table 9** displays the percentage of time when reductions in flow attributable to Scenario A diversion occur in the December through June period. Further, as flow decreases below 90 cfs, relatively small flow reductions resulting from increased diversions under Scenario C become proportionately greater, which occurs during all months evaluated. Therefore, reductions in flow of 10 percent or more occur during all months of the SCCC steelhead adult immigration and juvenile outmigration periods under Scenario C.

However, as previously described for Scenario A, substantial flow reductions, as indicated by reductions of 10 percent or more, occur more frequently at lower flows simply because small reductions in flow represent a large percentage of the total flow when a 10 percent reduction in flow would not necessarily result in a substantial loss of migratory habitat or a substantial reduction in passage potential. Therefore, as discussed above, evaluating only the percentage of time when flow reductions of 10 percent or more occur may confound the analysis.

A more direct assessment of diversion effects on steelhead evaluates the reduction in suitable fish passage conditions due to Scenario C. Therefore, each of the identified passage flow indicator values was evaluated. Specifically, the number and percentage of days in each month (over the entire 82-year period of record) was identified when Scenario C resulted in reducing flow from above to below a migratory flow threshold (**Table 10**). Suitable migration flows were reduced below each of the passage flow indicator values less than 2 percent of the time under Scenario C, relative to the Existing Condition scenario.

Overall occurrence of suitable adult steelhead migration conditions (i.e., occurrence of threshold flows) were reduced about 2 percent for both the 60 cfs and 72 cfs thresholds (Table 10). The 60 cfs threshold was reduced a total of 119 days out of the 12,434 days modeled during the upstream migration period (December-April). In comparison to existing conditions, the percent occurrence of 60 cfs or greater flows during the upstream migration period was reduced 1.0 percent, from 46.5 to 45.5 percent. Percent reductions ranged from 0.5 percent in March to 1.3 percent in December. The net change in days meeting the 60 cfs threshold (i.e., reduction in days meeting the threshold under existing conditions) was 2.1 percent overall (119 out of 5,773 days). Net reduction ranged from 0.9 percent in March to 6.7 percent in December.

Similarly, the 72 cfs threshold was reduced 110 days out of the 12,434 days modeled during the upstream migration period (December-April). The percent occurrence of 72 cfs or greater flows during the upstream migration period was reduced 0.9 percent, from 45.0 to 44.1 percent. Percent reductions ranged from 0.6 percent in March to 1.1 percent in January. The net change in days meeting the 72 cfs threshold was 2.0 percent overall (110 out of 5,598 days). Net reduction ranged from 0.9 percent in March to 5.6 percent in December.

Overall occurrence of suitable juvenile steelhead migration conditions (i.e., occurrence of threshold flows) were reduced less than 3 percent for both the 50 cfs and the 56 cfs thresholds (Table 10). The 50 cfs threshold was reduced a total of 104 days out of the 10,004 days modeled during the downstream migration period (March-June). In comparison to existing conditions, the percent occurrence of 50 cfs or greater flows during the upstream migration period was reduced 1.0 percent, from 37.8 to 36.8 percent. Percent reductions ranged from 0.5 percent in June to 1.8 percent in May. The net change in days meeting the 50 cfs threshold (i.e., reduction in days meeting the threshold under existing conditions) was 2.8 percent overall (104 out of 3,780 days). Net reduction ranged from 1.6 percent in March to 6.0 percent in May.

Similarly, the 56 cfs threshold was reduced 96 days out of the 10,004 days modeled. The percent occurrence of 56 cfs or greater flows during the upstream migration period was reduced 1.0 percent, from 37.0 to 36.0 percent. Percent reductions ranged from 0.7 percent in June to 1.3 percent in May. The net change in days meeting the 56 cfs threshold was 2.6 percent overall (96 out of 3,700 days). Net reduction ranged from 1.6 percent in March to 6.5 percent in May.

Effects on water quality are as described above, for Scenario A.

### 5.0.5 Scenario C Conclusion

In general, modeled flows were reduced under Scenario C, relative to the Existing Condition scenario. Implementation of Scenario C is anticipated to reduce flows in the Salinas River during the SCCC steelhead adult immigration period by up to 2.1 percent and during the juvenile outmigration period by up to 2.8 percent relative to existing conditions. However, the effect of Scenario C on occurrence of suitable fish passage conditions (passage thresholds) is very infrequent (monthly reductions in flows meeting passage thresholds relative to existing conditions occur from less than 1% of the time to no more than 5.5 percent of the time during juvenile and adult migration periods). Furthermore, flow reductions would be disproportionately high during the lowest flow periods. Implementation of Scenario B would not have an effect on the occurrence of high flows, flows greater than 100 cfs, which are more closely associated with steelhead migration than the threshold flows used in this evaluation, nor on availability of potential rearing habitat associated with side channel and flood plain inundation. Therefore, in consideration of the timing, frequency, magnitude, and duration of flow changes that could occur associated with implementing Scenario C, these flow changes are not considered to be substantial impacts on SCCC Steelhead.

There is a limited potential for tidewater goby and Monterey roach downstream of the project site. Since these species prefer quiescent conditions, flow reductions would not be expected to have a detrimental effect on them, should they be present.

Additionally, removing stormwater runoff and Salinas Treatment Facility effluent should have no appreciable effect on water quality within the Salinas River.

Therefore, in consideration of the timing, frequency, magnitude, and duration of flow changes that could occur associated with implementing Scenario C, as well as improvements in water quality, implementation of Scenario C is considered to be ***Less than Significant*** on SCCC Steelhead, Monterey roach, and tidewater goby.

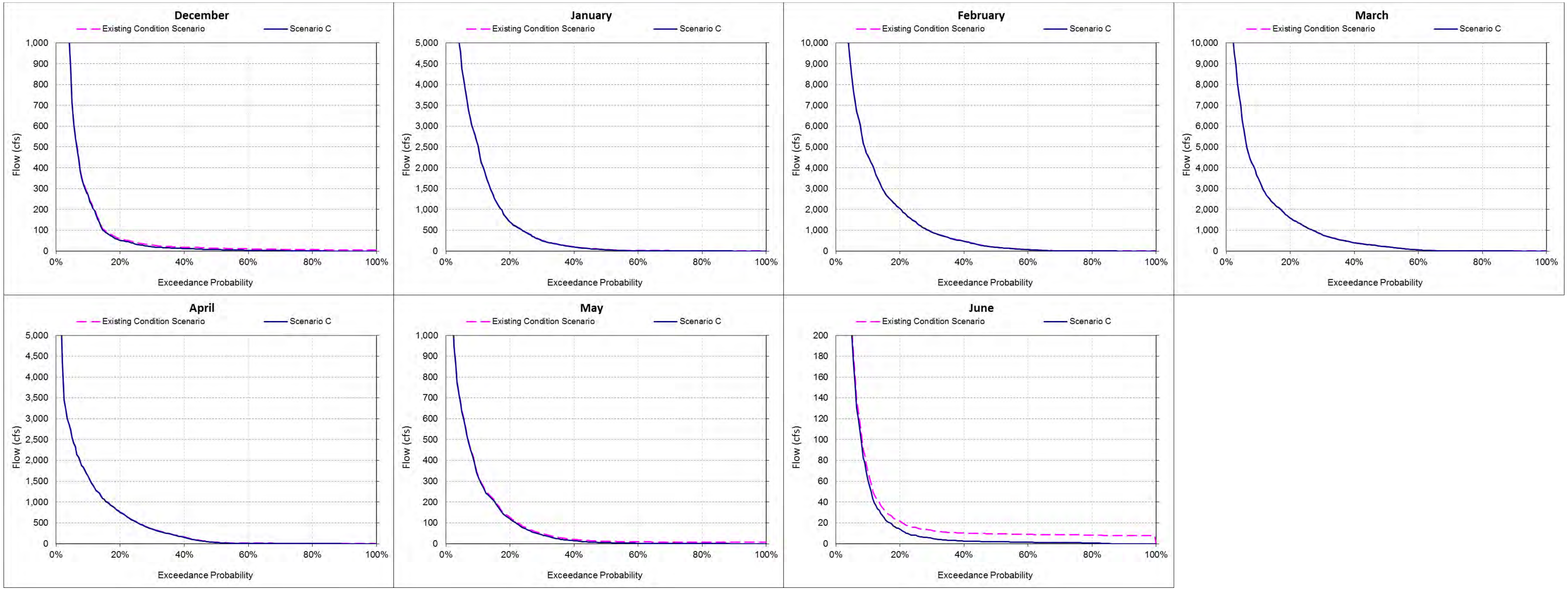


**Figure 3a – Monthly exceedance probability distributions of modeled daily flows for Scenario C, relative to the Existing Condition scenario.**

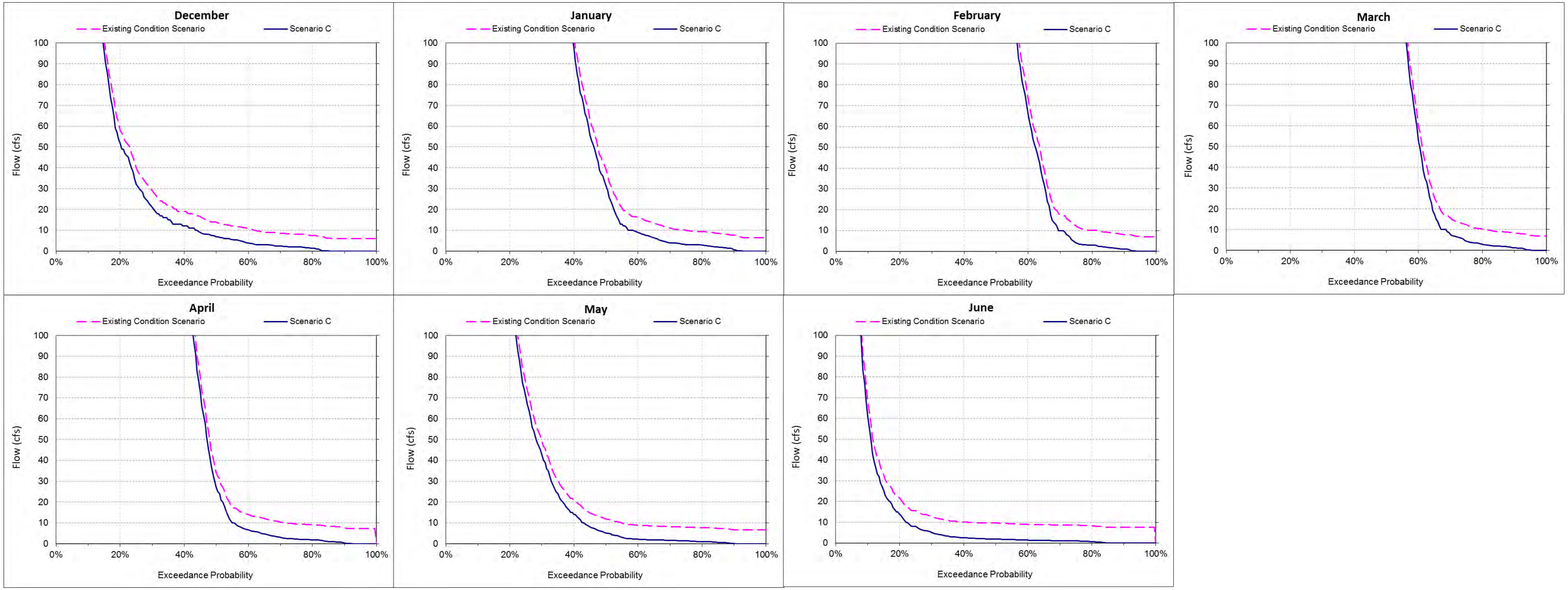


**Figure 3b – Monthly exceedance probability distributions of modeled daily flows for Scenario C, relative to the Existing Condition scenario (y-axis restricted to 100 cfs)**

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**Table 9 – Percentages of time that modeled flows under Scenario C are less than modeled flows under the baseline condition (the Existing Condition scenario) during both the SCCC steelhead adult immigration period (December through April) and juvenile outmigration period (March through June).**

| Analytical Scenario | December | January | February | March | April | May | June |
|---|---|---|---|---|---|---|---|
| **Percent of time Scenario C has less flow than the Existing Condition Scenario** | 100% | 100% | 100% | 100% | 100% | 100% | 100% |
| **Percent of time Scenario C has slightly less flow than the Existing Condition Scenario (1% < X <10%)** | 12.6% | 24.2% | 26.6% | 28.8% | 25.4% | 21.7 % | 8.9% |
| **Percent of time Scenario C has substantially less flow than the Existing Condition Scenario (X > 10% )** | 82.3% | 56.2% | 40.4% | 40.8% | 54.5% | 73.6 % | 90.4 % |
| **Total Days Modeled** | 2,573 | 2,542 | 2,317 | 2,542 | 2,460 | 2,542 | 2,460 |

**Table 10 – Model results estimates of the number of days and percentage of time represented by those days that diversions under Scenario C caused flows in the Salinas River to be reduced below the adult and juvenile passage thresholds relative to potential number of passage days and baseline conditions.**

| Life stage/ Period | Number of days meeting threshold | | Percent of potential migration period meeting threshold | | Change in percentage of potential migration period meeting threshold (%) | Reduction in number of days meeting threshold relative to baseline | Reduction in threshold occurrence relative to baseline (%) |
|---|---|---|---|---|---|---|---|
| | Baseline | Scenario C | Baseline | Scenario C | | | |
| **Adult upstream Migration** | | | | | | | |
| **60 cfs threshold** | | | | | | | |
| **Dec** | 508 | 474 | 19.7 | 18.4 | 1.3 | 34 | 6.7 |
| **Jan** | 1,160 | 1,130 | 45.6 | 44.5 | 1.2 | 30 | 2.6 |
| **Feb** | 1,430 | 1,402 | 61.7 | 60.5 | 1.2 | 28 | 2.0 |
| **Mar** | 1,524 | 1,511 | 60.0 | 59.4 | 0.5 | 13 | 0.9 |
| **Apr** | 1,151 | 1,137 | 46.8 | 46.2 | 0.6 | 14 | 1.2 |
| **All** | 5,773 | 5,654 | 46.4 | 45.5 | 1.0 | 119 | 2.1 |
| **72 cfs threshold** | | | | | | | |
| **Dec** | 467 | 441 | 18.2 | 17.1 | 1.0 | 26 | 5.6 |
| **Jan** | 1,111 | 1,083 | 43.7 | 42.6 | 1.1 | 28 | 2.5 |
| **Feb** | 1,397 | 1,373 | 60.3 | 59.3 | 1.0 | 24 | 1.7 |
| **Mar** | 1,498 | 1,484 | 58.9 | 58.4 | 0.6 | 14 | 0.9 |
| **Apr** | 1,125 | 1,107 | 45.7 | 45.0 | 0.7 | 18 | 1.6 |
| **All** | 5,598 | 5,488 | 45.0 | 44.1 | 0.9 | 110 | 2.0 |
| **Juvenile Downstream Migration** | | | | | | | |
| **50 cfs threshold** | | | | | | | |
| **Mar** | 1,555 | 1,530 | 61.2 | 60.2 | 1.0 | 25 | 1.6 |
| **Apr** | 1,179 | 1,158 | 47.9 | 47.0 | 0.9 | 21 | 1.8 |
| **May** | 762 | 716 | 30.0 | 28.2 | 1.8 | 46 | 6.0 |
| **Jun** | 284 | 272 | 11.5 | 11.0 | 0.5 | 12 | 4.2 |
| **All** | 3,780 | 3,676 | 37.8 | 36.8 | 1.0 | 104 | 2.8 |
| **56 cfs threshold** | | | | | | | |
| **Mar** | 1,539 | 1,515 | 60.5 | 59.6 | 0.9 | 24 | 1.6 |
| **Apr** | 1,166 | 1,145 | 47.4 | 46.5 | 0.9 | 21 | 1.8 |
| **May** | 720 | 687 | 28.3 | 27.0 | 1.3 | 33 | 4.6 |
| **Jun** | 275 | 257 | 11.2 | 10.5 | 0.7 | 18 | 6.5 |
| **All** | 3,700 | 3,604 | 37.0 | 36.0 | 1.0 | 96 | 2.6 |

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# Appendix G

# Fisheries Impact Assessments: Reclamation Ditch/Tembladero Slough Diversions

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# Appendix G1

# Memorandum Regarding Fisheries Impact Assessment – Reclamation Ditch/Tembladero Slough Diversion

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# TECHNICAL MEMORANDUM

**TO:** Denise Duffy
Denise Duffy and Associates

**FROM:** Jeff Hagar
Hagar Environmental Science

**DATE:** February 28, 2015

**PROJECT:** Pure Water Monterey Groundwater Replenishment (GWR) Project – Reclamation Ditch and Tembladero Slough Source Water Diversion Fisheries Effects Analysis

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## 1.1 Purpose

The Monterey Regional Water Pollution Control Agency (MRWPCA) is preparing an Environmental Impact Report (EIR) for the proposed Pure Water Monterey Groundwater Replenishment Project (GWR Project). The project will develop high quality replacement water for existing urban supplies; and an enhanced agricultural irrigation (Crop Irrigation) component that will increase the amount of recycled water available to the existing Castroville Seawater Intrusion Project in northern Monterey County. The proposed project would consist of source water conveyance facilities, treatment facilities, product water conveyance facilities, and replenishment/recharge facilities. Proposed source waters could include:

- City of Salinas (City) Agricultural wash water currently treated and disposed via evaporation and percolation at the Salinas Industrial Wastewater Treatment Facility;
- Storm water collection systems of the City of Salinas and the Lake El Estero watershed in Monterey; and
- Secondary or tertiary effluent from the Regional Treatment Plant.
- Blanco Drain water;
- Storm water collection systems of other MRWPCA member entities and other watersheds in the Salinas and Monterey areas; and
- Reclamation Ditch / Tembladero Slough water.

Two of these source waters, Blanco Drain water and Reclamation Ditch and Tembladero Slough water, involve potential diversions from surface waters that may support fish fauna or are tributary to waters potentially supporting fish fauna. In this report, Hagar Environmental Science (HES) has evaluated the GWR Projects related flow change effects on fish fauna and associated habitat in the Reclamation Ditch, and Tembladero Slough. Environmental effects of the project on fish fauna related to the Blanco Drain and all other Salinas River areas is treated in a separate report prepared by HDR Engineering, Inc. (2014).

## 1.2 Environmental Setting

The environmental setting for fisheries consists of all aquatic resources that could be directly or indirectly affected by the project. This includes the alternative diversion locations on the Reclamation Ditch near Davis Road and Tembladero Slough at the Castroville Pump Station. The setting also includes downstream aquatic habitats that may be altered by flow modifications including the Reclamation Ditch downstream to its confluence with Tembladero Slough, Tembladero Slough downstream to its confluence with the Old Salinas River channel, and the Old Salinas River downstream to Moss Landing Harbor (Figure 1). Since the project alternatives potentially influence migratory fish including steelhead (*Oncorhynchus mykiss*), the environmental setting also includes the watershed upstream of the Davis Road diversion site.

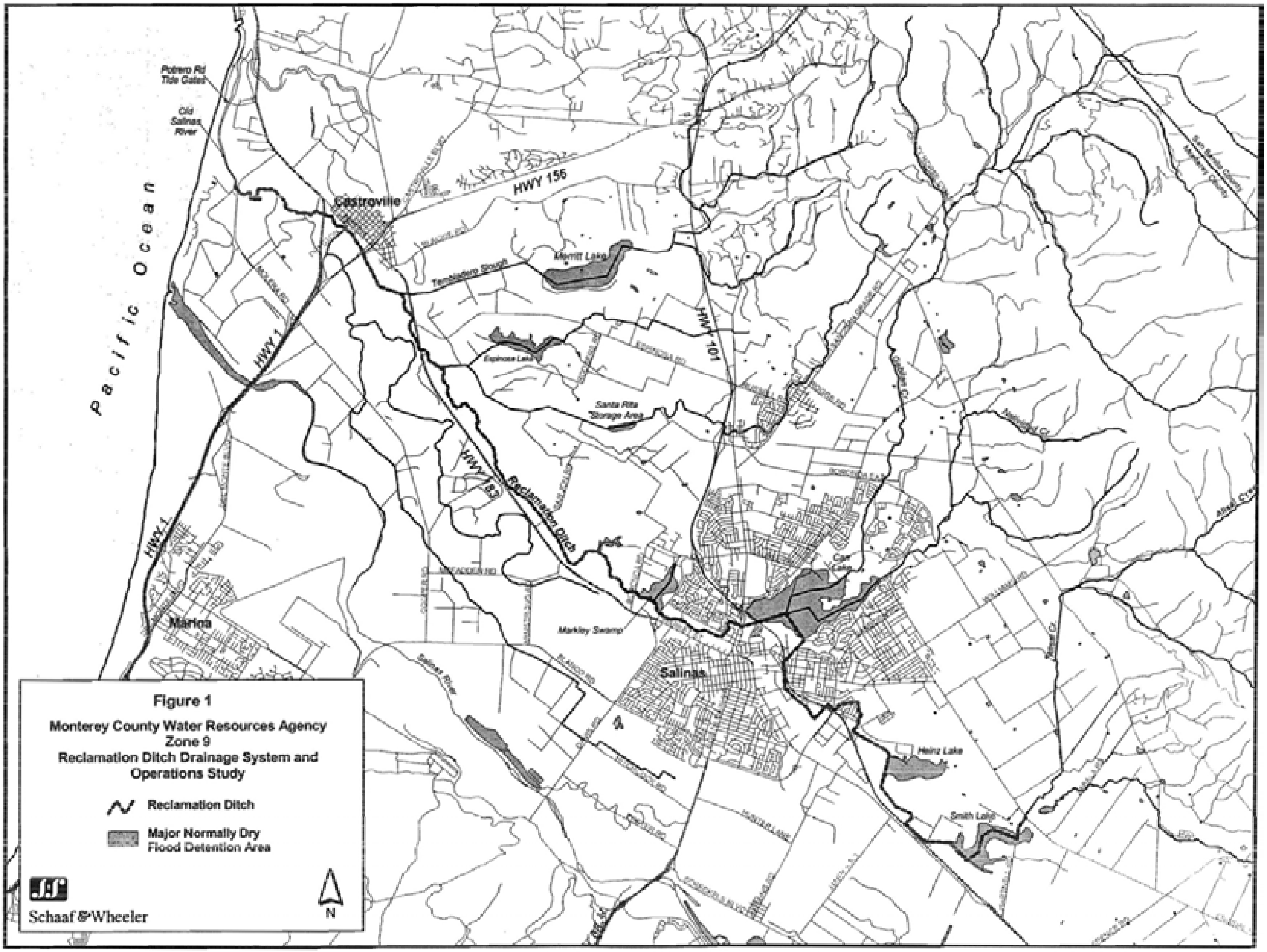


**Figure 1. Project Area.**

### 1.2.1 Reclamation Ditch, Tembladero Slough, and the Old Salinas River

The Reclamation Ditch watershed is approximately 157 square miles with headwaters in the Gabilan Range above Salinas and discharging into the Tembladero Slough then to the Old Salinas River just upstream from Moss Landing Harbor (CCoWS 2006). The lower watershed areas were formerly low lying areas with seasonal lakes, swamps, and wetland. Much of the middle and lower watershed channels have been altered for drainage and conveyance of flood flows. The watershed has five main tributaries including Gabilan Creek, Natividad Creek, Alisal Creek, Santa Rita Creek and the Merritt Lake drainage. Gabilan, Natividad, and Alisal Creeks converge at Carr Lake, a seasonal lake in the center of Salinas, and the outlet from Carr Lake forms the head of the Reclamation Ditch. During the growing season the Carr Lake bed is used for agricultural production (CCoWS 2006). The majority of runoff in the basin was historically generated in the Gabilan and Alisal Creek subwatersheds (CCoWS 2006 reproduced from Cozzens 1944).

The watershed also contains the City of Salinas and portions of Castroville and Prunedale. Summer flows are predominantly agricultural tile drainage. Winter flows include storm runoff from throughout the basin (Schaaf & Wheeler 2014).

The Salinas Reclamation Ditch was built between 1917 and 1920 to collect and drain surface runoff generated in the watershed. It includes the outlet of Carr Lake and a network of channels draining much of the City of Salinas as well as many of the former lakes and sloughs. Urban runoff from the City of Salinas drains into various channels of the Reclamation Ditch system via approximately 54 stormwater outfalls. The whole system drains into Tembladero Slough (an extended brackish, sub-tidal slough), then the Old Salinas River, and ultimately into Moss Landing Harbor through the Potrero Tide Gates (CCoWS 2006).

The Reclamation Ditch system drained an extensive system of interconnected sub-tidal lakes and swamps that formerly existed between Salinas and Castroville. These include Merritt Lake, Espinosa Lake, Santa Rita Slough, Vierra Lake, Fontes Lake, Boronda Lake, Markley Swamp, and Mill Lake (CCoWS 2006). The lakes naturally had poor drainage and were only connected during periods of high runoff. Most of the lakes are now farmed, but still flood regularly during winter storm events and are used for detention flood storage. Following the de-watering of the original lakebeds, land subsidence (Bechtel Corp 1959) of up to several feet was observed resulting in poor natural drainage of surface waters. Surface water pump stations have been installed and operated to allow continued agricultural use of these areas.

The following description of hydrologic conditions in the watershed is drawn largely from CCoWS (2006).

The streams of the Gabilan subwatershed are ephemeral in the upper-most sections, perennial or near-perennial in certain reaches mid-way down the range, and then again ephemeral in the lowest parts of the subwatershed as the streams begin to flow over old alluvium at the foot of the range. Upon entering the broad system of alluvial plains that is the Salinas Valley, most of the streams are ephemeral, sparsely vegetated, relatively small ditches. As they near the Cities of Salinas and Castroville, the ditches converge into wider ditches with perennial standing water in the dry season and storm runoff in the wet season. Water in the dry season is derived from urban runoff, agricultural tailwater, and permitted discharges. Finally, within a few kilometers of the coast, the ditches flow into Tembladero Slough.

#### *1.2.1.1 Channel Conditions*

Channel conditions vary widely in the Reclamation Ditch watershed (CCoWS 2006). At the highest elevations in the Gabilan Range the streams are mostly ephemeral with narrow channels and gentle to moderate gradient. Channel substrate is predominantly gravel and cobble and dominant streamside vegetation is primarily oak savanna with grazed riparian woodland with mixed oak, gray and coulter pines at the highest elevations. Also, there are several seasonal ranch ponds scattered throughout this area, some of which are on-stream. Adjacent land uses are predominantly cattle ranching with State Park lands at the highest elevations (CCoWS 2006).

In the steep mountain canyons of the Gabilan Range, streams are typically narrow and of steep gradient (> 4%). Channel substrate is primarily cobble/boulder. Streams generally flow year-round, especially in the mid to lower elevations of this zone. Riparian vegetation is dense, usually consisting of big-leaf maples, tan oaks, white alder, and sycamore trees. The dense vegetation helps keep the water temperatures cold throughout the year (CCoWS 2006). Adjacent land use is ranching (Casagrande 2001). The presence of pools, large woody debris, such as root wads and downed trees, in addition to cool water temperatures and well-oxygenated flow create suitable habitat conditions for fish (Hager 2001).

In the foothills and alluvial fans of the Gabilan Range, streams are usually ephemeral in some locations with moderate slope (2-4%), smaller average substrate sizes, and shift in riparian species composition from maple and tan oak to willow, box elder, and cottonwood. Riparian vegetation is still commonly found throughout much of the foothill stream reaches, although some reaches have lost a substantial portion of their streamside vegetation (CCoWS 2006). The adjacent land uses are predominantly ranching with some areas developed for row crop agriculture (Casagrande 2001).

Between the foothill zone and the city of Salinas, the stream channels are modified by human development to a greater degree. Some of these still support significant amounts of native riparian vegetation but have been channelized to some extent, thus eliminating the streams ability to fully access the adjacent floodplain during high runoff events. These stream reaches have a gentle slope (< 2%), predominantly sand substrate, and in most areas lack summer flow. Adjacent land use is row-crop agriculture, residential/urban areas, and ranching lands (Casagrande 2001). Some of these stream reaches support native warmwater fish and amphibians. Other stream reaches in this zone have steep banks that are either un-vegetated or support only introduced annual weeds. Such conditions are generally of low habitat quality for riparian-associated organisms, due to the lack of overhead cover, in-channel complexity, and sources of or woody/plant debris. The steep unvegetated banks are also more susceptible to erosion, particularly during high flows. Such bank erosion is a source of sediment that later accumulates in stream channels further downstream.

Most of the stream channels of lower valley bottom have been converted into ditches or drainage canals (Figure 2). These ditches generally have steep side slopes without native riparian vegetation or access to a floodplain, a substrate of primarily fine-grained sediment (mostly silts and clays), and an undefined low-flow channel. The lack of pools and in-stream complexity limits the amount of shelter or overwintering habitat for fish and amphibian species. Sections of the ditch system are occasionally lined with riprap to protect against erosion. Their dry-season flow today is artificially perennial from local urban and agricultural runoff sources (CCoWS 2006). These channels are generally maintained as a drainage canal without tree canopy. The adjacent agricultural lands are used for growing table crops (leafy greens, berries, and artichokes). The growers prevent vegetation from establishing along the Reclamation Ditch banks to discourage birds and rodents from nesting near their fields (Schaaf & Wheeler 2014). Within the City of Salinas, the Reclamation Ditch is an urban watercourse with steep sides and numerous pipe culverts or bridges with lined inverts. (Schaaf & Wheeler 2014). The Reclamation Ditch generally has low gradient though at some locations, particularly bridges, there is a local increase in gradient that presents potential issues for fish migration (Figure 3).

**Figure 2: Reclamation Ditch near Davis Road proposed project site.**

**Figure 3: Reclamation Ditch at San Jon Road and USGS gage weir.**

Downstream of the Highway 183 crossing, the Reclamation Ditch becomes known as Tembladero Slough (Figure 4). At this point the slope flattens significantly, lowering flow velocity and allowing increased sediment deposition (Schaaf & Wheeler 1999). Tembladero Slough is a broad, gentle sloped (< 2%), sinuous channel with slow-moving, perennial flows and fresh water with salinity levels generally lower than 1.5 parts per thousand (ppt) (CCoWS 2006). Riparian vegetation, which is managed by use of herbicides, is sparse, occurring in clusters. Where vegetation is present, it is usually annual weeds along with an occasional clump of willows, tules and/or watercress (CCoWS 2006). Tembladero Slough is tidally influenced from the Old Salinas River up to Highway 183 in Castroville (Schaaf & Wheeler 2014).

**Figure 4: Tembladero Slough at Castroville proposed project site.**

Tembladero Slough joins with the Old Salinas River, which carries the controlled outflow from the Salinas River Lagoon, and together they form a back-beach swale that runs behind the dunes toward Moss Landing Harbor. The Tembladero- Old Salinas River confluence is just downstream of Molera Road and the Old Salinas River flows down through the Potrero Road tide gates to Moss Landing Harbor. This reach also has a gentle slope and meandering channel but is tidally influenced and has brackish water and salt concentration fluctuations due to the tidal cycle (CCoWS 2006). The banks support vegetation tolerant of saltwater, such as pickleweed and/or salt grass. Channel substrate is fine silts and clays.

The Potrero Road tide gates are installed on the Old Salinas River just upstream of Moss Landing Harbor. The tide gates consist of ten box culverts each with a flap gate on the downstream side. During periods of high stream flow and low tide, the gates are opened by the differential water pressure. When the tide is high, the gates close, impeding the flow of the tide up the Old Salinas River. Under conditions of simultaneous high outflows and high spring tides, the gates can impede outflows and increase stage in Tembladero Slough.

#### *1.2.1.2 Streamflow*

The flow regime varies significantly in different parts of the watershed. The hydrology of the study area has been dramatically altered. The impervious area has increased significantly with the expansion of the cities of Salinas and Castroville. Compare flow at the Gabilan Creek Gage (Table 1) just upstream of Salinas with flow at the San Jon Gage, downstream of Salinas (Table 2). The final result in the middle to lower sections of the watershed is that there is less standing water in the dry season, and more runoff in the wet season. The entire system is highly episodic, with little or no flow for most of the time, interrupted occasionally by large runoff events during the wet season (CCoWS 2006). Sources contributing to the stream flow vary seasonally, and include, urban runoff, agricultural tile drain water, and permitted discharge in the dry season and stormwater/urban runoff in the wet season (CCoWS, 2014).

The USGS streamflow gage at San Jon Road (Station 11152650, Reclamation Ditch near Salinas, CA) is located just downstream of the Davis Road proposed diversion site and is relevant for this project. The period of record is 28 years and is split into October 1970 to February 1986 and June 2002 to the present. Measured daily mean discharge at the San Jon Road location ranges from 0 cubic feet per second (cfs) to over 500 cfs and is highest in December through April (Table 2). This seasonal pattern is typical of the Mediterranean climate of Central California.

**Table 1: Summary of Daily Mean Discharge (cfs) by Month for USGS Flow Data, Station 11152600, Gabilan Creek near Salinas, California, for the Period of Record (October 1970 to February 1986, June 2002 to October 2014).**

| Month | Minimum | Average (cfs) | Maximum |
|---|---|---|---|
| Oct | 0 | 0.11 | 11 |
| Nov | 0 | 0.54 | 120 |
| Dec | 0 | 2.54 | 200 |
| Jan | 0 | 6.23 | 194 |
| Feb | 0 | 10.55 | 279 |
| Mar | 0 | 13.22 | 159 |
| Apr | 0 | 9.64 | 298 |
| May | 0 | 2.20 | 41 |
| Jun | 0 | 0.90 | 20 |
| Jul | 0 | 0.39 | 6.1 |
| Aug | 0 | 0.21 | 5.7 |
| Sep | 0 | 0.11 | 3.3 |

**Table 2: Summary of Daily Mean Discharge (cfs) by Month for USGS Flow Data, Station 11152650, Reclamation Ditch at San Jon Road, for the Period of Record (October 1970 to February 1986, June 2002 to December 2013).**

| Month | Minimum | Average (cfs) | Maximum |
|---|---|---|---|
| Oct | 0.10 | 6.32 | 163.00 |
| Nov | 0.03 | 11.6 | 263.0 |
| Dec | 0.00 | 16.9 | 310.0 |
| Jan | 0.20 | 27.8 | 450.0 |
| Feb | 0.29 | 32.2 | 401.0 |
| Mar | 0.61 | 36.6 | 524.0 |
| Apr | 1.10 | 22.2 | 473.0 |
| May | 0.63 | 8.02 | 91.00 |
| Jun | 0.27 | 6.10 | 34.00 |
| Jul | 0.23 | 5.76 | 30.00 |
| Aug | 0.38 | 6.06 | 31.00 |
| Sep | 0.63 | 5.19 | 58.00 |

The Reclamation Ditch is perennial downstream of agricultural and urban development. According to USGS records, flow west of Salinas at the San Jon Road gage only ceased on three days between 1971 and 1985, and on those days, standing water was probably still present throughout most of the Reclamation Ditch (Schaaf & Wheeler 2014). The presence of standing water is reflective of historical conditions, since the area was a system of lakes, while the presence of dry-season flow is a consequence of dry-season urban discharges and agricultural tailwater discharge. Average annual runoff at the San Jon Road gage has declined by almost a third in recent years as water conservation practices have reduced the amount of agricultural irrigation (Schaaf & Wheeler 2014).

There are no instream flow requirements for fisheries or aquatic life in the Reclamation Ditch watershed. There are no known studies that methodically document passage obstacles or barriers in the watershed and no studies of instream flow needs for fish species, including steelhead.

#### *1.2.1.3 Water Quality*

The water quality in the Reclamation Ditch is generally poor, containing high levels of nitrates and pesticides and low levels of dissolved oxygen. The Reclamation Ditch (Salinas Reclamation Canal) and all of its tributary streams are on the California Listing of Water Quality Limited Stream Segments, as reported under Section 303(d) of the Federal Clean Water Act (Central Coast Regional Water Quality Control Board (CCRWQCB 2011). The CCRWQCB Water Quality Control Plan for the Central Coast Basin (Basin Plan) designated beneficial uses of the Reclamation Ditch as including water contact recreation, non-contact water recreation, wildlife habitat, warm water fish habitat and commercial or sport fishing. Tembladero Slough is designated as having additional beneficial uses of estuarine habitat, rare/threatened/endangered species, and spawning/reproduction/early development habitat (CCRWQCB 2011).

The Reclamation Ditch (Salinas Reclamation Canal) and Tembladero Slough are listed as impaired water bodies pursuant to Section 303(d) of the Clean Water Act for ammonia, fecal coliform, pesticides, nitrate, toxicity, dissolved oxygen, and other parameters. Water quality has been sampled and monitored for the past 15 years under various programs, including the Central Coast Ambient Monitoring Program (CCAMP) under the RWQCB, the Central Coast Watershed Studies (CCoWS) program of the Watershed Institute at California State University Monterey Bay, and the Cooperative Monitoring Program under the Conditional Waiver of Waste Discharges from Irrigated Lands (Ag Waiver) (Schaaf & Wheeler 2014). Many of these parameters can be at levels that result in toxicity to aquatic life (CCRWQCB Order No. R3-2012-0011 (Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands).

### 1.2.2 Fish Fauna

The fish community in the Project Area, and especially in the Reclamation Ditch, has been influenced by habitat alteration during the course of human settlement and development. The fish community, like the Salinas and Pajaro River Watersheds, is similar to and was likely derived from that of the Sacramento/San Joaquin Watersheds (Snyder 1913). There are no known fish surveys of the Reclamation Ditch watershed though anecdotal information (CCoWS 2006) and surveys in nearby water bodies are indicative of species that are likely to be found there (Table 3).

**Table 3. Fish Species Occurring in the Reclamation Ditch Watershed and Vicinity.**

| Common Name | Scientific Name | Rec Ditch Watershed *(CCoWS 2006)*[1] | Old Salinas River *HES 2001* | Salinas Lagoon *HES 2014* | *Snyder (1913), Hubbs (1947)*[2] |
|---|---|---|---|---|---|
| **NATIVE FRESHWATER SPECIES** | | | | | |
| Pacific lamprey | *Lampetra tridentata* | X | | X | X |
| California roach | *Hesperoleucus symmetricus* | X | | | X |
| Hitch | *Lavinia exilicauda* | X | X | X | X |
| Sacramento blackfish | *Orthodon microlepidotus* | X | | X | X |
| Sacramento pikeminnow | *Ptychocheilus grandis* | X | X | X | X |
| Speckled dace | *Rhinichthys osculus* | | | | X |
| Sacramento sucker | *Catostomus occidentalis* | X | X | X | X |
| Steelhead/rainbow trout | *Oncorhynchus mykiss* | | | X | |
| Chinook salmon | *Oncorhynchus tshawytscha* | | | X | |
| Threespine stickleback | *Gasterosteus aculeatus* | X | X | X | X |
| Prickly sculpin | *Cottus asper* | X | | X | X |
| Coastrange sculpin | *Cottus aleuticus* | | | | X |
| Riffle sculpin | *Cottus gulosus* | | | | X |
| Sacramento perch | *Archoplites interruptus* | | | | X |
| Tule perch | *Hysterocarpus traski* | | | | X |
| **ESTUARINE SPECIES** | | | | | |
| Pacific herring | *Clupea pallasii* | | X | X | X |
| Topsmelt | *Atherinops affinis* | | | X | |
| Pacific staghorn sculpin | *Leptocottus armatus* | | X | X | X |
| Striped bass | *Morone saxatilis* | | | X | |
| Shiner surfperch | *Cymatogaster aggregata* | | | X | X |
| Yellowfin goby | *Acanthogobius flavimanus* | | | X | |
| Arrow goby | *Clevelandia ios* | | | X | |
| Tidewater goby | *Eucyclogobius newberryi* | | | X | X |
| Starry flounder | *Platichthys stellatus* | | | X | X |
| **INTRODUCED WARMWATER SPECIES** | | | | | |
| Threadfin shad | *Dorosoma patenense* | | | X | |
| Goldfish | *Carassius auratus* | X | | | |
| Carp | *Cyprinus carpio* | X | X | X | X |
| Golden shiner | *Notemigonus chrysoleucas* | X | | | |
| Fathead minnow | *Pimephales promelas* | X | | | |
| Bullhead | *Ameiurus sp.* | X | | | |
| Mosquitofish | *Gambusia affinis* | X | X | X | |
| Sunfish | *Lepomis sp.* | X | | | |
| Bluegill | *Lepomis macrochirus* | X | | | |
| Largemouth bass | *Micropterus salmoides* | X | | | |
| Black crappie | *Pomoxis nigromaculatus* | | X | | |

[1] Fish kill in Tembladero Slough reported by CDFG (2002) and various observations by J. Casagrande and J. Hager.
[2] Snyder collections near Salinas, Spreckels, and "Blanco"; Hubbs collections in Salinas River Lagoon.

Based on habitat characteristics it is likely that the headwater perennial streams in the Reclamation Ditch watershed support riffle sculpin (*Cottus gulosus*), speckled dace (*Rhinichthys osculus*), trout (*Oncorhynchus mykiss*), and possibly Sacramento sucker (*Catostomus occidentalis*). Trout have been observed in Gabilan Creek recently (CCoWS 2006) including young trout (1 to 2 inches), along the downstream side of the Old Stage Road Crossing in June 2004 (CCoWS 2006). In early March 2004, a 30-inch adult female steelhead was found dead in Gabilan Creek along Little River Drive (CCoWS 2006). The fish had not spawned and was found at the base of a sediment stabilizer structure. The exact cause of death was not determined but was possibly the lack of suitable flow combined with a possible migration barrier (CCoWS 2006). The fish was found as flows dropped from higher levels on February 25-28 following a storm, and the timing is consistent with a fish attempting to migrate to spawning habitat higher in the watershed.

Although trout have been stocked by landowners in the watershed historically (CCoWS 2006), the presence of suitable habitat in Gabilan Creek, occupied by *O. mykiss* (likely resident life-history form), and the adult steelhead found in 2004 indicate that the Reclamation Ditch watershed should be considered as potential steelhead habitat. Suitable habitat conditions for rainbow trout/steelhead are also likely to exist in the upper reaches of Alisal, Towne, and Mud Creeks (CCoWS 2006).

Spawning habitat is only found within the upper foothill and mountainous reaches of the Gabilan Range where suitable substrate (gravel/cobble) is dominant and stream flow is still abundant (CCoWS 2006). Additionally, the middle reaches of the Reclamation Ditch are characterized by degraded water quality and maintained drainage channels devoid of vegetation that do not provide cover for fish. In order to reach the spawning habitat upstream, steelhead would have to navigate through a series of man-made obstacles. Most are passable during periods of prolonged stream flow to achieve suitable flow depth and duration for passage (CCoWS 2006). The duration of adequate flow in the middle reaches of the Reclamation Ditch Watershed is, in average years, brief and because of this, the migration window is very short (CCoWS 2006). Although the duration of adequate flow in the middle reaches of the Reclamation Ditch Watershed is brief in most years, the distance between Moss Landing Harbor and the upper reaches of Gabilan Creek is not excessive for migrating steelhead.

The middle reaches of the watershed (between the Gabilan Mountains and the City of Salinas) are ephemeral and thus do not support fish. Some intermittent reaches support California roach (*Hesperoleucus symmetricus*) and threespine stickleback (*Gasterosteus aculeatus*) which are both tolerant of high temperature and low dissolved oxygen (CCoWS 2006).

The downstream habitats of the watershed support warm-water fish communities (i.e., minnows, suckers, and introduced fishes). The slow, warmwater habitats of lower Natividad Creek/Laurel Pond, the lower Santa Rita Creek drainage, the Reclamation Ditch, Tembladero Slough, and the Old Salinas River support most of the original native warmwater fish species as well as introduced warmwater species. Species include the native Sacramento sucker, Sacramento blackfish, Sacramento pikeminnow, hitch, California roach, threespine stickleback and a variety of introduced fish like carp, fathead minnow and mosquito fish.

The Salinas River Lagoon fishery has been sampled at intervals since the early 1900's (Snyder 1913, Hubbs 1947) and most recently in the early 1990's (Gilchrist et al. 1997) and in annual surveys by MCWRA from 2002 to 2014 (HES 2014). The fish species assemblage in the Salinas River Lagoon may be representative of other aquatic environments in the lower Salinas Valley including the Old Salinas River Channel and Tembladero Slough. The Lagoon supports a mixed assemblage of marine, freshwater, and estuarine species generally typical of lagoons along the Central California Coast (Table 3). The mix of species in any year is influenced by freshwater inflows, opening and closing of the sandbar at the mouth of the Lagoon, and the resulting conditions of water quality and productivity.

Native freshwater species using the Lagoon included Sacramento blackfish (*Orthodon microlepidotus*), hitch (*Lavinia exilicauda*), Sacramento pikeminnow (*Ptychocheilus grandis*), Sacramento sucker (*Catostomus occidentalis*), prickly sculpin (*Cottus asper*), and threespine stickleback. Several other freshwater species have been collected historically in the Lagoon but are no longer found there. Hubbs collected Sacramento perch from several areas of the Lagoon and recorded speckled dace (*Rhinichthys osculus*) as rare at a single site in the freshwater portion (Hubbs 1947). Thicktail chub (*Gila crassicauda*), an extinct large minnow formerly occupying lowland streams and estuaries, have been well documented at archaeological sites in the Pajaro and Salinas Basins (Gobalet and Jones 1995) and probably occurred in the Salinas River Lagoon. Introduced freshwater species include carp and white bass. The single white bass taken in 1990 probably came from the population in Nacimiento Reservoir and is likely a transient species in the Lagoon. Other reservoir species, such as threadfin shad, may be expected to reach the Lagoon during wet years when large flood control releases are made. In years with low freshwater inflow and saline conditions in the Lagoon, freshwater species may be restricted to the upper reaches of the Lagoon or to freshwater areas upstream of the Lagoon (Gilchrist et al. 1997).

Several marine species use the Lagoon for reproduction or juvenile rearing. Starry flounders spawn in the ocean but juveniles enter the Lagoon and can rear there for two or more years. As they grow older they become less tolerant of fresh water and leave the Lagoon. Staghorn sculpin also enter the Lagoon as juveniles but usually only remain for a year. In 1991, five species of surfperch, both adults and young-of-year, were found in the Lagoon during the summer. Other marine species found include Pacific herring, topsmelt, surf smelt, northern anchovy, jacksmelt, striped bass, and English sole (Gilchrist et al. 1997). The green sturgeon reported by CDFW in 1975 is probably atypical since they usually use larger rivers further north.

### 1.2.3 Sensitive Aquatic Resources

There are two special status fish species that have historically been found in the Lower Salinas River, Salinas River Lagoon, or nearby aquatic environments: the South-Central California coastal steelhead (*Oncorhynchus mykiss*) and the tidewater goby (*Eucyclogobius newberryi*). These species and key life history features are discussed in the following sections. Tidewater goby were first reported from the Lagoon in 1946 but were not recorded there again until 2013 (HES 2014). The Lagoon is important to steelhead in that it may provide rearing habitat for juvenile steelhead under certain conditions and it is the passageway through which spawning adults enter the river and seaward migrating juveniles enter the ocean. Occasional use of the Lagoon by juvenile steelhead has been reported only in recent years (HES 2012, HES 2013, HES 2014). Current water management practices can influence the quality of Lagoon habitat and the ability of steelhead to move between the Lagoon and the ocean.

#### *1.2.3.1 South-Central California Coastal Steelhead*

NMFS listed the South-Central California Coast steelhead (SCCC steelhead) as threatened in 1997 (62 FR 43937) and affirmed the listing in 2006 (71 FR 834). In September 2012, NMFS completed a 5-year status review of the SCCC steelhead Distinct Population Segment (DPS). Based upon a review of available information, NMFS (2011) recommended that the SCCC steelhead DPS remain classified as a threatened species. The SCCC steelhead DPS includes all naturally spawned anadromous populations of *O. mykiss* in coastal river basins from the Pajaro River in Monterey County southward to but not including the Santa Maria River in San Luis Obispo County (65 FR 36074, 71 FR 834). Although *O. mykiss* exhibits both resident and anadromous life history characteristics, the SCCC steelhead DPS includes only the anadromous life form of *O. mykiss*.

#### *Critical Habitat Designation*

Critical Habitat for SCCC steelhead was designated in February 2000 (65 FR 7764) and was reaffirmed in 2005 (70 FR 52488). Section 3 of the ESA (16 U.S.C. 1532(5)) defines critical habitat as ‘‘(i) the specific areas within the geographical area occupied by the species, at the time it is listed on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by the species at the time it is listed. The freshwater primary constituent elements of critical habitat include: 1) spawning habitat, including spawning substrate, and adequate water quantity and quality; 2) freshwater rearing habitat including floodplain connectivity, and natural escape and velocity cover; and 3) freshwater migration corridors free of obstructions, with water quantity and quality conditions that allow movement" (NMFS 2005, MCWRA 2013).

The Critical Habitat designation includes Gabilan Creek, the Reclamation Ditch, Tembladero Slough, the Old Salinas River and Salinas River Lagoon, and Lower Salinas River. The primary constituent element of critical habitat that could potentially be affected by the Proposed Project is migration habitat in the Reclamation Ditch, Tembladero Slough and Old Salinas River.

***Life History Overview***

Steelhead/rainbow trout have a very flexible life history. *O. mykiss* that migrate to the ocean (anadromous) undergo physiological changes in the process of smoltification that allow them to adapt to seawater. These fish, commonly referred to as steelhead, spend a variable amount of time in the ocean, typically one to two years, grow rapidly and return to spawn, generally in the stream where they hatched. Some *O. mykiss* within any given stream, and the proportion may vary considerably depending on local circumstances, do not migrate to the sea. These fish reach sexual maturity and spawn without entering the ocean and are often known as resident or stream rainbow trout. They mature at smaller sizes than sea-run steelhead and produce fewer eggs. Resident *O. mykiss* can persist for generations in locations where migration to sea has been precluded such as above landslides and dams and during extended droughts. There are a number of documented life-history strategies that are intermediate between resident populations and fully anadromous populations. Intermediate life-history patterns include fish that migrate within the stream (potadromous), fish that migrate only as far as estuarine habitat, and fish that migrate to near-shore ocean areas. These life-history patterns do not appear to be genetically distinct, and have been observed interbreeding (Shapovalov and Taft 1954, Barnhart 1986, Pearcy 1992, Busby et al. 1996, Hayes et al. 2011).

There are selective advantages to both anadromous and resident strategies (Cramer et al. 1995). Anadromous fish grow faster and reach a larger size thereby gaining a potential to produce more offspring than resident fish. At the same time, however, migratory fish are exposed to many sources of mortality and there is a risk that conditions may become unsuitable for migration, particularly in California where fluctuating climatic conditions can result in long periods when streams have tenuous connection to the ocean. In California, many streams support both resident and anadromous forms with no observable genetic differentiation. During extended drought periods it is possible for populations to sustain themselves through resident spawning and then revert to an anadromous life history when suitable conditions return. Presence of resident rainbow trout populations tends to increase in the southern part of the range (Cramer et al. 1995). Rainbow trout observed in freshwater habitat may be the offspring of either anadromous or resident fish; it is not possible to distinguish them based on external observation.

All steelhead within the SCCC steelhead DPS are considered "winter steelhead" based on their migratory timing and behavior. They ascend streams during the winter when winter rainfall results in suitable flow and temperature (Busby et al. 1996, Moyle 2002). Steelhead along the Central California coast enter freshwater to spawn when winter rains have been sufficient to raise streamflows and breach the sandbars that form at the mouths of many streams during the summer. Increased streamflow during runoff events also appears to provide cues that stimulate migration and allows better conditions for fish to pass obstructions and shallow areas on their way upstream. The season for upstream migration of steelhead adults lasts from late October through the end of May but typically the bulk of migration (over 95% in Waddell Creek) occurs between mid-December and mid-April (Shapovalov and Taft 1954, NMFS 2007). Steelhead are unique among the other Pacific salmonids in that they do not all die after spawning. Some return immediately to the ocean (generally by the late spring but dependent on runoff conditions), others return after holding for a period in freshwater.

Steelhead have strong swimming and leaping abilities that allow them to ascend streams into small tributary and headwater reaches. Steelhead can swim at rates of up to 4.5 feet per second (fps) for extended periods of time and can achieve burst speeds of 14 to 26 fps during passage through difficult areas (Bell 1986). Leaping ability is dependent on the size and condition of fish and hydraulic conditions at the jump. Given satisfactory conditions, a conservative estimate of steelhead leaping ability is a height of 6 to 9 feet (Bjornn and Reiser 1991), though other estimates range from 11 feet (Bell 1986) to as high as 15 feet (McEwan 1999).

*O. mykiss* select spawning sites with gravel substrate and with sufficient flow velocity to maintain circulation through the gravel and provide a clean, well-oxygenated environment for incubating eggs. Preferred flow velocity is in the range of 1-3 feet per second (Raleigh et al. 1984) and preferred gravel substrate is in the range of 0.25 to 4 inches in diameter for steelhead and 0.25 to 2.5 inches for non-anadromous rainbow trout (Bjornn and Reiser 1991). Typically, sites with preferred features for spawning occur most frequently in the pool tail/riffle head areas where flow accelerates out of the pool into the higher gradient section below. In such an area, the female will create a pit, or redd, by undulating her tail and body against the substrate. This process also disturbs fine sediment in the substrate and lifts it into the current to be carried downstream, cleaning the nest area. Incubation and emergence success are influenced by accumulation of fine sediments (less than 3.3 mm) in the substrate. Embryo survival for steelhead decreases when the percentage of substrate particles less than 6.4 mm reaches 25-30% and is extremely low when fines are 60% or more. Emergence of steelhead fry is generally high when fine sediments are less than 5% of substrate volume but drops sharply with fine sediment volume of 15% or more (Bjornn and Reiser 1991).

*O. mykiss* hatch in the gravel-cobble substrate of the streambed. After two to three weeks the young fry emerge from the gravel and begin to feed in the stream. Some begin to disperse downstream in the months following their emergence but the rest continue to rear in the stream for a period of up to a few years (Shapovalov and Taft 1954). After emergence from the gravel, fry inhabit low velocity areas along the stream margins. As they feed and grow they gradually move to deeper and faster water (Bjorkstedt et al. 2005). Cover in the form of fallen trees, roots, undercut banks, boulders, and overhanging vegetation are important components of rearing habitat. Heads of pools generally provide classic conditions where trout can hold in lower velocity areas as currents bring food from the riffles upstream. Often, local populations thrive under conditions that may depart widely from species norms (Behnke 1992). Trout can inhabit quite small streams, particularly in coastal streams. Often habitat may be far more limiting for older juveniles than habitat for younger fish. The critical period is during base flow conditions that generally occur between May and October in Central California. Streamflow can drop to very low levels with loss of depth and velocity in riffle and run habitats, or in the extreme, only isolated pools with intervening dry sections of stream. Any diversion or other depletion of streamflow during this critical period can be potentially damaging to rearing juvenile steelhead. During winter as water temperatures decrease and flows increase, juveniles seek hydraulic refuge within pools, interstitial spaces in cobble and boulder substrates, or near large woody debris (MCWRA 2013).

Temperature is an important factor for *O. mykiss*, particularly during the over-summer rearing period. In many Central California streams growth slows or ceases in conjunction with warm, low flow conditions in late summer. Upper incipient lethal temperature for Pacific salmonids is in the range of 75°F to 77°F (24ºC to 25ºC) for continuous long-term exposure (Brett 1952; Brett et al. 1982). Elevated temperature below the lethal threshold can have indirect influence on survival due to depression of growth rate, increased susceptibility to disease, lowered ability to evade predators, decreased migratory behavior, and influences on smoltification (Zaugg and Wagner 1973, Adams et al. 1975). Preferred temperatures for steelhead parr range from 54°F to 64°F (12ºC to 18ºC), although optimum growth rates may occur at slightly higher temperatures if food is abundant (Smith 1999, Hokanson, et al. 1977, Myrick and Cech 2005). Behnke (1992) has found native redband trout in intermittent desert streams thriving in water of 83°F (28ºC) and actively feeding at that temperature. These populations have apparently become adapted to conditions in the region.

During the dry season a lagoon forms at the mouths of many California coastal streams. Lagoon habitat has been shown to be very important for rearing juvenile steelhead. Smith (1990) estimated that relatively large numbers of juvenile steelhead were present in San Gregorio, Pescadero, and areas, particularly larger individuals; that juvenile steelhead that rear in the lagoon experience higher growth rates than stream-reared fish; and that lagoon-reared fish comprise a high percentage of returning adult steelhead. Similarly, Bond (2006) found both high growth rates and high rates of return for estuary-reared steelhead in Scott Creek. Bond calculated that estuary-reared steelhead comprised between 8% and 48% of all downstream migrating juveniles but 85% of the returning adult population. Juvenile *O. mykiss* can migrate downstream to a lagoon at almost any point from the time they emerge from the gravel until they migrate to sea as smolts. Some *O. mykiss* rear in a lagoon until maturity and return upstream to spawn without entering the ocean.

After 1 to 3 years of rearing in freshwater, whether in the stream or in a lagoon, anadromous *O. mykiss* undergo the process of smoltification and enter the ocean. Seaward migration of smolts occurs primarily in the late-winter or spring, typically in March through late-May (Shapovalov and Taft 1954, Hayes et al. 2011). These fish may reside in the ocean for between 2 and 4 years (Barnhart 1986, Moyle 2002) prior to returning to spawn. Migrating smolts require adequate flows for passage and downstream movement, suitable temperature and water quality conditions, and cover from predators (NMFS 2007). Increased flow provides greater depths, currents, and surface turbulence all of which help to increase travel rates and survival of smolts (NMFS 2007)

Habitat conditions for steelhead in the Salinas Basin are distinct from most other streams in the South-Central California Coast (MCWRA 2001). The Salinas River drains an inland valley separated from the ocean by the coastal mountains. The Salinas Valley is expected to have significant differences in rainfall, air temperature, vegetation, and summer fog. These in turn are expected to influence steelhead habitat conditions including stream temperature during the summer rearing periods and the duration and frequency of streamflow conditions suitable for migration (NMFS 2007). Steelhead in the Salinas River may experience a greater number of years when access to the ocean is not possible due to low streamflow. Migration of adults from the ocean may begin later in the season, and seaward migration of juveniles may be truncated in the spring as compared to the other coastal drainages (MCWRA 2001). Climate conditions in the Reclamation Ditch watershed, located in the far northern part of the Salinas Valley and close to Monterey Bay, may be somewhat moderated in this respect.

### *1.2.3.2 Tidewater Goby*

#### *Status and Distribution*

Tidewater goby (*Eucyclogobius newberryi*) are a small, short-lived California endemic species that inhabits coastal brackish water habitats entirely within California, ranging from Tillas Slough (mouth of the Smith River, Del Norte County) near the Oregon border south to Agua Hedionda Lagoon (northern San Diego County) (Figure 5). Tidewater goby are currently listed as endangered under the Federal ESA (59 FR 5494) but have been proposed for reclassification as threatened (79 FR 14340). Tidewater goby are considered to be a species with moderate threats and a high potential for recovery (USFWS 2005). Tidewater goby has had fully protected status from the State of California since 1987.

Hubbs (1947) reported collecting tidewater goby in low to moderate abundance at three locations in the Salinas River Lagoon in August 1946. Tidewater gobies were recently collected again there in 2013 (HES 2014). Tidewater goby have also been found in Bennett Slough (northern end of Elkhorn Slough) (USFWS 2005). The critical habitat designation for tidewater goby includes Bennett Slough (north of the project area) and the Salinas River (USFWS 2013).

#### *Life History*

Tidewater goby are uniquely adapted to coastal lagoons and the uppermost brackish zone of larger estuaries, rarely invading marine or freshwater habitats (USFWS 2005). Tidewater gobies are small fish (rarely exceeding two inches in length) that generally live for only 1 year, with few individuals living longer than a year (Moyle 2002 cited in USFWS 2005). Reproduction occurs at all times of the year, as indicated by female tidewater gobies in various stages of ovarian development (Swenson 1999 cited in USFWS 2005). The peak of spawning activity occurs during the spring and then again in the late-summer. Fluctuations in reproduction are probably due to death of breeding adults in early summer and colder temperatures or hydrological disruptions in winter (Swift et al. 1989 cited in USFWS 2005). Reproduction takes place in water between 48°F and 77°F (9°C and 25°C) and at salinities of 2 to 27 ppt (Swenson 1999 cited in USFWS 2005).

Male tidewater gobies begin digging breeding burrows in relatively unconsolidated, clean, coarse sand (averaging 0.5 millimeter [0.02 inch] in diameter), in April or May after lagoons close to the ocean (Swift et al. 1989; Swenson 1995 cited in USFWS 2005). Swenson (1995 cited in USFWS 2005) has shown that tidewater gobies also prefer this substrate in the laboratory. Burrows are at least 70 to 100 millimeters (3 to 4 inches) from each other. After hatching, the larval tidewater gobies, measuring 4 to 5 millimeters (mm) in standard length (SL), emerge from the burrow and swim upward to join the plankton (Wang 1986, Swift et al. 1989). Juvenile tidewater gobies become benthic dwellers at 16 to 18 mm SL (Moyle 2002). Tidewater gobies are known to be preyed upon by native species such as small steelhead, prickly sculpin, and staghorn sculpin (Swift et al. 1989 cited in USFWS 2005).

**Figure 5: Tidewater goby, Salinas River Lagoon, October 2013. (*photo J. Hagar*)**

Tidewater goby abundance fluctuates spatially and seasonally, due in part to their predominantly annual life cycle (Swenson 1999). Tidewater goby populations also vary greatly with the varying environmental conditions (e.g., drought, El Niño) among years (USFWS 2007). This environmental variation is a normal phenomenon, but one that makes the determination of trends in population size difficult. For example, tidewater goby populations decrease during the rainy season when lagoons are open and influenced by flood events, and then recover during the following summer (USFWS 2007). Swift et al. (1989) estimated that individual tidewater gobies within a population at Aliso Creek Lagoon ranged from 1,000 to 1,500 in the late winter-early spring and 10,000 to 15,000 tidewater gobies in the late summer-early fall.

Their short life span and restricted habitat make individual populations vulnerable to unique catastrophic events (floods, toxic events, introduction of predator species, drought, or habitat alteration). Nevertheless, available information indicates that *Eucyclogobius* is tolerant of a very wide range of salinity, temperature, and other water quality conditions.

The USFWS characterizes tidewater goby populations (i.e., localities) along the California coast as metapopulations (a group of distinct populations that are genetically interconnected through occasional exchange of animals) (USFWS 2007). While individual populations may be periodically extirpated under natural conditions, a metapopulation is likely to persist through colonization or re-colonization events that establish new populations (USFWS 2007). Local populations of tidewater gobies occupy coastal lagoons and estuaries that in most cases are separated from each other by the open ocean. Very few tidewater gobies have ever been captured in the marine environment (Swift et al. 1989), which suggests this species rarely occurs in the open ocean (USFWS 2007). Some tidewater goby populations persist on a consistent basis (potential sources of individuals for re-colonization), while other tidewater goby populations appear to experience intermittent extirpations. Local extirpations may result from one or a series of factors, such as the drying up of some small streams during prolonged droughts, water diversions, and estuarine habitat modifications (USFWS 2007). Some localities where tidewater gobies have been extirpated apparently have been re-colonized when extant populations were present within a relatively short distance of the extirpated population (i.e., less than 6 miles (10 kilometers)). More recently, another tidewater goby researcher has suggested that re-colonizations have typically been between populations separated by no more than 10 miles (16 kilometers) (Swift 2007 cited in USFWS 2007). Flooding during winter rains can contribute to re-colonization of estuarine habitats where tidewater goby populations have previously been extirpated. The closest known populations that could recolonize the Salinas River Lagoon are in the Pajaro River and Elkhorn Slough (USFWS 2005, Kukowski 1972, Swift et al. 1989). The mouth of Elkhorn Slough is connected to the Salinas River Lagoon through the Old Salinas River. The mouth of the Pajaro River is about 3 miles (5 kilometers) north of the mouth of Elkhorn Slough and about 7 miles (11 kilometers) north of the Salinas River Lagoon.

***Habitat Characteristics***

The tidewater goby favors the calm conditions that prevail when the lagoons are cut off from the ocean by beach sandbars. They are bottom dwellers and are typically found at water depths of less than 3 feet. Tidewater gobies typically inhabit areas of slow-moving water, avoiding strong wave action or currents. Particularly important to the persistence of the species in lagoons is the presence of backwater, marshy habitats, which provide refuge habitat during winter flood flows (J. Smith pers. comm. 1999 as referenced in Environmental Science Associates 2001). Optimal lagoon habitats are shallow, sandy-bottomed areas 20 to 10 cm deep, surrounded by beds of emergent vegetation. Open areas are critical for breeding, while vegetation is critical for overwintering survival (providing refuge from high flows) and probably for feeding as well (Moyle 2002).

Swift et al. (1989) found that all sizes of *E. newberryi* usually occur at the upper end of lagoons at salinities of 10 ppt or less. Of 60 collections, 65% were at 0-10 ppt, 20% were at 10-20 ppt, 17% at 20-30 ppt, and 2% at 42 ppt. The collection at 42 ppt was made at Bennett Slough, a tributary of Elkhorn Slough in Monterey County (Swift et al. 1989). In lab tests conducted by the CDFW, tidewater gobies were maintained in freshwater, 10-15 ppt, 20 ppt, and normal seawater (33 ppt) with reproduction taking place under all four conditions (Worcester and Lea 1996). Differences in reproductive success, if any, were not reported. Worcester and Lea also held tidewater gobies in hypersaline water (45-54 ppt) for 6 months with no mortality. Holding temperatures during these tests ranged from 39°F to 71°F (4.0°C to 21.5°C). In salinity tolerance tests reported by Swift et al. (1989), tidewater gobies in salinities above 41 ppt experienced high mortality. In an experiment where salinity increased slowly due to evaporation, over half the gobies survived hypersaline conditions up to 1.75 times that of seawater.

Swift et al. (1989) list several criteria for lagoon conditions that favor tidewater gobies. These include: little or no channelization; allowing closure to the ocean for much of the year so that tidal fluctuation is absent or minimal; fresh unconsolidated sand is optimal for reproduction; high quality of inflowing water to increase habitable area of a lagoon in summer. Nutrient enrichment can stimulate algal blooms, deplete oxygen, and lead to hydrogen sulfide formation. Most fish species are intolerant of low dissolved oxygen and high hydrogen sulfide concentrations. Introduced predatory fish should be excluded. Centrarchid fish (sunfish and bass) and tidewater gobies are not usually found together and may not be able to coexist (Swift et al. 1989).

Gobies may move upstream during winter rains and high flows of inlet streams (Swift et al. 1989) as well as during the summer when algal blooms and hydrogen sulfide forms in the substrate and enters the water column. During this period most fish are at the upper end of lagoons where freshwater inflow occurs or at the seaward end where occasional waves wash into the Lagoon (Swift et al. 1989).

Currently, the majority of the most stable and largest tidewater goby populations consist of lagoons and estuaries of intermediate sizes (5 to 125 acres or 2 to 50 hectares) that have remained relatively unaffected by human activities (USFWS 2005). Many of the localities where tidewater gobies are regularly present may be “source” populations for localities that intermittently lose their tidewater goby populations. Large wetlands are likely to have lower rates of extirpation than small wetlands. In addition, populations at small sites were sensitive to drought, presumably because droughts can eliminate suitable habitat at small wetlands (USFWS 2007).

## 1.3 Effects Assessment

### 1.3.1 Significance Thresholds and Evaluation Criteria

The California Environmental Quality Act (CEQA) Guidelines provide a discussion of significance criteria for evaluation of environmental effects of a project. Appendix G of the CEQA Guidelines suggests the following evaluation criteria for biological resources:

Would the project:

- Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service?
- Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites?
- Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations or by the California Department of Fish and Wildlife or U.S. Fish and Wildlife Service;
- Conflict with any local policies or ordinances protecting fishery resources; or
- Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Conservation Community Plan, or other approved local, regional, or state habitat conservation plan.

In order to apply these general criteria to any particular project, it is helpful to identify specific, measurable, indicators that can be used to compare baseline (without project) conditions for potentially effected resources to conditions that are expected to occur with the project or various alternatives.

The GWR project would potentially alter habitat conditions by changing flow patterns. Flow would be diverted at certain locations and times in varying amounts. This would also require construction of facilities to divert and conduct flows to desired locations. Therefore, indicators for this assessment are primarily related to changes in flow. It is important that impact analyses include assessment of components of the flow regime that can be used to characterize the entire range of flows and specific hydrologic phenomena (e.g., floods and low flows) that are vital to the integrity of river ecosystems, and thus fish species. These components of the flow regime include: (1) magnitude; (2) frequency; (3) duration; (4) timing; and (5) rate of change of hydrologic conditions (Poff et al. 1997). Furthermore, Poff et al. (1997) report that by defining flow regimes in these terms, the ecological consequences of particular human activities that modify one or more components of the flow regime can be considered explicitly. Therefore, effects analysis for the GWR project relied heavily on evaluating changes to the hydrographs caused by project water diversions.

In order to identify potential effects of the Project's Diversion Scenarios on stream flow, a 10 percent decrease in flow relative to existing conditions was defined as a relevant indicator of potential effects. A decrease in flow of 10 percent or greater during a relevant evaluation period has been previously identified by various environmental documents as an appropriate criterion to evaluate flow changes (USFWS et al. 1999, USDOI et al. 1999, JSA 2003).

Accordingly, evaluation of the GWR project relies on previously established information and uses changes in flow of 10 percent or greater, as expressed by flow exceedance probabilities, as an indicator of potential effects on riverine habitat. Further, since SCCC steelhead are the only protected species using riverine portions of the project area (tidewater goby are an estuarine species), additional analysis was developed for this species.

Migration, both upstream for adults and downstream for adults (kelts) and juveniles (smolts) are the potentially affected steelhead life stages. Potential project affects to these life stages are related to changes in flows resulting from each of the different Diversion Scenarios. This analysis used previously established minimum flow thresholds for steelhead migration to assess changes in the duration of periods available for migration. Modeled hydrologic data reflecting project operations scenarios was used to evaluate the amount of time project flows were in a range suitable for migration and this was compared to the amount of time flow is in a suitable range under baseline conditions.

For the purposes of this analysis, the effect of a Diversion Scenario would be considered less than significant if it would result in either of the following:

- A change in stream flow during relevant analytical periods of less than 10%.
- A change in frequency of occurrence of flow at or above migration thresholds of less than 10%, relative to specific flow thresholds during steelhead adult or smolt migration periods.

A change in streamflow of 10% or more may or may not be considered significant depending on the species and lifestages likely to be present, habitat requirements and behavior of those species or lifestages, and potential for the given flow change to influence key habitat features. Furthermore, for an impact to be considered less than significant, implementation of a Diversion Scenario will not cause creation of an obstacle or hazard to migrating steelhead (adults, juveniles or smolts) or other native resident or migratory fish.

Five diversion scenarios (Cases) are evaluated:

- Case 0: Base Condition Flow = USGS San Jon Road gage (11152650), scaled down by a factor of 0.937 for Davis Road location and scaled up by a factor of 1.4 for Castroville location.
- Case 1: Divert up to 2.99 cfs of available flow from Reclamation Ditch at Davis Road and up to 2.99 cfs of available flow from Tembladero Slough at Castroville; leave a minimum base flow of 2 cfs December-May, or 0.69 cfs June-November at Davis Road location and leave constant minimum base flow of 1 cfs in Tembladero Slough.
- Case 2: Divert up to 6.0 cfs of available flow from Reclamation Ditch at Davis Road and up to 2.99 cfs of available flow from Tembladero Slough at Castroville; leave minimum base flows of 2 cfs December-May, or 0.69 cfs June-November at Davis Rd location and leave constant minimum base flow of 1 cfs in Tembladero Slough.
- Case 3: Divert up to 2.99 cfs of available flow from Reclamation Ditch at Davis Road and up to 2.99 cfs of available flow from Tembladero Slough at Castroville; leave minimum base flows of 1.0 cfs year-round in both Tembladero Slough and Reclamation Ditch.
- Case 4: Divert up to 6.0 cfs of available flow from Reclamation Ditch at Davis Road and up to 2.99 cfs of available flow from Tembladero Slough at Castroville; Leave minimum base flows of 1.0 cfs year-round in both Tembladero Slough and Reclamation Ditch.

### 1.3.2 Construction Related Effects

#### *1.3.2.1 All Cases*

The diversion facility would include an inlet consisting of a concrete box with a screened inlet in the channel bottom (Schaaf & Wheeler 2014). The inlet structure would measure a minimum of 4-ft. wide by 6-ft. long and the channel invert would be concrete lined with a permanent low-flow channel adjacent to the inlet. This would prevent capturing the required minimum by-pass flows. The channel banks above the inlet structure would be protected with grouted rip-rap to prevent scour and potential bank sloughing into the by-pass and inlet (Schaaf & Wheeler 2014). Dewatering the channel to complete construction of the in-channel structures would represent a short-term temporary impact to aquatic habitat and aquatic species within the construction area. Effects could be avoided and minimized to less than significant levels by completing the work during the low flow season when migratory steelhead would not be present. Best management practices (BMPs) including removal of fish and other aquatic species prior to construction would minimize effects on aquatic habitat or species to less than significant levels. Tidewater goby are not expected to be present at the Davis Road site due to its degraded condition and distance upstream from estuarine habitat. There is a potential for tidewater goby to be present at the Castroville site. Preconstruction surveys would be completed to determine whether tidewater goby are present at the site and if so, consultation with the USFWS would be required to determine appropriate avoidance and minimization measures.

### 1.3.3 Operation- Effects of Diversion Structures

#### *1.3.3.1 All Cases*

The inlet would be screened to minimize entrainment of fish (Schaaf & Wheeler 2014). The screening system would be in compliance with Statewide Fish Screening Policy (http://www.dfg.ca.gov/fish/Resources/Projects/Engin/Engin_ScreenPolicy.asp) and Fish Screening Criteria developed by CDFW for structure placement, approach velocity, sweeping velocity, screen openings, and screen construction (http://www.dfg.ca.gov/fish/Resources/Projects/Engin/Engin_ScreenCriteria.asp).

The Statewide Fish Screening Policy is structured to comply with existing fish screening statutes, the National Environmental Policy Act (NEPA), CEQA, the Federal Endangered Species Act (ESA), the California Endangered Species Act (CESA), and court decisions in place at the time of its adoption.

Compliance with these policies and criteria would reduce potential effects of the diversion structure to less than significant levels. Due to the possibility of migrating steelhead in Tembladero Slough and the Reclamation Ditch, facilities in those locations would also be in compliance with NMFS Anadromous Salmonid Passage Facility Design criteria and specifications (NMFS 2008). Compliance with these policies and criteria and would reduce potential effects of the diversion structure to less than significant levels.

### 1.3.4 Operation- Alteration of Flows

Potential project effects on flows were determined by comparing estimated flows with the project to present conditions for each Case. Modeled flow results are used for comparative purposes, rather than for absolute predictions, and the focus of the analysis is on comparative differences between the scenarios (e.g., a comparison of estimated conditions under Case 1, relative to conditions without the project). All of the assumptions (e.g., hydrologic conditions, climatic conditions, upstream storage conditions, etc.) are the same for both the with-project and without-project flow estimates, except assumptions associated with the diversion Case itself, and the focus of the analysis is the differences in the results.

Flow data used in these analyses were provided by Schaaf & Wheeler. The analyses use

USGS gaged flow from the San Jon Road gage (Station 11152650, Reclamation Ditch near Salinas, CA). The gage is located just downstream of the Davis Road proposed diversion site and is relevant for this project. The period of record is 28 years and is split into October 1970 to February 1986 and June 2002 to the present. Average annual runoff at the San Jon Road gage has declined by almost a third in recent years as water conservation practices have reduced the amount of agricultural irrigation (Schaaf & Wheeler 2014). Therefore, only the 2002-2013 data were used in this analysis. The years in this limited data set have mean annual flows with a higher minimum, lower maximum, and lower average than the longer data set.

Changes in flow were estimated for both the Davis Road proposed project site and the Castroville proposed project site. Schaaf & Wheeler calculated the sub-basin sizes for the entire Reclamation Ditch watershed (Schaaf & Wheeler 2014). Based on those data, the basin size above the USGS gage is 109.4 square-miles. The drainage basin above the proposed diversion point on the Reclamation Ditch at Davis Road is 102.5 square-miles, or 93.7% of the gaged area. Historic mean daily flows at the diversion point were calculated by scaling the recorded flows at San Jon Road by that factor. For alternatives at the Castroville proposed project site (Case 3 and 4), the gaged flow record from the San Jon Road gage was also used; however, since the drainage basin above the MRWPCA Castroville Pump Station is 148.5 square-miles, or 136% of the gaged area, the historic mean daily flow records were scaled by 136%.

Daily estimated flow data were used to develop exceedance probability distributions (exceedance curves) by three separate seasonal periods including: adult steelhead upstream migration (December through April), steelhead smolt migration (March through May), and dry season (June through September). These exceedance probability distributions were developed from ranked and sorted data, and show the percentage of time (probability) that a given value is exceeded. These curves show the differences in general long-term flow patterns between the base Case and each of four alternative diversion scenarios.

Effects of the project on steelhead migration were assessed by calculating changes in periods of time when flows are sufficient to allow migration. Minimum flows for migration of both adult steelhead moving upstream to spawn and smolts moving downstream to the ocean were determined through site specific studies in the Reclamation Ditch (HES 2015). Minimum passage flow thresholds were estimated at two critical passage sites: the USGS stream gage weir at San Jon Road and at a site near Boronda Road (Table 4). Flow thresholds for steelhead passage were estimated from measured channel geometry and application of the Manning equation (HES 2015). Due to error inherent in the method for obtaining these estimates, the accuracy of the threshold estimates is assumed to be no better that +/- 30% (HES 2015). Estimates of the number of days when stream flow equaled or exceeded these thresholds during the appropriate migration season were calculated for the Base Case and each of the diversion Cases. Migration seasons were defined to encompass the major period for each life stage typical of the Salinas River basin: December through April for adults and March through May for smolts. Although migration can occur outside these windows under some conditions, expanding the analytical period can minimize the potential effects by including greater time periods with low potential for occurrence of the species (e.g. a change of 10 days of suitable passage would be considered significant over a 90 day migration season but not over a 120 day season). For adult migration the migration season is designated by the year it ends (e.g. the 2003 migration season starts December 1, 2002 and ends April 30, 2003.

**Table 4: Minimum Passage Flow Estimates for Steelhead Migrating Through the Reclamation Ditch Downstream of Davis Road *(Source: Hagar Environmental Science 2015).***

| Location | Adult | Smolt |
|---|---|---|
| San Jon Road (USGS gage weir) | 78 cfs | 31 cfs |
| Boronda Road critical riffle | 32 cfs | 11 cfs |

*1.3.4.1 Case 1*

***Divert up to 2.99 cfs of available flow from Reclamation Ditch at Davis Road and up to 2.99 cfs of available flow from Tembladero Slough at Castroville with minimum bypass flow of 2 cfs December-May and 0.69 cfs June-November at Davis Road location and 1 cfs in Tembladero Slough.***

For Case 1 during the adult migration period, the largest proportional flow reductions downstream of Davis Road would occur when Base Case flow is in the range of 1 to 30 cfs (Figure 6). Flow reductions for base case flows over 30 cfs would be 10% or less. The 2.99 cfs diversion at Castroville under Case 1, combined with the Davis Road diversion, results in larger flow reductions in Tembladero Slough and downstream reaches to Monterey Bay with flow reductions of 10% or more for Base Case flows of 1 to 60 cfs (Figure 7).

Steelhead are most likely to migrate during high flows that occur during winter storm runoff. Minimum migration flows for adult steelhead passage in the Reclamation Ditch have been estimated at 32 cfs to 78 cfs with the most difficult passage conditions at the San Jon Road stream gage (HES 2015). Diversion of 2.99 cfs would curtail periods when migration for adult steelhead is possible. Assuming a minimum passage flow of 78 cfs at the San Jon Road stream gage site, it is estimated that there would be reductions of 0% to 20% (average 8%) in the number of days annually meeting the minimum migration threshold for adult steelhead (Figure 8, Table 5). The number of potential migration days is reduced in 9 years out of the 11 modeled and in 4 years the reduction is 10% or more. Although the actual number of days involved is generally small (1 to 2 fewer days meeting migration criteria), the migration windows (periods when flows are in a suitable range) are also relatively short. One or 2 days of additional flow could make the difference between successful passage through the lower watershed and failure. If migration periods are curtailed when the diversion causes flows to drop below passage thresholds, adult steelhead could become stranded below difficult passage locations such as the stream gage at San Jon Road. Given the species status as threatened, a change in flow of this magnitude (10% or more reduction in migration periods in 36% of years) is potentially significant for migrating adult steelhead.

Flow reductions in Tembladero Slough downstream of the Castroville proposed diversion would have less effect on steelhead migration than the diversion at Davis Road since Tembladero Slough has a very low gradient downstream of the Castroville proposed project site and there are no critical passage sections such as the riprap and gaging weir at San Jon Road upstream. Tembladero Slough is tidally influenced from the Old Salinas River up to Highway 183 in Castroville and the backwater condition caused by the tide gates would prevent measurable reductions in water levels throughout that reach (Schaaf & Wheeler 2014).

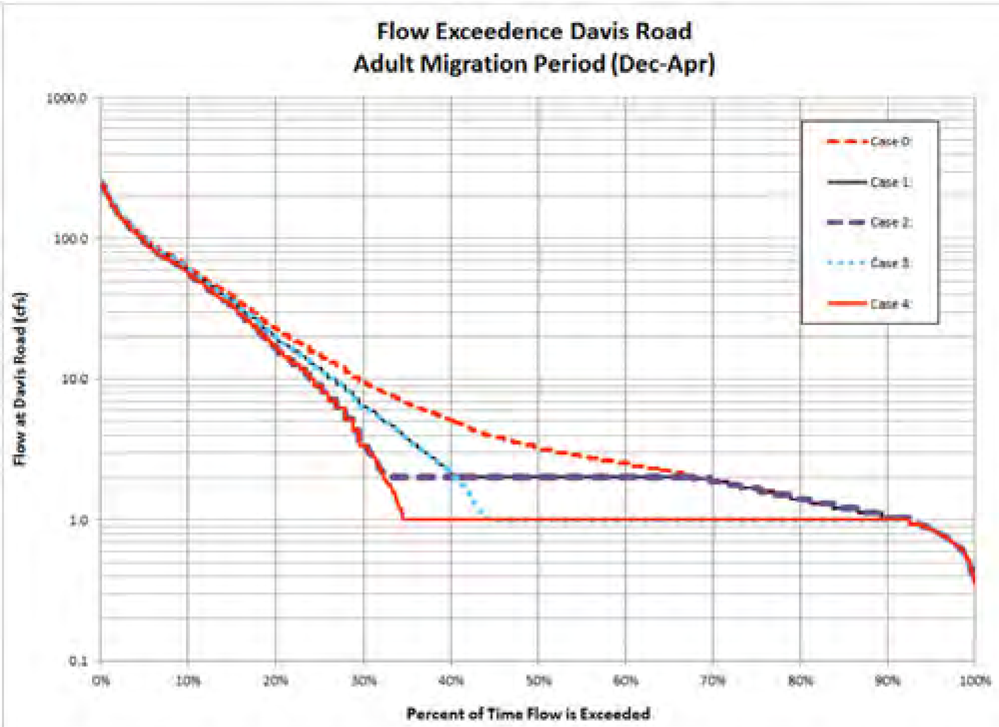


**Figure 6. Flow exceedance curve for Davis Road proposed project site during adult steelhead migration period.**

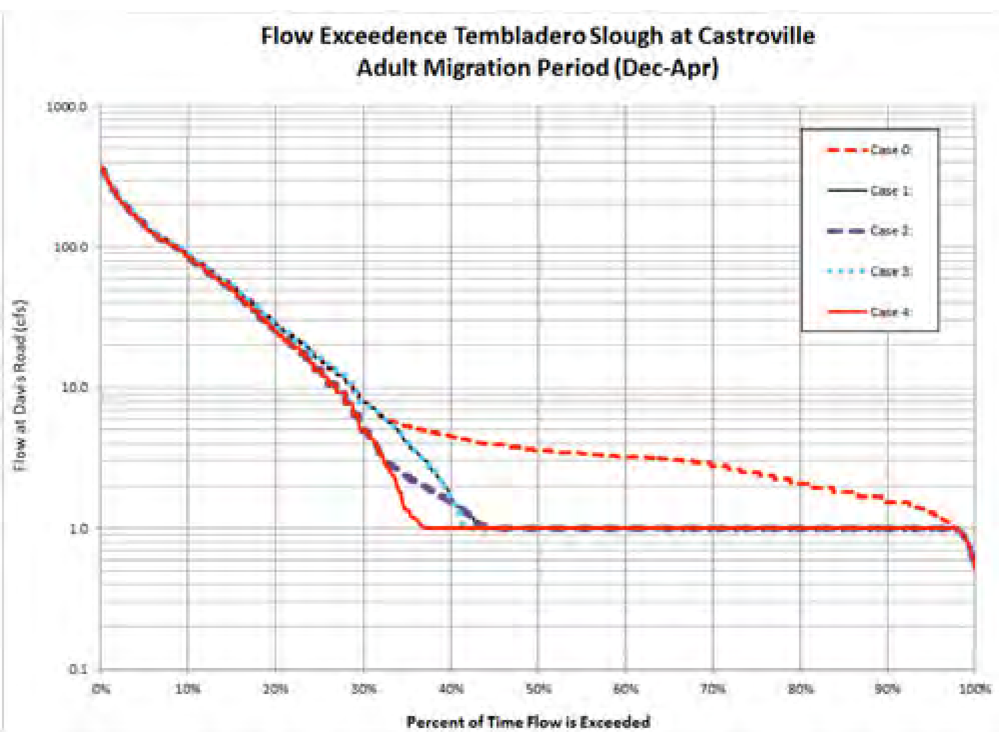


**Figure 7. Flow exceedance curve for Tembladero Slough at Castroville proposed diversion site during steelhead smolt migration period.**

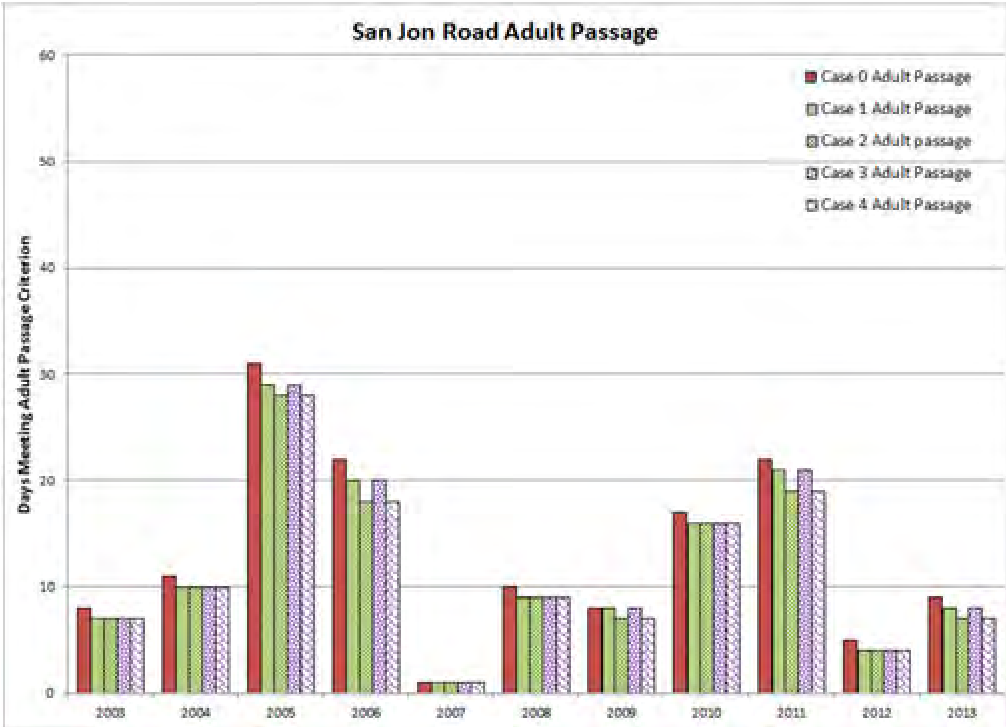


**Figure 8. Number of days meeting minimum passage flow (78 cfs) for adult steelhead downstream of the Davis Road proposed project site during December through April.**

**Table 5: Simulated number of days meeting migration criteria (and percent reduction from base case) at San Jon Road during adult steelhead migration seasons. *Note*: migration season begins December 1 and ends April 30 the following year and is designated by the year it ends; partial periods (2002 and 2014) are omitted.**

| | Number of Days Meeting Adult Migration Criteria (78 cfs) | | | | |
|---|---|---|---|---|---|
| **Migration Period** | **Case 0** | **Case 1** | **Case 2** | **Case 3** | **Case 4** |
| 2003 | 8 | 7 (-13%) | 7 (-13%) | 7 (-13%) | 7 (-13%) |
| 2004 | 11 | 10 (-9%) | 10 (-9%) | 10 (-9%) | 10 (-9%) |
| 2005 | 31 | 29 (-6%) | 28 (-10%) | 29 (-6%) | 28 (-10%) |
| 2006 | 22 | 20 (-9%) | 18 (-18%) | 20 (-9%) | 18 (-18%) |
| 2007 | 1 | 1 (0%) | 1 (0%) | 1 (0%) | 1 (0%) |
| 2008 | 10 | 9 (-10%) | 9 (-10%) | 9 (-10%) | 9 (-10%) |
| 2009 | 8 | 8 (0%) | 7 (-13%) | 8 (0%) | 7 (-13%) |
| 2010 | 17 | 16 (-6%) | 16 (-6%) | 16 (-6%) | 16 (-6%) |
| 2011 | 22 | 21 (-5%) | 19 (-14%) | 21 (-5%) | 19 (-14%) |
| 2012 | 5 | 4 (-20%) | 4 (-20%) | 4 (-20%) | 4 (-20%) |
| 2013 | 9 | 8 (-11%) | 7 (-22%) | 8 (-11%) | 7 (-22%) |
| Total | 144 | 133 (-8%) | 126 (-13%) | 133 (-8%) | 126 (-13%) |

During the smolt migration period (March through May), flows at the Davis Road site are generally lower than during the adult migration period and proportional reduction in flow from the diversion would be greater (Figure 9). The 2.99 cfs Tembladero Slough diversion would similarly reduce flows downstream of the Castroville proposed diversion location (Figure 10). As described for adult migration, smolt migration flows are more an issue in the Reclamation Ditch, upstream of Tembladero Slough than in Tembladero Slough which is a low-gradient channel without critical passage sections and with tidal influence that tends to backwater the channel as far upstream as the Castroville Diversion location.

Although smolts need less flow to migrate in the Reclamation Ditch than adults, the channel is severely lacking in cover and smolts are exposed to potential predation from birds. Minimum migration flow for smolts is estimated at between 11 cfs and 31 cfs, depending on location, again with the most difficult passage at the San Jon Road stream gage (HES 2015). Proportional reductions in flow can be quite large in this range (Figure 9). For example, a flow of 3 cfs or more occurs at the Davis Road proposed project site approximately 56% of the time under the base case but only about 28% of the time with Case 1.

Based on a minimum passage flow for smolts of 31 cfs at the San Jon Road site, the number of days with flows meeting minimum smolt passage criteria is reduced by 0% to 7% annually or an average of 4% (Figure 11, Table 6). The reduction is never more than 10%. The number of days meeting smolt migration criteria is reduced under Case 1 compared to the base case (Case 0) in 2 years out of 11 years simulated. In some cases the actual reduction in terms of days is small however; the number of days available in the base case is also small at times (e.g. 2011). Flow alterations downstream of the Davis Road site of this magnitude do not meet the significance criteria during the smolt migration period and would be considered less than significant. It should be noted however, the accuracy of the flow threshold estimate for smolt migration is +/- 30%. If the lower end of the range were used for minimum passage flow for smolts (30% of 31 cfs is 22 cfs), the number of days meeting the passage criteria would be reduced by up to 17%, and 27% of years would have reductions of 10% or more.

**Table 6: Simulated number of days meeting migration criteria (and % reduction from base case) at San Jon Road during simulated steelhead smolt migration seasons (March-May).**

| | Number of Days Meeting Smolt Migration Criteria (31cfs) | | | | |
|---|---|---|---|---|---|
| **Migration Period** | **Case 0** | **Case 1** | **Case 2** | **Case 3** | **Case 4** |
| 2003 | 4 | 4 (0%) | 4 (0%) | 4 (0%) | 4 (0%) |
| 2004 | 2 | 2 (0%) | 2 (0%) | 2 (0%) | 2 (0%) |
| 2005 | 19 | 19 (0%) | 18 (-5%) | 19 (0%) | 18 (-5%) |
| 2006 | 41 | 38 (-7%) | 35 (-15%) | 38 (-7%) | 35 (-15%) |
| 2007 | 0 | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| 2008 | 0 | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| 2009 | 5 | 5 (0%) | 5 (0%) | 5 (0%) | 5 (0%) |
| 2010 | 17 | 17 (0%) | 16 (-6%) | 17 (0%) | 16 (-6%) |
| 2011 | 15 | 14 (-7%) | 13 (-13%) | 14 (-7%) | 13 (-13%) |
| 2012 | 9 | 9 (0%) | 9 (0%) | 9 (0%) | 9 (0%) |
| 2013 | 0 | 0 (0%) | 0 (0%) | 0 (0%) | 0 (0%) |
| Total | 112 | 108 (-4%) | 102 (-9%) | 108 (-4%) | 102 (-9%) |

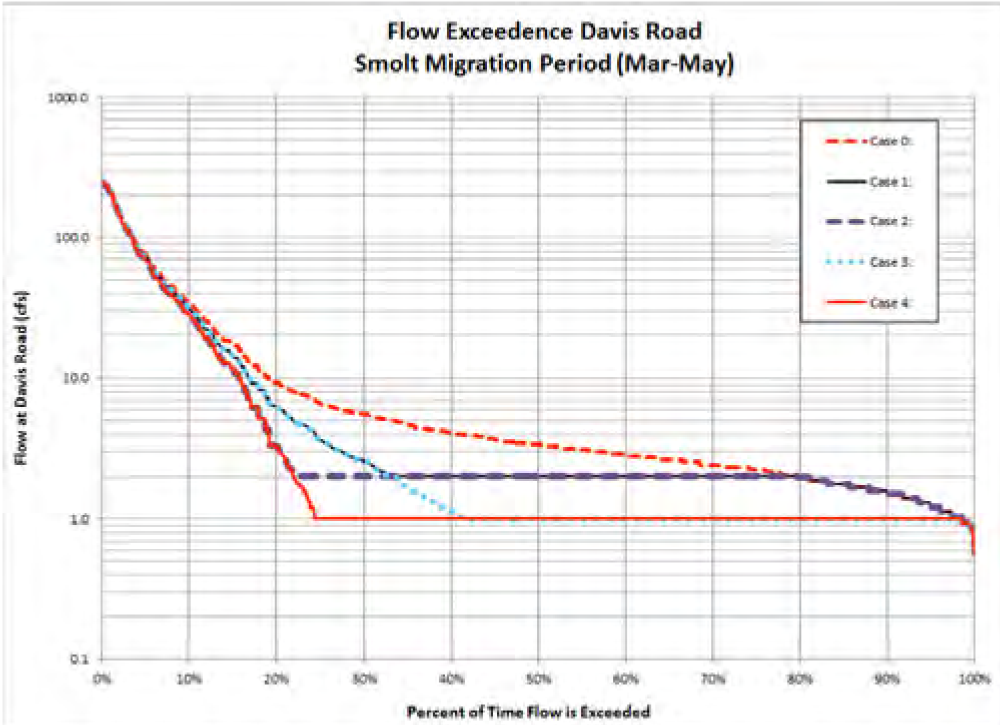


**Figure 9. Flow exceedance curve for Davis Road proposed project site during steelhead smolt migration period.**

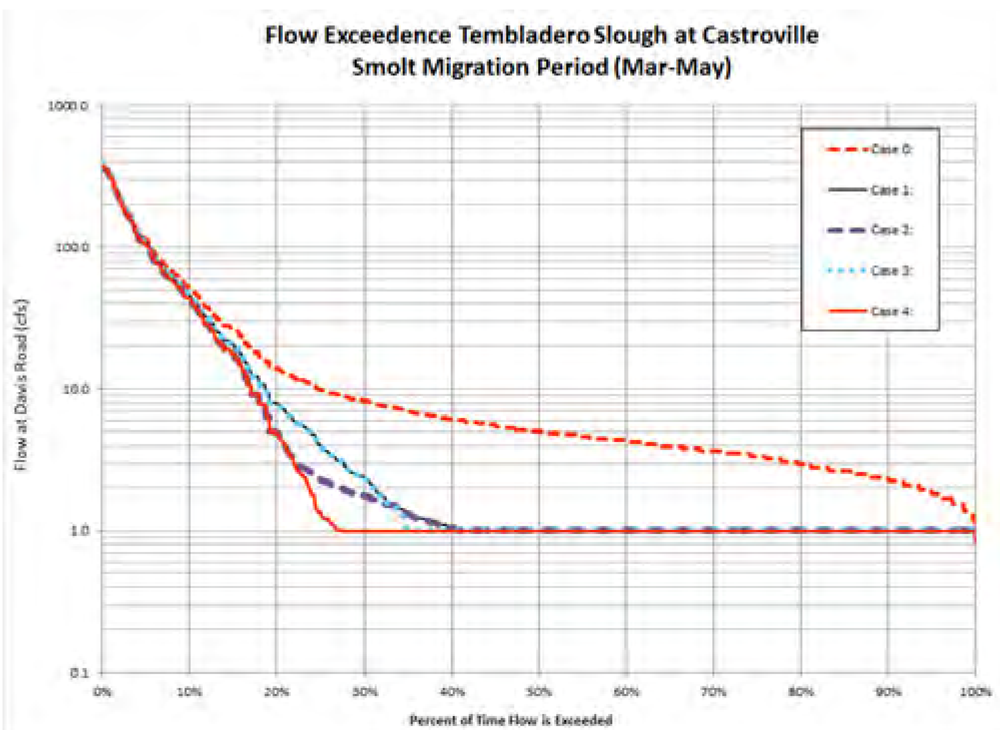


**Figure 10. Flow exceedance curve for Tembladero Slough at Castroville proposed project site during steelhead smolt migration period.**

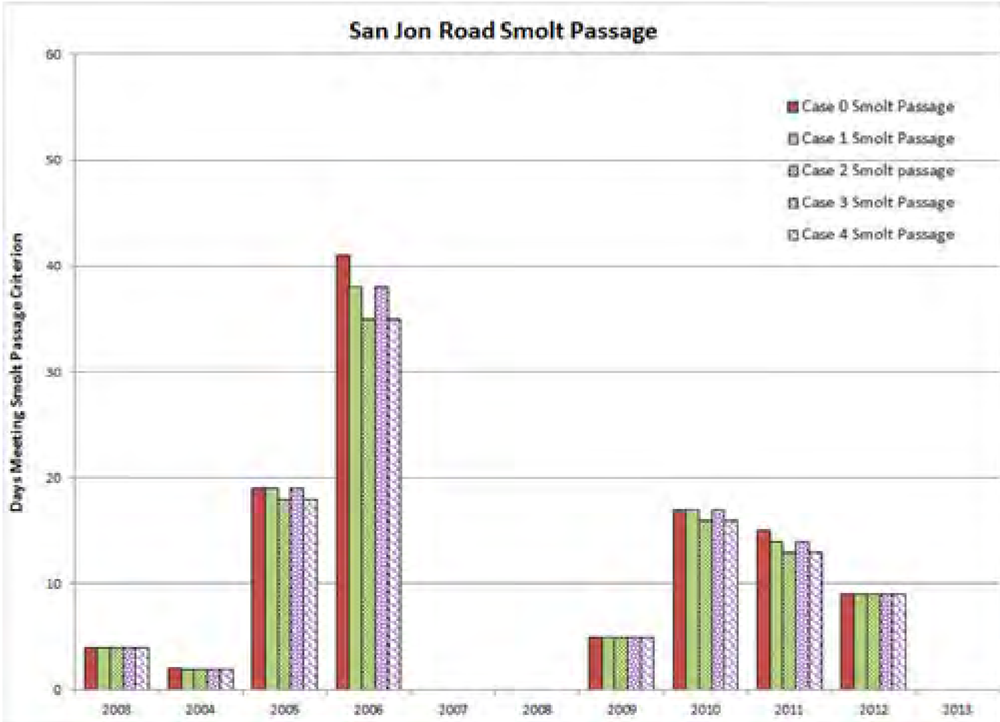


**Figure 11. Number of Days meeting minimum passage flow (31 cfs) for steelhead smolts downstream of the Davis Road proposed project site during March, April, and May.**

Flow reductions during the dry season exceed 10% across the majority of the range of flows simulated at Davis Road and Castroville (Figures 12 and 13). However, during the dry season (June-September), special status species are not expected to be present in the Reclamation Ditch downstream of the Davis Road proposed project site. Steelhead use these reaches only for migration, during the winter and spring, and potential dry season rearing habitat exists only in headwater reaches. There is a limited potential for tidewater goby near or downstream of the Castroville project site. Since goby prefer quiescent conditions, and since the channel is tidally backwatered in this reach, flow reductions in the range simulated would not be expected to have a detrimental effect on them, should they be present. Native and introduced warmwater species likely to be present are not migrating during this period. The 0.69 cfs minimum flow maintains base habitat conditions for species likely to be present. Flow changes from Case 1 during the dry season (Figures 12 and 13) would have a less than significant effect.

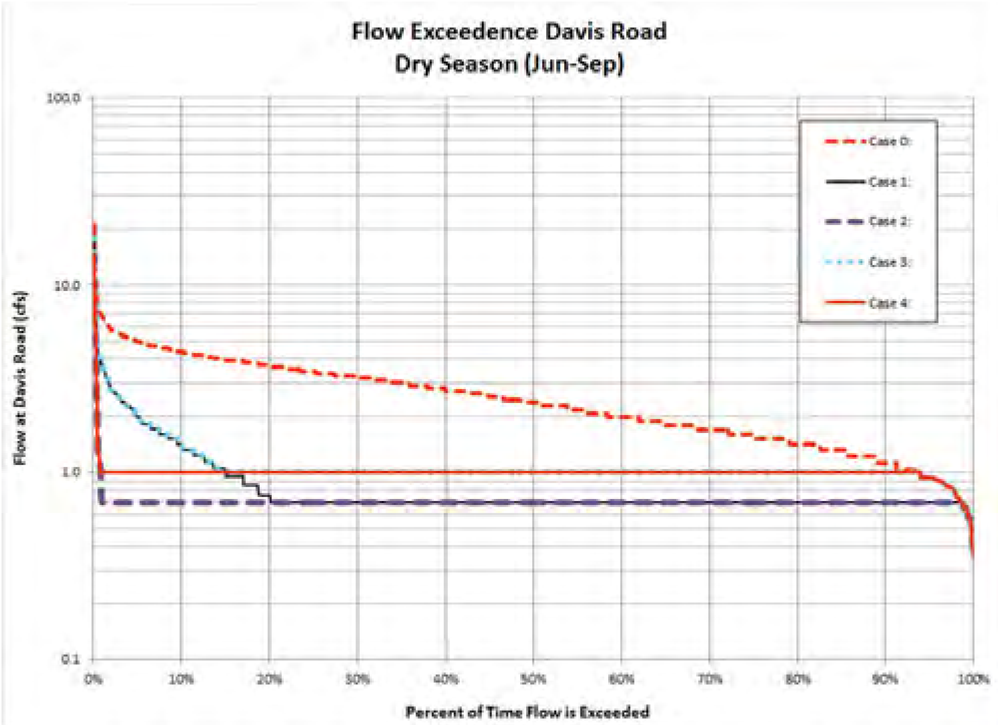


**Figure 12. Flow exceedance curve for Davis Road proposed project site during summer dry-season.**

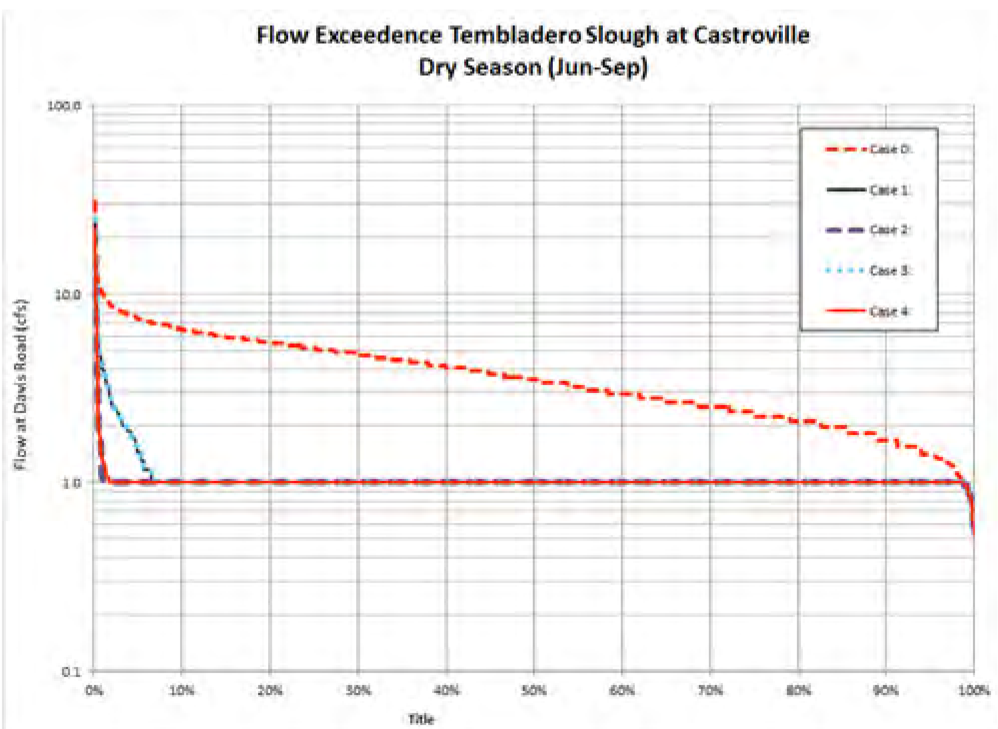


**Figure 13. Flow exceedance curve for Tembladero Slough at Castroville proposed project site during summer dry-season.**

#### *1.3.4.2 Case 2*

***Divert up to 6.0 cfs of available flow from Reclamation Ditch at Davis Road and up to 2.99 cfs of available flow from Tembladero Slough at Castroville with minimum bypass flow of 2 cfs December-May and 0.69 cfs June-November at Davis Road location and 1 cfs in Tembladero Slough.***

Analysis of Case 2 was identical to Case 1 except the Target Diversion at the Davis Road site was 6 cfs instead of 2.99 cfs. For Case 2 during the adult migration period, the largest proportional flow reductions in the Reclamation Ditch would occur in the range of 1 to 60 cfs. Flow reductions for base case flows of 60 cfs or less would be 10% or more for the Reclamation Ditch (Figure 6). The 2.99 cfs diversion at Castroville under Case 2, combined with the Davis Road diversion, results in larger flow reductions in Tembladero Slough and downstream reaches to Monterey Bay with flow reductions of 10% or more for Base Case flows of 1 to 90 cfs (Figure 7).

Case 2 has a greater potential effect on adult steelhead migration than Case 1 given the larger diversion rate. Assuming a minimum passage flow of 78 cfs at the San Jon Road stream gage site, it is estimated that there would be reductions of 0% to 22% (average 13%) in the number of days annually meeting the minimum migration threshold for adult steelhead (Figure 8, Table 5). The number of potential migration days is reduced in 10 years out of the 11 modeled and in 8 years the reduction is 10% or more. Although the actual number of days involved is generally small (1 to 4 fewer days meeting migration criteria), the migration windows (periods when flows are in a suitable range) are also relatively short. One or 2 days of additional flow could make the difference between successful passage through the lower watershed and failure. Curtailment of migration flows by this amount could limit the ability of steelhead to reach spawning habitat in the upper watershed and adult steelhead could become stranded below difficult passage locations such as the stream gage at San Jon Road. Given the species status as threatened, a change in flow of this magnitude (10% or more reduction in migration periods in 73% of years) is potentially significant for migrating adult steelhead.

As discussed previously for Case 1, flow reductions in Tembladero Slough downstream of the Castroville proposed diversion would have less effect on steelhead migration than the diversion at Davis Road since Tembladero Slough has a very low gradient downstream of the Castroville proposed project site and there are no critical passage sections such as the riprap and gaging weir at San Jon Road upstream. Tembladero Slough is tidally influenced from the Old Salinas River up to Highway 183 in Castroville and the backwater condition caused by the tide gates would prevent measurable reductions in water levels throughout that reach (Schaaf & Wheeler 2014).

During the smolt migration period (March through May), flows at the Davis Road site are generally lower than the adult migration period and proportional reduction in flow from the diversion would be greater (Figures 9 and 10). Although smolts need less flow to migrate than adults, the channel is severely lacking in cover and smolts are exposed to potential predation from birds. As previously described, smolt migration flows are more an issue in the Reclamation Ditch, upstream of Tembladero Slough than in Tembladero Slough which is a low-gradient channel without critical passage sections and with tidal influence that tends to backwater the channel as far upstream as the Castroville Diversion location.

Minimum migration flow for smolts is estimated at between 11 cfs and 31 cfs, depending on location, again with the most difficult passage at the San Jon Road stream gage (HES 2015). Based on a minimum passage flow for smolts of 31 cfs at the San Jon Road site, the number of days with flows meeting minimum smolt passage criteria is reduced by 0% to 15% annually or 9% on average (Figure 11, Table 6). The reduction is 10% or more in 2 of the 11 years simulated. The number of days meeting smolt migration criteria is reduced under Case 2 compared to the base case (Case 0) in 4 of 11 years simulated. In some cases the actual reduction in terms of days is small however; the number of days available in the base case is also small at times. Flow alterations of this magnitude during the smolt migration period, particularly given the sensitivity of smolts migrating through this degraded habitat, and considering the low accuracy of the method for estimating minimum passage flow, would be potentially significant downstream of the Davis Road site.

Flow reductions during the dry season (June-September) exceed 10% across the majority of the range of flows simulated at Davis Road and Castroville (Figures 12 and 13). Flow reductions from Case 2 result in the minimum bypass flow of 0.69 cfs at Davis Road and 1 cfs at Castroville occurring virtually the entire time (Figures 12 and 13). Special status species are not expected to be present in the Reclamation Ditch downstream of the Davis Road proposed project site during this period. Tidewater goby, if present in Tembladero Slough downstream of the Castroville site, are not likely to be affected by the flow changes projected. Native and introduced warmwater species likely to be present are not migrating during this period. The 0.69 cfs minimum flow maintains base habitat conditions for species likely to be present. Flow changes from Case 2 during the dry season would have a less than significant effect on fish species in the Reclamation Ditch and Tembladero Slough.

#### *1.3.4.3 Case 3*

> ***Divert up to 2.99 cfs of available flow from Reclamation Ditch at Davis Road and up to 2.99 cfs of available flow from Tembladero Slough at Castroville with 1 cfs bypass flow at both locations.***

Case 3 differs from Case 1 only in the amount of bypass flows provided: 1 cfs at both

Davis Road and Castroville in Case 3 vs. 2 cfs in winter and 0.69 cfs in summer below Davis Road for Case 1. For Case 3 during the adult migration period, the largest proportional flow reductions in the Reclamation Ditch at Davis Road would occur in the range of 1 to 30 cfs. Flow reductions in the Reclamation Ditch for base case flows in that range would be 10% or more (Figure 6). The 2.99 cfs diversion at Castroville under Case 3, combined with the Davis Road diversion, results in larger flow reductions in Tembladero Slough and downstream reaches to Monterey Bay with flow reductions of 10% or more for Base Case flows in the range of 1 to 60 cfs (Figure 7).

As discussed previously for Case 1, diversion at Castroville would have less effect on steelhead migration than diversion at Davis Road since Tembladero Slough has a very low gradient downstream of the Castroville proposed project site and there are no critical passage sections such as the riprap and gaging weir at San Jon Road upstream. Tembladero Slough is tidally influenced from the Old Salinas River up to Highway 183 in Castroville and the backwater condition caused by the tide gates would prevent measurable reductions in water levels throughout that reach (Schaaf & Wheeler 2014).

Assuming a minimum passage flow of 78 cfs at the San Jon Road stream gage site, it is estimated that there would be reductions of 0% to 20% (average 8%) in the number of days annually meeting the minimum migration threshold for adult steelhead (Figure 8, Table 5). This is identical to Case 1. The number of potential migration days is reduced in 9 years out of the 11 modeled and in 4 years the reduction is 10% or more. Although the actual number of days involved is generally small (1 to 2 fewer days meeting migration criteria), the migration windows (periods when flows are in a suitable range) are also relatively short. One or 2 days of additional flow could make the difference between successful passage through the lower watershed and failure. Curtailment of migration flows by this amount could limit the ability of steelhead to reach spawning habitat in the upper watershed and adult steelhead could become stranded below difficult passage locations such as the stream gage at San Jon Road. Given the species status as threatened, a change in flow of this magnitude (10% or more reduction in migration periods in 36% of years) is potentially significant for migrating adult steelhead.

During the smolt migration period (March through May), flows at the Davis Road site are generally lower than the adult migration period and proportional reduction in flow from the diversion would be greater (Figures 9 and 10). Although smolts need less flow to migrate than adults, the channel is severely lacking in cover and smolts are exposed to potential predation from birds. As previously described, smolt migration flows are more an issue in the Reclamation Ditch, upstream of Tembladero Slough than in Tembladero Slough which is a low-gradient channel without critical passage sections and with tidal influence that tends to backwater the channel as far upstream as the Castroville Diversion location.

Minimum migration flow for smolts is estimated at between 11 cfs and 31 cfs, depending on location, again with the most difficult passage at the San Jon Road stream gage (HES 2015). Based on a minimum passage flow for smolts of 31 cfs at the San Jon Road site, the number of days with flows meeting minimum smolt passage criteria is reduced by 0% to 7% annually or an average of 4% (Figure 11, Table 6), identical to Case 1. The reduction is never more than 10%. The number of days meeting smolt migration criteria is reduced under Case 3 compared to the base case (Case 0) in 2 years out of 11 years simulated. In some cases the actual reduction in terms of days is small however; the number of days available in the base case is also small at times (e.g. 2011). Flow alterations downstream of the Davis Road site of this magnitude do not meet the significance criteria during the smolt migration period and would be considered less than significant. As for Case 1, it should be noted that the accuracy of the flow threshold estimate for smolt migration is low and that if the lower end of the range were used for minimum passage flow for smolts the number of days meeting the passage criteria would be reduced by up to 17% from the Base Case, and 27% of years would have reductions of 10% or more.

Flow reductions during the dry season (June-September) exceed 10% across the majority of the range of flows simulated at Davis Road and Castroville (Figures 12 and 13). Flow reductions from Case 3 are comparable to Case 1 during the dry season except that Case 3 has the higher minimum bypass flow occurring in the Reclamation Ditch for about 80% of the time (Figures 12 and 13). Special status species are not expected to be present in the Reclamation Ditch downstream of the Davis Road proposed project site during the dry season. Tidewater goby, if present in Tembladero Slough downstream of the Castroville site, are not likely to be affected by the flow changes projected. Tidewater goby prefer quiescent conditions and the channel is tidally backwatered in this reach and should not experience significant drawdown related to project diversions. Native and introduced warmwater species likely to be present are not migrating during this period. The 1 cfs minimum flow maintains base habitat conditions for species likely to be present. Flow changes from Case 3 would have a less than significant effect on fish species in the Reclamation Ditch and Tembladero Slough during the dry season.

#### *1.3.4.4 Case 4*

> ***Divert up to 6.0 cfs of available flow from Reclamation Ditch at Davis Road and up to 2.99 cfs of available flow from Tembladero Slough at Castroville with 1 cfs bypass flow at both locations.***

Case 4 is identical to Case 2 except for the amount of bypass flows provided: 1 cfs at both Davis Road and Castroville in Case 4 vs. 2 cfs in winter and 0.69 cfs in summer below Davis Road for Case 2. During the adult migration period, the largest proportional flow reductions for Case 4 would occur in the range of 1 to 60 cfs for the reach downstream of Davis Road. Flow reductions for base case flows of 60 cfs or less would be 10% or more for the Reclamation Ditch (Figures 6). The 2.99 cfs diversion at Castroville under Case 4, combined with the Davis Road diversion, results in larger flow reductions in Tembladero Slough and downstream reaches to Monterey Bay with flow reductions of 10% or more for Base Case flows of 1 to 90 cfs (Figure 7).

Case 4 has a greater potential effect on adult steelhead migration than Case 1 or Case 3 given the larger diversion rate. Assuming a minimum passage flow of 78 cfs at the San Jon Road stream gage site, it is estimated that there would be reductions of 0% to 22% (average of 13%) in the number of days annually meeting the minimum migration threshold for adult steelhead (Figure 8, Table 5), identical to Case 2. The number of potential migration days is reduced in 10 years out of the 11 modeled and in 8 years the reduction is 10% or more. Although the actual number of days involved is generally small (1 to 4 fewer days meeting migration criteria), the migration windows (periods when flows are in a suitable range) are also relatively short. One or 2 days of additional flow could make the difference between successful passage through the lower watershed and failure. Curtailment of migration flows by this amount could limit the ability of steelhead to reach spawning habitat in the upper watershed and adult steelhead could become stranded below difficult passage locations such as the stream gage at San Jon Road. Given the species status as threatened, a change in flow of this magnitude (10% or more reduction in migration periods in 73% of years) is potentially significant for migrating adult steelhead.

As discussed previously for Case 1, flow reductions in Tembladero Slough downstream of the Castroville proposed diversion would have less effect on steelhead migration than the diversion at Davis Road since Tembladero Slough has a very low gradient downstream of the Castroville proposed project site and there are no critical passage sections such as the riprap and gaging weir at San Jon Road upstream. Tembladero Slough is tidally influenced from the Old Salinas River up to Highway 183 in Castroville and the backwater condition caused by the tide gates would prevent measurable reductions in water levels throughout that reach (Schaaf & Wheeler 2014).

During the smolt migration period (March through May), flows at the Davis Road site are generally lower than the adult migration period and proportional reduction in flow from the diversion would be greater (Figures 9 and 10). Although smolts need less flow to migrate than adults, the channel is severely lacking in cover and smolts are exposed to potential predation from birds. As previously described, smolt migration flows are more an issue in the Reclamation Ditch, upstream of Tembladero Slough than in Tembladero Slough which is a low-gradient channel without critical passage sections and with tidal influence that tends to backwater the channel as far upstream as the Castroville Diversion location.

Minimum migration flow for smolts is estimated at between 11 cfs and 31 cfs, depending on location, again with the most difficult passage at the San Jon Road stream gage (HES 2014). Based on a minimum passage flow for smolts of 31 cfs at the San Jon Road site, the number of days with flows meeting minimum smolt passage criteria is reduced by 0% to 15% annually or an average of 9% (Figure 11, Table 6), identical to Case 2. The reduction is 10% or more in 2 of the 11 years simulated. The number of days meeting smolt migration criteria is reduced under Case 4 compared to the base case (Case 0) in 4 of 11 years simulated. In some cases the actual reduction in terms of days is small however; the number of days available in the base case is also small at times. Flow alterations of this magnitude during the smolt migration period, particularly given the sensitivity of smolts migrating through this degraded habitat, and considering the low accuracy of the method for estimating minimum passage flow, would be potentially significant downstream of the Davis Road site.

Flow reductions during the dry season (June-September) exceed 10% across the majority of the range of flows simulated at Davis Road and Castroville (Figures 12 and 13). Flow reductions from Case 4 result in the minimum bypass flow of 1 cfs at both the Davis Road and Castroville locations occurring virtually the entire time (Figures 12 and 13). As in Cases 1, 2, and 3, flow reduction at the level that would occur for Case 4 would have less than significant effect on fish species potentially present in the Reclamation Ditch and Tembladero Slough during the dry season.

#### *1.3.4.5 Conclusion*

Case 1 and Case 3 have identical diversion profiles but differ in the minimum bypass amounts. Similarly, Case 2 and Case 4 have identical diversion profiles but feature higher diversions at Davis Road than Cases 1 and 3 (6 cfs vs. 2.99 cfs). All four cases have potentially significant effects on adult steelhead migration although Cases 2 and 4 have greater effect than Cases 1 and 3. The different minimum bypass provisions have no effect on steelhead migration since they are well below the minimum flows required for either smolts or adults. For adult migration it is estimated that there would be reductions of 0% to 20% (average 8%) in the number of days annually meeting the minimum migration threshold for both Case 1 and 3. For both Cases 2 and 4 average annual reduction in the number of days meeting the adult migration threshold would be 13%. During the hydrologic period examined, there would be a 10% or larger reduction in the number of days with flow meeting the migration threshold in 4 years out of 11 for Cases 1 and 3 and in 8 years out of 11 for Cases 2 and 4. Given steelheads status as a threatened species, a change in flow of this magnitude is potentially significant for migrating adult steelhead.

During the potential migration period for steelhead smolts, only Cases 2 and 4 would result in a significant reduction in the number of days meeting migration criteria, while

Cases 1 and 3 would have a less than significant effect. The number of days meeting migration criteria would be reduced in only two years under Cases 1 and 3 and the reduction would be less than 10% in both years. For Cases 2 and 4, the number of days meeting migration criteria would be reduced in 4 years out of 11 with 2 of those years having a reduction greater than 10%. Flow alterations of the magnitude occurring during the smolt migration period under Cases 2 and 4 would be potentially significant downstream of the Davis Road site, particularly given the sensitivity of smolts migrating through this degraded habitat, and considering the low accuracy of the method for estimating minimum passage flow.

Flow reductions during the dry season (June-September) exceed 10% across nearly the full range of baseline flows. However, special status species are not expected to be present in the Reclamation Ditch downstream of the Davis Road proposed project site. Steelhead use these reaches only for migration, during the winter and spring, and potential dry season rearing habitat exists only in headwater reaches. There is a limited potential for tidewater goby near or downstream of the Castroville project site. Since goby prefer quiescent conditions, and since the channel is tidally backwatered in this reach, flow reductions would not be expected to have a detrimental effect on them, should they be present. Native and introduced warmwater species likely to be present are not migrating during this period. Habitat in the Reclamation Ditch and Tembladero Slough are highly degraded in terms of channel structure, riparian vegetation, and water quality. The minimum bypass flows of 0.69 cfs (Cases 1 and 2) or 1 cfs (Cases 3 and 4) downstream of Davis Road maintain base habitat conditions for species likely to be present. Flow changes during the dry season for both cases would have a less than significant effect.

Overall, Cases 1 and 3 would have slightly less effect on steelhead migration than Cases 2 and 4 due to the lower diversion rates at Davis Road. Case 3 would have slightly more flow below Davis Road due to the higher bypass flow during the dry season but the effect is less than significant.

## 1.4 MITIGATION MEASURES

Potential significant effects on migrating adult steelhead and steelhead smolts could be mitigated by operating diversions to maintain flow within suitable windows for migration during periods when steelhead may be migrating. Steelhead adults migrate during December through April and require a flow of at least 78 cfs to pass over the weir at San Jon Road. If the diversion is operated to avoid dropping flow below this level, negative effects to migrating steelhead adults could be avoided. Steelhead smolts migrate primarily during March through May and require a flow of at least 31 cfs to meet passage criteria at the San Jon Road weir. Operating the diversion during March through May to avoid reducing flow below this level would avoid potentially significant effects on steelhead smolt migration.

When natural flow (without diversion) drops below these thresholds, presumably steelhead would no longer be able to migrate and diversions could be resumed. Since there is some uncertainty in the conditions required by steelhead to migrate and in estimating the flow level that meets those criteria, it is prudent do define a window for the migration flow threshold rather than to use a single numeric value. For example, it is assumed that adult steelhead need a depth of 0.7 feet to migrate but in fact they may be able to pass an obstacle with only 0.5 feet of depth. In addition, there is likely a minimum of at least 10% error in estimation of the flow that provides a depth of 0.7 feet. Given this potential for error it is not unreasonable to assume an error of +/- 30% in our estimate of the migration threshold (HES 2015). Therefore, a reasonable flow window for protection of adult steelhead migration would be 55 to 101 cfs. Similarly, a reasonable window for smolt migration would be 22 to 40 cfs. Operation of the diversion such that it would not cause flows to drop below the upper migration limit and would be resumed when flows drop below the lower migration threshold would avoid significant impacts to steelhead migration (Table 7).

**Table 7: Diversion schedule to avoid significant effects to migrating steelhead (flow measured at San Jon Road gage).**

| Migration Period | Operate Diversion only when flow is below (cfs): | Operate Diversion only when flow is above (cfs): |
|---|---|---|
| December | 55 | 101 |
| January | 55 | 101 |
| February | 55 | 101 |
| March | 22 | 101 |
| April | 22 | 101 |
| May | 22 | 40 |

Modification of the San Jon Road stream gage weir to allow passage of steelhead at lower flows could expand the range of flows when the diversion could be operated and would greatly increase the amount of time available for steelhead migration in the Reclamation Ditch watershed. For example, if the weir could be modified to allow passage at flows similar to the Boronda Road passage site then the migration threshold would be 32 cfs for adult steelhead and 11 for steelhead smolts. This would be approximately equivalent to flows of 34 cfs and 12 cfs at the San Jon Road gage[3]. The window for migration, calculated in the same way as for the San Jon Road site, would be 22 to 42 for adult steelhead and 8 to 14 for steelhead smolts. An operation schedule as in Table 8 would avoid significant effects on steelhead migration if the San Jon Road weir were modified to achieve passage at flows comparable to the Boronda Road site.

**Table 8: Diversion schedule to avoid significant effects to migrating steelhead if the San Jon Road weir were improved for steelhead passage (flow measured at San Jon Road gage).**

| Migration Period | Operate Diversion only when flow is below (cfs): | Operate Diversion only when flow is above (cfs): |
|---|---|---|
| December | 22 | 42 |
| January | 22 | 42 |
| February | 22 | 42 |
| March | 8 | 42 |
| April | 8 | 42 |
| May | 8 | 14 |

[3] Flow at Boronda Road is similar to the diversion site and is 93.7% of the flow at San Jon Road based on drainage area (Schaaf and Wheeler 2014)

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# Appendix G2

# Memorandum Regarding Reclamation Ditch Steelhead Migration Passage Assessment

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# TECHNICAL MEMORANDUM

**TO:** Denise Duffy
Denise Duffy and Associates

**FROM:** Jeff Hagar
Hagar Environmental Science

**DATE:** February 27, 2015

**PROJECT:** Pure Water Monterey Groundwater Replenishment (GWR) Project – Estimation of Minimum Flows for Migration of Steelhead in the Reclamation Ditch

The Monterey Regional Water Pollution Control Agency (MRWPCA) is preparing an Environmental Impact Report (EIR) for the proposed Pure Water Monterey Groundwater Replenishment Project (GWR Project). The project will develop high quality replacement water for existing urban supplies; and an enhanced agricultural irrigation (Crop Irrigation) component that will increase the amount of recycled water available to the existing Castroville Seawater Intrusion Project in northern Monterey County. The project could involve diversion of flows from the Reclamation Ditch watershed at a site near Davis Road and a site in Castroville on Tembladero Slough (Figure 1). The reclamation ditch watershed has the potential to support steelhead trout (*Oncorhynchus mykiss*). Potential salmonid habitat exists upstream of the project site, although the extent and quality of such habitat has not been well quantified. Diversion of flow from the Reclamation Ditch has the potential to affect steelhead during periods when they are migrating, either upstream as adults or downstream as smolts.

Steelhead trout are listed as a threatened species under the Federal Endangered Species Act (ESA). Full levels of production for anadromous salmonids in Central California coastal streams rely on the ability of adult steelhead to enter the streams and easily access spawning and rearing habitat in the upper reaches and for smolts to return to the ocean. Unlike other Pacific salmon, some steelhead survive after spawning and return downstream to the ocean. As many as 20% of adult steelhead spawners may be repeat spawners and some fish may return to spawn up to 3 or 4 times (Shapovalov and Taft 1954). Even obstacles that are not complete barriers can impair populations by delaying migration rates and exposing fish to potential predation or poaching.

The purpose of the work described here was to identify fish passage obstacles between the Davis Road project site and the Tembladero Slough proposed diversion site and determine the minimum amount of flow necessary for steelhead migration through the reach. Passage in Tembladero Slough is not expected to be influenced by a diversion near Castroville since

Tembladero Slough is tidal up to this area and backwatering of the channel prevents formation of critical riffles or other shallow locations. The accepted methodology for minimum passage flow assessment involves measurement of stage and flow at a range of flows bracketing the minimum passage flow (CDFW 2013). The time frame for completion of the environmental documents did not provide opportunity to wait for winter flow conditions to collect the necessary data. Instead, HES used an alternative method using channel geometry measurements and the Manning equation to make an approximation of minimum passage flow needs. This method gives an "order-of-magnitude" approximation for planning level application only. This information was collected on October 20, 2014 during a site visit with representatives of HES, Monterey Peninsula Water Management District, Schaaf & Wheeler, and Denise Duffy & Associates.

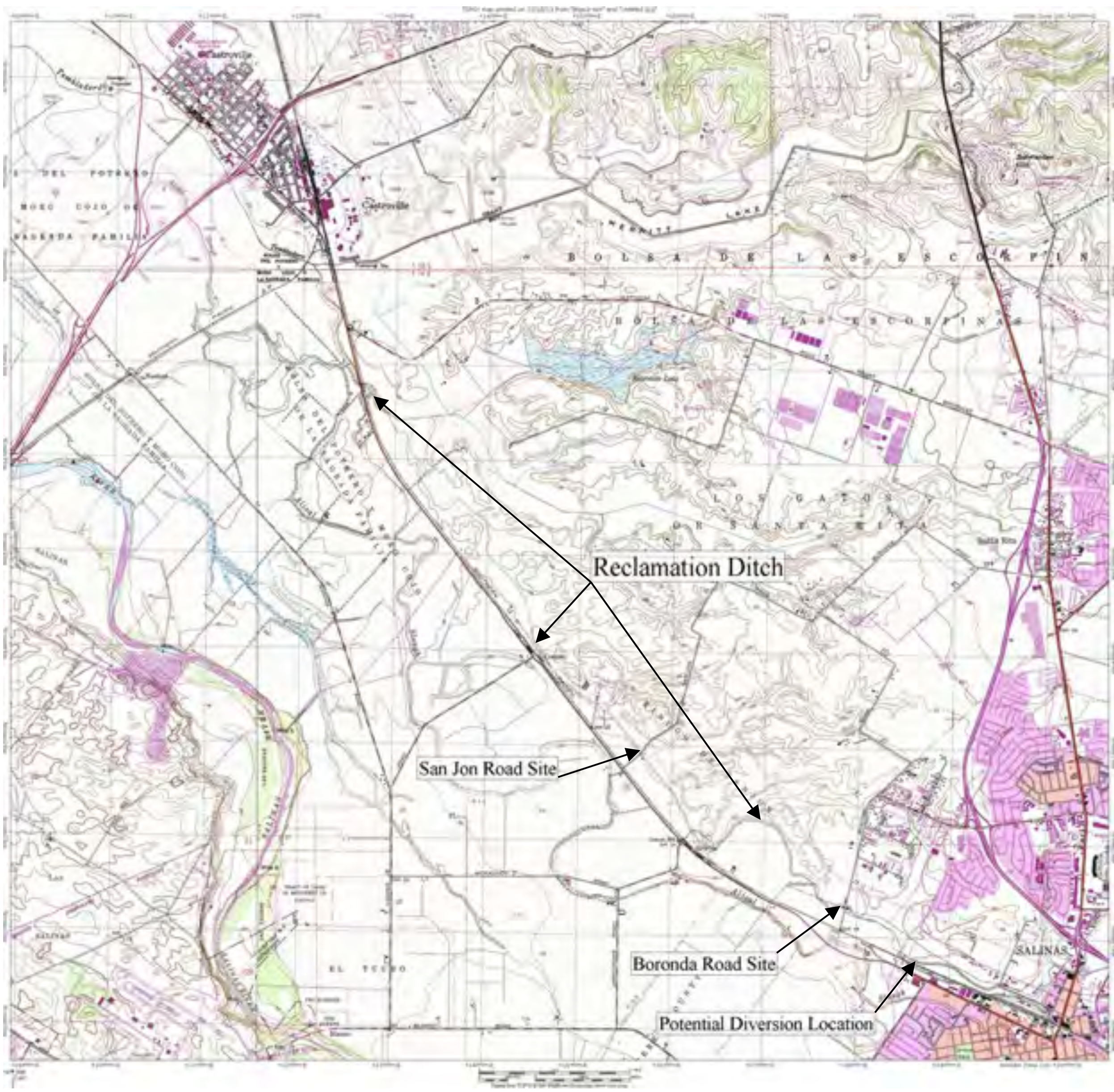


**Figure 1. Study area.**

During the October 20 site visit several road crossings of the Reclamation Ditch between Castroville and Salinas were evaluated for passage conditions.  Two sites, San Jon Road and Boronda Road (Figure 1), were selected for assessment based on judged severity of passage conditions and access issues.

The San Jon site has a USGS stream gage installation with a trapezoidal concrete channel section and gaging weir (Figure 2).  There are two elements that produce difficult passage at this site.  First is the concrete lip at the lower edge of the apron.  This presents a jumping obstacle at low flows without a pool at the base.  The second is the concrete apron itself which presents uniformly very shallow flow.  The concrete lip is probably not a problem for upstream migrating adults when there is sufficient flow for passage over the apron.  The lip is also not a problem for downstream migrating smolts or adults.  The Boronda Road site has rock rip-rap fill in the channel downstream of the road bridge creating a critical passage riffle (Figure 3).  This presents shallow water depth at lower flow levels without any other passage issues.

**Figure 2. San Jon Road critical passage site.**

Channel characteristics were measured at each of these sites for use in hydraulic modeling.  Data collection included a channel cross-section at each site detailing bed elevation and water surface; a longitudinal profile of the thalweg through the site detailing bed elevation and water surface; and an estimate for Manning resistance coefficient (n).  At the San Jon Road site, stage discharge data for the USGS gage were also available online (http://waterdata.usgs.gov/nwisweb/get_ratings?site_no=11152650&file_type=exsa).  This information was used to develop an approximation of minimum passage flow estimates for migrating adult steelhead and steelhead smolts.  Use of the Manning equation to estimate flow under these conditions is subject to substantial potential error. This information is used for project planning purposes only and is not a substitute for more rigorous methods such as the CDFW methodology (CDFW 2013). Passage flow estimates presented here should be verified by on-site observations during higher flow conditions.

**Figure 3. Boronda Road critical passage site.**

Methodology

The migration passage flow assessment is based on standards developed in the fisheries literature. These standards assume that there must be sufficient depth over the shallowest riffles for the target species to swim upstream with its body completely covered. Specifically, the critical depth must occur across 25% of the wetted channel width and across a contiguous section comprising 10% of the wetted channel width (Thompson 1972, Bjornn and Reiser 1991, CDFW 2013). The critical depths used in this analysis are 0.7 feet for adult steelhead and 0.4

feet for steelhead smolts. Although shallower critical depths are often justifiable (e.g. 0.6 feet for adults and 0.3 feet for smolts), these values were used in order to be consistent with the standards used by CDFW (CDFW 2013).

Flow velocity is also a consideration for migrating steelhead. Steelhead have strong swimming and leaping abilities that allow them to ascend streams into small tributary and headwater reaches. Steelhead can swim at rates of up to 4.5 feet per second (fps) for extended periods of time and can achieve burst speeds of 14 to 26 fps during passage through difficult areas (Bell 1986).

Critical passage flows are estimated through application of the Manning equation. The Manning equation is an empirical formula (based on observation rather than theory) that estimates the average velocity of a liquid flowing in an open channel (i.e., a conduit that does not completely enclose the liquid) (Gauckler 1867, Manning 1891).

The equation is given as:

$$V = k/n\ R_h^{\ 2/3}\ S^{\ 1/2}$$

where:

- $V$ is the cross-sectional average velocity ( ft/s in this application);
- $k$ is a conversion factor of 1.4859 $ft^{1/3}/s$;
- $n$ is the Manning coefficient (unitless);
- $R_h$ is the hydraulic radius (ft), also given by A/P where A is the cross-sectional area of flow ($ft^2$); and P is the wetted perimeter;
- $S$ is the slope of the hydraulic grade line or the linear hydraulic head loss (ft./ft.), which is the same as the channel bed slope when the water depth is constant.

Since flow (Q) is equal to VA the equation can be rewritten to solve for flow as:

$$Q = k/n\ A\ R_h^{\ 2/3}\ S^{\ 1/2}$$

This equation can be solved for any given flow stage with the channel geometry parameters: area, wetted perimeter, channel slope, and an estimate of the Manning coefficient.

At each passage study site, a critical cross-section was selected where the depth of flow was at a minimum across the channel width. Cross-sections incorporated the shallowest portion on the probable route a migrating salmonid would follow. A fiberglass survey tape was stretched across the channel and streambed and water surface elevations were measured at regular intervals along the tape using plane surveying techniques. A site benchmark was also established and surveyed. Conditions at each passage site were documented with photographs when measurements were made. Time was recorded at the beginning of each cross-section and at intervals across the channel. At the San Jon Road site, stage and time were recorded from the permanent staff plate at the station. Flow at the time of the survey was estimated from the 15-minute gage record at the San Jon Road site maintained by the USGS (http://waterdata.usgs.gov/usa/nwis/uv?site_no=11152650). Parameters used in the analysis and resulting flow and mean velocity estimates are presented in Table 1.

Cross-section data were entered in a spreadsheet configured to allow determination of the critical water surface elevation at which depth criteria were met. The cross-sectional area of flow is calculated from the channel bed elevation cross-section and measured or projected water surface elevation. Each point on the cross-section represents a cell with boundaries extending halfway to both adjacent measurement points and depth equal to the difference between the bed elevation and the water surface elevation. Cell width and depth are multiplied to give area and individual cell areas are summed across the cross-section. The wetted perimeter is the portion of the cross-section's perimeter that is "wet" and is also calculated by adding the length of bed for each cross-section cell. The channel slope was approximated from the USGS 1:24,000 topographical map for the area. Chow (1959) gives values for Manning coefficient based on channel condition. We used a value of 0.037 for both sites; this value is intermediate between an excavated or dredged channel, of earth, straight, uniform, with short grass and few weeds and an excavated or dredged channel, of earth, winding and sluggish, with stony bottom and weedy banks (Chow 1959).

For each depth criteria (0.4 or 0.7 feet) a stage was set for which 25% of the wetted channel width and a contiguous portion totaling at least 10% of the wetted width had a depth equal to or greater than the criteria value. Cross-section area and wetted perimeter were calculated and entered in the Manning equation to give an estimate of flow.

As a check on parameter value specification and overall performance of the analysis, the calculated flow values associated with target flow depths were compared to the rating curve for the San Jon Road stream gage site (Appendix A). The gage reads water levels a few feet upstream of the critical passage cross-section used in this analysis. On the October 20 survey date, the on-site staff plate read 0.72 at the time channel and water surface measurements were collected. This corresponds to a reported flow of 1.3 $ft^3/s$ (cfs) during that period. Use of the Manning equation resulted in a flow estimate of 2 cfs. The difference may be related to the very shallow flow across the apron at the time of the survey and the difficulty of getting accurate water surface elevations. An additional data point was available from observations made by Schaaf and Wheeler on February 9, 2015 (Andrew Sterbenz, personal communication, February 24, 2015). The depth of flow measured at 9:00 am on that date was 0.3 feet and the corresponding flow from the USGS gage was 18 cfs. Using a Manning coefficient value of 0.37 gives a flow estimate of 19 cfs. This description applies to the ditch in the near vicinity of the gage installation.

As can be seen, the San Jon Road site results in significantly higher minimum passage flow requirements than the less altered Boronda Road site (Table 1). The Boronda Road site is probably representative of other critical passage sections in the Reclamation Ditch downstream of the potential diversion location (e.g., the farm access road downstream of the San Jon Road site). Potential for steelhead migration success through the Reclamation Ditch could be dramatically improved by altering the San Jon Road site to a more passage friendly configuration.

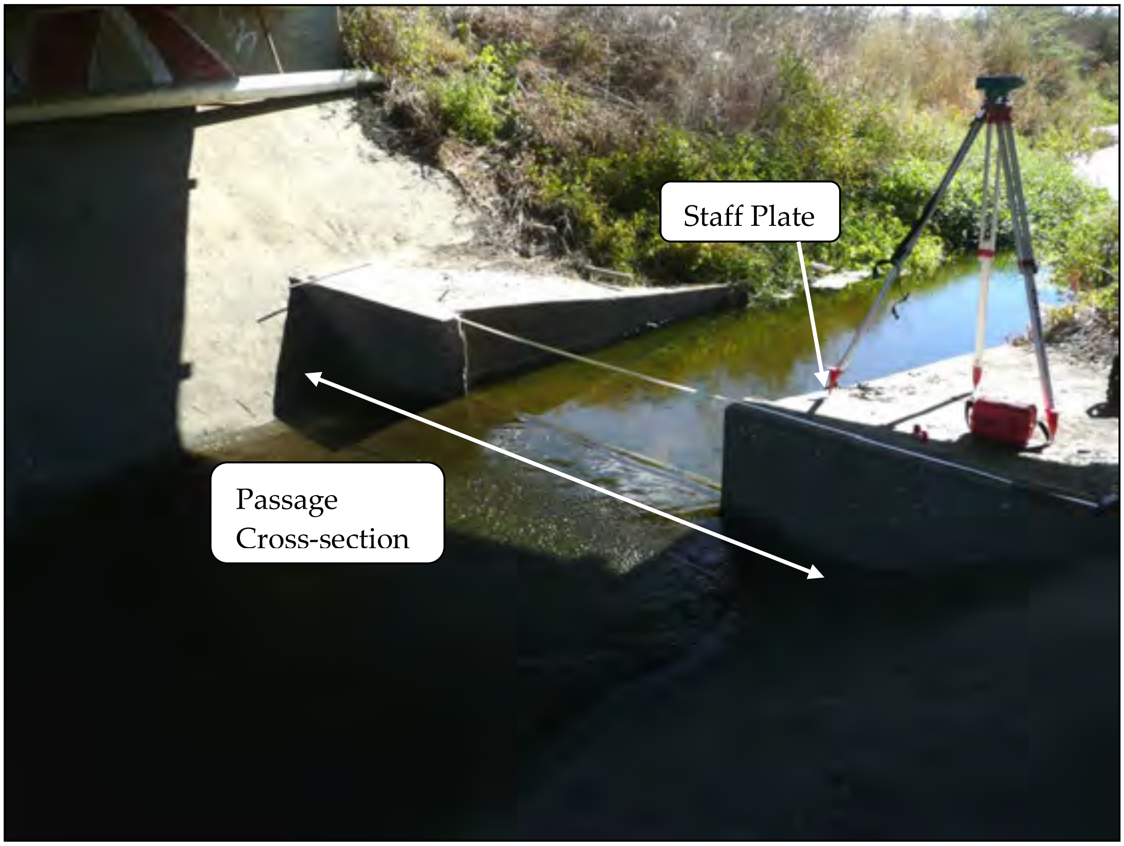


**Figure 4. San Jon Road site.**

This method gives an "order-of-magnitude" approximation of minimum flows for steelhead migration for planning level application only. There are numerous sources of error in the method including, estimation of parameter values, measurement of flow and associated rating curve, measurement of channel features and placement of cross-sections, and assumptions about depth required for steelhead passage. For example, it is assumed that adult steelhead need a depth of 0.7 feet to migrate but in fact they may be able to pass an obstacle with only 0.5 feet of depth. In addition, there is likely a minimum of at least 5-10% error in estimation of the flow that provides a depth of 0.7 feet. In addition, the Manning equation is an empirical equation for flow in uniform open channels. Uniform open channel flow takes place whenever there is a constant volumetric flow rate of liquid through a section of channel that has a constant bottom slope, constant hydraulic radius (that is constant channel size and shape), and constant channel surface roughness (constant Manning roughness coefficient). Under these conditions, the liquid will flow at a constant depth, often called the normal depth for the given channel and volumetric flow rate. Observations at the San Jon Road site indicate that the assumption of uniform flow may be problematic at some flows (Andrew Sterbenz, personal communication, February 2015). Given this potential for error it is not unreasonable to assume an error of +/-30% in our estimate of the migration threshold.

**Table 1: Channel geometry parameters for critical passage sites in the Reclamation Ditch with associated minimum passage flow estimates.**

| | San Jon Road | | | Boronda Road | | |
|---|---|---|---|---|---|---|
| **Parameter** | October 20 | Depth Criterion= 0.4 ft. | Depth Criterion= 0.7 ft. | October 20 | Depth Criterion= 0.4 ft. | Depth Criterion= 0.7 ft. |
| $n$ Manning coefficient | 0.037 | 0.037 | 0.037 | 0.037 | 0.037 | 0.037 |
| $S$ Hydraulic slope | 0.070 | 0.070 | 0.070 | 0.0280 | 0.0280 | 0.0280 |
| $A$ Cross-sectional area ($ft^2$) | 1.0949 | 5.5281 | 10.2636 | 1.3970 | 3.5157 | 6.8266 |
| $P$ Wetted perimeter (ft.) | 13.5651 | 14.8049 | 16.8706 | 9.0279 | 10.8492 | 11.8447 |
| $R$ = A/P hydraulic radius (ft.) | 0.0807 | 0.3734 | 0.6084 | 0.1547 | 0.3240 | 0.5763 |
| $Q$ Estimated Flow ($ft^3/s$) | 2.2 | 30.5 | 78.5 | 2.7 | 11.2 | 31.9 |
| $V$ Estimated velocity (f/s) | 2.0 | 5.5 | 7.6 | 1.9 | 3.2 | 4.7 |

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# Appendix A

Rating Curve for USGS Reclamation Ditch at San Jon Road Gage (11152650)

for October 20, 2014

| Stage | Shift | Discharge | Stage | Shift | Discharge | Stage | Shift | Discharge |
|---|---|---|---|---|---|---|---|---|
| 0.56 | 0.00 | 0.00 | 0.95 | 0.00 | 5.15 | 1.34 | 0.00 | 16.11 |
| 0.57 | 0.00 | 0.04 | 0.96 | 0.00 | 5.36 | 1.35 | 0.00 | 16.46 |
| 0.58 | 0.00 | 0.06 | 0.97 | 0.00 | 5.57 | 1.36 | 0.00 | 16.82 |
| 0.59 | 0.00 | 0.08 | 0.98 | 0.00 | 5.79 | 1.37 | 0.00 | 17.18 |
| 0.60 | 0.00 | 0.11 | 0.99 | 0.00 | 6.02 | 1.38 | 0.00 | 17.54 |
| 0.61 | 0.00 | 0.15 | 1.00 | 0.00 | 6.24 | 1.39 | 0.00 | 17.91 |
| 0.62 | 0.00 | 0.20 | 1.01 | 0.00 | 6.47 | 1.40 | 0.00 | 18.28 |
| 0.63 | 0.00 | 0.25 | 1.02 | 0.00 | 6.71 | 1.41 | 0.00 | 18.65 |
| 0.64 | 0.00 | 0.31 | 1.03 | 0.00 | 6.94 | 1.42 | 0.00 | 19.03 |
| 0.65 | 0.00 | 0.38 | 1.04 | 0.00 | 7.18 | 1.43 | 0.00 | 19.41 |
| 0.66 | 0.00 | 0.46 | 1.05 | 0.00 | 7.43 | 1.44 | 0.00 | 19.79 |
| 0.67 | 0.00 | 0.55 | 1.06 | 0.00 | 7.68 | 1.45 | 0.00 | 20.18 |
| 0.68 | 0.00 | 0.65 | 1.07 | 0.00 | 7.93 | 1.46 | 0.00 | 20.57 |
| 0.69 | 0.00 | 0.76 | 1.08 | 0.00 | 8.19 | 1.47 | 0.00 | 20.96 |
| 0.70 | 0.00 | 0.87 | 1.09 | 0.00 | 8.45 | 1.48 | 0.00 | 21.36 |
| 0.71 | 0.00 | 1.00 | 1.10 | 0.00 | 8.71 | 1.49 | 0.00 | 21.76 |
| 0.72 | 0.00 | 1.13 | 1.11 | 0.00 | 8.98 | 1.50 | 0.00 | 22.16 |
| 0.73 | 0.00 | 1.26 | 1.12 | 0.00 | 9.25 | 1.51 | 0.00 | 22.57 |
| 0.74 | 0.00 | 1.40 | 1.13 | 0.00 | 9.52 | 1.52 | 0.00 | 22.98 |
| 0.75 | 0.00 | 1.54 | 1.14 | 0.00 | 9.80 | 1.53 | 0.00 | 23.39 |
| 0.76 | 0.00 | 1.70 | 1.15 | 0.00 | 10.08 | 1.54 | 0.00 | 23.81 |
| 0.77 | 0.00 | 1.85 | 1.16 | 0.00 | 10.37 | 1.55 | 0.00 | 24.23 |
| 0.78 | 0.00 | 2.01 | 1.17 | 0.00 | 10.66 | 1.56 | 0.00 | 24.65 |
| 0.79 | 0.00 | 2.18 | 1.18 | 0.00 | 10.95 | 1.57 | 0.00 | 25.08 |
| 0.80 | 0.00 | 2.35 | 1.19 | 0.00 | 11.25 | 1.58 | 0.00 | 25.51 |
| 0.81 | 0.00 | 2.52 | 1.20 | 0.00 | 11.55 | 1.59 | 0.00 | 25.94 |
| 0.82 | 0.00 | 2.69 | 1.21 | 0.00 | 11.85 | 1.60 | 0.00 | 26.38 |
| 0.83 | 0.00 | 2.87 | 1.22 | 0.00 | 12.16 | 1.61 | 0.00 | 26.82 |
| 0.84 | 0.00 | 3.05 | 1.23 | 0.00 | 12.47 | 1.62 | 0.00 | 27.26 |
| 0.85 | 0.00 | 3.23 | 1.24 | 0.00 | 12.78 | 1.63 | 0.00 | 27.71 |
| 0.86 | 0.00 | 3.41 | 1.25 | 0.00 | 13.10 | 1.64 | 0.00 | 28.16 |
| 0.87 | 0.00 | 3.60 | 1.26 | 0.00 | 13.42 | 1.65 | 0.00 | 28.61 |
| 0.88 | 0.00 | 3.78 | 1.27 | 0.00 | 13.74 | 1.66 | 0.00 | 29.06 |
| 0.89 | 0.00 | 3.96 | 1.28 | 0.00 | 14.07 | 1.67 | 0.00 | 29.52 |
| 0.90 | 0.00 | 4.15 | 1.29 | 0.00 | 14.40 | 1.68 | 0.00 | 29.99 |
| 0.91 | 0.00 | 4.34 | 1.30 | 0.00 | 14.74 | 1.69 | 0.00 | 30.45 |
| 0.92 | 0.00 | 4.54 | 1.31 | 0.00 | 15.08 | 1.70 | 0.00 | 30.92 |
| 0.93 | 0.00 | 4.74 | 1.32 | 0.00 | 15.42 | 1.71 | 0.00 | 31.39 |
| 0.94 | 0.00 | 4.94 | 1.33 | 0.00 | 15.76 | 1.72 | 0.00 | 31.87 |
| Stage | Shift | Discharge | Stage | Shift | Discharge | Stage | Shift | Discharge |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1.73 | 0.00 | 32.35 | 2.12 | 0.00 | 53.52 | 2.51 | 0.00 | 79.38 |
| 1.74 | 0.00 | 32.83 | 2.13 | 0.00 | 54.12 | 2.52 | 0.00 | 80.11 |
| 1.75 | 0.00 | 33.32 | 2.14 | 0.00 | 54.73 | 2.53 | 0.00 | 80.83 |
| 1.76 | 0.00 | 33.81 | 2.15 | 0.00 | 55.34 | 2.54 | 0.00 | 81.56 |
| 1.77 | 0.00 | 34.30 | 2.16 | 0.00 | 55.96 | 2.55 | 0.00 | 82.29 |
| 1.78 | 0.00 | 34.79 | 2.17 | 0.00 | 56.58 | 2.56 | 0.00 | 83.03 |
| 1.79 | 0.00 | 35.29 | 2.18 | 0.00 | 57.20 | 2.57 | 0.00 | 83.77 |
| 1.80 | 0.00 | 35.79 | 2.19 | 0.00 | 57.82 | 2.58 | 0.00 | 84.51 |
| 1.81 | 0.00 | 36.30 | 2.20 | 0.00 | 58.45 | 2.59 | 0.00 | 85.25 |
| 1.82 | 0.00 | 36.81 | 2.21 | 0.00 | 59.08 | 2.60 | 0.00 | 86.00 |
| 1.83 | 0.00 | 37.32 | 2.22 | 0.00 | 59.71 | 2.61 | 0.00 | 86.90 |
| 1.84 | 0.00 | 37.83 | 2.23 | 0.00 | 60.35 | 2.62 | 0.00 | 87.81 |
| 1.85 | 0.00 | 38.35 | 2.24 | 0.00 | 60.98 | 2.63 | 0.00 | 88.72 |
| 1.86 | 0.00 | 38.87 | 2.25 | 0.00 | 61.63 | 2.64 | 0.00 | 89.65 |
| 1.87 | 0.00 | 39.40 | 2.26 | 0.00 | 62.27 | 2.65 | 0.00 | 90.58 |
| 1.88 | 0.00 | 39.92 | 2.27 | 0.00 | 62.92 | 2.66 | 0.00 | 91.52 |
| 1.89 | 0.00 | 40.45 | 2.28 | 0.00 | 63.57 | 2.67 | 0.00 | 92.47 |
| 1.90 | 0.00 | 40.99 | 2.29 | 0.00 | 64.23 | 2.68 | 0.00 | 93.43 |
| 1.91 | 0.00 | 41.52 | 2.30 | 0.00 | 64.88 | 2.69 | 0.00 | 94.40 |
| 1.92 | 0.00 | 42.06 | 2.31 | 0.00 | 65.54 | 2.70 | 0.00 | 95.37 |
| 1.93 | 0.00 | 42.61 | 2.32 | 0.00 | 66.21 | 2.71 | 0.00 | 96.36 |
| 1.94 | 0.00 | 43.15 | 2.33 | 0.00 | 66.87 | 2.72 | 0.00 | 97.35 |
| 1.95 | 0.00 | 43.70 | 2.34 | 0.00 | 67.54 | 2.73 | 0.00 | 98.35 |
| 1.96 | 0.00 | 44.25 | 2.35 | 0.00 | 68.22 | 2.74 | 0.00 | 99.36 |
| 1.97 | 0.00 | 44.81 | 2.36 | 0.00 | 68.89 | 2.75 | 0.00 | 100.38 |
| 1.98 | 0.00 | 45.37 | 2.37 | 0.00 | 69.57 | 2.76 | 0.00 | 101.41 |
| 1.99 | 0.00 | 45.93 | 2.38 | 0.00 | 70.25 | 2.77 | 0.00 | 102.45 |
| 2.00 | 0.00 | 46.49 | 2.39 | 0.00 | 70.94 | 2.78 | 0.00 | 103.50 |
| 2.01 | 0.00 | 47.06 | 2.40 | 0.00 | 71.62 | 2.79 | 0.00 | 104.56 |
| 2.02 | 0.00 | 47.63 | 2.41 | 0.00 | 72.31 | 2.80 | 0.00 | 105.62 |
| 2.03 | 0.00 | 48.21 | 2.42 | 0.00 | 73.01 | 2.81 | 0.00 | 106.70 |
| 2.04 | 0.00 | 48.79 | 2.43 | 0.00 | 73.70 | 2.82 | 0.00 | 107.79 |
| 2.05 | 0.00 | 49.37 | 2.44 | 0.00 | 74.40 | 2.83 | 0.00 | 108.88 |
| 2.06 | 0.00 | 49.95 | 2.45 | 0.00 | 75.11 | 2.84 | 0.00 | 109.99 |
| 2.07 | 0.00 | 50.54 | 2.46 | 0.00 | 75.81 | 2.85 | 0.00 | 111.10 |
| 2.08 | 0.00 | 51.13 | 2.47 | 0.00 | 76.52 | 2.86 | 0.00 | 112.23 |
| 2.09 | 0.00 | 51.72 | 2.48 | 0.00 | 77.23 | 2.87 | 0.00 | 113.36 |
| 2.10 | 0.00 | 52.32 | 2.49 | 0.00 | 77.95 | 2.88 | 0.00 | 114.51 |
| 2.11 | 0.00 | 52.92 | 2.50 | 0.00 | 78.66 | 2.89 | 0.00 | 115.66 |

| Stage | Shift | Discharge | Stage | Shift | Discharge | Stage | Shift | Discharge |
|---|---|---|---|---|---|---|---|---|
| 2.90 | 0.00 | 116.83 | 3.29 | 0.00 | 171.05 | 3.68 | 0.00 | 246.10 |
| 2.91 | 0.00 | 118.00 | 3.30 | 0.00 | 172.69 | 3.69 | 0.00 | 248.35 |
| 2.92 | 0.00 | 119.19 | 3.31 | 0.00 | 174.35 | 3.70 | 0.00 | 250.62 |
| 2.93 | 0.00 | 120.38 | 3.32 | 0.00 | 176.01 | 3.71 | 0.00 | 252.91 |
| 2.94 | 0.00 | 121.59 | 3.33 | 0.00 | 177.69 | 3.72 | 0.00 | 255.22 |
| 2.95 | 0.00 | 122.81 | 3.34 | 0.00 | 179.39 | 3.73 | 0.00 | 257.54 |
| 2.96 | 0.00 | 124.03 | 3.35 | 0.00 | 181.10 | 3.74 | 0.00 | 259.88 |
| 2.97 | 0.00 | 125.27 | 3.36 | 0.00 | 182.82 | 3.75 | 0.00 | 262.25 |
| 2.98 | 0.00 | 126.52 | 3.37 | 0.00 | 184.56 | 3.76 | 0.00 | 264.63 |
| 2.99 | 0.00 | 127.78 | 3.38 | 0.00 | 186.31 | 3.77 | 0.00 | 267.03 |
| 3.00 | 0.00 | 129.05 | 3.39 | 0.00 | 188.08 | 3.78 | 0.00 | 269.45 |
| 3.01 | 0.00 | 130.33 | 3.40 | 0.00 | 189.86 | 3.79 | 0.00 | 271.88 |
| 3.02 | 0.00 | 131.63 | 3.41 | 0.00 | 191.65 | 3.80 | 0.00 | 274.34 |
| 3.03 | 0.00 | 132.93 | 3.42 | 0.00 | 193.46 | 3.81 | 0.00 | 276.82 |
| 3.04 | 0.00 | 134.25 | 3.43 | 0.00 | 195.29 | 3.82 | 0.00 | 279.31 |
| 3.05 | 0.00 | 135.57 | 3.44 | 0.00 | 197.13 | 3.83 | 0.00 | 281.83 |
| 3.06 | 0.00 | 136.91 | 3.45 | 0.00 | 198.99 | 3.84 | 0.00 | 284.37 |
| 3.07 | 0.00 | 138.26 | 3.46 | 0.00 | 200.86 | 3.85 | 0.00 | 286.92 |
| 3.08 | 0.00 | 139.62 | 3.47 | 0.00 | 202.74 | 3.86 | 0.00 | 289.50 |
| 3.09 | 0.00 | 141.00 | 3.48 | 0.00 | 204.65 | 3.87 | 0.00 | 292.09 |
| 3.10 | 0.00 | 142.38 | 3.49 | 0.00 | 206.56 | 3.88 | 0.00 | 294.71 |
| 3.11 | 0.00 | 143.78 | 3.50 | 0.00 | 208.50 | 3.89 | 0.00 | 297.34 |
| 3.12 | 0.00 | 145.19 | 3.51 | 0.00 | 210.44 | 3.90 | 0.00 | 300.00 |
| 3.13 | 0.00 | 146.61 | 3.52 | 0.00 | 212.41 | 3.91 | 0.00 | 302.67 |
| 3.14 | 0.00 | 148.04 | 3.53 | 0.00 | 214.39 | 3.92 | 0.00 | 305.37 |
| 3.15 | 0.00 | 149.49 | 3.54 | 0.00 | 216.39 | 3.93 | 0.00 | 308.08 |
| 3.16 | 0.00 | 150.94 | 3.55 | 0.00 | 218.40 | 3.94 | 0.00 | 310.82 |
| 3.17 | 0.00 | 152.41 | 3.56 | 0.00 | 220.43 | 3.95 | 0.00 | 313.58 |
| 3.18 | 0.00 | 153.90 | 3.57 | 0.00 | 222.47 | 3.96 | 0.00 | 316.36 |
| 3.19 | 0.00 | 155.39 | 3.58 | 0.00 | 224.54 | 3.97 | 0.00 | 319.16 |
| 3.20 | 0.00 | 156.90 | 3.59 | 0.00 | 226.62 | 3.98 | 0.00 | 321.98 |
| 3.21 | 0.00 | 158.42 | 3.60 | 0.00 | 228.71 | 3.99 | 0.00 | 324.82 |
| 3.22 | 0.00 | 159.95 | 3.61 | 0.00 | 230.83 | 4.00 | 0.00 | 327.69 |
| 3.23 | 0.00 | 161.50 | 3.62 | 0.00 | 232.95 | 4.01 | 0.00 | 330.58 |
| 3.24 | 0.00 | 163.06 | 3.63 | 0.00 | 235.10 | 4.02 | 0.00 | 333.49 |
| 3.25 | 0.00 | 164.63 | 3.64 | 0.00 | 237.27 | 4.03 | 0.00 | 336.42 |
| 3.26 | 0.00 | 166.22 | 3.65 | 0.00 | 239.45 | 4.04 | 0.00 | 339.38 |
| 3.27 | 0.00 | 167.81 | 3.66 | 0.00 | 241.65 | 4.05 | 0.00 | 342.35 |
| 3.28 | 0.00 | 169.43 | 3.67 | 0.00 | 243.86 | 4.06 | 0.00 | 345.36 |

| Stage | Shift | Discharge | Stage | Shift | Discharge | Stage | Shift | Discharge |
|---|---|---|---|---|---|---|---|---|
| 4.07 | 0.00 | 348.38 | 4.46 | 0.00 | 487.44 | | | |
| 4.08 | 0.00 | 351.43 | 4.47 | 0.00 | 491.60 | | | |
| 4.09 | 0.00 | 354.50 | 4.48 | 0.00 | 495.78 | | | |
| 4.10 | 0.00 | 357.59 | 4.49 | 0.00 | 500.00 | | | |
| 4.11 | 0.00 | 360.71 | | | | | | |
| 4.12 | 0.00 | 363.85 | | | | | | |
| 4.13 | 0.00 | 367.01 | | | | | | |
| 4.14 | 0.00 | 370.20 | | | | | | |
| 4.15 | 0.00 | 373.41 | | | | | | |
| 4.16 | 0.00 | 376.65 | | | | | | |
| 4.17 | 0.00 | 379.91 | | | | | | |
| 4.18 | 0.00 | 383.20 | | | | | | |
| 4.19 | 0.00 | 386.51 | | | | | | |
| 4.20 | 0.00 | 389.84 | | | | | | |
| 4.21 | 0.00 | 393.20 | | | | | | |
| 4.22 | 0.00 | 396.59 | | | | | | |
| 4.23 | 0.00 | 400.00 | | | | | | |
| 4.24 | 0.00 | 403.49 | | | | | | |
| 4.25 | 0.00 | 407.02 | | | | | | |
| 4.26 | 0.00 | 410.56 | | | | | | |
| 4.27 | 0.00 | 414.14 | | | | | | |
| 4.28 | 0.00 | 417.74 | | | | | | |
| 4.29 | 0.00 | 421.37 | | | | | | |
| 4.30 | 0.00 | 425.03 | | | | | | |
| 4.31 | 0.00 | 428.71 | | | | | | |
| 4.32 | 0.00 | 432.43 | | | | | | |
| 4.33 | 0.00 | 436.17 | | | | | | |
| 4.34 | 0.00 | 439.94 | | | | | | |
| 4.35 | 0.00 | 443.73 | | | | | | |
| 4.36 | 0.00 | 447.56 | | | | | | |
| 4.37 | 0.00 | 451.42 | | | | | | |
| 4.38 | 0.00 | 455.30 | | | | | | |
| 4.39 | 0.00 | 459.21 | | | | | | |
| 4.40 | 0.00 | 463.16 | | | | | | |
| 4.41 | 0.00 | 467.13 | | | | | | |
| 4.42 | 0.00 | 471.13 | | | | | | |
| 4.43 | 0.00 | 475.16 | | | | | | |
| 4.44 | 0.00 | 479.23 | | | | | | |
| 4.45 | 0.00 | 483.32 | | | | | | |

# Appendix H rev

# Supporting Information for the Biological Resources: Terrestrial Section

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# Appendix H

# Attachment 1 – Biological Memorandum

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**Denise Duffy & Associates, Inc.**
PLANNING AND ENVIRONMENTAL CONSULTING

# MEMORANDUM

**Date:** March 19, 2015

**To:** Bob Holden, MRWPCA

**From:** Erin Harwayne, DD&A
Shaelyn Hession, DD&A

**Subject:** Pure Water Monterey Groundwater Replenishment Project – Revisions to the Reclamation Ditch at Davis Road Source Water Diversion Site and Blanco Drain Pipeline Source Water Diversion Site

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The purpose of this memorandum is to identify any additional impacts to biological resources not previously considered, as a result of the revisions to the Project Study Area at the Reclamation Ditch at Davis Road Source Water Diversion Site (revised diversion site) and Blanco Drain Pipeline Source Water Diversion Site (revised pipeline site).

## Revised Reclamation Ditch at Davis Road Source Water Diversion Site

The proposed revised diversion site is located along the Reclamation Ditch, east of North Davis Road in Salinas, California, approximately 105 feet downstream of the location originally proposed (Figure 1). The revised diversion site includes approximately 0.06 acre of aquatic habitat and 0.11 acre ruderal/developed habitat initially evaluated as part of the Reclamation Ditch Affected Reach. An additional area of approximately 0.79 acre of ruderal/developed/agriculture habitat is now included as part of the revised site.

Given the proximity of the revised site to the location originally proposed, the habitat present within the revised site, and that a portion of the site had previous been evaluated and considered, no additional impacts to biological resources beyond impacts previously considered are expected as a result of the revision to the Project Study Area.

## Revised Blanco Drain Pipeline Source Water Diversion Site

The revision to the Project Study Area as part of the revised pipeline site includes the addition of approximately 5.8 acres to the Project Study Area, east of the Treatment Facilities at the Regional Treatment Plant (Figure 2). The revised pipeline site includes approximately 0.6 acre of non-native grassland, and 5.2 acres of ruderal/developed habitat. Most of the grassland included in the revised pipeline site is a continuation of grassland areas for which impacts were considered as part of the original Blanco Drain Diversion Site.

Given the proximity of the revised pipeline site to areas considered as part of the original Project Study Area, and the habitat present within the revised pipeline site, no additional impacts to biological resources beyond impacts previously considered are expected as a result of the revision.

If you have any questions or comments regarding this memorandum, please feel free to contact Erin Harwayne or Shaelyn Hession at (831) 373-4341.


| | | | |
|---|---|---|---|
| Reclamation Ditch at Davis Road Source Water Diversion Site Revision Map | Date: 3/23/2015<br>Scale: 1 inch = 0.02 miles<br>Project: 2013-13 | Monterey \| San Jose<br>**Denise Duffy and Associates, Inc.**<br>Environmental Consultants Resource Planners<br>947 Cass Street, Suite 5<br>Monterey, CA 93940<br>(831) 373-4341 | Figure<br>1 |

C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\MemoFig1RecDitchSiteRevision20150323.mxd


Blanco Drain PipelineSource Water Diversion Site Revision Map

C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\MemoFig2BlancoPipelineRevision20150323.mxd

Date: 3/23/2015

Scale: 1 inch = 0.06 miles

Project: 2013-13

Monterey | San Jose
**Denise Duffy and Associates, Inc.**
Environmental Consultants Resource Planners
947 Cass Street, Suite 5
Monterey, CA 93940
(831) 373-4341

Figure 2

# Appendix H

# Attachment 2 – California Natural Diversity Database RareFind Occurrence Report

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# Selected Elements by Scientific Name

## California Department of Fish and Wildlife

## California Natural Diversity Database

**Query Criteria:** Quad is (Moss Landing (3612177) or Marina (3612167) or Seaside (3612157) or Monterey (3612158) or Prunedale (3612176) or San Juan Bautista (3612175) or Natividad (3612165) or Salinas (3612166) or Spreckels (3612156) or Soberanes Point (3612148) or Mt. Carmel (3612147) or Soquel (3612188) or Watsonville East (3612186) or Watsonville West (3612187) or Chualar (3612155) or Carmel Valley (3612146))

| Species | Element Code | Federal Status | State Status | Global Rank | State Rank | Rare Plant Rank/CDFW SSC or FP |
|---|---|---|---|---|---|---|
| ***Accipiter cooperii***<br>Cooper's hawk | ABNKC12040 | None | None | G5 | S4 | WL |
| ***Agelaius tricolor***<br>tricolored blackbird | ABPBXB0020 | None | Endangered | G2G3 | S1S2 | SSC |
| ***Agrostis lacuna-vernalis***<br>vernal pool bent grass | PMPOA041N0 | None | None | G1 | S1 | 1B.1 |
| ***Allium hickmanii***<br>Hickman's onion | PMLIL02140 | None | None | G2 | S2 | 1B.2 |
| ***Ambystoma californiense***<br>California tiger salamander | AAAAA01180 | Threatened | Threatened | G2G3 | S2S3 | SSC |
| ***Ambystoma macrodactylum croceum***<br>Santa Cruz long-toed salamander | AAAAA01082 | Endangered | Endangered | G5T1T2 | S1S2 | FP |
| ***Anniella pulchra nigra***<br>black legless lizard | ARACC01011 | None | None | G3G4T2T3Q | S2 | SSC |
| ***Anniella pulchra pulchra***<br>silvery legless lizard | ARACC01012 | None | None | G3G4T3T4Q | S3 | SSC |
| ***Antrozous pallidus***<br>pallid bat | AMACC10010 | None | None | G5 | S3 | SSC |
| ***Aquila chrysaetos***<br>golden eagle | ABNKC22010 | None | None | G5 | S3 | FP |
| ***Arctostaphylos andersonii***<br>Anderson's manzanita | PDERI04030 | None | None | G2 | S2 | 1B.2 |
| ***Arctostaphylos edmundsii***<br>Little Sur manzanita | PDERI04260 | None | None | G2? | S2? | 1B.2 |
| ***Arctostaphylos hookeri ssp. hookeri***<br>Hooker's manzanita | PDERI040J1 | None | None | G3T2 | S2 | 1B.2 |
| ***Arctostaphylos montereyensis***<br>Toro manzanita | PDERI040R0 | None | None | G2? | S2? | 1B.2 |
| ***Arctostaphylos pajaroensis***<br>Pajaro manzanita | PDERI04100 | None | None | G1 | S1 | 1B.1 |
| ***Arctostaphylos pumila***<br>sandmat manzanita | PDERI04180 | None | None | G1 | S1 | 1B.2 |
| ***Arctostaphylos regismontana***<br>Kings Mountain manzanita | PDERI041C0 | None | None | G2 | S2 | 1B.2 |
| ***Asio flammeus***<br>short-eared owl | ABNSB13040 | None | None | G5 | S3 | SSC |
| ***Astragalus tener var. tener***<br>alkali milk-vetch | PDFAB0F8R1 | None | None | G2T2 | S2 | 1B.2 |

| Species | Element Code | Federal Status | State Status | Global Rank | State Rank | Rare Plant Rank/CDFW SSC or FP |
|---|---|---|---|---|---|---|
| ***Astragalus tener var. titi***<br>coastal dunes milk-vetch | PDFAB0F8R2 | Endangered | Endangered | G2T1 | S1 | 1B.1 |
| ***Athene cunicularia***<br>burrowing owl | ABNSB10010 | None | None | G4 | S3 | SSC |
| ***Bryoria spiralifera***<br>twisted horsehair lichen | NLTEST5460 | None | None | G3 | S1S2 | 1B.1 |
| ***Buteo regalis***<br>ferruginous hawk | ABNKC19120 | None | None | G4 | S3S4 | WL |
| ***Buteo swainsoni***<br>Swainson's hawk | ABNKC19070 | None | Threatened | G5 | S3 | |
| ***California macrophylla***<br>round-leaved filaree | PDGER01070 | None | None | G2 | S2 | 1B.1 |
| ***Castilleja ambigua var. insalutata***<br>pink Johnny-nip | PDSCR0D403 | None | None | G4T1 | S1 | 1B.1 |
| ***Central Dune Scrub***<br>Central Dune Scrub | CTT21320CA | None | None | G2 | S2.2 | |
| ***Central Maritime Chaparral***<br>Central Maritime Chaparral | CTT37C20CA | None | None | G2 | S2.2 | |
| ***Centromadia parryi ssp. congdonii***<br>Congdon's tarplant | PDAST4R0P1 | None | None | G3T2 | S2 | 1B.1 |
| ***Charadrius alexandrinus nivosus***<br>western snowy plover | ABNNB03031 | Threatened | None | G3T3 | S2 | SSC |
| ***Chorizanthe pungens var. pungens***<br>Monterey spineflower | PDPGN040M2 | Threatened | None | G2T2 | S2 | 1B.2 |
| ***Chorizanthe robusta var. robusta***<br>robust spineflower | PDPGN040Q2 | Endangered | None | G2T1 | S1 | 1B.1 |
| ***Cicindela ohlone***<br>Ohlone tiger beetle | IICOL026L0 | Endangered | None | G1 | S1 | |
| ***Clarkia jolonensis***<br>Jolon clarkia | PDONA050L0 | None | None | G2 | S2 | 1B.2 |
| ***Coastal and Valley Freshwater Marsh***<br>Coastal and Valley Freshwater Marsh | CTT52410CA | None | None | G3 | S2.1 | |
| ***Coastal Brackish Marsh***<br>Coastal Brackish Marsh | CTT52200CA | None | None | G2 | S2.1 | |
| ***Coelus globosus***<br>globose dune beetle | IICOL4A010 | None | None | G1G2 | S1S2 | |
| ***Collinsia multicolor***<br>San Francisco collinsia | PDSCR0H0B0 | None | None | G2 | S2 | 1B.2 |
| ***Cordylanthus rigidus ssp. littoralis***<br>seaside bird's-beak | PDSCR0J0P2 | None | Endangered | G5T2 | S2 | 1B.1 |
| ***Corynorhinus townsendii***<br>Townsend's big-eared bat | AMACC08010 | None | Candidate Threatened | G3G4 | S2 | SSC |

| Species | Element Code | Federal Status | State Status | Global Rank | State Rank | Rare Plant Rank/CDFW SSC or FP |
|---|---|---|---|---|---|---|
| ***Cypseloides niger***<br>black swift | ABNUA01010 | None | None | G4 | S2 | SSC |
| ***Danaus plexippus***<br>monarch butterfly | IILEPP2010 | None | None | G5 | S3 | |
| ***Delphinium californicum ssp. interius***<br>Hospital Canyon larkspur | PDRAN0B0A2 | None | None | G3T3 | S3 | 1B.2 |
| ***Delphinium hutchinsoniae***<br>Hutchinson's larkspur | PDRAN0B0V0 | None | None | G2 | S2 | 1B.2 |
| ***Delphinium umbraculorum***<br>umbrella larkspur | PDRAN0B1W0 | None | None | G3 | S3 | 1B.3 |
| ***Dipodomys venustus venustus***<br>Santa Cruz kangaroo rat | AMAFD03042 | None | None | G4T1 | S1 | |
| ***Elanus leucurus***<br>white-tailed kite | ABNKC06010 | None | None | G5 | S3S4 | FP |
| ***Emys marmorata***<br>western pond turtle | ARAAD02030 | None | None | G3G4 | S3 | SSC |
| ***Eremophila alpestris actia***<br>California horned lark | ABPAT02011 | None | None | G5T3Q | S3 | WL |
| ***Ericameria fasciculata***<br>Eastwood's goldenbush | PDAST3L080 | None | None | G2 | S2 | 1B.1 |
| ***Eriogonum nortonii***<br>Pinnacles buckwheat | PDPGN08470 | None | None | G2 | S2 | 1B.3 |
| ***Erysimum ammophilum***<br>sand-loving wallflower | PDBRA16010 | None | None | G2 | S2 | 1B.2 |
| ***Erysimum menziesii***<br>Menzies' wallflower | PDBRA160R0 | Endangered | Endangered | G1 | S1 | 1B.1 |
| ***Eucyclogobius newberryi***<br>tidewater goby | AFCQN04010 | Endangered | None | G3 | S2S3 | SSC |
| ***Euphilotes enoptes smithi***<br>Smith's blue butterfly | IILEPG2026 | Endangered | None | G5T1T2 | S1S2 | |
| ***Falco mexicanus***<br>prairie falcon | ABNKD06090 | None | None | G5 | S4 | WL |
| ***Fritillaria liliacea***<br>fragrant fritillary | PMLIL0V0C0 | None | None | G2 | S2 | 1B.2 |
| ***Gilia tenuiflora ssp. arenaria***<br>Monterey gilia | PDPLM041P2 | Endangered | Threatened | G3G4T2 | S2 | 1B.2 |
| ***Helminthoglypta sequoicola consors***<br>redwood shoulderband | IMGASC2421 | None | None | G2T1 | S1 | |
| ***Hesperocyparis goveniana***<br>Gowen cypress | PGCUP04031 | Threatened | None | G1 | S1 | 1B.2 |
| ***Hesperocyparis macrocarpa***<br>Monterey cypress | PGCUP04060 | None | None | G1 | S1 | 1B.2 |

| Species | Element Code | Federal Status | State Status | Global Rank | State Rank | Rare Plant Rank/CDFW SSC or FP |
|---|---|---|---|---|---|---|
| ***Holocarpha macradenia***<br>Santa Cruz tarplant | PDAST4X020 | Threatened | Endangered | G1 | S1 | 1B.1 |
| ***Horkelia cuneata var. sericea***<br>Kellogg's horkelia | PDROS0W043 | None | None | G4T2 | S2? | 1B.1 |
| ***Lasiurus cinereus***<br>hoary bat | AMACC05030 | None | None | G5 | S4 | |
| ***Lasthenia conjugens***<br>Contra Costa goldfields | PDAST5L040 | Endangered | None | G1 | S1 | 1B.1 |
| ***Layia carnosa***<br>beach layia | PDAST5N010 | Endangered | Endangered | G2 | S2 | 1B.1 |
| ***Legenere limosa***<br>legenere | PDCAM0C010 | None | None | G2 | S2 | 1B.1 |
| ***Linderiella occidentalis***<br>California linderiella | ICBRA06010 | None | None | G2G3 | S2S3 | |
| ***Lupinus tidestromii***<br>Tidestrom's lupine | PDFAB2B3Y0 | Endangered | Endangered | G1 | S1 | 1B.1 |
| ***Malacothamnus palmeri var. involucratus***<br>Carmel Valley bush-mallow | PDMAL0Q0B1 | None | None | G3T3Q | S3 | 1B.2 |
| ***Malacothamnus palmeri var. palmeri***<br>Santa Lucia bush-mallow | PDMAL0Q0B5 | None | None | G3T2Q | S2 | 1B.2 |
| ***Malacothrix saxatilis var. arachnoidea***<br>Carmel Valley malacothrix | PDAST660C2 | None | None | G5T2 | S2 | 1B.2 |
| ***Microseris paludosa***<br>marsh microseris | PDAST6E0D0 | None | None | G2 | S2 | 1B.2 |
| ***Monardella sinuata ssp. nigrescens***<br>northern curly-leaved monardella | PDLAM18162 | None | None | G3T2 | S2 | 1B.2 |
| ***Monolopia gracilens***<br>woodland woollythreads | PDAST6G010 | None | None | G2G3 | S2S3 | 1B.2 |
| ***Monterey Cypress Forest***<br>Monterey Cypress Forest | CTT83150CA | None | None | G1 | S1.2 | |
| ***Monterey Pine Forest***<br>Monterey Pine Forest | CTT83130CA | None | None | G1 | S1.1 | |
| ***Monterey Pygmy Cypress Forest***<br>Monterey Pygmy Cypress Forest | CTT83162CA | None | None | G1 | S1.1 | |
| ***Northern Bishop Pine Forest***<br>Northern Bishop Pine Forest | CTT83121CA | None | None | G2 | S2.2 | |
| ***Northern Coastal Salt Marsh***<br>Northern Coastal Salt Marsh | CTT52110CA | None | None | G3 | S3.2 | |
| ***Oceanodroma homochroa***<br>ashy storm-petrel | ABNDC04030 | None | None | G2 | S2 | SSC |
| ***Oncorhynchus mykiss irideus***<br>steelhead - central California coast DPS | AFCHA0209G | Threatened | None | G5T2T3Q | S2S3 | |

| Species | Element Code | Federal Status | State Status | Global Rank | State Rank | Rare Plant Rank/CDFW SSC or FP |
|---|---|---|---|---|---|---|
| ***Oncorhynchus mykiss irideus***<br>steelhead - south/central California coast DPS | AFCHA0209H | Threatened | None | G5T2Q | S2 | SSC |
| ***Optioservus canus***<br>Pinnacles optioservus riffle beetle | IICOL5E020 | None | None | G1 | S1 | |
| ***Pedicularis dudleyi***<br>Dudley's lousewort | PDSCR1K0D0 | None | Rare | G2 | S2 | 1B.2 |
| ***Pelecanus occidentalis californicus***<br>California brown pelican | ABNFC01021 | Delisted | Delisted | G4T3 | S3 | FP |
| ***Penstemon rattanii var. kleei***<br>Santa Cruz Mountains beardtongue | PDSCR1L5B1 | None | None | G4T2 | S2 | 1B.2 |
| ***Pentachaeta bellidiflora***<br>white-rayed pentachaeta | PDAST6X030 | Endangered | Endangered | G1 | S1 | 1B.1 |
| ***Phrynosoma blainvillii***<br>coast horned lizard | ARACF12100 | None | None | G3G4 | S3S4 | SSC |
| ***Pinus radiata***<br>Monterey pine | PGPIN040V0 | None | None | G1 | S1 | 1B.1 |
| ***Piperia yadonii***<br>Yadon's rein orchid | PMORC1X070 | Endangered | None | G2 | S2 | 1B.1 |
| ***Plagiobothrys chorisianus var. chorisianus***<br>Choris' popcornflower | PDBOR0V061 | None | None | G3T2Q | S2 | 1B.2 |
| ***Plagiobothrys uncinatus***<br>hooked popcornflower | PDBOR0V170 | None | None | G2 | S2 | 1B.2 |
| ***Potentilla hickmanii***<br>Hickman's cinquefoil | PDROS1B0U0 | Endangered | Endangered | G1 | S1 | 1B.1 |
| ***Rallus longirostris obsoletus***<br>California clapper rail | ABNME05016 | Endangered | Endangered | G5T1 | S1 | FP |
| ***Ramalina thrausta***<br>angel's hair lichen | NLLEC3S340 | None | None | G5 | S2? | 2B.1 |
| ***Rana boylii***<br>foothill yellow-legged frog | AAABH01050 | None | None | G3 | S2S3 | SSC |
| ***Rana draytonii***<br>California red-legged frog | AAABH01022 | Threatened | None | G2G3 | S2S3 | SSC |
| ***Reithrodontomys megalotis distichlis***<br>Salinas harvest mouse | AMAFF02032 | None | None | G5T1 | S1 | |
| ***Riparia riparia***<br>bank swallow | ABPAU08010 | None | Threatened | G5 | S2 | |
| ***Rosa pinetorum***<br>pine rose | PDROS1J0W0 | None | None | G2Q | S2 | 1B.2 |
| ***Sidalcea malachroides***<br>maple-leaved checkerbloom | PDMAL110E0 | None | None | G3 | S3 | 4.2 |
| ***Spirinchus thaleichthys***<br>longfin smelt | AFCHB03010 | Candidate | Threatened | G5 | S1 | SSC |

| Species | Element Code | Federal Status | State Status | Global Rank | State Rank | Rare Plant Rank/CDFW SSC or FP |
|---|---|---|---|---|---|---|
| ***Stebbinsoseris decipiens***<br>Santa Cruz microseris | PDAST6E050 | None | None | G2 | S2 | 1B.2 |
| ***Taricha torosa***<br>Coast Range newt | AAAAF02032 | None | None | G4 | S4 | SSC |
| ***Taxidea taxus***<br>American badger | AMAJF04010 | None | None | G5 | S3 | SSC |
| ***Thaleichthys pacificus***<br>eulachon | AFCHB04010 | Threatened | None | G5 | S3 | SSC |
| ***Thamnophis hammondii***<br>two-striped garter snake | ARADB36160 | None | None | G4 | S3S4 | SSC |
| ***Tortula californica***<br>California screw moss | NBMUS7L090 | None | None | G2? | S2 | 1B.2 |
| ***Trifolium buckwestiorum***<br>Santa Cruz clover | PDFAB402W0 | None | None | G2 | S2 | 1B.1 |
| ***Trifolium hydrophilum***<br>saline clover | PDFAB400R5 | None | None | G2 | S2 | 1B.2 |
| ***Trifolium polyodon***<br>Pacific Grove clover | PDFAB402H0 | None | Rare | G1 | S1 | 1B.1 |
| ***Trifolium trichocalyx***<br>Monterey clover | PDFAB402J0 | Endangered | Endangered | G1 | S1 | 1B.1 |
| ***Trimerotropis infantilis***<br>Zayante band-winged grasshopper | IIORT36030 | Endangered | None | G1 | S1 | |
| ***Tryonia imitator***<br>mimic tryonia (=California brackishwater snail) | IMGASJ7040 | None | None | G2 | S2 | |
| ***Valley Needlegrass Grassland***<br>Valley Needlegrass Grassland | CTT42110CA | None | None | G3 | S3.1 | |
| ***Vireo bellii pusillus***<br>least Bell's vireo | ABPBW01114 | Endangered | Endangered | G5T2 | S2 | |

**Record Count: 117**

# Appendix H

# Attachment 3 – List of Special-Status Plant and Wildlife Species Known or with the Potential to Occur in the Vicinity of the Project Study Area

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**Table A Revised: Special-Status Species Known or With the Potential to Occur Within the Pure Water Monterey GWR Project Vicinity**

| Species | Status (USFWS/ CDFW/ CNPS) | General Habitat | Potential Occurrence within Project Study Area |
|---|---|---|---|
| **MAMMALS** | | | |
| *Antrozous pallidus* Pallid bat | --/ SSC/ -- | Occurs in a wide variety of habitats including grasslands, shrublands, arid desert areas, oak savanna, coastal forested areas, and coniferous forests of the mountain regions of California. Most common in open, dry habitats with rocky areas for roosting. Day roosts include caves, crevices, mines, and occasionally hollow trees and buildings. Seems to prefer rocky outcrops, cliffs, and crevices with access to open habitats for foraging. Similar structures are used for night roosting and will also use more open sites such as eaves, awnings, and open areas under bridges for feeding roosts. | **Moderate:** The pallid bat may roost in trees within the Project Study Area, most likely coast live oak trees and riparian forest, and may forage over non-native grasslands, central coastal scrub, and central maritime chaparral habitats. Therefore, it may occur at the Salinas Treatment Facility site, Blanco Drain site, Product Water Conveyance: RUWAP and Coastal alignment options, Injection Well Facilities site, CalAm Distribution System: Monterey Pipeline, and the three Affected Reaches. However, project components contain little to no habitat to support day roosts. |
| *Dipodomys venustus venustus* Santa Cruz kangaroo rat | --/ CNDDB/ -- | Common permanent residents of chaparral and foothill woodland habitats within the Santa Cruz Mountains from 0-1799 meters. Use well-drained loam or sandy loam soils for burrowing. Burrows are typically shallow (2-20 inches below the surface) and simple with a main chamber and few escape chambers. | **Unlikely:** Project Study Area is not located with the Santa Cruz Mountains. |
| *Lasiurus cinereus* Hoary bat | --/ CNDDB/ -- | Prefers open habitats or habitat mosaics with access to trees for cover and open areas or edge for feeding. Generally roost in dense foliage of trees. | **High:** The hoary bat may roost in within the Project Study Area, most likely coast live oak trees and riparian forest, and may forage over the open habitats, including non-native grasslands, central coastal scrub, and central maritime chaparral habitats. Therefore, it may occur at the Product Water Conveyance: RUWAP and Coastal alignment options, Injection Well Facilities site, and the three Affected Reaches.<br>There is a high potential for hoary bat to forage and roost within these habitats, but maternity roosts are unlikely to occur. |
| *Neotoma macrotis luciana* Monterey dusky-footed woodrat | --/ SSC/ -- | Forest and oak woodland habitats of moderate canopy with moderate to dense understory. Also occurs in chaparral habitats. | **High:** Suitable habitat is present within the oak woodland, coastal scrub, and maritime chaparral habitats within the Project Study Area. Woodrat nests were observed during surveys in 2014 within the Injection Well Facilities site. Suitable habitat occurs within the Salinas Treatment Facility site, Blanco Drain Diversion site, along the Product Water Conveyance: RUWAP and Coastal alignment options, Injection Well Facilities site, CalAm Distribution System: Monterey Pipeline, and the three Affected Reaches. The riparian habitat at Roberts Lake and Locke Paddon Lake is likely not dense enough to provide woodrat habitat and the species is unlikely to occur there. |
| *Reithrodontomys megalotis* | --/ CNDDB/ | Known only to occur from the Monterey Bay region. Occurs in fresh and brackish water wetlands, and probably in the | **Moderate:** Three CNDDB occurrences of this species are recorded within the Project Study Area, near Seaside Marina, and |

**Table A Revised: Special-Status Species Known or With the Potential to Occur Within the Pure Water Monterey GWR Project Vicinity**

| Species | Status (USFWS/ CDFW/ CNPS) | General Habitat | Potential Occurrence within Project Study Area |
|---|---|---|---|
| *distichlis* Salinas harvest mouse | -- | adjacent uplands around the mouth of the Salinas River. | Armstrong Ranch. Suitable habitat present at the SalinasTreatment Facility site, Blanco Drain Diversion site, Lake El Estero, Locke Paddon Lake (Product Water Conveyance: Coastal alignment option) (included in CNDDB occurrence), Roberts Lake (adjacent to CNDDB occurrence) (CalAm Distribution System: Monterey Pipeline) & the Affected Reaches. |
| *Sorex ornatus salarius* Monterey ornate shrew | --/ SSC/ -- | Mostly moist or riparian woodland habitats, and within chaparral, grassland, and emergent wetland habitats where there is a thick duff or downed logs. | **Moderate:** Suitable habitat is present within the Project Study Area along the Salinas River within the Salinas Treatment Facility and the Blanco Drain Diversion sites, Product Water Conveyance: RUWAP and Coastal alignment options, Injection Well Facilities site, CalAm Distribution System: Monterey Pipeline, and the three Affected Reaches. The CNDDB does not report any occurrences within the 16 Quads analyzed; however, this species is known to occur within the vicinity of the Project Study Area (Bolster, 1998). |
| *Taxidea taxus* American badger | --/ SSC/ -- | Dry, open grasslands, fields, pastures savannas, and mountain meadows near timberline are preferred. The principal requirements seem to be sufficient food, friable soils, and relatively open, uncultivated grounds. | **High:** One CNDDB occurrence of this species is recorded within the Project Study Area, near Seaside and Sand City. However, this is a historic occurrence and the area has since been developed. Suitable habitat within the Project Study Area is present within the non-native grassland habitat within the Product Water Conveyance: RUWAP and Coastal alignment options. |
| **BIRDS** | | | |
| *Accipiter cooperii* Cooper's hawk | --/ WL/ -- | Resident throughout most of the wooded portion of the state. Dense stands of live oak, riparian deciduous, or other forest habitats near water used most frequently. Seldom found in areas without dense tree stands, or patchy woodland habitats. | **Moderate:** Possible nesting and foraging habitat is present within the Project Study Area. |
| *Agelaius tricolor* Tricolored blackbird | --/ SSC/ -- | Nest in colonies in dense riparian vegetation, along rivers, lagoons, lakes, and ponds. Forages over grassland or aquatic habitats. | **High:** The CNDDB reports an occurrence of this species at Locke Paddon Lake. |
| *Aquila chrysaetos* Golden eagle | --/ FP/ -- | Use rolling foot-hills, mountain terrain, wide arid plateaus deeply cut by streams and canyons, open mountain slopes, cliffs, and rocky outcrops. Nest in secluded cliffs with overhanging ledges as well as large trees. | **Low:** Foraging habitat is present within the Project Study Area |
| *Asio flammeus* Short-eared owl | --/ SSC/ -- | Usually found in open areas with few trees, such as annual and perennial grasslands, prairies, meadows, dunes, irrigated lands, and saline and freshwater emergent marshes. Dense vegetation is required for roosting and nesting cover. This includes tall grasses, brush, ditches, and wetlands. Open, | **Unlikely:** This species does not breed within Monterey County and only low quality overwintering habitat is present within the Project Study Area. The Project is unlikely to impact this species, as overwintering habitat is not typically protected. |

**Table A Revised: Special-Status Species Known or With the Potential to Occur Within the Pure Water Monterey GWR Project Vicinity**

| Species | Status (USFWS/ CDFW/ CNPS) | General Habitat | Potential Occurrence within Project Study Area |
|---|---|---|---|
| | | treeless areas containing elevated sites for perching, such as fence posts or small mounds, are also needed. Some individuals breed in northern California. | |
| *Athene cunicularia* Burrowing owl | --/ SSC/ -- | Year round resident of open, dry grassland and desert habitats, and in grass, forb and open shrub stages of pinyon-juniper and ponderosa pine habitats. Frequent open grasslands and shrublands with perches and burrows. Use rodent burrows (often California ground squirrel) for roosting and nesting cover. Pipes, culverts, and nest boxes may be substituted for burrows in areas where burrows are not available. | **High:** Three CNDDB occurrences of this species are recorded within the Project Study Area. Suitable habitat for this species is present within the non-native grassland habitat along the Product Water Conveyance: RUWAP and Coastal alignment options. Additionally, this species may be present within the coastal dune scrub areas within the CalAm Distribution System: Monterey Pipeline, based on CNDDB observations within the area and despite the lack of typical habitat for the species. |
| *Brachyramphus marmoratus* Marbled murrelet (nesting) | FT/ SE/ -- | Occur year-round in marine subtidal and pelagic habitats from the Oregon border to Point Sal. Partial to coastlines with stands of mature redwood and Douglas-fir. Requires dense mature forests of redwood and/or Douglas-fir for breeding and nesting. | **Unlikely:** No CNDDB occurrences within quads searched. No habitat is present within the Project study area. |
| *Buteo regalis* Ferruginous hawk | --/ CNDDB/ -- | An uncommon winter resident and migrant at lower elevations and open grasslands in the Modoc Plateau, Central Valley, and Coast Ranges and a fairly common winter resident of grassland and agricultural areas in southwestern California. Frequent open grasslands, sagebrush flats, desert scrub, low foothills surrounding valleys, and fringes of pinyon-juniper habitats. Does not breed in California. | **Low:** A CNDDB occurrence of this species is recorded within the Project Study Area near Armstrong Ranch. However, this species does not breed in California and is, therefore, unlikely to be impacted by the Project. |
| *Charadrius alexandrius nivosus* Western snowy plover | FT/ SSC/ -- | Sandy beaches on marine and estuarine shores, also salt pond levees and the shores of large alkali lakes. Requires sandy, gravelly or friable soil substrate for nesting. | **Unlikely:** Three CNDDB occurrences are recorded within portions of the Project Study Area. No suitable habitat for this species is present within the Project Study Area. However, suitable habitat is present immediately adjacent to the Project Study Area at the southern end of Fort Ord, near the Highway One Fremont Street Exit in Seaside (Seaside occurrence). |
| *Cypseloides niger* Black swift | --/ SSC/ -- | Regularly nests in moist crevices or caves on sea cliffs above the surf, or on cliffs behind or adjacent to waterfalls in deep canyons. Forages widely over many habitats. | **Unlikely:** No suitable habitat present within the Project Study Area. The nearest CNDDB occurrence is approximately five miles from the Project Study Area. |
| *Elanus leucurus* White-tailed kite | --/ FP/ -- | Open groves, river valleys, marshes, and grasslands. Prefer such area with low roosts (fences etc.). Nest in shrubs and trees adjacent to grasslands. | **High:** Appropriate nesting and foraging habitat present within the Project Study Area, particularly within the vicinity of Armstrong Ranch. The nearest CNDDB occurrence is approximately seven miles from the Project Study Area; however, an occurrence is also known within Armstrong Ranch, immediately adjacent to the Project Study Area. |
| *Empidonax* | FE/ | Breeds in riparian habitat in areas ranging in elevation from | **Unlikely:** No CNDDB occurrences within quads searched. |

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| Species | Status (USFWS/ CDFW/ CNPS) | General Habitat | Potential Occurrence within Project Study Area |
|---|---|---|---|
| *traillii extimus* Southwestern willow flycatcher (nesting) | SE/ -- | sea level to over 2,600 meters. Builds nest in trees in densely vegetated areas. This species establishes nesting territories and builds, and forages in mosaics of relatively dense and expansive areas of trees and shrubs, near or adjacent to surface water or underlain by saturated soils. Not typically found nesting in areas without willows (*Salix sp*.), tamarisk (*Tamarix ramosissima)*, or both. | Habitat is present within the Project Study Area. This species has a low potential for occurrence as no breeding pairs have been seen in recent decades and the species is unlikely to reoccupy this area until brown-headed cowbirds, which parasitize the nest of other species, are heavily controlled. |
| *Eremophila alpestris actia* California horned lark | --/ WL/ -- | Variety of open habitats, usually where large trees and/or shrubs are absent. Found from grasslands along the coast to deserts at sea-level and alpine dwarf-shrub habitats are higher elevations. Builds open cup-like nests on the ground. | **High:** A CNDDB occurrence of this species is recorded within the Project Study Area near Armstrong Ranch in Marina. Suitable habitat is present within the Project Study Area within the non-native grassland habitat at the Product Water Conveyance: RUWAP and Coastal alignment options. |
| *Falco mexicanus* Prairie falcon | --/ WL/ -- | Associated primarily with perennial grasslands, savannahs, rangeland, some agricultural fields, and desert scrub areas. Uses open terrain for foraging; nests in open terrain with canyons, cliffs, escarpments, and rock outcrops. | **Low:** May forage within Project Study Area, near Armstrong Ranch. No suitable nesting habitat is present within the Project Study Area and is, therefore, unlikely to be impacted by the Project. The nearest CNDDB occurrence is within the Spreckels Quad (exact occurrence location information not available). |
| *Oceanodroma homochroa* Ashy storm petrel | --/ SSC/ -- | Tied to land only to nest, otherwise remains over open sea. Nests in natural cavities, sea caves, or rock crevices on offshore islands and prominent peninsulas of the mainland. | **Unlikely:** No suitable habitat present within the Project Study Area. |
| *Pelecanus occidentalis californicus* California brown pelican | FD/ SD,FP/ -- | Found in estuarine, marine subtidal, and marine pelagic waters along the California coast. Usually rests on water or inaccessible rocks, but also uses mudflats, sandy beaches, wharfs, and jetties. | **Unlikely:** Only low quality habitat is present within the Project Study Area. |
| *Rallus longirostris obsoletus* California clapper rail | FE/ SE,FP/ -- | Occur within a range of salt and brackish marshes. | **Unlikely:** Only low quality habitat is present within the Project Study Area. This species is now likely restricted to the San Francisco Bay area. Occurrences have been recorded at Elkhorn Slough; however, this species has not been observed there since the 1980s. |
| *Riparia riparia* Bank swallow | --/ ST/ -- | Nest colonially in sand banks. Found near water; fields, marshes, streams, and lakes. | **Unlikely:** No suitable habitat present within the Project Study Area. The nearest CNDDB occurrence is approximately 3 miles from the Project Study Area. An occurrence of this species was also reported by California State Parks in 2008 on Fort Ord, approximately 2,000 feet from the Product Water Conveyance: Coastal alignment option. |
| *Sterna antillarum* | FE / SE,CFP/ | Sea beaches, bays; large rivers, bars. | **Unlikely:** No CNDDB occurrences within quads searched. No habitat is present within the Project Study Area. |

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| Species | Status (USFWS/ CDFW/ CNPS) | General Habitat | Potential Occurrence within Project Study Area |
|---|---|---|---|
| *browni*<br>California least tern (nesting colony) | -- | | |
| *Vireo bellii pusillus*<br>Least Bell's vireo | FE/<br>SE/<br>-- | Riparian habitats. Breed in willow riparian forest supporting a dense, shrubby understory. Oak woodland with a willow riparian understory is also used in some areas, and individuals sometimes enter adjacent chaparral, coastal sage scrub, or desert scrub habitats to forage. | **Unlikely:** Only low quality habitat is present within the Project Study Area; considered extirpated in northern Monterey County. |
| **REPTILES AND AMPHIBIANS** | | | |
| *Ambystoma californiense*<br>California tiger salamander | FT/<br>ST/<br>-- | Annual grassland and grassy understory of valley-foothill hardwood habitats in central and northern California. Need underground refuges and vernal pools or other seasonal water sources. | **Unlikely:** No breeding habitat is present within the Project Study Area. Several breeding locations are known within Fort Ord; however, all of these are located 2.0 miles or greater from the Project Study Area, outside of the known dispersal range for this species. A tiger salamander breeding site is also known within Armstrong Ranch, approximately 300 feet from the Project Study Area, and suitable upland habitat is present within the Project Study Area in this area. However, it was determined through genetic testing that the tiger salamander population at this location was non-native. |
| *Ambystoma macrodactylum croceum*<br>Santa Cruz long-toed salamander | FE/<br>SE/<br>-- | Preferred habitats include ponderosa pine, montane hardwood-conifer, mixed conifer, montane riparian, red fir, and wet meadows. This is an isolated subspecies which occurs in a small number of localities in Santa Cruz and Monterey Counties. Adults spend the majority of the time in underground burrows and beneath objects. Larvae prefer shallow water with clumps of vegetation. | **Unlikely:** No breeding habitat is present on the Project Study Area. The nearest CNDDB occurrence is approximately five miles Project Study Area, outside of the potential dispersal range for this species. |
| *Anniella pulchra*<br>California legless lizard (includes *A. p. nigra* and *A. p. pulchra* as recognized by the DFG) | --/<br>SSC/<br>-- | Requires moist, warm habitats with loose soil for burrowing and prostrate plant cover, often forages in leaf litter at plant bases; may be found on beaches, sandy washes, and in woodland, chaparral, and riparian areas. | **High:** Suitable habitat present within any of the undeveloped areas of the Project Study Area. The CNDDB reports occurrences within six of the 16 Quads analyzed. Additionally, a specific occurrence is reported within the Project Study Area in Marina, near the Fort Ord Natural Reserve (FONR). |
| *Emys marmorata*<br>Western pond turtle | --/<br>SSC/<br>-- | Associated with permanent or nearly permanent water in a wide variety of habitats including streams, lakes, ponds, irrigation ditches, etc. Require basking sites such as partially submerged logs, rocks, mats of vegetation, or open banks. | **High:** Suitable habitat is present within the Project Study Area near Locke Paddon Lake and Robert's Lake. The nearest CNDDB occurrence is less than 100 feet from the Project Study Area. |

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| Species | Status (USFWS/ CDFW/ CNPS) | General Habitat | Potential Occurrence within Project Study Area |
|---|---|---|---|
| | | | |
| *Phrynosoma blainvillii* Coast horned lizard | --/ SSC/ -- | Associated with open patches of sandy soils in washes, chaparral, scrub, and grasslands. | **High:** Two CNDDB occurrences of this species are recorded within the Project Study Area near Armstrong Ranch. Suitable habitat for this species is present within the Project Study Area of the Product Water Conveyance: RUWAP and Coastal alignment options, Injection Well Facilities site, CalAm Distribution System: Monterey Pipeline, Reclamation Ditch Affected Reach, and Old Salinas River Channel Affected Reach. |
| *Rana boylii* Foothill yellow-legged frog | --/ SSC/ -- | Partly-shaded, shallow streams and riffles with a rocky substrate in a variety of habitats, including hardwood, pine, and riparian forests, scrub, chaparral, and wet meadows. Rarely encountered far from permanent water. | **Unlikely:** No habitat is present within the Project Study Area. |
| *Rana draytonii* California red-legged frog | FT/ SSC/ -- | Lowlands and foothills in or near permanent or late-season sources of deep water with dense, shrubby, or emergent riparian vegetation. During late summer or fall adults are known to utilize a variety of upland habitats with leaf litter or mammal burrows. | **High:** The nearest CNDDB occurrence is located approximately one mile from the Project Study Area along the Salinas River. CRLF were observed breeding at this location in 2009. Appropriate breeding habitat also includes Roberts Lake and Locke Paddon Lake; although these resources are likely outside of the dispersal range for CRLF. |
| *Taricha torosa* Coast Range newt | --/ SSC/ -- | Occurs mainly in valley-foothill hardwood, valley-foothill hardwood-conifer, coastal scrub, and mixed chaparral but is known to occur in grasslands and mixed conifer types. Seek cover under rocks and logs, in mammal burrows, rock fissures, or man-made structures such as wells. Breed in intermittent ponds, streams, lakes, and reservoir. | **Moderate:** Aestivation habitat is present within the Project Study Area. |
| *Thamnophis hammondii* Two-striped garter snake | --/ SSC/ -- | Associated with permanent or semi-permanent bodies of water bordered by dense vegetation in a variety of habitats from sea level to 2400m elevation. | **Moderate:** Suitable habitat is present within the Project Study Area near Locke Paddon Lake and Roberts Lake. The nearest CNDDB occurrence is approximately 10 miles from the Project Study Area. |
| **INVERTEBRATES** | | | |
| *Branchinecta lynchi* Vernal pool fairy shrimp | FT/ --/ -- | Require ephemeral pools with no flow. Associated with vernal pool/grasslands from near Red Bluff (Shasta County), through the central valley, and into the South Coast Mountains Region. Require ephemeral pools with no flow. | **Unlikely:** No CNDDB occurrences within quads searched. California fairy shrimp (*Linderella occidentalis*) known to occur in vernal pools in the vicinity of the Project Study Area, but no vernal pool fairy shrimp have been identified. No habitat is present within the Project Study Area. |
| *Cicindela ohlone* Ohlone tiger beetle | FE/ CNDDB/ -- | Coastal terraces with remnant stands of open native grassland with clay or sandy soils. Hunt, breed, and dig small vertical burrows along sunny single-track trails and dirt roads (maintained by cattle, hikers, etc.) in coast terrace meadows that still support native grasses. Current range from the City of | **Unlikely:** Project Study Area is outside of the known current range. |

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| Species | Status (USFWS/ CDFW/ CNPS) | General Habitat | Potential Occurrence within Project Study Area |
|---|---|---|---|
| | | Scotts Valley to the eastern edge of the City of Santa Cruz. | |
| *Coelus globosus* Globose dune beetle | --/ CNDDB/ -- | Coastal dunes. These beetles are primarily subterranean, tunneling through sand underneath dune vegetation. | **Unlikely:** Suitable habitat is present within the foredune habitat adjacent to the Project Study Area. The nearest CNDDB occurrence is approximately 1,000 feet from the Project Study Area, near the Highway 1 Fremont Street Exit in Seaside. This species is restricted to the foredunes within 100 feet of the wave wash zone. It has not been collected from Monterey beaches for many years, and may have been extirpated in the Project vicinity (Doyen, 1976). |
| *Danaus plexippus* Monarch butterfly | --/ CNDDB/ -- | Overwinters in coastal California using colonial roosts generally found in Eucalyptus, pine, and acacia trees. Overwintering habitat for this species within the Coastal Zone represents ESHA. Local ordinances often protect this species as well. | **High:** A CNDDB occurrence of this species is reported within the Project Study Area, located within the Eucalyptus grove across from the Naval Post-graduate School in Monterey along the CalAm Distribution System: Monterey Pipeline. |
| *Euphilotes enoptes smithi* Smith's blue butterfly | FE/ CNDDB/ -- | Most commonly associated with coastal dunes and coastal sage scrub plant communities in Monterey and Santa Cruz Counties. Plant hosts are *Eriogonum latifolium* and *E. parvifolium*. | **High:** The CNDDB reports an occurrence of this species that ranges from Seaside to Monterey and includes portions of the Project Study Area. The host plants for this species were identified within the Project Study Area, near Fort Ord Dunes State Park (Product Water Conveyance: Coastal alignment option) and Window on the Bay Waterfront Park (CalAm Distribution System: Monterey Pipeline). In addition, the coastal scrub and coastal dune scrub habitats within the Reclamation Ditch Affected Reach and Old Salinas Channel Affected Reach may support obligate host species. |
| *Helminthoglypta sequoicola consors* Redwood shoulderband snail | --/ CNDDB/ -- | Known only from the south slope of San Juan grade, near foot, 8 miles northwest of Salinas. | **Unlikely:** The only known occurrence of this species is not in the vicinity of the Project Study Area. |
| *Linderiella occidentalis* California linderiella | --/ CNDDB/ -- | Ephemeral ponds with no flow. Generally associated with hardpans. | **Unlikely:** No suitable habitat present within the Project Study Area. |
| *Optioservus canus* Pinnacles optioservus riffle beetle | --/ CNDDB/ -- | Species of this genus generally prefer gravelly or rocky streams and some often occur on moss covered rocks. Both adults and larvae crawl on rocks and gravel mostly in riffle areas. | **Unlikely:** No suitable habitat present within the Project Study Area. |

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| Species | Status (USFWS/ CDFW/ CNPS) | General Habitat | Potential Occurrence within Project Study Area |
|---|---|---|---|
| *Trimerotropis infantilis* Zayante band-winged grasshopper | FE/ CNDDB/ -- | Open sandy areas with sparse, low annual and perennial herbs on high ridges with sparse ponderosa pine. Often occurs with Ben Lomond wallflower. Restricted to sand parkland habitat found on ridges and hills within the Zayante sandhills habitat in Santa Cruz County. Flight season extends from late May through August. | **Unlikely:** No suitable habitat present within the Project Study Area. |
| *Tryonia imitator* Mimic tryonia (=California brackishwater snail) | --/ CNDDB/ -- | Inhabits coastal lagoons, estuaries and salt marshes. Found only in permanently submerged areas in a variety of sediment types. Tolerant of a wide range of salinities. | **Low:** Marginal habitat is present within Roberts Lake and the Old Salinas River Channel. There are no occurrences known for Roberts Lake and the habitat present is marginal. A historic CNDDB occurrence is present within the Affected Reaches Project Study Area in the Old Salinas River Channel; however, this occurrence is from 1981 and presence at this location is listed as extirpated. The nearest modern CNDDB occurrence is approximately 0.5 miles from the Project Study Area within Elkhorn Slough. |
| **PLANTS** | | | |
| *Agrostis lacuna-vernalis* Vernal pool bent grass | --/ CNDDB / 1B | Vernal pool mima mounds at elevations of 115-145 meters. Annual herb in the Poaceae family; blooms April-May. Known only from Butterfly Valley and Machine Gun Flats of Ft. Ord National Monument. | **Unlikely:** No suitable habitat present within the Project Study Area and not identified during focused botanical surveys in 2014. |
| *Allium hickmanii* Hickman's onion | --/ CNDDB/ 1B | Closed-cone coniferous forests, maritime chaparral, coastal prairie, coastal scrub, and valley and foothill grasslands at elevations of 5-200 meters. Bulbiferous herb in the Alliaceae family; blooms March-May. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Artcostaphylos andersonii* Anderson's manzanita | --/ CNDDB / 1B | Openings and edges of broadleaved upland forest, chaparral, and north coast coniferous forest at elevations of 60-760 meters. Evergreen shrub in the Ericaceae family; blooms November-May. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Artcostaphylos edmundsii* Little Sur manzanita | --/ CNDDB/ 1B | Coastal bluff scrub and chaparral on sandy soils at elevations of 30-105 meters. Evergreen shrub in the Ericaceae family; blooms November-April. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Arctostaphylos hookeri* ssp. *hookeri* Hooker's manzanita | --/ CNDDB / 1B | Closed-cone coniferous forest, chaparral, cismontane woodland, and coastal scrub on sandy soils at elevations of 85-536 meters. Evergreen shrub in the Ericaceae family; blooms January-June. | **Present:** Observed near CSUMB and the Naval Post-Graduate School in the City of Monterey during focused botanical surveys in 2009, 2010, and 2014. |
| *Arctostaphylos montereyensis* | --/ CNDDB | Maritime chaparral, cismontane woodland, and coastal scrub on sandy soils at elevations of 30-730 meters. Evergreen | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |

**Table A Revised: Special-Status Species Known or With the Potential to Occur Within the Pure Water Monterey GWR Project Vicinity**

| Species | Status (USFWS/ CDFW/ CNPS) | General Habitat | Potential Occurrence within Project Study Area |
|---|---|---|---|
| Toro manzanita | 1B | shrub in the Ericaceae family; blooms February-March. | |
| *Arctostaphylos pajaroensis* Pajaro manzanita | --/ CNDDB 1B | Chaparral on sandy soils at elevations of 30-760 meters. Evergreen shrub in the Ericaceae family; blooms December-March. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Arctostaphylos pumila* Sandmat manzanita | --/ CNDDB 1B | Closed-cone coniferous forests, maritime chaparral, cismontane woodland, coastal dunes, and coastal scrub on sandy soils at elevations of 3-205 meters. Evergreen shrub in the Ericaceae family; blooms February-May. | **Present:** Observed throughout Fort Ord Dunes State Park (Product Water Conveyance: Coastal alignment option), and near California State University at Monterey Bay (CSUMB) (Product Water Conveyance: RUWAP alignment option) during focused botanical surveys in 2014. |
| *Arenaria paludicola* Marsh sandwort | FE/ SE/ 1B | Known from only two natural occurrences in Black Lake Canyon and at Oso Flaco Lake. Sandy openings of freshwater of brackish marshes and swamps at elevations of 3-170 meters. Stoloniferous perennial herb in the Caryophyllaceae family; blooms May-August. | **Unlikely:** No CNDDB occurrences within quads searched. Suitable habitat is present within the Project Study Area; however, the Project Study Area is not located near the only two occurrences of this species. |
| *Artcostaphylos regismontana* Kings mountain manzanita | --/ CNDDB/ 1B | Broadleaved upland forest, chaparral, and north coast coniferous forest on granitic or sandstone souls at elevations between 305-730 meters. Evergreen shrub in the Ericaceae family; blooms January-April | **Unlikely:** Project Study Area is outside of the species elevation range. |
| *Astragalus tener* var. *tener* Alkali milk-vetch | --/ CNDDB/ 1B | Playas, valley and foothill grassland on adobe clay, and vernal pools on alkaline soils at elevations of 1-60 meters. Annual herb in the Fabaceae family; blooms March-June. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Astragalus tener* var. *titi* Coastal dunes milk-vetch | FE/ SE/ 1B | Coastal bluff scrub on sandy soils, coastal dunes, and mesic areas of coastal prairie at elevations of 1-50 meters. Annual herb in the Fabaceae family; blooms March-May. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Bryoria spiralifera* Twisted horsehair lichen | --/ CNDDB/ 1B | California North Coast coniferous forest at an elevation of 0 – 30 meters. Often found on conifers, including *Picea sitchensis*, *Pinus contorta* var. *contorta*, *Pseudotsuga menziesii*, *Abies grandis*, and *Tsuga heterophylla*. Fruticose lichen in the Parmeliaceae family. | **Unlikely:** No suitable habitat present within the Project Study Area. |
| *California macrophylla* Round-leaved filaree | --/ CNDDB/ 1B | Cismontane woodland and valley and foothill grassland on clay soils at elevations of 15-1200 meters. Annual herb in the Geraniaceae family; blooms March-May. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Castilleja ambigua var. insalutata* Pink Johnny-nip | --/ CNDDB/ 1B | Coastal prairie and coastal scrub at elevations of 0-100 meters. Annual herb in the Orobanchaceae family; blooms May-August. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |

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| Species | Status (USFWS/ CDFW/ CNPS) | General Habitat | Potential Occurrence within Project Study Area |
|---|---|---|---|
| *Ceanothus cuneatus* ssp. *rigidus* Monterey ceanothus | --/ CNDDB/ 4 | Closed cone coniferous forest, chaparral, and coastal scrub on sandy soils at elevations of 3-200 meters. Evergreen shrub in the Rhamnaceae family, blooms February-April. | **Present:** Observed at the Injection Well Facilities site, throughout Fort Ord Dunes State Park (Product Water Conveyance: Coastal alignment option), within Sand City (CalAm Distribution System: Monterey Pipeline), and near CSUMB (Product Water Conveyance: RUWAP alignment option) during focused botanical surveys in 2009, 2010, and 2014. |
| *Centromadia parryi* ssp. *congdonii* Congdon's tarplant | --/ CNDDB/ 1B | Valley and foothill grassland on alkaline soils at elevations of 1-230 meters. Annual herb in the Asteraceae family; blooms June-November. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Chorizanthe pungens* var. *pungens* Monterey spineflower | FT/ CNDDB/ 1B | Maritime chaparral, cismontane woodland, coastal dunes, coastal scrub, and valley and foothill grassland on sandy soils at elevations of 3-450 meters. Annual herb in the Polygonaceae family; blooms April-June. | **Present:** Observed throughout Fort Ord, near Armstrong Ranch, and on the dunes at the Injection Well Facilities site during focused botanical surveys in 2009, 2010, and 2014. |
| *Chorizanthe robusta* var. *robusta* Robust spineflower | FE/ CNDDB/ 1B | Openings in cismontane woodland, coastal dunes, and coastal scrub on sandy or gravelly soils at elevations of 3-300 meters. Annual herb in the Polygonaceae family; blooms April-September. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Clarkia jolonensis* Jolon clarkia | --/ CNDDB/ 1B | Cismontane woodland, chaparral, riparian woodland, and coastal scrub at elevations of 20-660 meters. Annual herb in the Onagraceae family; blooms April-June. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Collinsia multicolor* San Francisco collinsia | --/ CNDDB/ 1B | Closed-cone coniferous forest and coastal scrub, sometimes on serpentinite soils, at elevations of 30-250 meters. Annual herb in the Scrophulariaceae family; blooms March-May. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Cordylanthus rigidus* ssp. *littoralis* Seaside bird's-beak | --/ SE/ 1B | Closed-cone coniferous forests, chaparral, cismontane woodlands, coastal dunes, and coastal scrub on sandy soils, often on disturbed sites, at elevations of 0-425 meters. Hemi-parasitic, annual herb in the Scrophulariaceae family; blooms April-October. | **High:**. There is a high likelihood Seaside bird's beak may occur within the unsurveyed portion of the Injection Well Facilities site. |
| *Delphinium californicum* ssp. *interius* Hospital Canyon larkspur | --/ CNDDB/ 1B | Openings in chaparral, coastal scrub, and mesic areas of cismontane woodland at elevations of 230-1095 meters. Perennial herb in the Ranunculaceae family; blooms April-June. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |

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| Species | Status (USFWS/ CDFW/ CNPS) | General Habitat | Potential Occurrence within Project Study Area |
|---|---|---|---|
| *Delphinium hutchinsoniae* Hutchinson's larkspur | --/ CNDDB/ 1B | Broadleaved upland forest, chaparral, coastal scrub, and coastal prairie at elevations of 0-427 meters. Perennial herb in the Ranunculaceae family; blooms March-June. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Delphinium umbraculorum* Umbrella larkspur | --/ CNDDB/ 1B | Cismontane woodland at elevations of 400-1600 meters. Perennial herb in the Ranunculaceae family; blooms April-June. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014 |
| *Ericameria fasciculata* Eastwood's goldenbush | --/ CNDDB/ 1B | Closed-cone coniferous forest, maritime chaparral, coastal dunes, and openings in coastal scrub on sandy soils at elevations of 30-275 meters. Evergreen shrub in the Asteraceae family; blooms July-October. | **Present:** Observed at the Injection Well Facilities site and near CSUMB (Product Water Conveyance: RUWAP alignment option) during focused botanical surveys in 2014. |
| *Eriogonum nortonii* Pinnacles buckwheat | --/ CNDDB/ 1B | Chaparral and valley and foothill grassland on sandy soils, often on recent burns, at elevations of 300-975 meters. Annual herb in the Polygonaceae family; blooms May-September. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014 |
| *Erysimum ammophilum* Sand-loving (coast) wallflower | --/ CNDDB/ 1B | Maritime chaparral, coastal dunes, and openings in coastal scrub on sandy soils at elevations of 0-60 meters. Perennial herb in the Brassicaceae family; blooms February-June. | **Present:** Observed near the Naval Postgraduate School (CalAm Distribution System: Monterey Pipeline) during focused botanical surveys in 2009, 2010, and 2014. |
| *Erysimum menziesii* Menzies' wallflower | FE/ SE/ 1B | Coastal dunes at elevations of 0-35 meters. Perennial herb in the Brassicaceae family; blooms March-June. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Fritillaria liliacea* Fragrant fritillary | --/ CNDDB/ 1B | Cismontane woodland, coastal prairie, coastal scrub, and valley and foothill grassland, often serpentinite, at elevations of 3-410 meters. Bulbiferous perennial herb in the Liliaceae family; blooms February-April. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Gilia tenuiflora* ssp. *arenaria* Monterey (sand) gilia | FE/ ST/ 1B | Maritime chaparral, cismontane woodland, coastal dunes, and openings in coastal scrub on sandy soils at elevations of 0-45 meters. Annual herb in the Polemoniaceae family; blooms April-June. | **High:** There is a high likelihood sand gilia may occur within the unsurveyed portion of the Injection Well Facilities site. |
| *Hesperocyparis goveniana* Gowen cypress | FT/ CNDDB/ 1B | Closed-cone coniferous forest and maritime chaparral at elevations of 30-300 meters. Evergreen tree in the Cupressaceae family. Natively occurring only at Point Lobos near Gibson Creek and the Huckleberry Hill Nature Preserve near Highway 68. | **Not Present:** Not identified during focused botanical survey in 2009, 2010, and 2014. Project Study Area it outside of currently known range for this species. |

**Table A Revised: Special-Status Species Known or With the Potential to Occur Within the Pure Water Monterey GWR Project Vicinity**

| Species | Status (USFWS/ CDFW/ CNPS) | General Habitat | Potential Occurrence within Project Study Area |
|---|---|---|---|
| *Hesperocyparis macrocarpa* Monterey cypress | --/ CNDDB/ 1B | Closed-cone coniferous forest at elevations of 10-30 meters. Evergreen tree in the Cupressaceae family. Natively occurring only at Cypress Point in Pebble Beach and Point Lobos State Park; widely planted and naturalized elsewhere. | **Not Present:** Project Study Area is outside of currently known range for this species. Although several individuals of this species were observed within the Project Study Area, these individuals are planted specimens or volunteers from planted specimens and are not considered special-status. Therefore, no natively-occurring Monterey cypress trees are present within the Project Study Area. |
| *Holocarpha macradenia* Santa Cruz tarplant | FT/ SE/ 1B | Coastal prairies and valley foothill grasslands, often clay or sandy soils, at elevations of 10-220 meters. Annual herb in the Asteraceae family; blooms June-October. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Horkelia cuneata* var. *sericea* Kellogg's horkelia | --/ CNDDB/ 1B | Closed-cone coniferous forests, maritime chaparral, and openings in coastal scrub on sandy or gravelly soils at elevations of 10-200 meters. Perennial herb in the Rosaceae family; blooms April-September. | **Present:** Observed within the Product Water Conveyance: RUWAP and Coastal alignment options and the Injection Well Facilities site during focused botanical surveys in 2009, 2010, and 2014. |
| *Lasthenia conjugens* Contra Costa goldfields | FE/ CNDDB/ 1B | Mesic areas of valley and foothill grassland, alkaline playas, cismontane woodland, and vernal pools at elevations of 0-470 meters. Annual herb in the Asteraceae family; blooms March-June. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Layia carnosa* Beach layia | FE/ SE/ 1B | Coastal dunes and coastal scrub on sandy soils at elevations of 0-60 meters. Annual herb in the Asteraceae family; blooms March-July. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Legenere limosa* Legenere | --/ CNDDB/ 1B | Vernal pools and wetlands at elevations of 1-880 meters. Annual herb in the Campanulaceae family; blooms April- June. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014 |
| *Lupinus tidestromii* Tidestrom's lupine | FE/ SE/ 1B | Coastal dunes at elevations of 0-100 meters. Perennial rhizomatous herb in the Fabaceae family; blooms April-June. Only Monterey County plants are state-listed Endangered as var. *tidestromii*. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Malacothamnus palmeri* var. *involucratus* Carmel Valley bush-mallow | --/ CNDDB/ 1B | Chaparral, cismontane woodland, and coastal scrub at elevations of 30-1100 meters. Deciduous shrub in the Malvaceae family; blooms May-August. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Malacothamnus palmeri* var. *palmeri* Santa Lucia | --/ CNDDB/ 1B | Chaparral on rocky soils at elevations of 60-360 meters. Deciduous shrub in the Malvaceae family; blooms May-July. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |

**Table A Revised: Special-Status Species Known or With the Potential to Occur Within the Pure Water Monterey GWR Project Vicinity**

| Species | Status (USFWS/ CDFW/ CNPS) | General Habitat | Potential Occurrence within Project Study Area |
|---|---|---|---|
| bush-mallow | | | |
| *Malacothrix saxatilis* var. *arachnoidea* Carmel Valley malacothrix | --/ CNDDB/ 1B | Chaparral and coastal scrub on rocky soils at elevations of 25-1036 meters. Perennial rhizomatous herb in the Asteraceae family; blooms June-December (uncommon in March). | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Microseris paludosa* Marsh microseris | --/ CNDDB/ 1B | Closed-cone coniferous forest, cismontane woodland, coastal scrub, and valley and foothill grasslands at elevations of 3-300 meters. Perennial herb in the Asteraceae family; blooms April-June (July). | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Monardella sinuata ssp. nigrescens* Northern curly-leaved monardella | --/ CNDDB/ 1B | Closed-cone coniferous forest, chaparral, coastal dunes, coastal prairie, coastal scrub, and lower montane coniferous forest (ponderosa pine sandhills) on sandy soils at elevations of 0-305 meters. Annual herb in the Lamiaceae family; blooms May-September. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Monolopia gracilens* Woodland woolythreads | --/ CNDDB/ 1B | Openings of broadleaved upland forest, chaparral, cismontane woodland, North Coast coniferous forest, and valley and foothill grassland on serpentinite soils at elevations of 100-1200 meters. Annual herb in the Asteraceae family; blooms February-July. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Pinus radiata* Monterey pine | --/ --/ 1B | Closed-cone coniferous forest at elevations of 25-185 meters. Evergreen tree in the Pinaceae family. Only three native stands in CA, at Ano Nuevo, Cambria, and the Monterey Peninsula; introduced in many areas. | **Present:** Several Monterey pine trees are present within the Project Study Area; however, the majority of these individuals are planted specimens or volunteers from planted specimens and are not considered special-status. The only special-status individual of this species is located within the Presidio of Monterey. |
| *Pedicularis dudleyi* Dudley's lousewort | --/ SR/ 1B | Maritime chaparral, cismontane woodland, North Coast coniferous forest, and valley and foothill grassland at elevations of 60-900 meters. Perennial herb in the Orbanchaceae family; blooms April-June. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Penstemon rattanii var. kleei* Santa Cruz Mountains beardtongue | --/ CNDDB/ 1B | Chaparral and lower montane and North Coast coniferous forests at elevations of 400-1100 meters. Perennial herb in the Plantaginaceae family; blooms May-June. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014 |
| *Pentachaeta bellidiflora* White-rayed | FE/ SE/ 1B | Cismontane woodland and valley and foothill grasslands, often on serpentinite soils, at elevations of 35-620 meters. Annual herb in the Asteraceae family; blooms March-May. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |

**Table A Revised: Special-Status Species Known or With the Potential to Occur Within the Pure Water Monterey GWR Project Vicinity**

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|---|---|---|---|
| pentachaeta | | | |
| *Piperia yadonii* Yadon's rein orchid | FE/ CNDDB/ 1B | Sandy soils in coastal bluff scrub, closed-cone coniferous forest, and maritime chaparral at elevations of 10-510 meters. Annual herb in the Orchidaceae family; blooms May-August. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Plagiobothrys chorisianus var. chorisianus* Choris' popcornflower | --/ CNDDB/ 1B | Mesic areas of chaparral, coastal prairie, and coastal scrub at elevations of 15-160 meters. Annual herb in the Boraginaceae family; blooms March-June. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Plagiobothrys uncinatus* Hooked popcornflower | --/ CNDDB/ 1B | Chaparral, cismontane woodlands, and valley and foothill grasslands on sandy soils at elevations of 300-760 meters. Annual herb in the Boraginaceae family; blooms April-May. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014 |
| *Potentilla hickmanii* Hickman's cinquefoil | FE/ SE/ 1B | Coastal bluff scrub, closed-cone coniferous forests, vernally mesic meadows, and freshwater marshes and swamps at elevations of 10-149 meters. Perennial herb in the Rosaceae family; blooms April-August. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Ramalina thrausta* Angel's hair lichen | --/ CNDDB/ 2B | Found in California North Coast coniferous forest at an elevation of 75 - 430 meters. Found on dead twigs, other lichen, and on *Alnus rubra*, *Calocedrus decurrens*, *Pseudotsuga menziesii*,*Quercus garryana*, and *Rubus spectabilis*. It has also been found growing on and amid *Ramalina menziesii* and *Usnea* spp. Fruticose lichen in the Ramalinaceae family. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Rosa pinetorum* Pine rose | --/ CNDDB/ 1B | Closed-cone coniferous forest at elevations of 2-300 meters. Shrub in the Rosaceae family; blooms May-July. Possible hybrid of *R. spithamea*, *R. gymnocarpa*, or others; further study needed. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Sidalcea malachroides* Maple-leaved checkerbloom | --/ CNDDB/ 4 | Broadleaved upland forest, coastal prairie, coastal scrub, north coast coniferous forest, and riparian woodlands, often in disturbed areas, at elevations of 2-700 meters. Perennial herb in the Malvaceae family; blooms April-August. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Stebbinsoseris decipiens* Santa Cruz microseris | --/ CNDDB/ 1B | Broadleaved upland forest, closed-cone coniferous forest, chaparral, coastal prairie, coastal scrub, and openings in valley and foothill grassland, sometimes on serpentinite, at elevations of 10-500 meters. Annual herb in the Asteraceae family; blooms April-May. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Tortula californica* | --/ CNDDB/ | Valley and foothill grassland and chenopod scrub on sandy soils at elevations of 10-1460. Moss in the Pottiaceae family. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014 |

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| Species | Status (USFWS/ CDFW/ CNPS) | General Habitat | Potential Occurrence within Project Study Area |
|---|---|---|---|
| California screw moss | 1B | | |
| *Trifolium buckwestiorum* Santa Cruz clover | --/ CNDDB/ 1B | Broadleaved upland forest, cismontane woodland, and margins of coastal prairie on gravelly soils at elevations of 105-610 meters. Annual herb in the Fabaceae family; blooms April-October. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Trifolium hydrophilum* Saline clover | --/ CNDDB/ 1B | Marshes and swamps, valley and foothill grassland (mesic, alkaline), and vernal pools at elevations of 0-300 meters. Annual herb in the Fabaceae family; blooms April-June. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Trifolium polyodon* Pacific Grove clover | --/ SR/ 1B | Closed-cone coniferous forest, coastal prairie, meadows and seeps, and mesic areas in valley and foothill grassland at elevations of 5-120 meters. Annual herb in the Fabaceae family; blooms April-June. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |
| *Trifolium trichocalyx* Monterey clover | FE/ SE/ 1B | Sandy openings and burned areas of closed-cone coniferous forest at elevations of 30-240 meters. Annual herb in the Fabaceae family; blooms April-June. | **Not Present:** Not identified during focused botanical surveys in 2009, 2010, and 2014. |

# Appendix H

# Attachment 4 – Wildlife Species Observed within the Project Study Area

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# Wildlife Species Observed Within and Immediately Adjacent to the Monterey Peninsula Groundwater Replenishment Project

| Scientific Name | Common Name |
|---|---|
| **Mammals** | |
| *Mephitis mephitis* | Skunk |
| *Neotoma fuscipes luciana* | Monterey dusky-footed woodrat* |
| *Otospermophilus beecheyi* | California ground squirrel |
| *Peromyscus* sp. | Mouse |
| *Sylvilagus bachmani* | Brush rabbit |
| **Birds** | |
| *Agelaius phoeniceus* | Red-wing blackbird |
| *Anas platyrhynchos* | Mallard |
| *Anas strepera* | Gadwall |
| *Ardea herodias* | Great blue heron |
| *Branta canadensis* | Canada goose |
| *Calidris pusilla* | Semipalmated sandpiper |
| *Callipepla californica* | California Quail |
| *Calypte anna* | Anna's hummingbird |
| *Carduelis psaltria* | Lesser goldfinch |
| *Cathartes aura* | Turkey vulture |
| *Chamaea fasciata* | Wrentit |
| *Charadrius vociferus* | Killdeer |
| *Cistothorus palustris* | Marsh wren |
| *Colaptes auratus* | Northern Flicker |
| *Corvus brachyrhynchos* | American crow |
| *Elanus leucurus* | White-tailed kite** |
| *Euphagus cyanocephalus* | Brewer's blackbird |
| *Fulica americana* | American Coot |
| *Haemorhous mexicanus* | House finch |
| *Himantopus mexicanus* | Black-necked stilt |
| *Hirundo rustica* | Barn Swallow |
| *Limnodromus* sp. | Dowitcher |
| *Melospiza melodia* | Song sparrow |
| *Mergus merganser* | Common merganser |
| *Nycticorax nycticorax* | Black-crowned night heron*** |
| *Oxyura jamaicensis* | Ruddy duck |
| *Passer domesticus* | House sparrow |
| *Phalacrocorax penicillatus* | Brandt's cormorant |
| *Pipilo maculatus* | Spotted towhee |
| *Poecile rufescens* | Chestnut-backed chickadee |
| *Recurvirostra americana* | American avocet |
| *Sayornis nigricans* | Black phoebe |
| *Spizella pusilla* | Field sparrow |
| *Sturnella neglecta* | Western meadowlark |

# Wildlife Species Observed Within and Immediately Adjacent to the Monterey Peninsula Groundwater Replenishment Project

| Scientific Name | Common Name |
|---|---|
| *Sturnus vulgaris* | European Starling |
| *Tachycineta bicolor* | Tree swallow |
| *Toxostoma redivivum* | California thrasher |
| *Troglodytes aedon* | House wren |
| *Turdus migratorius* | American robin |
| *Zenaida macroura* | Mourning dove |
| *Zonotrichia leucophrys* | White-crowned sparrow |
| **Reptiles & Amphibians** | |
| *Crotalus oreganus oreganus* | Northern Pacific rattlesnake |
| *Elgaria multicarinata multicarinata* | California alligator lizard |
| *Pituophis catenifer catenifer* | Pacific gopher snake |
| *Sceloporus occidentalis bocourtii* | Coast range fence lizard |

**Notes**

*Several nests observed

**Observed overhead and adjacent to project site

***Observed overhead and adjacent to source water diversion site

# Appendix H

# Attachment 5 – Avian Species that maybe found within Non-Native Grassland Habitat

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# THE BIRDS OF FORT ORD EAST OF ROUTE 1

Revised 5 Feb 07

David Styer with historic data provided by Don Roberson

An asterisk (*) after a bird's name means that the species was probably breeding, or confirmed breeding on Fort Ord east of Route 1. This list is based almost entirely on my own inventories. These have taken place during the following time periods: 25 Feb - 16 Jun 96, 9 Jul - 16 Aug 97, 27 Jun - 16 Aug 98, 27 Jul - 19 Aug 99, 7 Jun - 28 Jun 00, 5 Feb 01 - 3 Mar 01, 17 Sep 01 - 2 Nov 01, 13 Dec - 31 Dec 01, and most of 2002 and 2003. In 2004–2006 only the more outstanding sightings were noted. The few records based on other people's sightings are noted. All collective references to Christmas Bird Counts (CBCs) refer to the nine Monterey CBCs provided by Roberson. This count takes place in a 15-mile diameter circle that includes the southwest portion of Ft. Ord.

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| 1. | Cackling Goose | 1 record: 1 seen by D. Roberson's CBC group on 29 Dec 00. |
| 2. | Canada Goose* | Seen in small numbers. Nested, but unsuccessfully in 2002. Successfully nested at Machine Gun Flats in 2005. |
| 3. | Wood Duck | The first record was 5 males at Boy Scout Lake on 12 Oct 05. Some were seen there until 7 Dec 05. |
| 4. | Gadwall* | The first record was five seen on 8 Aug 98 on a vernal pond. Expected in small numbers. In 2002 there were 3 records from 12 Mar to 24 Mar, and 5 records from 29 Aug to 29 Oct, all at Mudhen Lake. Seen in January and December in 2003.Nested on Machine Gun Flats in 2005; young noted on 22 May 05. |
| 5. | American Wigeon | Winter visitor. A pair was on Mudhen Lake on 18 Feb 01; 3 were there on 23 Mar 02, and 1 to 2 pairs were there from 23 Nov 02 through 31 Jan 03. Seen regularly at the vernal pools 29 Jan 05 through 2 Apr 05. Also, seen regularly at Boy Scout Lake Nov and Dec 05, with approximately 10 there on 13 Dec. |
| 6. | Mallard* | Seen on ponds through year. Young seen on Mudhen Lake 6 Jun 96 and on Boy Scout Pond on 2 Jun 96. Young seen on several ponds in 1998. One hundred to three hundred regularly visited Mudhen Lake in the fall of 2001. There were 87 visiting the vernal pool at Machine Gun Flats on 2 Mar 04. Bill Collins saw around 500 on the pond behind Range 37 in the fall of 2000. Ronnie L. Ryno found young at Mudhen Lake on 9 Jun 89 during the Monterey County Breeding Bird Atlas project. |
| 7. | Cinnamon Teal | First record: 1 male on the pond behind Range 37 on 31 Mar 96. Two spent most of Aug 99 on Fox Pond. There were several records in Mar 05, and 3 were on Mudhen Lake on 21 Jul 05.In early 2006 they were seen on Boy Scout Lake:2 on 24 Jan and 4 on 21 Feb. |
| 8. | Northern Shoveler | A pair was at Mudhen Lake on 29 Oct 01, 6 were there 6 Oct 02 and 3 were there on 25 Oct 05. |
| 9. | Northern Pintail | First record: 3 females on Mudhen Lake on 22 Oct 01. Six were there, including a male, on 2 Nov 01, 2 were there on 22 Oct 02, and a pair was at Boy Scout Lake on 13 Dec 05. |

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| 10. | Green-winged Teal | A pair was at Mudhen Lake from 30 Mar to 7 Apr 96. They visited Mudhen Lake in early Nov 02, and 20 were there on 5 Nov 02. On 12 Dec 05 19 males were on Mudhen Lake. The next day a flock of 35 (males and females) were on Boy Scout Lake. They were seen there in dwindling numbers up until 21 Feb 06. |
| 11. | Redhead | A male was seen at Mudhen Lake from 13 Dec 01 through 4 Feb 02. |
| 12. | Ring-necked Duck | An occasional fall and winter visitor. 1st record: 1 male in holding pond near west end of Eucalyptus Rd. on 28 Jun 98.There were 5 females on Mudhen Lake on 20 and 27 Nov, and 1 male there on 1 Dec 06. Notably, Bill Collins saw around 35 in the pond behind Range 37 in the fall of 2000. |
| 13. | Greater Scaup | 1 record: 1 female in the holding pond at the west end of Eucalyptus Road on 26 Oct 01. |
| 14. | Bufflehead | One female spent the entire summer of 1998 on the same pond (see ring-necked Duck). 2 females were on the same pond in Jan 03. A pair was on Machine Gun Flats on 22 Feb 05. |
| 15. | Common Goldeneye | Seen in winter 1996 on above-mentioned pond before inventory started, and in Dec 01. |
| 16. | Hooded Merganser | 2 records: One immature male on Mudhen Lake 25 Feb - 24 Mar 96, and 1 female on Mudhen Lake on 24 Nov 06. |
| 17. | Common Merganser | 1 record: seen in the Salinas River on 30 Apr 05. |
| 18. | Ruddy Duck | Occasional visitor. 2 males on the vernal pool on Machine Gun Flats on 17 Jul 98, and 1 female on the Catfish Pond on 18 Oct 02.Two females spent much of Dec 05 on Mudhen Lake. A resident of Mudhen Lake beginning 9 Oct 06. |
| 19. | Wild Turkey* | Seen irregularly during the inventory. Dick Pitschka and I saw 3 adult females and 7 young across Jacks Road from Mudhen Lake on 21 Jun 00. Noticeably more common by 2001 than in the past. In 2003 and 2004, 2 or 3 flocks of up to 20 were seen, and they continue to have young. |
| 20. | California Quail* | Seen, except in the most open grassland, throughout Ft. Ord, throughout the inventory. Possibly increasing: in 1996 most coveys with 10 or fewer birds. In 2001 many coveys with 10 to 20 birds. They continue roughly the same size through 2006. I have been told that coveys with a 100 California Quail were common in the past. |
| 21. | Loon species | 2 flew over the BLM office area on 2 Nov 01. |
| 22. | Pied-billed Grebe* | Seen throughout the year on permanent ponds. In 1996 and 1997 young produced only on Mudhen Lake. In 1998 young were produced on at least four vernal ponds. |
| 23. | Eared Grebe | 2 records: 1 stayed at the holding pond on the west end of Eucalyptus Road from 4 Oct to 11 Oct 01, and 1 was on Mudhen lake from 15 Nov 05 through 29 Nov 05. |

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| 24. | Double-crested Cormorant | Winter visitor to Mudhen Lake. Seen late December through March, irregularly until May. Up to 5 have been seen at once. On 30 Nov 06 30 flew over Mudhen Lake. |
| 25. | American Bittern | 1 record: 1 seen at Mudhen Lake on and around 7 Aug 99. |
| 26. | Great Blue Heron | One or two regularly visit the permanent ponds. |
| 27. | Great Egret | Occasional visitor to the permanent ponds. 1 frequently seen at the dwindling Mudhen Lake in 2003. One at a puddle in East Garrison on 22 Mar 05 was a surprise. |
| 28. | Green Heron | 4 records prior to 2006: 1 seen by Sam Fitton on 6 Apr 98, 1 seen at Mudhen Lake 11 Jun 02, 1 seen by Steve Moore at the pond on Crescent Bluff Road on 25 Apr 03, and 1 flew from Toro Creek Pond on 7 Jul 05. Bruce Gerow saw them regularly at the mouth of El Toro Creek, just off Ft. Ord. There were 5 records at Mudhen Lake and Boy Scout Lake in 2006. |
| 29. | Turkey Vulture | Seen throughout Ft. Ord throughout the year, although uncommon in the backcountry in the fall. Possibly breeding, but not confirmed, although evidence continues to build. Numbers on CBCs have increased almost steadily from 1 in 1984 to 17 in 2001. |
| 30. | Osprey | 1st record: 1 eating on top of high-tension tower by Range 45 on 6 Apr 96. 1 flew over Mudhen Lake on 19 Oct 01. In 2002 Osprey were seen on 4 Jan, 8 Jan, and 11 Apr. In 2003 there were 3 records: 1 on 3 Jan at Mudhen Lake, 1 in April flying over Ingman Court, and 1 on 3 May at El Toro Creek. Again, one was seen at Mudhen Lake on 3 Jan 04. |
| 31. | White-tailed Kite* | Seen in small numbers (1 or 2) over grasslands and vernal pools. In the spring of 1998 Roberto Maceira saw approximately 10 spending the day by one pool, and in the summer of 2006 Tim Buhl saw a group of 11, including young. |
| 32. | Bald Eagle | An immature bird was seen at Mudhen Lake in the spring of 1999. On 4 Mar 02 Bill Collins saw 1 subadult on Machine Gun Flats. |
| 33. | Northern Harrier | A winter resident on the grasslands, and an occasional migrant elsewhere. 1 to 3 are usually seen in grasslands. One summer record: 1 on 8 Jul 98. |
| 34. | Sharp-shinned Hawk | Fairly common fall migrant, arriving in Sep, and uncommon spring migrant. Also seen on 1 and 2 Aug 99. A winter resident in 2003 and 2004. |
| 35. | Cooper's Hawk* | Seen throughout the inventory, and widely, but thinly spread over Ft. Ord. |
| 36. | Red-shouldered Hawk* | Common year-round in the "front" of Ft. Ord, near housing. Seen less in other locations. Ronnie L Ryno observed an occupied nest near Mudhen Lake 16 Apr 86. |

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| 37. | Red-tailed Hawk* | Seen throughout Ft. Ord throughout the year. Eleven Red-tailed Hawks wheeling over the BLM office on 25 Jul 98 was an extraordinary sight. Nests are seen regularly; for example, Ronnie L. Ryno saw on occupied nest on 16 Apr 86. Usually around 10 are seen on CBCs, but on 28 Dec 84 there were 25 counted. |
| 38. | Ferruginous Hawk | 2 records: Don Roberson saw one in the Grasslands on 28 Dec 84, and I saw 1 near Imjin Rd. on 14 Apr 02. |
| 39. | Golden Eagle | 1st record: 1 over grassland, Oil Well Rd., on 6 Apr 96. An uncommon fall migrant, rare in other seasons. Seen in February, March, and September in 2003. One was seen on the CBC on 29 Dec 00, and on Lightfighter Road during the CBC on 27 Dec 05. |
| 40. | Crested Caracara | 1 record: Tim Buhl saw 1 fly across Highway 1 on 11 Sep 06. |
| 41. | American Kestrel* | Seen throughout the year. Perhaps 4 to 8 pairs breed on Ft. Ord. Especially visible on the grasslands. On the 9 CBCs the low count was 4 and the high count was 14. |
| 42. | Merlin | Uncommon migrant or winter visitor:1 was seen near Laguna Seca during the CBC on 27 Dec 89. 1 at Machine Gun Flats on 9 Mar 96 and on 11 Jan 02, 1 on First Ave. on 19 Oct 01, 1 at Parker Flats on 30 Dec 03, and 1 by Fox Pond on 9 Dec 04. 1 was seen at El Toro Creek on 26 Feb 05, and another was seen at Machine Gun Flats on 25 Mar 05. |
| 43. | Peregrine Falcon | One seen circling over First Ave. on 4 Oct 01. |
| 44. | Prairie Falcon | 3 records: 1 seen at Machine Gun Flats on 19 Oct 01, 1 seen by Bill Reese on 27 Dec 04, and 1 was seen flying over Old Reservation Rd. on 30 Aug 06. |
| 45. | Virginia Rail | 1 record: 1 first heard on 28 Oct responded repeatedly to a taped call on 30 Oct 06. |
| 46. | Sora | Few records: 1 on pond behind Range 37 on 31 Mar 96; 1 seen on Mudhen Lake on 1 and 2 Mar 01, and 1 was at the Catfish Pond much of Oct 04. They were heard from 21 Oct to 13 Nov 06 on Mudhen Lake, with a maximum of 3 heard on 26 Oct. |
| 47. | Common Moorhen | 2 records of single individuals on Mudhen Lake: on 23 Oct 01, and seen from16 Oct to 23 Oct 06. |
| 48. | American Coot* | In 1996 common through April, then most gone. Approximately 2 young produced in 1996 and 1997. In 1998 seen in summer on at least 6 ponds, with at least 25 young produced. In the dry year, 2001, only a pair at the Catfish Pond produced young (5). By summer 2004 all ponds except the Catfish Pond had dried, so Coots could only be seen there. Coots returned to the refilled Mudhen Lake by 25 Mar 05, and approximately 40 were seen there on 14 Nov 06. |

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| 49. | Killdeer | Seen at Mudhen Lake through Mar 96, but not later that year. Up to 8 seen at the vernal pool behind the BLM buildings in July and August of 1998. Larger numbers, e.g., 26 on 11 Dec 02, seen in fall or winter in fields such as Parker Flats. |
| 50. | Spotted Sandpiper | 1 record: 2 in breeding plumage at Fox Pond on 4 Jul 98. |
| 51. | Solitary Sandpiper | 3 records: 1 bird at vernal pond behind BLM headquarters on 1 Aug 98, 1 at the Catfish Pond on 29 Jul 03, and there was also 1 on the Salinas River at the mouth of El Toro Creek on 3 May 03. |
| 52. | Greater Yellowlegs | 2 March records in 1996: 6 on Reserve 12 on 9 Mar and 1 heard at Mudhen Lake on 24 Mar. Seen visiting the mud-flats behind the BLM buildings in July and August of 1998, at Fox Pond in Aug 99, 3 on Machine Gun Flats on 11 Jan 02. Visited Mudhen Lake and Machine Gun Flats in March, April, October, and November in 2003. There were 14 on Machine Gun Flats on 2 Mar 04, and 22 on 14 Mar 05.1 flew over South Boundary Road during the CBC on 29 Dec 00. |
| 53. | Whimbrel | 1 record: on 29 Jul 03 one flew over me on Parker Flats Road, and circled around and called. |
| 54. | Western Sandpiper | 1 record: 1 at Fox Pond on 14 Aug 99. |
| 55. | Least Sandpiper | 1 stayed at Fox Pond in 1999. First record: 31 Jul 99. Mary Paul saw 2 at Boy Scout Lake on19 Dec 05, and 1 was seen at the pond by Riso Ridge Road on 13 Nov 06. |
| 56. | Long-billed Dowitcher | Visitors to Fox Pond in 1999. I saw 1 on 5 Aug, the first record, and 10 or more on 18 Aug. |
| 57. | Wilson's Snipe | Steve Moore and Suzy Worcester have seen several at vernal pools; e.g., they saw 1 at Twin Pond on 6 Apr 03. In 2004 there was 1 at Machine Gun Flats on 22 Apr, and there were 2 at the Catfish Pond on 16 and 21 Oct. 3 records in 2005: 10 were counted at Machine Gun Flats on 29 Jan, 2 at Mudhen Lake on 29 Oct, and 1 at Toro Creek Pond on23 Nov. One was at Machine Gun Flats on 23 Jan 06. |
| 58. | Wilson's Phalarope | First record: 1 immature bird on pond behind BLM office on 2 Aug 98.There were 3 on Fox Pond in Aug 99. |
| 59. | Red-necked Phalarope | 3 on the pond on Reserve 5 on 26 Jul 97, up to 19 on Fox Pond in Aug 99, and up to 6 on Mudhen Lake in Aug 06. |
| 60. | Red Phalarope | 1 record: 1 seen by Bill Reese's CBC group on Mudhen Lake on 27 Dec 05. |
| 61. | Mew Gull | 1 record: a large and varied group of gulls were on top of the Commissary building during the CBC count on 28 Dec 84, when Ft. Ord was an active military base. There were 130 of these gulls. |
| 62. | California Gull | Several are regularly seen flying over Ft. Ord and visiting such places as Burger King in fall and winter. Don Roberson saw 1105 on the commissary roof during the CBC on 28 Dec 84. |
| 63. | Herring Gull | 1 record: 38 on 28 Dec84 (see comment at Mew Gull). |

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| 64. | Thayer's Gull | 1 record: 1 adult on 28 Dec84 (see comment at Mew Gull). |
| 65. | Western Gull | 2 records: Don Roberson counted 159 on the Commissary roof during the 28 Dec 84 CBC, and a flock of approximately 6 were seen flying over CSUMB on 19 Jul 98. |
| 66. | Glaucous-winged Gull | 1 record: 1 on 28 Dec84 (see comment at Mew Gull). |
| 67. | Black-legged Kittiwake | 1 record: an exhausted individual found by Shirley Tudor in the Inland Ranges on 25 Feb 11. |
| 68. | Elegant Tern | 2 records: Sam Fitton heard 1 on 26 Jul 97, and Bruce Gerow heard 1 on 1 Aug 98. |
| 69. | Rock Pigeon* | In spite of being common in the housing areas of Ft. Ord, they are infrequently seen in the interior backcountry. There are a few records each year. |
| 70. | Band-tailed Pigeon | Chuck Haugen had seen them along El Toro Creek. Charlie Saunders and I saw 5 on 18 Mar 03 flying over Trail 22. Following that, I saw 24 on 9 May, 7 on 16 Jun, and 3 on 11 Nov 03. In 2006 there were 6 at the BLM Offices on 4 Jan, 10 at Engineer Canyon Road on 8 Mar, and 30 down from Mudhen Lake on 5 Apr. Fifteen were seen on the CBC on 27 Dec 96. |
| 71. | Eurasian Collared-Dove | |
| 72. | Mourning Dove* | Seen, usually 1 to 4 at a time, throughout the inventory and in all areas. On 24 Jul 97, Robin Whatley and I counted over 60 in one spot along Oil Well Road, and I saw approximately 60 by Eucalyptus Road on 15 Oct 06. Less common in the dry years of 2002 and 2003, but a flock of 30 was seen in the grasslands on 2 Dec 03. |
| 73. | Greater Roadrunner* | Few records: near Mudhen Lake: 1 heard on 6 Apr 96 and 1 heard on 2 Nov 01. Also seen by Barloy Canyon Road and Trail 22 in the spring of 2002. People have said they see them down Crescent Bluff Road, and Engineering Canyon Road. Steve Moore and Eric Morgan independently saw 1 at Machine Gun Flats on 19 Apr 03, our only 2003 record. A Roadrunner on Eucalyptus Road entertained the volunteers on 18 May 04. Tammy Jakl saw 1 on Trail 10 on 26 Oct 05. Ronnie Ryno saw 1 near Mudhen Lake on16 Apr 89. Don Roberson saw 2 on the CBC on 28 Dec 84, and 1 on the CBC on 28 Dec 99. |
| 74. | Barn Owl* | Resident, but few seen. In Aug 98 they were found to come out at dusk over the grasslands at Skyline and Oil Well Roads, and hover like Red-tailed Hawks. [Id. aided by Sam Fitton.] In Jul 06 Wendi Wendt showed us a cliff-side nest with 4 young. |
| 75. | Western Screech-Owl* | Resident. Seen once or twice each year, including an adult and 1 young on 26 Jul 97. |
| 76. | Great Horned Owl* | A permanent resident, and breeding bird, seen throughout Ft. Ord. At least 5 pairs live in the vicinity of Eucalyptus Road. Mark Littlefield observed a nest with young on25 Feb 91. |

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| 77. | Burrowing Owl | Jack Massera reported that they used to live in the grasslands. Bruce Delgado saw 2 in Nov 97. The Fittons and I looked for them on 15 Aug 98, and we found pellets that were no more than a week old [*fida* Sam Fitton]. The volunteer group saw 1 on 4 Feb 03 near the corner of Skyline and Guidotti Roads. In late Oct 05 Jessie Quinn saw 3 or 4, and Phil Smith found 1 that stood by its hole under a Coyote Brush bush. Smith reported at least 12 on a subsequent trip that winter (2005-06). Observed on the 1993, 1994, 1998, 2005, and 2006 CBCs. |
| 78. | Common Poorwill* | In the chaparral throughout the inventory. Infrequently calls in July and August. Heard calling as early as 31 Jan 03. In fall they are seen but not heard. Late records: 6 on 20 Oct 01, and 4 on 28 Oct 06. |
| 79. | Vaux's Swift | |
| 80. | White-throated Swift | Appears to be nesting under the highway bridges adjacent to Ft. Ord. Seen widely over Ft. Ord on 19 Feb 01, as in a migration. Seen throughout the year, but usually scarce in winter. One was seen on the CBC of 29 Dec 94. They were common on the Reservation Road bridge over El Toro Creek in the fall of 2006, with at least 28 seen on 16 Nov, and seen until my last trip to the area on 24 Dec. |
| 81. | Anna's Hummingbird* | One to several seen everywhere except pure grassland throughout the year. Most actively breeding in winter. Ronnie Ryno saw an occupied nest on 8 May 89, and I watched nest activity at the BLM office area from 5 Jan to 16 Feb 06. Usually between 40 and 70 individuals have been counted on the CBCs, but 179 were noted on the 1984 CBC. |
| 82. | Rufous Hummingbird | Bruce Gerow said that a big migratory wave of Rufous Hummingbirds passed through Ft. Ord in April 1989. |
| 83. | Allen's Hummingbird* | Seen at BLM compound in 1996 and at the Catfish Pond from 16 Mar to 8 Jun 03, and again in 2004, starting 15 Feb. In 2004, also noted in the BLM office area on 11 Feb, and along El Toro Creek on 10 Mar. |
| 84. | Belted Kingfisher | One or two seem to visit Ft. Ord regularly, except during the breeding season. Seen most regularly at Mudhen Lake. They are more regular, and possibly nesting, in the Salinas River area, a region not inventoried prior to 2006. |
| 85. | Lewis's Woodpecker | From 20 Dec 93 to 6 May 94 there were "dozens" on eastern Ft. Ord. For example, 5 were seen on the CBC on 28 Dec 93. [See Don Roberson, *Monterey Birds,* $2^{nd}$ Edition, 2002.] Tim Buhl saw 1 at the Catfish Pond on 2 Oct 03. It was still there the next day. |
| 86. | Acorn Woodpecker* | In 1996 most individuals were along El Toro Creek. In 1998 there was a small colony next to Mudhen Lake. In the falls of 2001 and 2005, strong acorn years, Acorn Woodpeckers were widely distributed all over Ft. Ord. One to five could be seen in many places. By the end of the dry, low yield year, 2002, Acorn Woodpeckers were again scarce on Ft. Ord, with a total of 2 at Mudhen Lake. |

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| 87. | Red-breasted Sapsucker | 3 records of 1 near Mudhen Lake: 7 Apr 96, 12 Nov 02, and 21 Oct 06. In 2003 there were 3 records of 1 in the BLM office area: 4 Mar, 18 Mar, and 31 Dec. Not seen on CBCs. |
| 88. | Nuttall's Woodpecker* | Seen in oak trees throughout the year. Usually just 1 or 2 seen. Perhaps more easily seen in sycamore trees along El Toro Creek. Anywhere from 1 to 8 have been seen on CBCs. |
| 89. | Downy Woodpecker* | Thinly spread over riparian locations throughout the year. At most 2 have been seen on any CBC, but the count circle excludes most of the riparian areas of Ft. Ord. |
| 90. | Hairy Woodpecker* | Widely distributed on Ft. Ord in very small numbers. For example, a pair can usually be seen at Mudhen Lake. Much more widely distributed in the fall of 2001. At most 3 have been noted on any CBC. |
| 91. | Northern Flicker* | Seen throughout oak savannah throughout the inventory. Up to 10 seen per field trip. From 10 to 20 have been noted on most CBCs. |
| 92. | Olive-sided Flycatcher* | Uncommon spring migrant; 3 records of 1 each: on Crescent Bluff Rd. on 28 Apr 96, at El Toro Creek on 7 May 02, and Machine Gun Flats on 14 May 03. In 2004 through 2006 a pair nested in the BLM office area. On 13 Jul 04 an adult was seen with 2 fledglings. |
| 93. | Western Wood-Pewee | 4 records: 1 seen at the camp ground by West Camp Street on 15 Aug 99, and 1 May 03 (singing), 2 at the BLM office area on 8 May 03, and Bruce Gerow saw 1 at Mudhen Lake on 21 Apr 04. |
| 94. | Gray Flycatcher | 1 record: Jane Styer and I saw one near Skyline Road on 2 May 03. |
| 95. | Pacific-slope Flycatcher* | Summer resident in trees in riparian locations. First spring record: 17 Mar 04. In 1998 nested under eaves at front entrance to BLM main building. The latest annual record was 1 seen 27 Sep 01. Early arrival in 2004 with 3 March records; and in 2005 with arrival noted on 25 Mar. |
| 96. | Black Phoebe* | 1 or 2 pairs are seen at most riparian locations throughout the year. On CBCs prior to 1999 fewer than 8 individuals were noted per count; from 1999 on 10 or more have been noted per count |
| 97. | Say's Phoebe | Winter resident on grasslands: last seen on 7 May 02. First fall record: 10 Sep 02. Usually fewer than 5 seen on one field trip. Usually 5 to 15 individuals have been seen per CBC. |
| 98. | Ash-throated Flycatcher* | Summer resident throughout oak-chaparral. First spring record: 2 Apr 05. Infrequently seen in August. Latest record: 13 Aug 02. |
| 99. | Cassin's Kingbird | Bruce Gerow saw 1 very vocal bird on Ft. Ord near the Toro Estates Entrance from 19 to 21 May 01. Another vocal bird was seen at Boy Scout Lake on 19 Aug 05. |

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| 100. | Western Kingbird* | 1 or 2 pairs breed on the grasslands near El Toro Creek. The 1st spring records are usually in early April. Seen on 27 Mar 04. A "fall" migrant was on Machine Gun Flats on 2 Aug 99. Bruce Gerow confirmed breeding in 2001. |
| 101. | Loggerhead Shrike | Not seen in 1996. Uncommon, but widely distributed in somewhat open areas since then. |
| 102. | Hutton's Vireo* | Year-round resident in the Coast Live Oaks. When they are singing I can usually detect 1 to 4 individuals in one place. Most CBCs have recorded between 2 and 7 individuals. |
| 103. | Warbling Vireo* | Likely breeding in dense willow locations. Seen only in spring, and in drier years likely only a migrant. Earliest records: 27 Apr 02, 21 Apr 04, and 18 Apr 05. I was surprised that there was one at the Dam Crossing on 22 Jun 04. |
| 104. | Steller's Jay | Usually associated with El Toro Creek community, first recorded on Ft. Ord on 27 Jul 97. Widely distributed over Ft. Ord in the fall of 2001, a good acorn year. Noted around Mudhen Lake in November and December 05. |
| 105. | Western Scrub-Jay* | Highly visible common bird throughout the oak-chaparral throughout the inventory. The CBCs have recorded between 32 and 90 individuals. |
| 106. | American Crow* | Although abundant in the housing areas on Ft. Ord, it is uncommon in the backcountry. The CBCs have recorded between 16 and 90 individuals. |
| 107. | Common Raven | Infrequent visitor. Bruce Gerow saw two fly over the vicinity of Mudhen Lake in the spring of 1999. From then through 2003 I have widely scattered records: 10 Jun 00, 21 Oct 01, 3 May 02, 8 Aug 02, 17 Nov 02, 21 May 03, and 11 Sep 03. The six records in 2004 of up to 5 individuals suggest a population increase. In 2005 there were 4 records, and in 2006 there were 11 records of 1 to 4 individuals. |
| 108. | Horned Lark* | Seen in high grassland throughout the year. Young birds observed in June and July. They appear to be much more common in winter. They were uncommon in 2002. Five of the 9 CBCs have recorded no Horned Larks. The 28 Dec 93 CBC recorded 69 larks, far more than any other Ft. Ord count. |
| 109. | Purple Martin | 1 record: four flew west over Mudhen Lake on 14 Aug 99. |
| 110. | Tree Swallow* | Seen at ponds in small numbers. In 1996 first seen on 9 Mar, in 2001 on 12 Feb, in 2002 on 8 Feb, and in 2003 on 9 Mar. In July/August inventories, not seen in 1997, and last seen on 12 Jul 98, 1 Oct 01, 15 Jun 02, and 8 Jun 03. A possible migration peak in April. Three were seen on the 29 Dec 98 CBC. |

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| 111. | Violet-green Swallow* | At ponds in small numbers during the winter/spring inventory of 1996. Early record: 10 Feb 01. Around 60 birds seen on 2 Mar 01. Rarely seen in summer. In 2002 seen regularly from 6 Mar until 11 Jun, but not otherwise. In 2003 and 2004 seen until mid-June, probably nesting in a cliff face on Barloy Canyon Road. Also, 4 seen on the 29 Dec 98 CBC, and 3 were at Mudhen Lake on 30 Dec 03. |
| 112. | Northern Rough-winged Swallow | Seen in small numbers from early March (5 Mar 02) to early July (8 Jul 98). Seen as early as 12 Feb 01. |
| 113. | Cliff Swallow* | Summer resident. Until 2003 the early inventory date was 2 May 02. In 2003 approximately 50 were flying along El Toro Creek on 6 Apr, and in 2004 they were seen as early as 15 Mar. The most common swallow into August. Not seen in Sep 01, and last seen on 7 Aug 02, 12 Aug 03, and 19 Aug 05. |
| 114. | Barn Swallow* | Summer resident with nests observed. Usually first seen in March. One individual was seen on 20 Jan 06. Seen over the grasslands as well as over ponds. The 20 Barn Swallows seen over the vernal pond behind the BLM office appeared migratory. In Aug 04 a flock settled around the corner of Eucalyptus and Parker Flats Roads. Approximately 60 were seen there on the 20th. Some last records for the year are: 22 Sep 01, 12 Sep 02, and 12 Aug 03. One was seen on the 29 Dec 98 CBC. |
| 115. | Chestnut-backed Chickadee* | Seen throughout the inventory in scattered localities where there are oak trees. Up to 10 may be seen in a given location. The 1993 CBC reported 43 individuals, but the count has usually seen fewer than 15. |
| 116. | Oak Titmouse* | Common in the oaks and riparian woods throughout the year. Usually fewer than 10 are seen. The 1993 CBC reported 54 titmice, all other CBCs found 17 or fewer individuals. |
| 117. | Bushtit* | Common throughout the year wherever there are trees or chaparral. Usually seen in flocks (of up to 30 birds). Usually 100–200 are seen during CBCs, but 326 were counted on 28 Dec 84. |
| 118. | Red-breasted Nuthatch | Infrequent winter resident, noted on several CBCs.: 1 in '96, 2 on the golf course in '98, 3 in '00, and 1 seen near BLM office on 28 Dec 01. A small "wave" came through in the fall of 2004, with the 1st heard in Coast Live Oaks on 29 Sep., and one wintered in the BLM office area and was last seen on 30 Apr 05. |
| 119. | White-breasted Nuthatch | 5 records: 1 or 2 in the Valley Oaks near El Toro Creek on 27 Jul 97, 15 Aug 99, and 28 Oct 03; one was seen near El Toro Creek on 18 Sep 01. One was in the Coast Live Oaks at Boy Scout Lake on 16 Nov 05 |
| 120. | Pygmy Nuthatch* | 1 record prior to 2006: Don Roberson saw 2 on the golf course on the CBC on 28 Dec 99. On 6 Mar 06 a pair was seen mating in the pine planting along South Boundary Road. On 5 Jun they were seen feeding fledglings in the same location. |

121. Brown Creeper

Uncommon winter resident. They have been seen at the golf course on several CBCs: 1998. 2000, and 2005. There was 1 at BLM offices from 11 Dec 02 until 28 Jan 03.

122. Rock Wren

One was in an eroded area not far from the top of Oil Well Road, seen on 21 and 27 Oct 01.

123. Bewick's Wren*

Common in the trees, brush, and chaparral throughout the inventory. During the height of song one may hear roughly 10 singing. On CBCs anywhere from the teens to the 30s have usually been recorded. On 28 Dec 93 52 were counted.

124. House Wren*

Seen in riparian locations from March until July. Latest records: 19 Aug 99, 13 Oct 02, and 17 Oct 06. Less frequent, and last noted on 17 May, in the dry year 2004.

125. Marsh Wren

One singing on Mudhen Lake 25 Feb to 2 Mar 01, and 1 at the Catfish Pond in the fall (8 Oct) of 2002, in Mar 03, and Oct 04. Previously seen by Bill Collins in the pond near Range 36. They were seen at Mudhen Lake from 26 Oct to 15 Dec 06, with a maximum of 4 seen on 13 Dec.

126. Golden-crowned Kinglet

Few winter records. There were 2 noted on the golf course on the 1998 CBC. Seen in Dec 01 until 10 Mar 02. Not seen again until 12 Dec 02.

127. Ruby-crowned Kinglet

Winter resident in trees. Last seen on 6 Apr 96, 12 Apr 02, and 6 Apr 03. Main fall arrival in early October, *e.g.* 3 Oct 02, 6 Oct 03. Usually fewer than 10 are seen, but in the fall of 2006 up to 30 could be seen at a single place. Usually 15–30 are seen on the CBCs.

128. Blue-gray Gnatcatcher*

Recorded from 30 Mar 96 and 10 Mar 02 through spring in oak-chaparral areas. Last records: 7 Jul 98, 19 Aug 99, 2 seen in chapparal on the 2001 CBC, and 20 Aug 02. Robert Horn saw 1 near Creekside on 1 Nov 03.

129. Western Bluebird*

Seen throughout the year, although recorded on a minority of the stops. The flocks usually have 5 or fewer individuals. Bluebirds may have become more common on Ft. Ord between 1996 and 2006.

130. Mountain Bluebird

7 seen on Camp Ord on 3 Jan 37. [See Don Roberson, *Monterey Birds,* 2nd Edition, 2002.]

131. Townsend's Solitaire

1 record: 1 seen and photographed by the BLM Office on 22 Oct 07.

132. Swainson's Thrush

First heard singing in dense willows along Crescent Bluff Road on 4 May 96. Heard singing on 8 and 16 Jun 96 near Guidotti Gate. Migrant heard singing on 14 May 02. In 2003 a May migrant. Noted 23 to 30 Apr 05. Just 1 or 2 seen per day.

133. Hermit Thrush

Widely spread fall records of 1 to 3 birds starting 18 Oct 01, 13 Oct 02, and 14 Oct 03. A winter resident; most have left by the end of February. Sporadic records up to 6 Apr (2003). A surprising 9 seen at once at the Huffman Tank on 23 Nov 02.On the 9 CBCs a high of 22 were counted on 28 Dec 99 and a low of 3 were noted on 27 Dec 96.

| | | |
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| 134. | American Robin* | A few present in certain locations, e.g. Mudhen Lake, and the BLM compound. Seen throughout the year. On 15 Aug 98 there was a "fall" flock of ten by the BLM office. Only 1 record from 18 Sep through 18 Oct 01. After that, more frequently seen. In 2003 seen on 6 Jun, and not again until 7 Nov. On 3 Feb 04 there was a winter flock of 32 at the corner of Eucalyptus and Barloy Canyon Roads. An outstanding record was the 1190 counted on the 1994 CBC. |
| 135. | Varied Thrush | Seen by Don Roberson at Lower Pilarcitos Pond on 2 CBCs: 1 seen on 28 Dec 92 and 3 seen on 28 Dec 99. Also seen, 1 each, on 24 Nov and 25 Dec 06 at the BLM office area, and on 1 Dec 06 near Lower Pilarcitos Pond. The 24 Nov and 1 Dec birds were singing. |
| 136. | Wrentit* | Seen (heard) throughout the chaparral throughout the year. |
| 137. | Northern Mockingbird* | Small numbers usually seen near housing areas, but also seen around trees or shrubs in the grasslands. |
| 138. | Brown Thrasher | 1 seen near Mudhen Lake on 14 Oct 84. [See Don Roberson, *Monterey Birds,* 2nd Edition, 2002.] |
| 139. | California Thrasher* | Seen (heard) throughout the chaparral throughout the year, but with lower frequency than the Wrentit. |
| 140. | European Starling | Seen in many locations throughout the year. Common along El Toro Creek; however, infrequently seen at many places. In 2006 they were more common throughout Ft. Ord. |
| 141. | American Pipit | Winter visitor: 7 at Fox Pond on 14 Feb 01; 39 not far from the top of Oil Well Road on 17 Feb 01. In 2003 last seen on 21 Mar, and in 2004 on 12 Apr. |
| 142. | Cedar Waxwing | Winter resident. First fall record: 10 seen on 3 Oct 01. On 26 Feb 01 there were 44 by El Toro Creek. Late records: on 7 May 02 there were about 10 by El Toro Creek, and on 25 May 03 there were 32 in the same location; in 2004 there were 50 seen on 19 May and 7 seen on 4 Jun. In 2005 seen mainly in April. Seen just 3 times in 2006. |
| 143. | Phainopepla | 2 seen along Crescent Bluff Road on 12 Apr 02. Reported by Chuck Haugen in July 2002. Up to 3 seen visiting elderberries along El Toro Creek on 25 and 26 Jul 02. Next seen 28 and 29 Sep 06, when 2 visited an elderberry on the corner of Eucalyptus and Barloy Canyon Roads. Previously reported by Bruce Gerow as a non-breeding visitor during the Monterey Breeding Bird Atlas project. |
| 144. | Orange-crowned Warbler* | First annual records: 9 Mar 96, 1 Mar 01, 9 Mar 03, 15 Feb 04, 18 Feb 05. On 9 Mar 03, 16 were heard singing. Frequently recorded in chaparral/oaks from 14 Apr on. Infrequently recorded in July and August. In 2001 a noticeable fall migration in September and October, and 2 were seen on 1 Nov. In 2003 later individuals included 1 on 22 Oct and 1 on 4 Dec, both near water. They have been seen on approximately half of the CBCs. |
| 145. | Nashville Warbler | Migrant. 1st record: 1 at El Toro Creek on 17 Sep 01. Other records of 1 individual from 6 to 9 Oct 01, 11 Mar 03, and 21 Apr 03. |

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| 146. | Northern Parula | 1 sure record: 1 on 5 Oct 01 on 7th Street. Also, likely an immature female seen on Parker Flats Cutoff on 27 Oct 02. |
| 147. | Yellow Warbler | Spring records: 1 heard near Mudhen Lake on 21 Apr 96, and ones seen on 14 May and16 May 02, 17 Apr 03, and 17 and 25 Apr 04. In 2001 one to three were regularly seen from mid-September to mid-October. |
| 148. | Yellow-rumped Warbler | Winter resident. Peak on 6 Apr 96, and last seen on 20 Apr 96 and 12 Apr 02. First seen on 27 Sep 01, 1 Oct 02, and 26 Sep 06. Also, there was an isolated record of 1 on Ingman Ct. on 15 Aug 02. Nearly all are of the Audubon's race. I saw 1 bird of the Myrtle race on 2 Nov 01, and 2 on 19 Nov 03. On 9 CBCs a low of 27 were seen in 1989 and a high of 104 were seen in 1993. The 1993 CBC count included 12 of the Myrtle race. |
| 149. | Black-throated Gray Warbler | 4 spring records: 20 Apr, 28 Apr, 4 May 96, and 28 Apr 03. A female was seen on the golf course during the CBC on 29 Dec 98. |
| 150. | Townsend's Warbler | Winter resident. Earliest fall record 20 Sep 01. Seen through February in 2001. Six or fewer seen per field trip. Spring records: a female seen on 1 Jun 96 and 3 males on 23 Mar 02; in 2003 seen from 9 Mar until 8 May. On 9 CBCs fewer than 10 were noted on 4 years, and more than 10 on 5 years, with a maximum of 33 in1993. |
| 151. | Hermit Warbler | 3 records, all at the BLM office area: 1 on 5 May 03, 5 seen on 8 May 03, and 1 on 28 Apr 05. |
| 152. | Black-and-white Warbler | 1 record: 1 seen by Don Roberson on the 28 Dec 84 CBC. |
| 153. | MacGillivray's Warbler | In the spring of 1999 Bruce Gerow encountered a singing male in the chaparral on Crescent Bluff. |
| 154. | Common Yellowthroat* | Probably to be found all year at the corner of Barloy Canyon and Eucalyptus Roads and/or Mudhen Lake prior to the 2003 burn. In 2003 not seen in these areas following the July fire. In the dry year of 2004, just a few records from 21 Apr to 30 Jun. Mainly noted around Mudhen Lake in 2006. |
| 155. | Wilson's Warbler* | Summer resident some years along upper El Toro Creek. Earliest records: 7 Apr 96 and 27 Mar 04. Latest record: 2 Aug 97. A migratory flock of 10 at the BLM office on 8 May 03 was unusual. |
| 156. | Yellow-breasted Chat | 1 record: 1 heard singing in a tangle along Crescent Bluff Rd. on |
| 157. | Western Tanager | Spring migrants recorded on 4 May and 1 Jun 96, and from 1 to 8 May 03. In 2005 the early record was 24 Apr, and by 30 Apr a flock of 3 was seen. Two flocks noted in May 03, with a maximum of 10 at the BLM office on the 8th. Fall migrants on 25 Jul to 2 Aug 98, and until 20 Sep 01. A late bird was seen near Parker Flats Cut-off on 29 Oct 05. |
| 158. | [Green-tailed Towhee | 1 seen on 28 Feb 02 on Parker Flats Road near Eucalyptus Road. Efforts to find the bird later failed.] |

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| 159. | Spotted Towhee* | A permanent resident seen throughout the chaparral. In comparison with the California Towhee, this bird is more restricted in habitat and fewer are seen. |
| 160. | California Towhee* | Common throughout the year, and widely distributed. Seen on virtually all trips, although not in large flocks. On 9 CBCs a low of 18 were seen in 1989 and a high of 63 were noted in1993. |
| 161. | Rufous-crowned Sparrow* | In April of 2000 Sam Fitton found 2 singing by the big washout into Mudhen Lake. One was still there at least as late as 21 Jun 00. Seen along Barloy Canyon Road on 9 and 14 May 02, and from 13 Feb until 18 Mar in 2003. |
| 162. | Chipping Sparrow* | 1 record prior to 2004: 2 at the campground on Watkins Gate Rd. on 11 May 03. Regularly seen in the burn area in the spring of 2004, with nesting probable. Seen there again in 2005. |
| 163. | Lark Sparrow* | Seen all year, but infrequently in the winter. Most commonly seen in the grasslands, but also apparently breeding in or near the chaparral areas. Regularly seen at the BLM compound. |
| 164. | (Bell's) Sage Sparrow* | Resident. Thinly spread over the burned chaparral areas. I likely overlooked them before Bruce Gerow pointed out that they were there. My first record: 4 Jul 98. Birds with young fledgling seen on 3 Jul 06. Don Roberson noted between 1 and 4 individuals on the CBCs in11993, 1996, 1998, and 2000. |
| 165. | Savannah Sparrow | Winter resident in the grasslands. Approximately 60 seen high in the grasslands on 17 Dec 06. Last spring record: 28 Apr 96. First fall records: 26 Sep 01, and 22 Oct 02. |
| 166. | Grasshopper Sparrow* | Breeding bird of the grasslands. First seen on 14 Apr 96, on 27 Apr 02, on 21 Mar 03, on 9 Mar 04, and 16 Mar 05. Approximately 30 singing birds detected in 1996, 5 or 6 of these were on Machine Gun Flats. Bird in juvenal plumage seen on 16 Jun 96. Seen until the end of the inventory in 1996. There were 35 or more singing birds on Ft. Ord in Jun 00. There were likely as many in Jun 02, but likely fewer in 2003. |
| 167. | Fox Sparrow | Winter resident, but much more common in fall. First noted in chaparral on 5 Oct 01, 1 Oct 02, 30 Sep 03, and 29 Sep 05. Last seen on 25 Jan 02 and 14 Mar 03. Usually 1 or 2 seen, but 10 to 20 were at the Huffman Tank on 29 Oct 02. 84 were seen on the 28 Dec 84 CBC. All Fox Sparrows seen have been of the 'Sooty' race. |
| 168. | Song Sparrow* | There are 2 to 6 individuals at nearly every pond throughout the inventory. |
| 169. | Lincoln's Sparrow | Mostly a spring and fall migrant, but few recorded per year. The 2 that Sam Fitton and I saw at Fox Pond on 11 Aug 99 were unusually early. |
| 170. | White-throated Sparrow | 1 record: 1, perhaps immature, at Mudhen Lake 15 Oct 01. |
| 171. | Harris's Sparrow | One immature seen on Trail 22 on 16 Jan and 25 Jan 02. |

172. White-crowned Sparrow — Winter resident in backcountry Ft. Ord. Last seen on 29 Apr 05. Earliest fall record: 2 at Fox Pond on 13 Aug 99. In the fall of 2001 the main migration arrived by 26 Sep. I usually record fewer than 10, but I saw approximately 50 along El Toro Creek on 30 Nov 03.

173. Golden-crowned Sparrow — Common winter resident, October through April. Last seen on 21 Apr 96, and on 2 May 02. Seen in good numbers, around 20, by 5 Oct 01 (and 6 Oct 03). First noted in fall on 1 Oct 02 and 30 Sep 03.

174. Dark-eyed Junco* — Common breeding bird in oak woods and at the BLM compound. Seen throughout the year. In 2003 flocks of 50 were seen in October, but in other seasons 20 or fewer were seen.

175. Black-headed Grosbeak* — Summer resident near Guidotti Gate. Seen as early as 16 Apr 02 and 7 Apr 03, and as late as 1 Aug 99.

176. Lazuli Bunting* — 4 records prior to 2002: 28 Apr 96, 4 May 96, and 28 Jun 98, 1 Aug 99. The June record was of a singing male at Mudhen Lake. Strong migration in 2002, seen from 23 Apr to 25 May, with a peak of around 15 seen on 7 May. Weak migration in 2003, seen from 1 May until 6 Jun. A strong migration again in 2004; noted 19 Apr to 30 Jun, with around 30 individuals in the burn area alone. Probable breeding in the burn area followed the migration. In 2006 they probably bred in the 2005 burn area off Parker Flats Road.

177. Red-winged Blackbird* — Concentrated near ponds and also seen elsewhere throughout the year, although scarce in August, except, possibly, at the roost at the pond on Watkins Gate Road near West Camp Street.

178. Tricolored Blackbird* — The known colony on Oil Well Road has been active most years. The colony has maintained over 50 birds. On 26 Jul 98 I watched them come to feed at the play fields of El Toro Creek community. Ten or more visit the Equestrian Center in winter. They were seen there up to 28 Feb 02. 120 were counted on the 27 Dec 89 CBC, and 200 on the 28 Dec 93 CBC.

179. Western Meadowlark* — Small numbers on grassland and Machine Gun Flats in the spring and summer. Larger, more widespread groups of up to 50 seen in the fall and winter. Usually seen in double digits on the CBCs; a low of 8 was seen on the 29 Dec 01 count, and a high of 323 on 28 Dec 93.

180. Brewer's Blackbird* — Present throughout the inventory. Especially common at the BLM compound, prior to the fall of 2001. Common in residential areas. 850 were noted on the 27 Dec 89 CBC.

181. Brown-headed Cowbird — 5 records: 22 Mar 96, 30 May 02, 23 May 03, 29 Apr and 30 Apr 05.

182. Hooded Oriole* — Added to inventory on 11 Jul 98. Sam Fitton pointed out that they were near El Toro Creek. I found at least 3 pairs breeding in Fan Palms in El Toro community, and using Ft. Ord to feed. They continue to be seen only in this area.

| | | |
|---|---|---|
| 183. | Bullock's Oriole* | Summer resident. Earliest records: 20 Apr 02 and 2 Apr 03. Breeding along El Toro Creek, and possibly other riparian areas with tall (Eucalyptus) trees. Not seen after mid-August. Bruce Gerow noted especially large numbers of both oriole species nesting in the El Toro Creek area in 2001. |
| 184. | Purple Finch* | Present in the oaks and at the BLM compound throughout the inventory. Usually no more than 5, but sometimes 10 or 20 are in a flock. |
| 185. | House Finch* | Seen in small numbers throughout Ft. Ord throughout the inventory. Seen at the BLM compound in larger numbers. Abundant in the housing areas of Ft. Ord. |
| 186. | Pine Siskin* | At BLM compound from first inventory until 2001. However, not encountered in the fall (inventory in 2001). Seen Jan 02 through 23 Apr 02, and then gone: perhaps sensitive to drought. In the drought year of 2003 seen only from 23 Jan to 28 Apr. No Siskins noted in the dry year of 2004, and a few were noted in 2005 or 2006. |
| 187. | Lesser Goldfinch* | Seen throughout the inventory wherever there are trees. Uncommon in the backcountry in the dry season of 2002. Hardly seen after Jul 03, another dry season, and in2006 not noted after 7 Dec. |
| 188. | Lawrence's Goldfinch* | Seen at the BLM compound and in riparian locations in the chaparral. First seen on 24 Mar 96. Not seen at all in 1998. In 2000 last seen on 15 Jun. The 2002 records span 14 Apr to 20 Aug. In 2003 just 2 records of 2 each on 23 May and 16 Jun. The year 2004 was a strong one with records regularly from 19 Apr to 10 Sep, especially in the burn area where they probably bred. Two fall records: 2 near El Toro Creek on 27 Oct 01, and 1 at recent burn on 19 Oct 06. |
| 189. | American Goldfinch | Fall and winter resident. 1st record: approximately 50 near El Toro Creek on 9 Feb 01. Smaller numbers seen in fall starting 24 Oct 01, 22 Oct 03, and 1 Nov 05. Usually the first fall records are in October. |
| 190. | House Sparrow* | Common in the housing areas on Ft. Ord. Barely seen in Backcountry Ft. Ord. |

# Appendix H

# Attachment 6 – Rare Plants

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**Monterey Spineflower**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Monterey Ceanothus**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Sandmat Manzanita**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Eastwood's Goldenfleece**
>5 Indivudals
- Low
- Moderate
- < or = 5 Individuals

**Kellogg's Horkelia**
>5 Individuals
- Low
- < or = 5 Individuals

**Coast Wallflower**
- Low
- < or = 5 Individuals

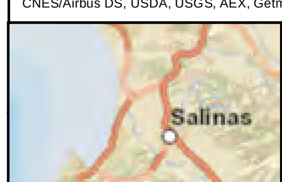
**Biological Project Study Area**

**Not Surveyed***

0 25 50 100
Feet
0 10 20 40
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,

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947 Cass Street, Suite 5
Monterey, CA 93940
(831) 373-4341


Page 1

*Maps show where rare plants were found in the surveyed areas


**Monterey Spineflower**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Monterey Ceanothus**
>5 Individuals
- Low
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**Sandmat Manzanita**
>5 Individuals
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**Eastwood's Goldenfleece**
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**Kellogg's Horkelia**
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- Low
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**Biological Project Study Area**

**Not Surveyed***

0 25 50 100
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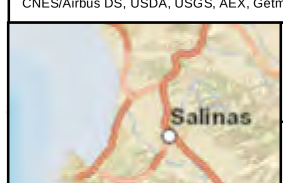


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**Coast Wallflower**
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**Biological Project Study Area**

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Feet
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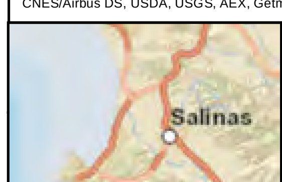


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**Coast Wallflower**
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**Biological Project Study Area**

**Not Surveyed***

0 25 50 100
Feet
0 10 20 40
Meters

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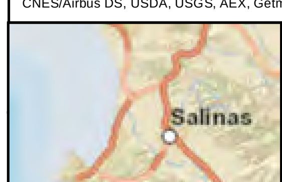
Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,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(831) 373-4341



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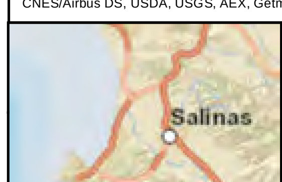


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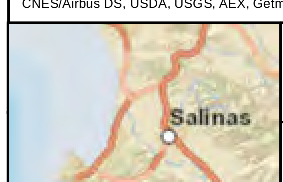


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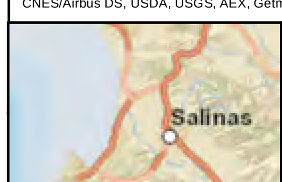


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- Moderate
- High
- < or = 5 Individuals

**Eastwood's Goldenfleece**
>5 Indivudals
- Low
- Moderate
- < or = 5 Individuals

**Kellogg's Horkelia**
>5 Individuals
- Low
- < or = 5 Individuals

**Coast Wallflower**
- Low
- < or = 5 Individuals

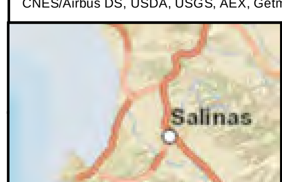
**Biological Project Study Area**

**Not Surveyed***

0 25 50 100
Feet
0 10 20 40
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,

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File: C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Rare Plant Booklet 20150212.mxd

Date: 2/19/2015

Scale: 1 in = 110 feet


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*Maps show where rare plants were found in the surveyed areas

**Monterey Spineflower**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Monterey Ceanothus**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Sandmat Manzanita**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Eastwood's Goldenfleece**
>5 Indivudals
- Low
- Moderate
- < or = 5 Individuals

**Kellogg's Horkelia**
>5 Individuals
- Low
- < or = 5 Individuals

**Coast Wallflower**
- Low
- < or = 5 Individuals

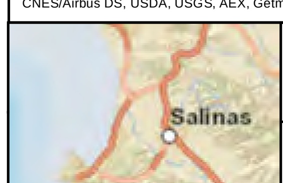
**Biological Project Study Area**

**Not Surveyed***

0 25 50 100
Feet
0 10 20 40
Meters

N

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Date: 2/19/2015

Scale: 1 in = 110 feet

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**Monterey Spineflower**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Monterey Ceanothus**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Sandmat Manzanita**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Eastwood's Goldenfleece**
>5 Indivudals
- Low
- Moderate
- < or = 5 Individuals

**Kellogg's Horkelia**
>5 Individuals
- Low
- < or = 5 Individuals

**Coast Wallflower**
- Low
- < or = 5 Individuals

**Biological Project Study Area**

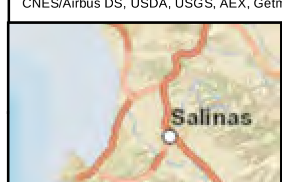
**Not Surveyed***

0 25 50 100
Feet

0 10 20 40
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,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*Maps show where rare plants were found in the surveyed areas


**Monterey Spineflower**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Monterey Ceanothus**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Sandmat Manzanita**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Eastwood's Goldenfleece**
>5 Indivudals
- Low
- Moderate
- < or = 5 Individuals

**Kellogg's Horkelia**
>5 Individuals
- Low
- < or = 5 Individuals

**Coast Wallflower**
- Low
- < or = 5 Individuals

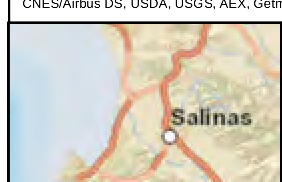
**Biological Project Study Area**

**Not Surveyed***

0 25 50 100
Feet
0 10 20 40
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,

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|---|---|---|---|
| Title: Rare Plants Within GWR PIA - 11 | Date: 2/19/2015 | Denise Duffy and Associates, Inc. | Page |
| File: C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Rare Plant Booklet 20150212.mxd | Scale: 1 in = 110 feet | Monterey \| San Jose<br>Environmental Consultants Resource Planners<br>947 Cass Street, Suite 5<br>Monterey, CA 93940<br>(831) 373-4341 | 11 |

*Maps show where rare plants were found in the surveyed areas


**Monterey Spineflower**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Monterey Ceanothus**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Sandmat Manzanita**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Eastwood's Goldenfleece**
>5 Indivudals
- Low
- Moderate
- < or = 5 Individuals

**Kellogg's Horkelia**
>5 Individuals
- Low
- < or = 5 Individuals

**Coast Wallflower**
- Low
- < or = 5 Individuals

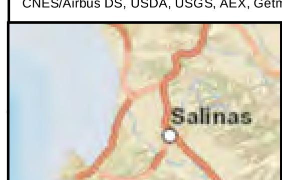
**Biological Project Study Area**

**Not Surveyed***

0 25 50 100
Feet
0 10 20 40
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,

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Date: 2/19/2015

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*Maps show where rare plants were found in the surveyed areas


**Monterey Spineflower**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Monterey Ceanothus**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Sandmat Manzanita**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Eastwood's Goldenfleece**
>5 Indivudals
- Low
- Moderate
- < or = 5 Individuals

**Kellogg's Horkelia**
>5 Individuals
- Low
- < or = 5 Individuals

**Coast Wallflower**
- Low
- < or = 5 Individuals

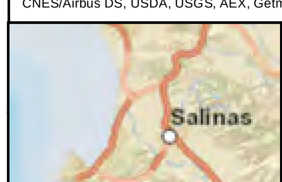
**Biological Project Study Area**

**Not Surveyed***

0 25 50 100
Feet
0 10 20 40
Meters

N






Title: Rare Plants Within GWR PIA - 13

File: C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Rare Plant Booklet 20150212.mxd

Date: 2/19/2015

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*Maps show where rare plants were found in the surveyed areas


**Monterey Spineflower**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Monterey Ceanothus**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Sandmat Manzanita**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Eastwood's Goldenfleece**
>5 Indivudals
- Low
- Moderate
- < or = 5 Individuals

**Kellogg's Horkelia**
>5 Individuals
- Low
- < or = 5 Individuals

**Coast Wallflower**
- Low
- < or = 5 Individuals

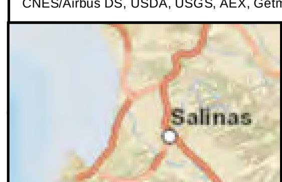
**Biological Project Study Area**

**Not Surveyed***

0 25 50 100
Feet
0 10 20 40
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,




Title: Rare Plants Within GWR PIA - 14

File: C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Rare Plant Booklet 20150212.mxd

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*Maps show where rare plants were found in the surveyed areas

**Monterey Spineflower**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Monterey Ceanothus**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Sandmat Manzanita**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Eastwood's Goldenfleece**
>5 Indivudals
- Low
- Moderate
- < or = 5 Individuals

**Kellogg's Horkelia**
>5 Individuals
- Low
- < or = 5 Individuals

**Coast Wallflower**
- Low
- < or = 5 Individuals

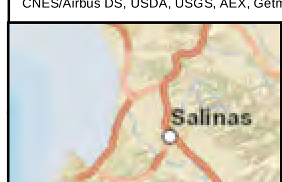
**Biological Project Study Area**

**Not Surveyed***

0 25 50 100
Feet
0 10 20 40
Meters

N

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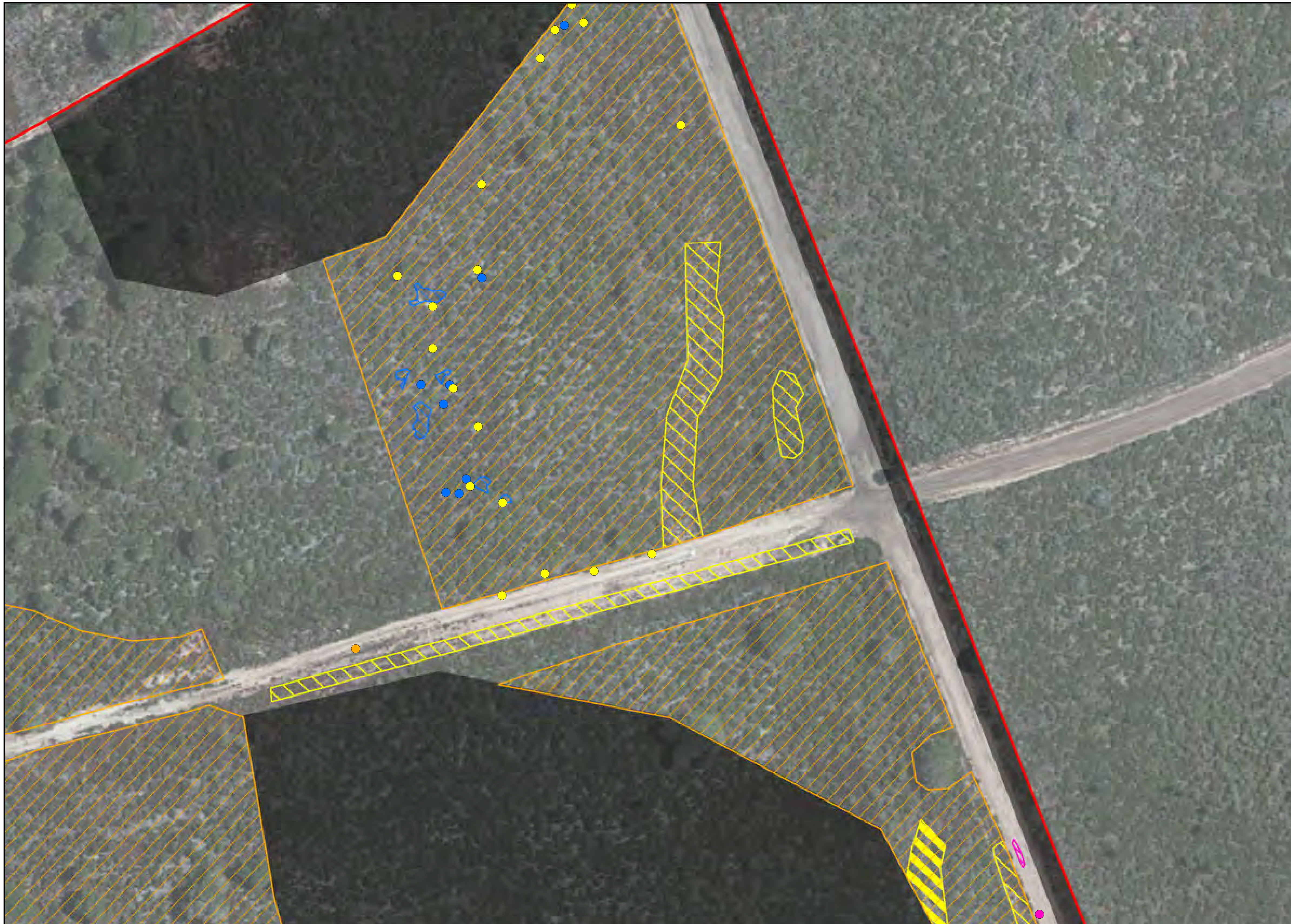
*Maps show where rare plants were found in the surveyed areas



**Monterey Spineflower**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Monterey Ceanothus**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Sandmat Manzanita**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Eastwood's Goldenfleece**
>5 Indivudals
- Low
- Moderate
- < or = 5 Individuals

**Kellogg's Horkelia**
>5 Individuals
- Low
- < or = 5 Individuals

**Coast Wallflower**
- Low
- < or = 5 Individuals

**Biological Project Study Area**

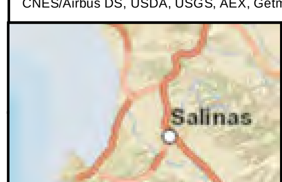
**Not Surveyed***

0 25 50 100
Feet

0 10 20 40
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,

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Date: 2/19/2015

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*Maps show where rare plants were found in the surveyed areas

**Monterey Spineflower**
>5 Individuals
Low
Moderate
High
< or = 5 Individuals

**Monterey Ceanothus**
>5 Individuals
Low
Moderate
High
< or = 5 Individuals

**Sandmat Manzanita**
>5 Individuals
Low
Moderate
High
< or = 5 Individuals

**Eastwood's Goldenfleece**
>5 Indivudals
Low
Moderate
< or = 5 Individuals

**Kellogg's Horkelia**
>5 Individuals
Low
< or = 5 Individuals

**Coast Wallflower**
Low
< or = 5 Individuals

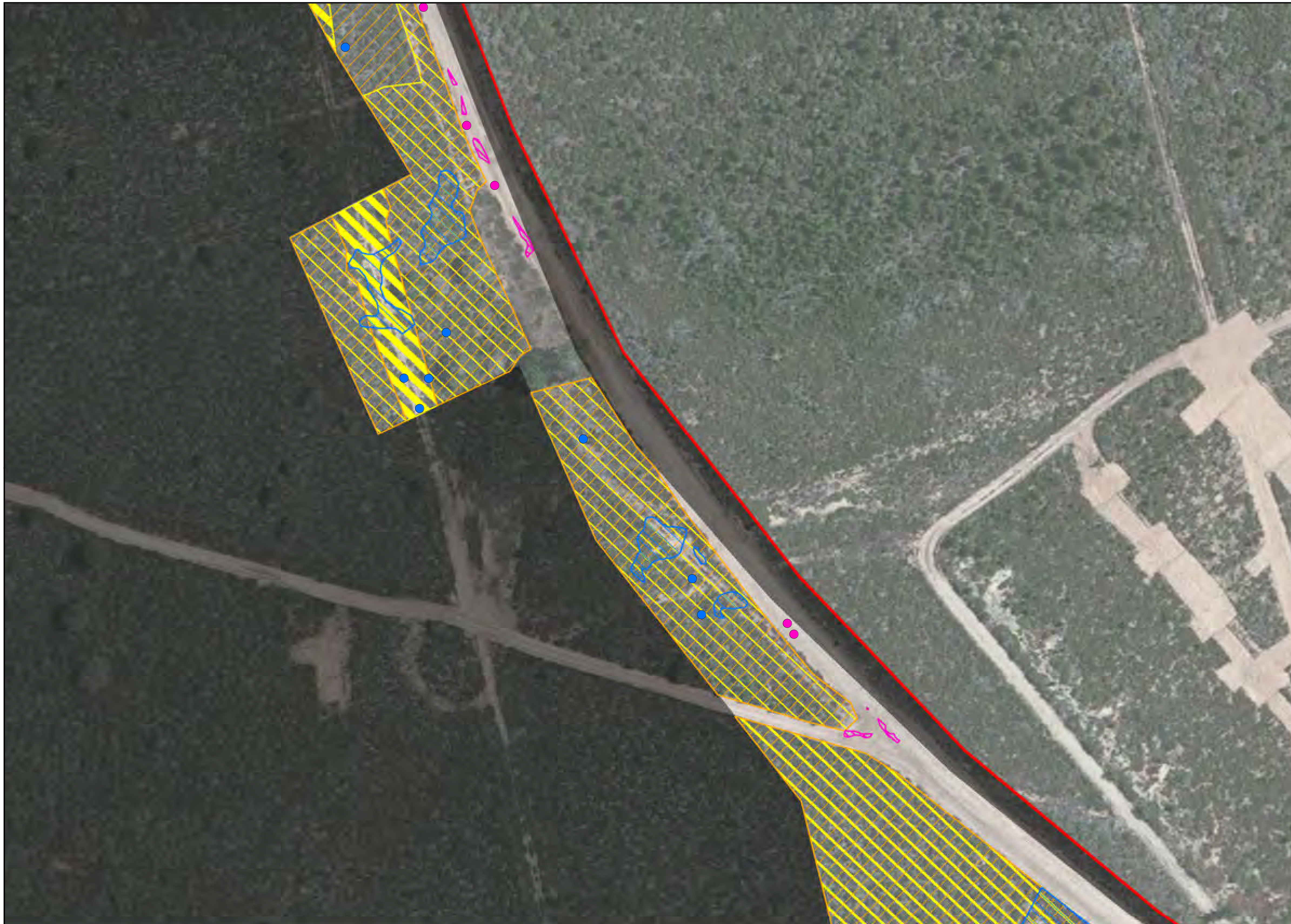
**Biological Project Study Area**

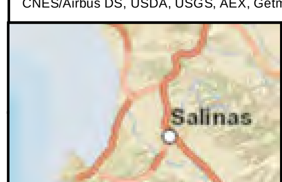
**Not Surveyed***

0 25 50 100
Feet
0 10 20 40
Meters

N





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Date: 2/19/2015

Scale: 1 in = 110 feet

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*Maps show where rare plants were found in the surveyed areas

**Monterey Spineflower**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Monterey Ceanothus**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Sandmat Manzanita**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Eastwood's Goldenfleece**
>5 Indivudals
- Low
- Moderate
- < or = 5 Individuals

**Kellogg's Horkelia**
>5 Individuals
- Low
- < or = 5 Individuals

**Coast Wallflower**
- Low
- < or = 5 Individuals

**Biological Project Study Area**

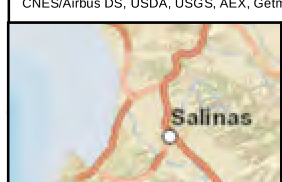
**Not Surveyed***

0 25 50 100
Feet

0 10 20 40
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,


Title: Rare Plants Within GWR PIA - 18

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Date: 2/19/2015

Scale: 1 in = 110 feet


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*Maps show where rare plants were found in the surveyed areas

**Monterey Spineflower**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Monterey Ceanothus**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Sandmat Manzanita**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Eastwood's Goldenfleece**
>5 Indivudals
- Low
- Moderate
- < or = 5 Individuals

**Kellogg's Horkelia**
>5 Individuals
- Low
- < or = 5 Individuals

**Coast Wallflower**
- Low
- < or = 5 Individuals

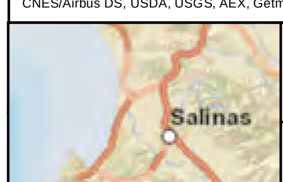
**Biological Project Study Area**

**Not Surveyed***

0 25 50 100
Feet
0 10 20 40
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,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Date: 2/19/2015

Scale: 1 in = 110 feet


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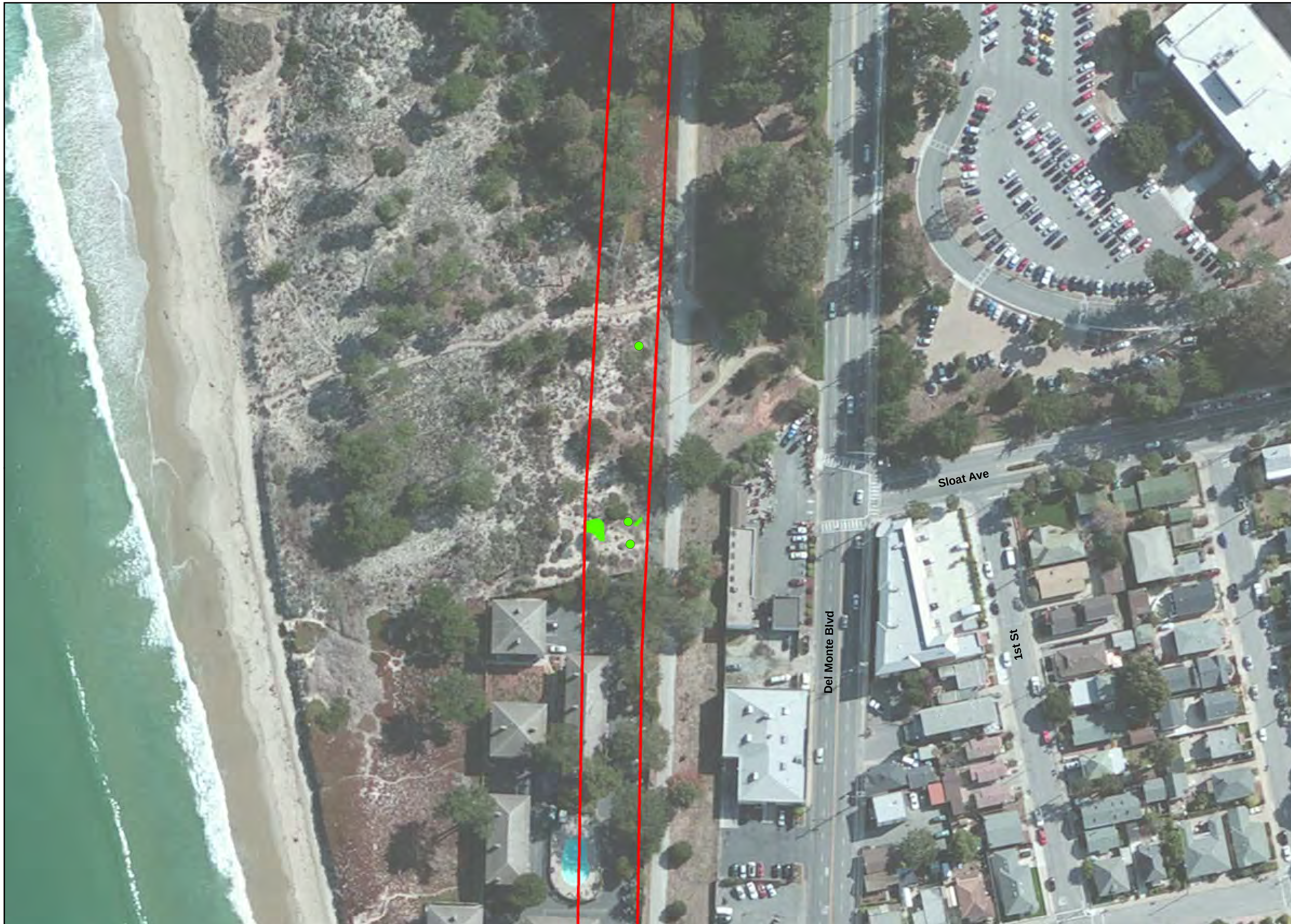



**Monterey Spineflower**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Monterey Ceanothus**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Sandmat Manzanita**
>5 Individuals
- Low
- Moderate
- High
- < or = 5 Individuals

**Eastwood's Goldenfleece**
>5 Indivudals
- Low
- Moderate
- < or = 5 Individuals

**Kellogg's Horkelia**
>5 Individuals
- Low
- < or = 5 Individuals

**Coast Wallflower**
- Low
- < or = 5 Individuals

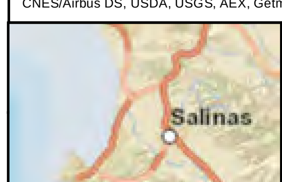
**Biological Project Study Area**

**Not Surveyed***

0 25 50 100
Feet
0 10 20 40
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,

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Date: 2/19/2015

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*Maps show where rare plants were found in the surveyed areas

# Appendix H

# Attachment 7 – Rare Wildlife Habitat

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**Smith's Blue Butterfly Habitat**

Dune Buckwheat (Eriogonum parvifolium)

> 5 Individuals

< or = 5 Individuals

Coast Buckwheat (Eriogonum latifolium)

> 5 Individuals

< or = 5 Individuals

**Monarch Butterfly Habitat**

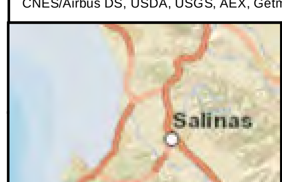
Eucalyptus (Eucalyptus globulus)

**Biological Project Study Area***

0 25 50 100
Feet
0 10 20 40
Meters

N

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Date: 2/19/2015

Scale: 1 in = 92 feet

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*Maps show where rare wildlife habitat was found in the surveyed areas

**Smith's Blue Butterfly Habitat**

Dune Buckwheat (Eriogonum parvifolium)

> 5 Individuals

< or = 5 Individuals

Coast Buckwheat (Eriogonum latifolium)

> 5 Individuals

< or = 5 Individuals

**Monarch Butterfly Habitat**

Eucalyptus (Eucalyptus globulus)

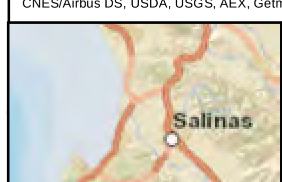
**Biological Project Study Area***

0 25 50 100
Feet

0 10 20 40
Meters

N

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Date: 2/19/2015

Scale: 1 in = 92 feet

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*Maps show where rare wildlife habitat was found in the surveyed areas

**Smith's Blue Butterfly Habitat**

Dune Buckwheat (Eriogonum parvifolium)

- > 5 Individuals
- < or = 5 Individuals

Coast Buckwheat (Eriogonum latifolium)

- > 5 Individuals
- < or = 5 Individuals

**Monarch Butterfly Habitat**

- Eucalyptus (Eucalyptus globulus)

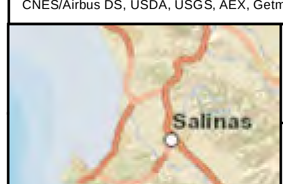
**Biological Project Study Area***

0 25 50 100
Feet

0 10 20 40
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,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File: C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Rare Wildlife Habitat Booklet 20150218.mxd

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*Maps show where rare wildlife habitat was found in the surveyed areas

**Smith's Blue Butterfly Habitat**

Dune Buckwheat (Eriogonum parvifolium)

- > 5 Individuals
- < or = 5 Individuals

Coast Buckwheat (Eriogonum latifolium)

- > 5 Individuals
- < or = 5 Individuals

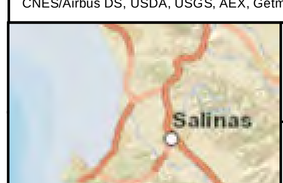
**Monarch Butterfly Habitat**

- Eucalyptus (Eucalyptus globulus)
- **Biological Project Study Area***

0 25 50 100
Feet
0 10 20 40
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,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Date: 2/19/2015

Scale: 1 in = 92 feet

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(831) 373-4341



*Maps show where rare wildlife habitat was found in the surveyed areas

**Smith's Blue Butterfly Habitat**

Dune Buckwheat (Eriogonum parvifolium)

- > 5 Individuals
- < or = 5 Individuals

Coast Buckwheat (Eriogonum latifolium)

- > 5 Individuals
- < or = 5 Individuals

**Monarch Butterfly Habitat**

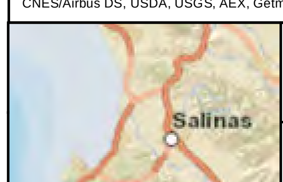
- Eucalyptus (Eucalyptus globulus)
- **Biological Project Study Area***

0 25 50 100
Feet

0 10 20 40
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,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Date: 2/19/2015

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(831) 373-4341




*Maps show where rare wildlife habitat was found in the surveyed areas

**Smith's Blue Butterfly Habitat**

Dune Buckwheat (Eriogonum parvifolium)

> 5 Individuals

< or = 5 Individuals

Coast Buckwheat (Eriogonum latifolium)

> 5 Individuals

< or = 5 Individuals

**Monarch Butterfly Habitat**

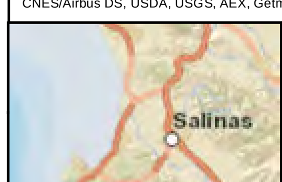
Eucalyptus (Eucalyptus globulus)

**Biological Project Study Area***


0 25 50 100
Feet
0 10 20 40
Meters

N



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*Maps show where rare wildlife habitat was found in the surveyed areas


**Smith's Blue Butterfly Habitat**

Dune Buckwheat (Eriogonum parvifolium)

- > 5 Individuals
- < or = 5 Individuals

Coast Buckwheat (Eriogonum latifolium)

- > 5 Individuals
- < or = 5 Individuals

**Monarch Butterfly Habitat**

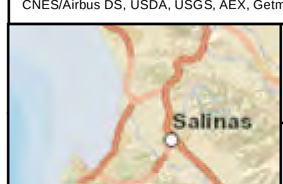
- Eucalyptus (Eucalyptus globulus)
- **Biological Project Study Area***

0 25 50 100
Feet

0 10 20 40
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,

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Scale: 1 in = 92 feet


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*Maps show where rare wildlife habitat was found in the surveyed areas

**Smith's Blue Butterfly Habitat**

Dune Buckwheat (Eriogonum parvifolium)

> 5 Individuals

< or = 5 Individuals

Coast Buckwheat (Eriogonum latifolium)

> 5 Individuals

< or = 5 Individuals

**Monarch Butterfly Habitat**

Eucalyptus (Eucalyptus globulus)

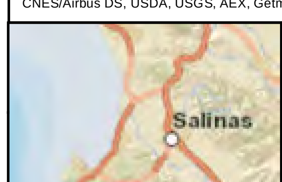
**Biological Project Study Area***

0 25 50 100
Feet

0 10 20 40
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,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Date: 2/19/2015

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*Maps show where rare wildlife habitat was found in the surveyed areas

**Smith's Blue Butterfly Habitat**

Dune Buckwheat (Eriogonum parvifolium)

- > 5 Individuals
- < or = 5 Individuals

Coast Buckwheat (Eriogonum latifolium)

- > 5 Individuals
- < or = 5 Individuals

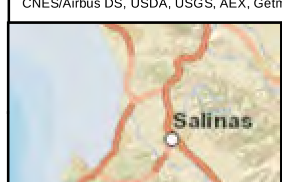
**Monarch Butterfly Habitat**

- Eucalyptus (Eucalyptus globulus)
- **Biological Project Study Area***

0 25 50 100
Feet
0 10 20 40
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,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Date: 2/19/2015

Scale: 1 in = 92 feet


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# Appendix H

# Attachment 8 – Habitat Classification

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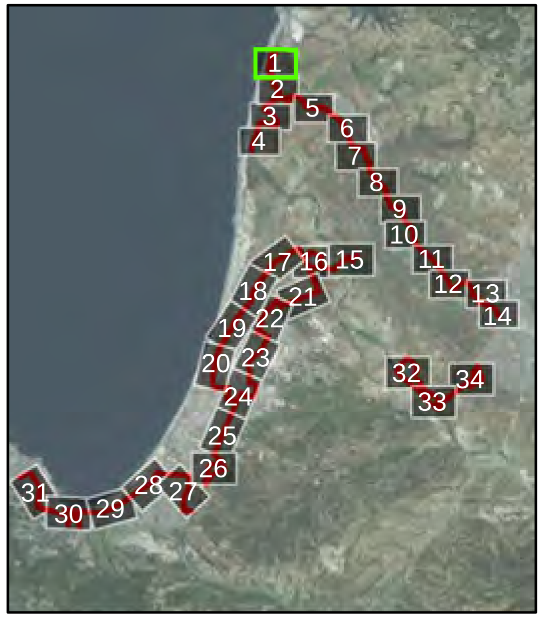




- Aquatic*
- Coastal Scrub
- Dune Scrub*
- Emergent Wetland*
- Eucalyptus Grove
- Maritime Chaparral*
- Non-native Grassland
- Oak Woodland
- Riparian*
- Ruderal/Developed/Active Agriculture
- Salt Marsh Wetland*
- Wastewater Ponds
- Biological Project Study Area

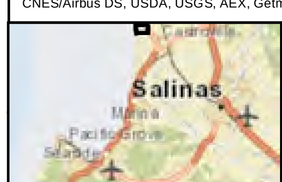
* Sensitive Habitat

0 135 270 540
Feet

0 45 90 180
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,

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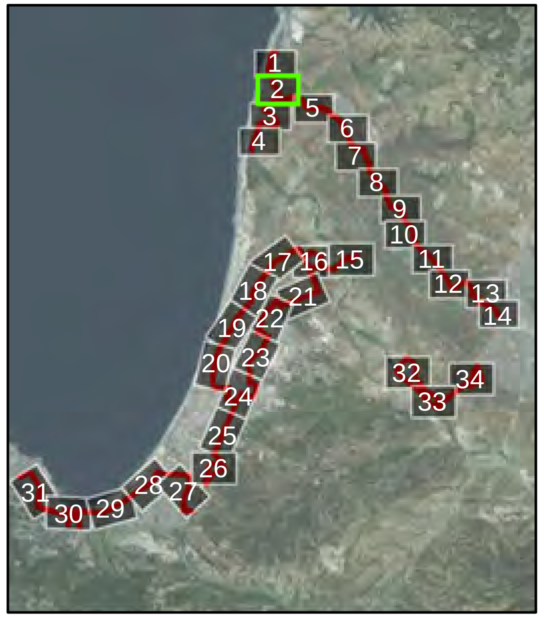


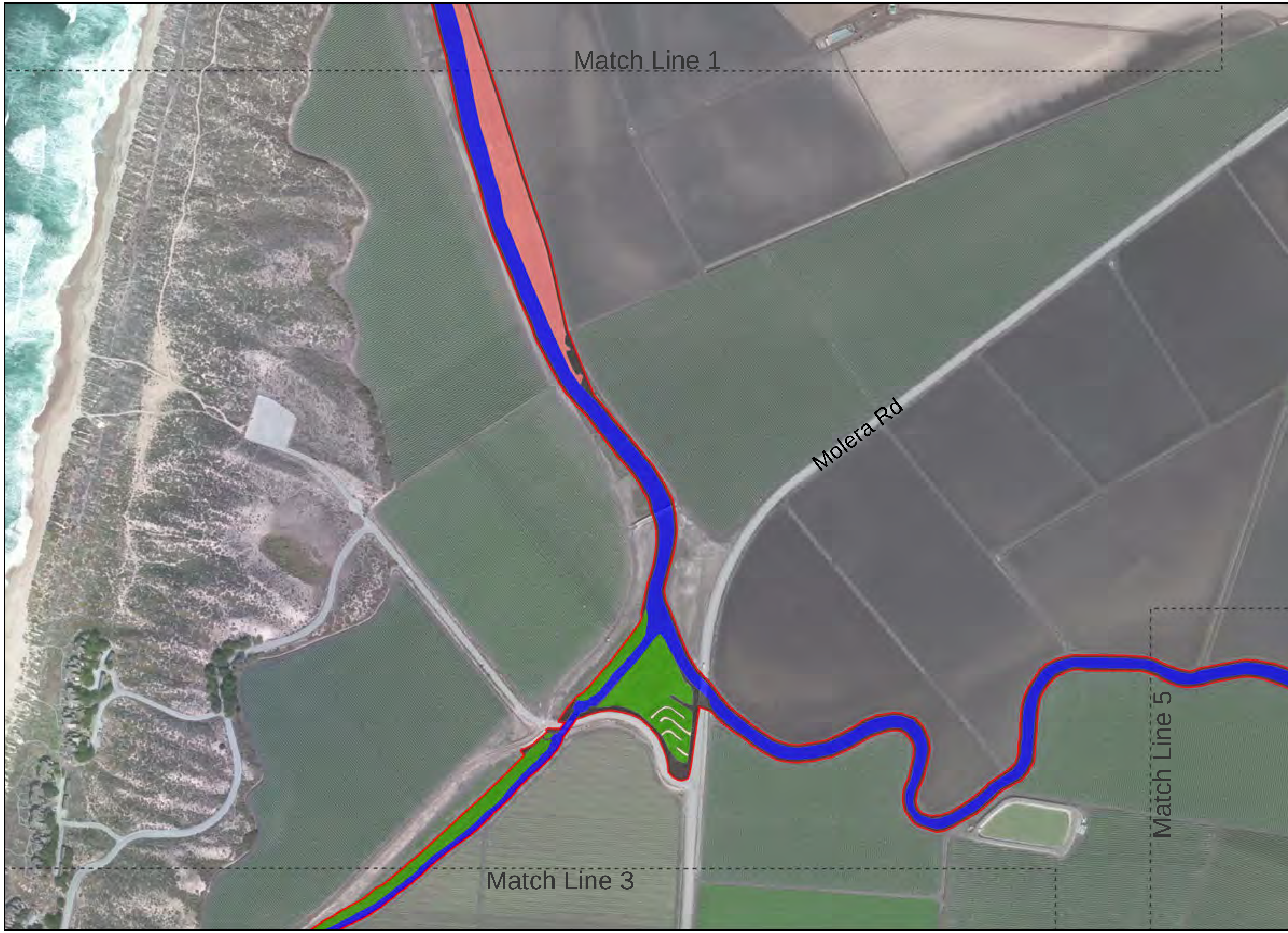


- Aquatic*
- Coastal Scrub
- Dune Scrub*
- Emergent Wetland*
- Eucalyptus Grove
- Maritime Chaparral*
- Non-native Grassland
- Oak Woodland
- Riparian*
- Ruderal/Developed/Active Agriculture
- Salt Marsh Wetland*
- Wastewater Ponds
- Biological Project Study Area

* Sensitive Habitat

0 135 270 540
Feet
0 45 90 180
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,


Title: Habitat Classsification Within GWR PIA - 2

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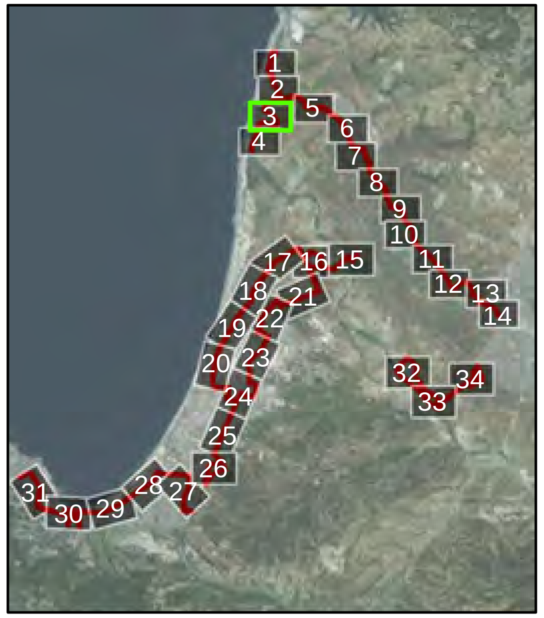




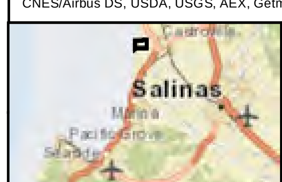
| | |
|---|---|
| Aquatic* | |
| Coastal Scrub | |
| Dune Scrub* | |
| Emergent Wetland* | |
| Eucalyptus Grove | |
| Maritime Chaparral* | |
| Non-native Grassland | |
| Oak Woodland | |
| Riparian* | |
| Ruderal/Developed/Active Agriculture | |
| Salt Marsh Wetland* | |
| Wastewater Ponds | |
| Biological Project Study Area | |

* Sensitive Habitat

0 135 270 540
Feet
0 45 90 180
Meters

N



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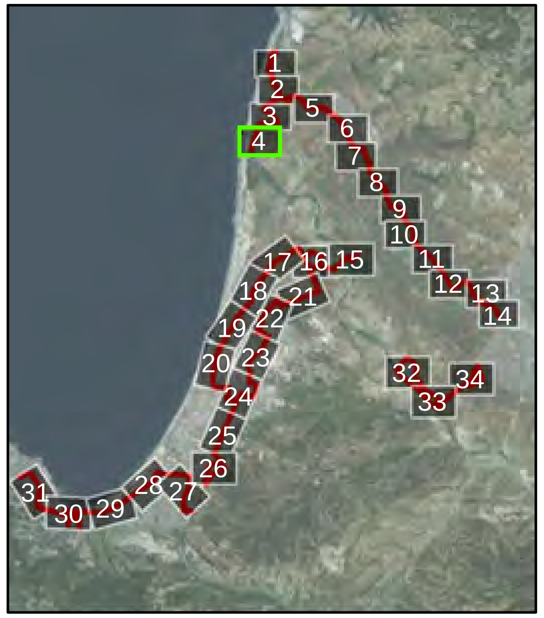




- Aquatic*
- Coastal Scrub
- Dune Scrub*
- Emergent Wetland*
- Eucalyptus Grove
- Maritime Chaparral*
- Non-native Grassland
- Oak Woodland
- Riparian*
- Ruderal/Developed/Active Agriculture
- Salt Marsh Wetland*
- Wastewater Ponds
- Biological Project Study Area

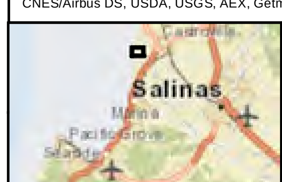
* Sensitive Habitat

0 135 270 540
Feet

0 45 90 180
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,

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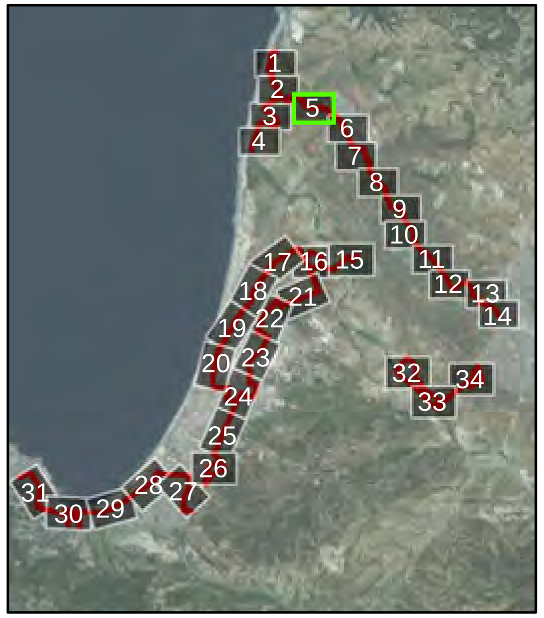


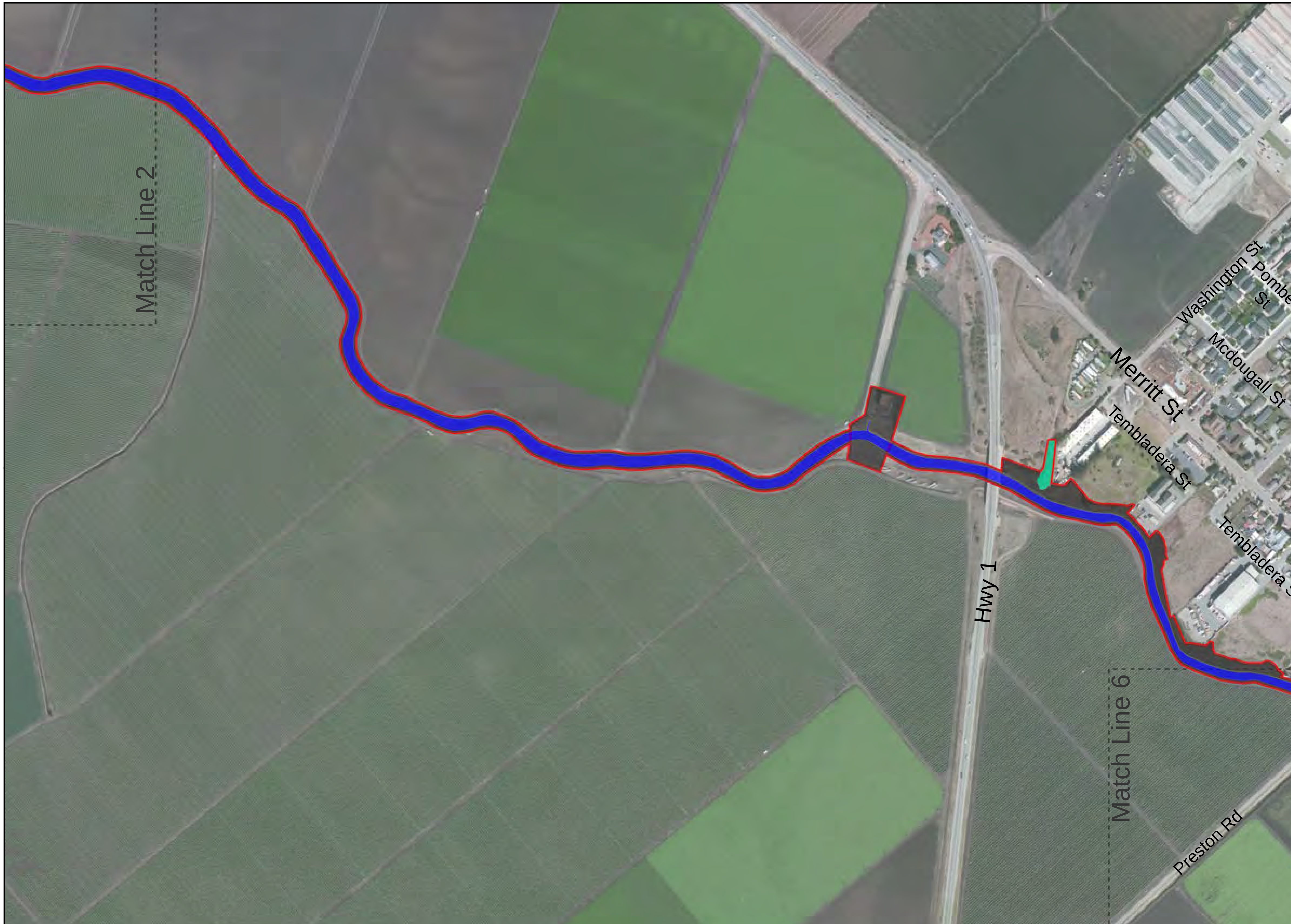

- Aquatic*
- Coastal Scrub
- Dune Scrub*
- Emergent Wetland*
- Eucalyptus Grove
- Maritime Chaparral*
- Non-native Grassland
- Oak Woodland
- Riparian*
- Ruderal/Developed/Active Agriculture
- Salt Marsh Wetland*
- Wastewater Ponds
- Biological Project Study Area

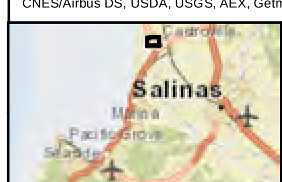
* Sensitive Habitat

0 135 270 540
Feet
0 45 90 180
Meters

N



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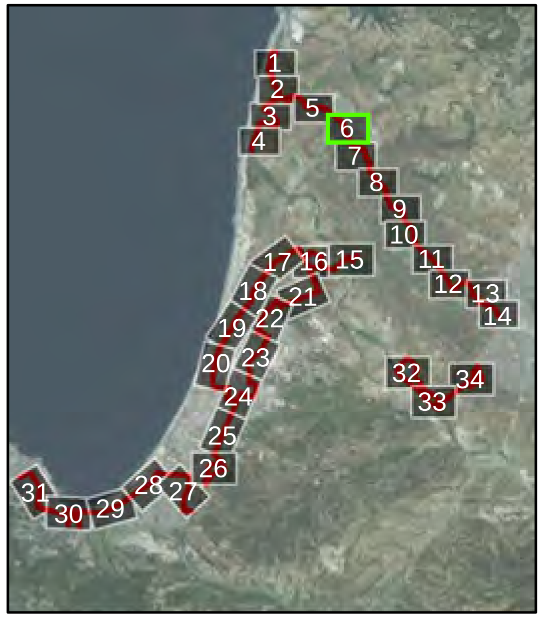


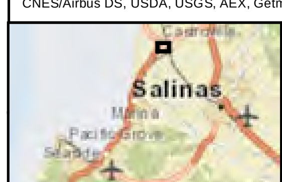

Aquatic*
Coastal Scrub
Dune Scrub*
Emergent Wetland*
Eucalyptus Grove
Maritime Chaparral*
Non-native Grassland
Oak Woodland
Riparian*
Ruderal/Developed/Active Agriculture
Salt Marsh Wetland*
Wastewater Ponds
Biological Project Study Area

* Sensitive Habitat

0 135 270 540
Feet
0 45 90 180
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,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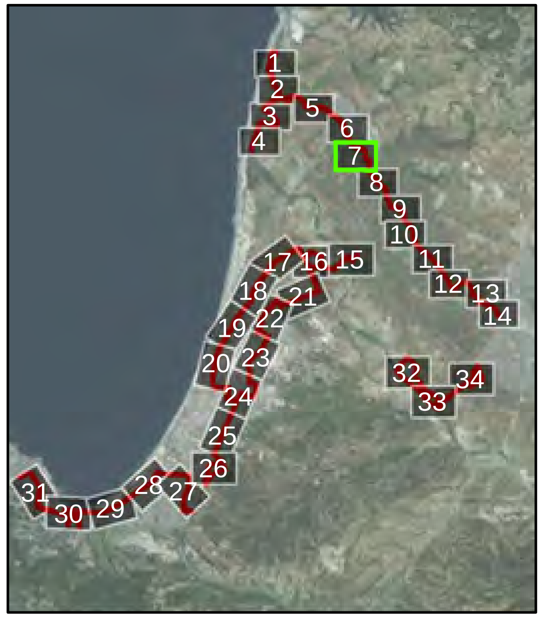


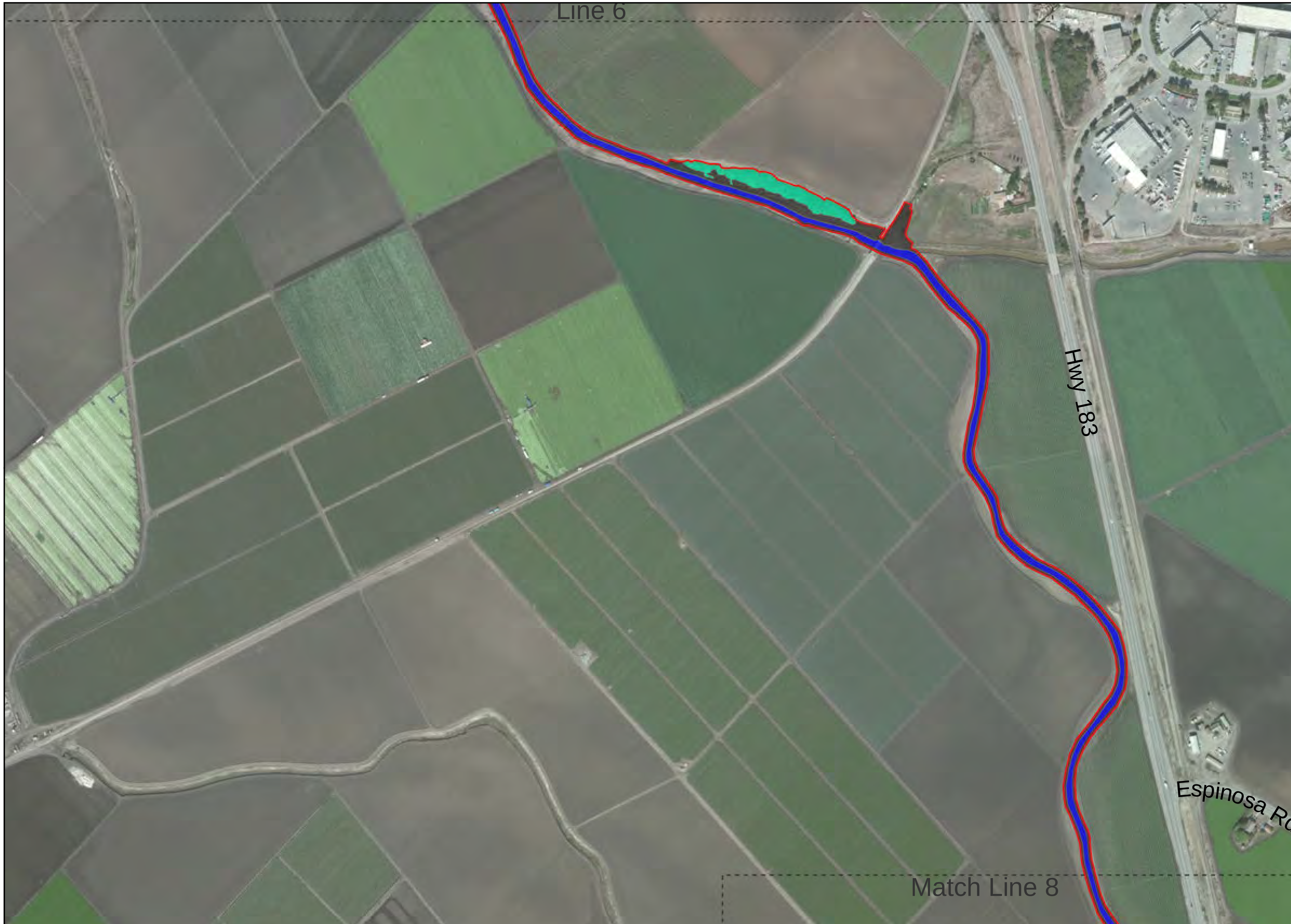

Aquatic*
Coastal Scrub
Dune Scrub*
Emergent Wetland*
Eucalyptus Grove
Maritime Chaparral*
Non-native Grassland
Oak Woodland
Riparian*
Ruderal/Developed/Active Agriculture
Salt Marsh Wetland*
Wastewater Ponds
Biological Project Study Area

* Sensitive Habitat

0 135 270 540
Feet
0 45 90 180
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,





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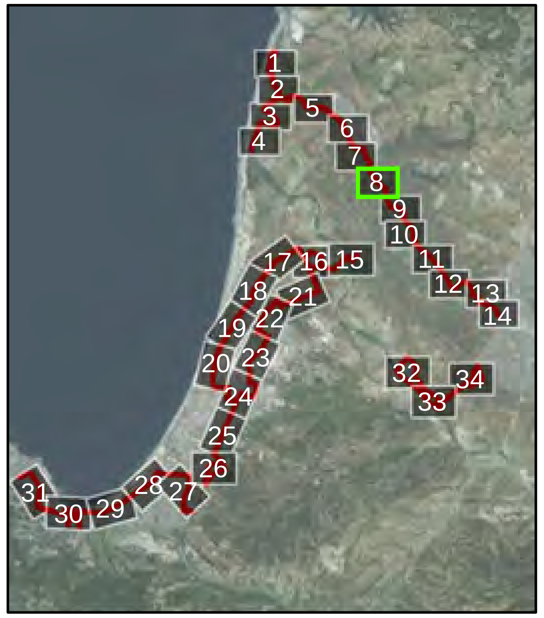


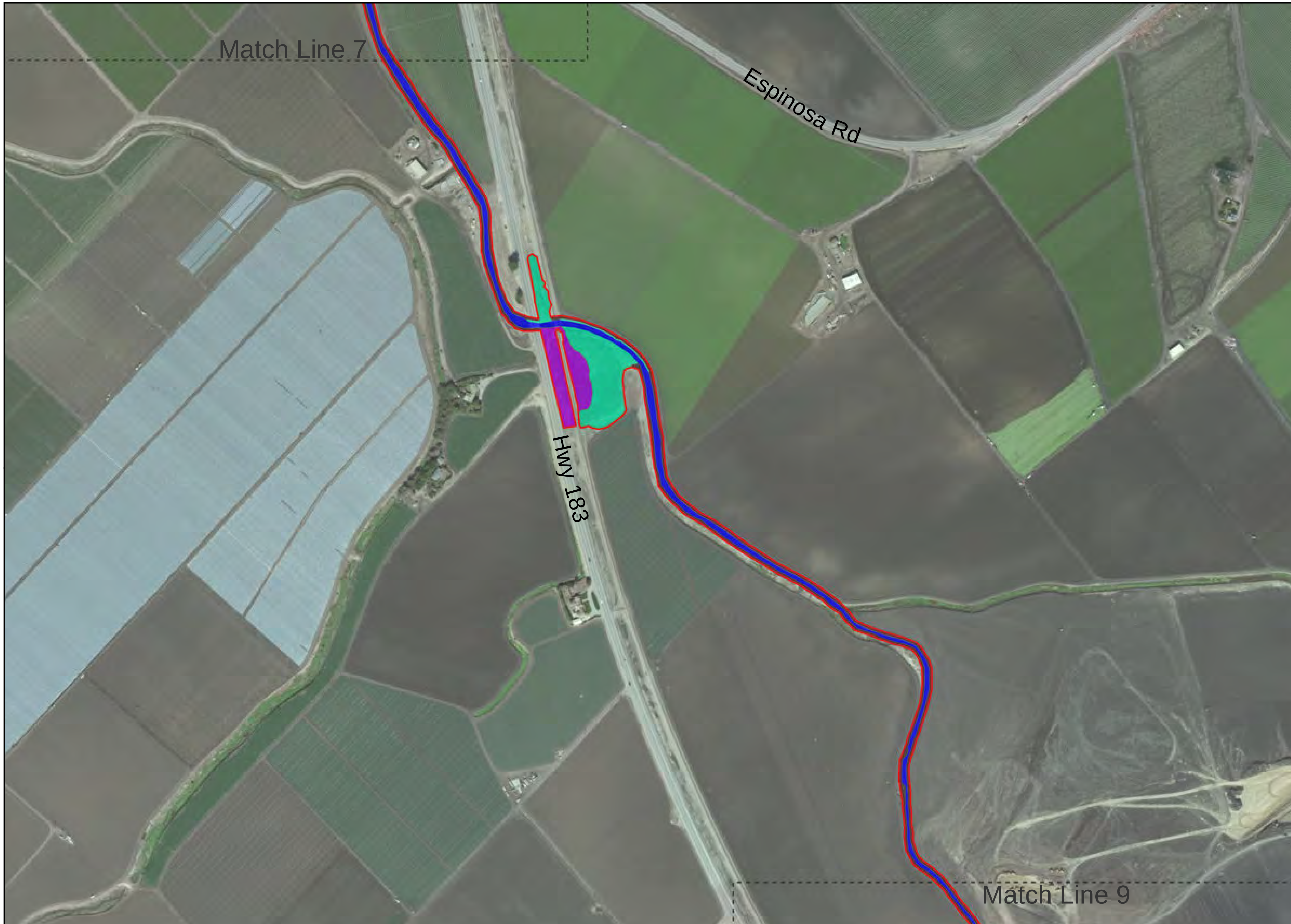


- Aquatic*
- Coastal Scrub
- Dune Scrub*
- Emergent Wetland*
- Eucalyptus Grove
- Maritime Chaparral*
- Non-native Grassland
- Oak Woodland
- Riparian*
- Ruderal/Developed/Active Agriculture
- Salt Marsh Wetland*
- Wastewater Ponds
- Biological Project Study Area

* Sensitive Habitat

0 135 270 540
Feet
0 45 90 180
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,


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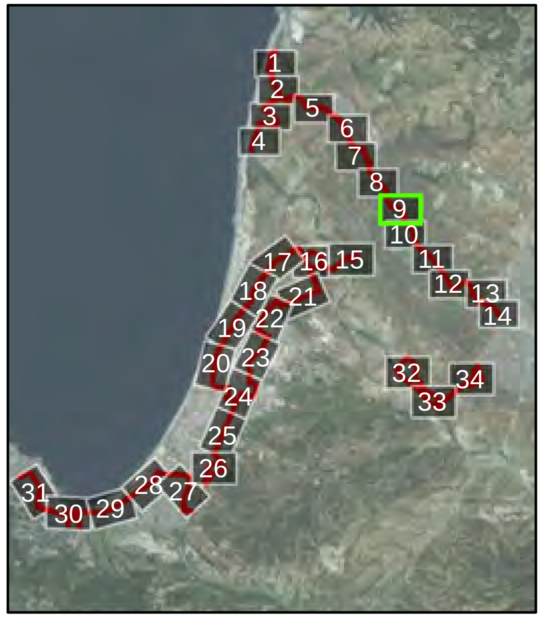


Aquatic*
Coastal Scrub
Dune Scrub*
Emergent Wetland*
Eucalyptus Grove
Maritime Chaparral*
Non-native Grassland
Oak Woodland
Riparian*
Ruderal/Developed/Active Agriculture
Salt Marsh Wetland*
Wastewater Ponds
Biological Project Study Area

* Sensitive Habitat

0 135 270 540
Feet
0 45 90 180
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,



Title: Habitat Classsification Within GWR PIA - 9

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Date: 3/23/2015

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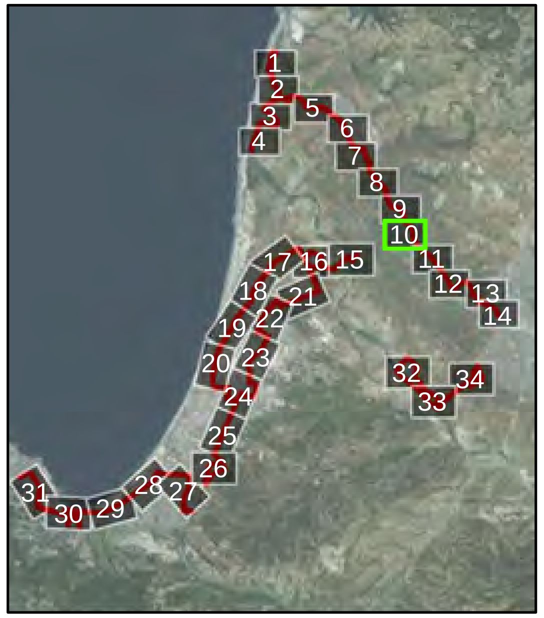



- Aquatic*
- Coastal Scrub
- Dune Scrub*
- Emergent Wetland*
- Eucalyptus Grove
- Maritime Chaparral*
- Non-native Grassland
- Oak Woodland
- Riparian*
- Ruderal/Developed/Active Agriculture
- Salt Marsh Wetland*
- Wastewater Ponds
- Biological Project Study Area

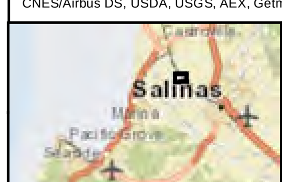
* Sensitive Habitat

0 135 270 540
Feet

0 45 90 180
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,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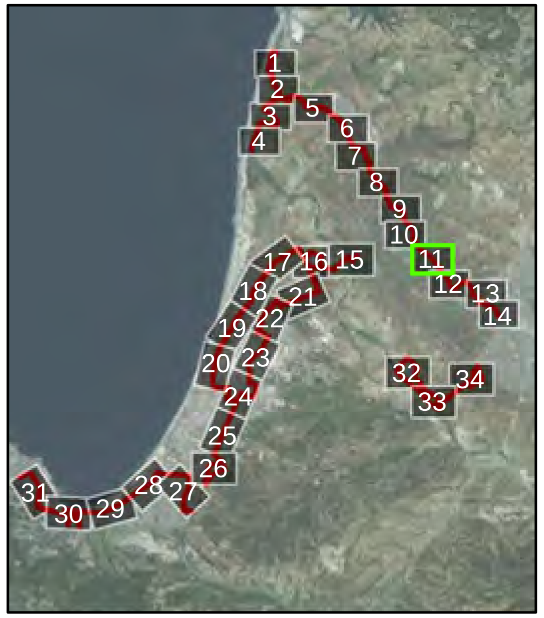




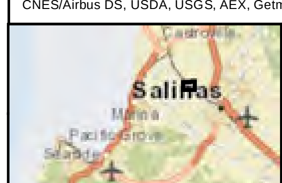
- Aquatic*
- Coastal Scrub
- Dune Scrub*
- Emergent Wetland*
- Eucalyptus Grove
- Maritime Chaparral*
- Non-native Grassland
- Oak Woodland
- Riparian*
- Ruderal/Developed/Active Agriculture
- Salt Marsh Wetland*
- Wastewater Ponds
- Biological Project Study Area

* Sensitive Habitat

0 135 270 540
Feet
0 45 90 180
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,




Title: Habitat Classsification Within GWR PIA - 11

File: C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Habitat Booklet 20150323a.mxd

Date: 3/23/2015

Scale: 1 in = 480 feet

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Environmental Consultants Resource Planners
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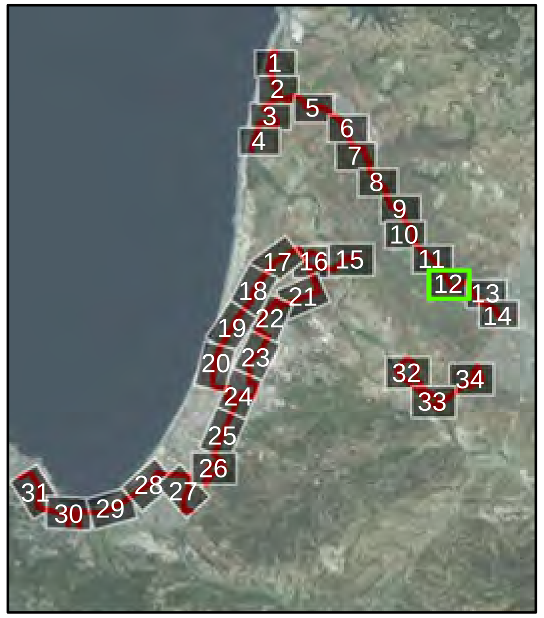
Monterey, CA 93940
(831) 373-4341



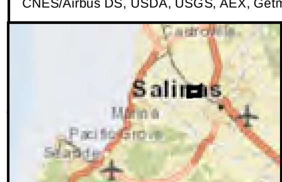

- Aquatic*
- Coastal Scrub
- Dune Scrub*
- Emergent Wetland*
- Eucalyptus Grove
- Maritime Chaparral*
- Non-native Grassland
- Oak Woodland
- Riparian*
- Ruderal/Developed/Active Agriculture
- Salt Marsh Wetland*
- Wastewater Ponds
- Biological Project Study Area

* Sensitive Habitat

0 135 270 540
Feet
0 45 90 180
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,


Title: Habitat Classsification Within GWR PIA - 12

File: C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Habitat Booklet 20150323a.mxd

Date: 3/23/2015

Scale: 1 in = 480 feet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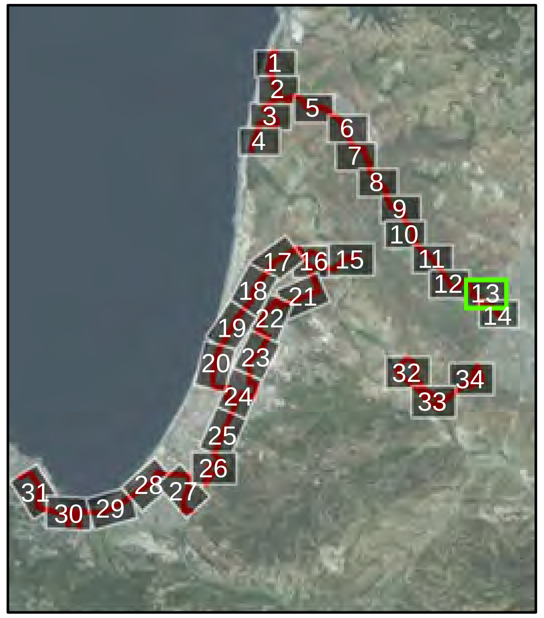


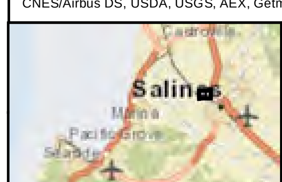

Aquatic*
Coastal Scrub
Dune Scrub*
Emergent Wetland*
Eucalyptus Grove
Maritime Chaparral*
Non-native Grassland
Oak Woodland
Riparian*
Ruderal/Developed/Active Agriculture
Salt Marsh Wetland*
Wastewater Ponds
Biological Project Study Area

* Sensitive Habitat

0 135 270 540
Feet
0 45 90 180
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,


Title: Habitat Classsification Within GWR PIA - 13

File: C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Habitat Booklet 20150323a.mxd

Date: 3/23/2015

Scale: 1 in = 480 feet

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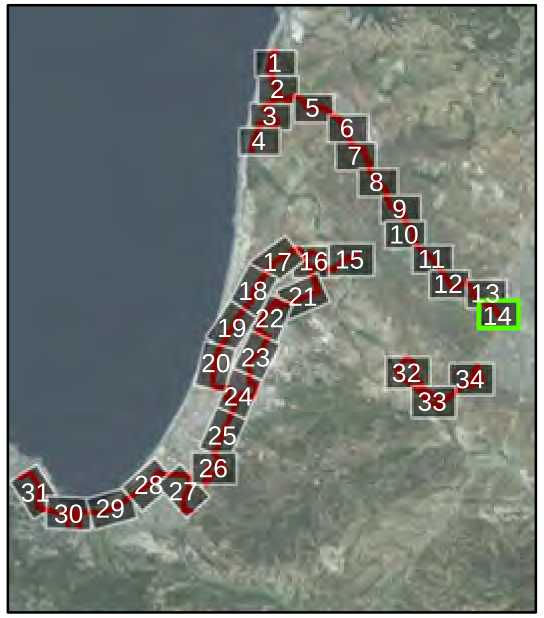




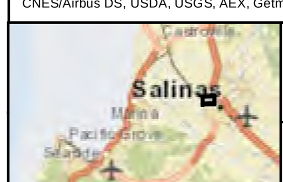
- Aquatic*
- Coastal Scrub
- Dune Scrub*
- Emergent Wetland*
- Eucalyptus Grove
- Maritime Chaparral*
- Non-native Grassland
- Oak Woodland
- Riparian*
- Ruderal/Developed/Active Agriculture
- Salt Marsh Wetland*
- Wastewater Ponds
- Biological Project Study Area

* Sensitive Habitat

0 135 270 540
Feet
0 45 90 180
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,




Title: Habitat Classsification Within GWR PIA - 14

File: C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Habitat Booklet 20150323a.mxd

Date: 3/23/2015

Scale: 1 in = 480 feet

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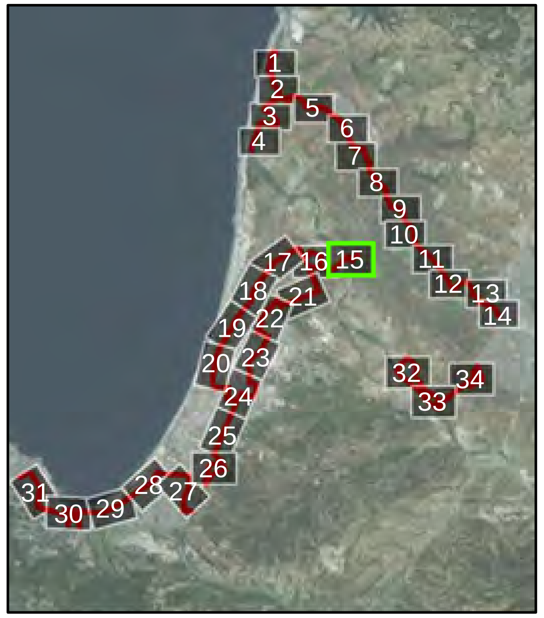




- Aquatic*
- Coastal Scrub
- Dune Scrub*
- Emergent Wetland*
- Eucalyptus Grove
- Maritime Chaparral*
- Non-native Grassland
- Oak Woodland
- Riparian*
- Ruderal/Developed/Active Agriculture
- Salt Marsh Wetland*
- Wastewater Ponds
- Biological Project Study Area

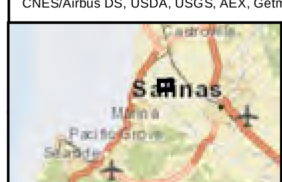
* Sensitive Habitat

0 245 490 980
Feet

0 85 170 340
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,




Title: Habitat Classsification Within GWR PIA - 15

File: C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Habitat Booklet 20150323a.mxd

Date: 3/23/2015

Scale: 1 in = 870 feet

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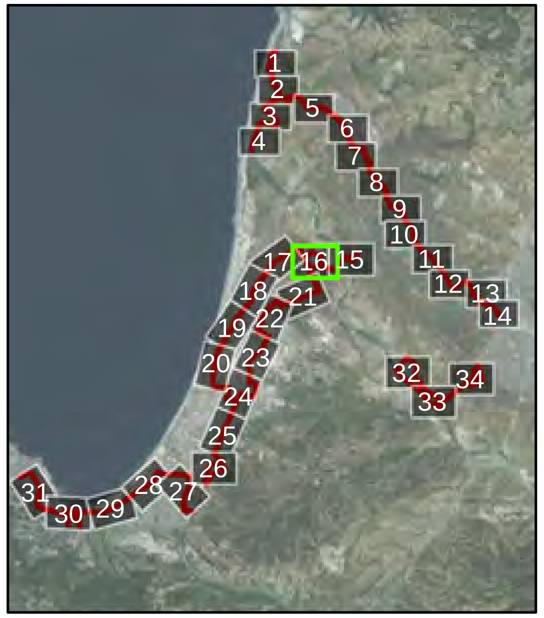


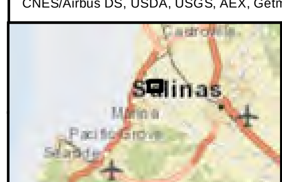

Aquatic*
Coastal Scrub
Dune Scrub*
Emergent Wetland*
Eucalyptus Grove
Maritime Chaparral*
Non-native Grassland
Oak Woodland
Riparian*
Ruderal/Developed/Active Agriculture
Salt Marsh Wetland*
Wastewater Ponds
Biological Project Study Area

* Sensitive Habitat

0 150 300 600
Feet
0 50 100 200
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,


Title: Habitat Classsification Within GWR PIA - 16

File: C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Habitat Booklet 20150323a.mxd

Date: 3/23/2015

Scale: 1 in = 540 feet

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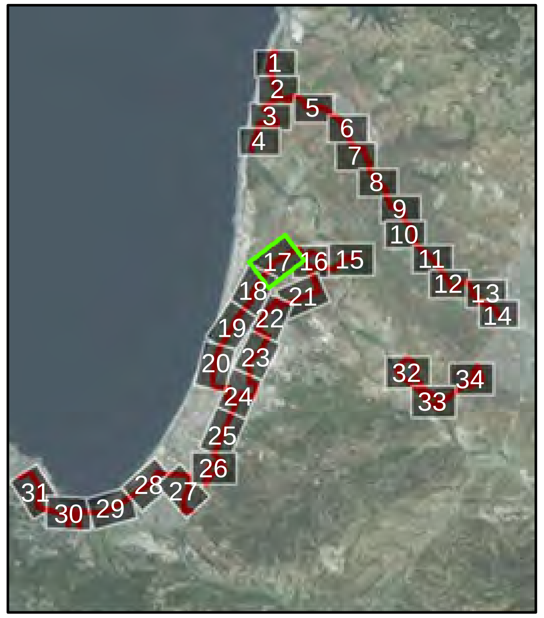


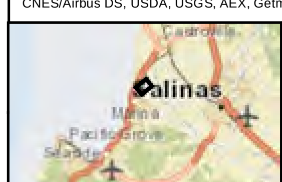

- Aquatic*
- Coastal Scrub
- Dune Scrub*
- Emergent Wetland*
- Eucalyptus Grove
- Maritime Chaparral*
- Non-native Grassland
- Oak Woodland
- Riparian*
- Ruderal/Developed/Active Agriculture
- Salt Marsh Wetland*
- Wastewater Ponds
- Biological Project Study Area

* Sensitive Habitat

0 150 300 600
Feet
0 50 100 200
Meters

N




Title: Habitat Classsification Within GWR PIA - 17

File: C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Habitat Booklet 20150323a.mxd

Date: 3/23/2015

Scale: 1 in = 530 feet

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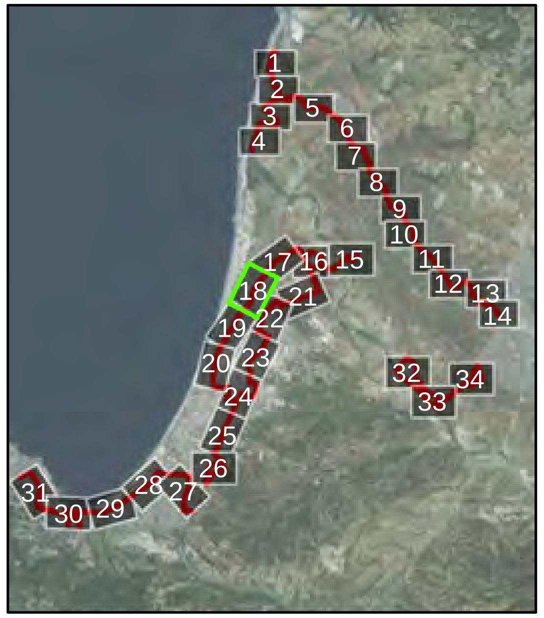




- Aquatic*
- Coastal Scrub
- Dune Scrub*
- Emergent Wetland*
- Eucalyptus Grove
- Maritime Chaparral*
- Non-native Grassland
- Oak Woodland
- Riparian*
- Ruderal/Developed/Active Agriculture
- Salt Marsh Wetland*
- Wastewater Ponds
- Biological Project Study Area

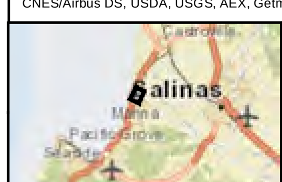
* Sensitive Habitat

0 150 300 600
Feet

0 50 100 200
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,




Title: Habitat Classsification Within GWR PIA - 18

File: C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Habitat Booklet 20150323a.mxd

Date: 3/23/2015

Scale: 1 in = 530 feet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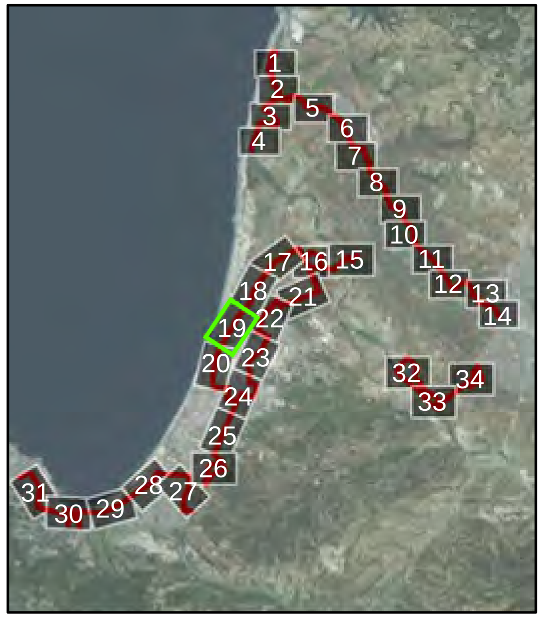


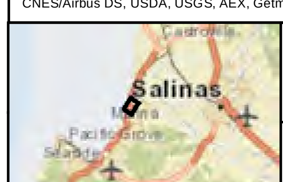

- Aquatic*
- Coastal Scrub
- Dune Scrub*
- Emergent Wetland*
- Eucalyptus Grove
- Maritime Chaparral*
- Non-native Grassland
- Oak Woodland
- Riparian*
- Ruderal/Developed/Active Agriculture
- Salt Marsh Wetland*
- Wastewater Ponds
- Biological Project Study Area

* Sensitive Habitat

0 150 300 600
Feet
0 50 100 200
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,


Title: Habitat Classsification Within GWR PIA - 19

File: C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Habitat Booklet 20150323a.mxd

Date: 3/23/2015

Scale: 1 in = 530 feet

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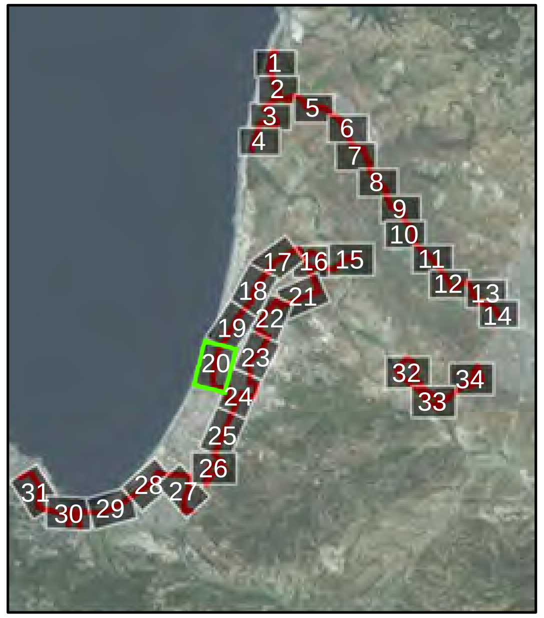




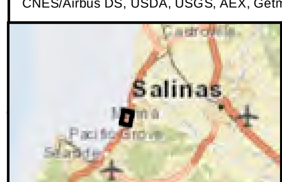
- Aquatic*
- Coastal Scrub
- Dune Scrub*
- Emergent Wetland*
- Eucalyptus Grove
- Maritime Chaparral*
- Non-native Grassland
- Oak Woodland
- Riparian*
- Ruderal/Developed/Active Agriculture
- Salt Marsh Wetland*
- Wastewater Ponds
- Biological Project Study Area

* Sensitive Habitat

0 150 300 600
Feet
0 50 100 200
Meters

N






Title: Habitat Classsification Within GWR PIA - 20

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Date: 3/23/2015

Scale: 1 in = 530 feet

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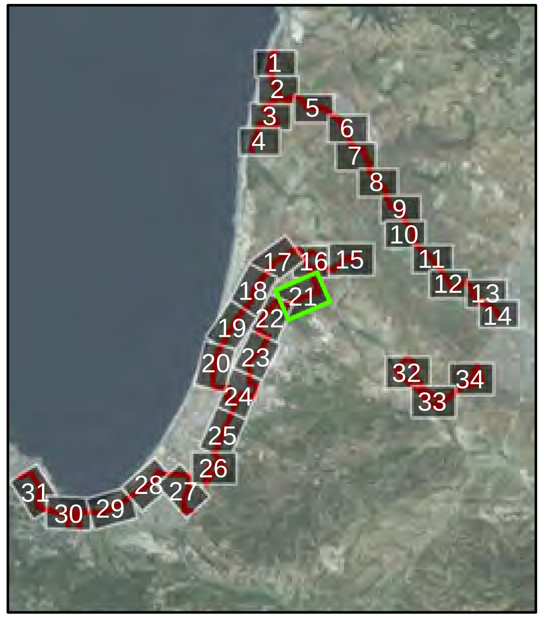



- Aquatic*
- Coastal Scrub
- Dune Scrub*
- Emergent Wetland*
- Eucalyptus Grove
- Maritime Chaparral*
- Non-native Grassland
- Oak Woodland
- Riparian*
- Ruderal/Developed/Active Agriculture
- Salt Marsh Wetland*
- Wastewater Ponds
- Biological Project Study Area

* Sensitive Habitat

0 150 300 600
Feet
0 50 100 200
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,


Title: Habitat Classsification Within GWR PIA - 21

File: C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Habitat Booklet 20150323a.mxd

Date: 3/23/2015

Scale: 1 in = 530 feet

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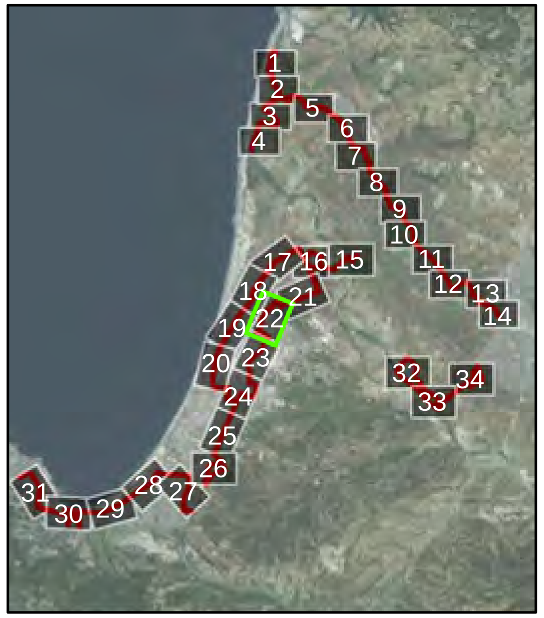




- Aquatic*
- Coastal Scrub
- Dune Scrub*
- Emergent Wetland*
- Eucalyptus Grove
- Maritime Chaparral*
- Non-native Grassland
- Oak Woodland
- Riparian*
- Ruderal/Developed/Active Agriculture
- Salt Marsh Wetland*
- Wastewater Ponds
- Biological Project Study Area

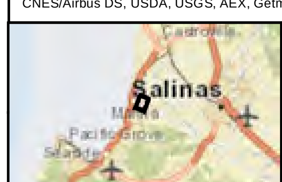
* Sensitive Habitat

0 150 300 600
Feet

0 50 100 200
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,




Title: Habitat Classsification Within GWR PIA - 22

File: C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Habitat Booklet 20150323a.mxd

Date: 3/23/2015

Scale: 1 in = 530 feet

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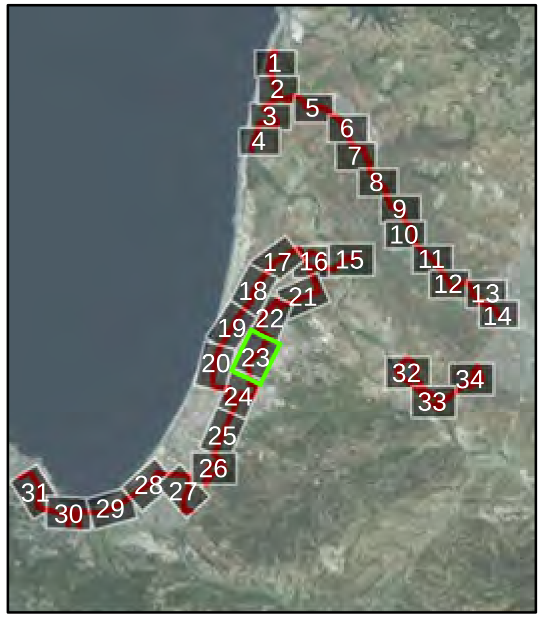


Aquatic*
Coastal Scrub
Dune Scrub*
Emergent Wetland*
Eucalyptus Grove
Maritime Chaparral*
Non-native Grassland
Oak Woodland
Riparian*
Ruderal/Developed/Active Agriculture
Salt Marsh Wetland*
Wastewater Ponds
Biological Project Study Area

* Sensitive Habitat

0 150 300 600
Feet
0 50 100 200
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,



Title: Habitat Classsification Within GWR PIA - 23

File: C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Habitat Booklet 20150323a.mxd

Date: 3/23/2015

Scale: 1 in = 530 feet

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Monterey, CA 93940
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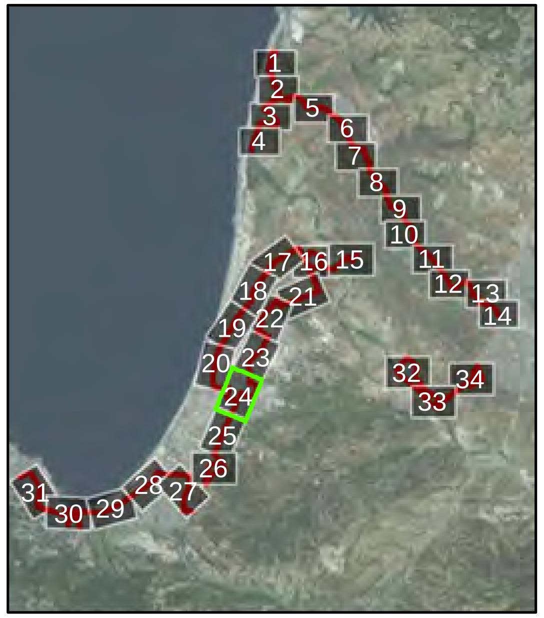


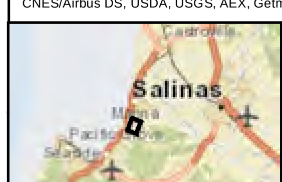

- Aquatic*
- Coastal Scrub
- Dune Scrub*
- Emergent Wetland*
- Eucalyptus Grove
- Maritime Chaparral*
- Non-native Grassland
- Oak Woodland
- Riparian*
- Ruderal/Developed/Active Agriculture
- Salt Marsh Wetland*
- Wastewater Ponds
- Biological Project Study Area

* Sensitive Habitat

0 150 300 600
Feet
0 50 100 200
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,


Title: Habitat Classsification Within GWR PIA - 24

File: C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Habitat Booklet 20150323a.mxd

Date: 3/23/2015

Scale: 1 in = 530 feet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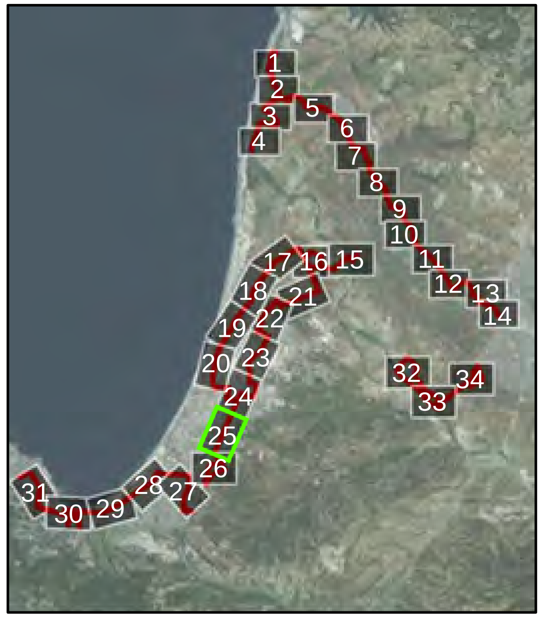
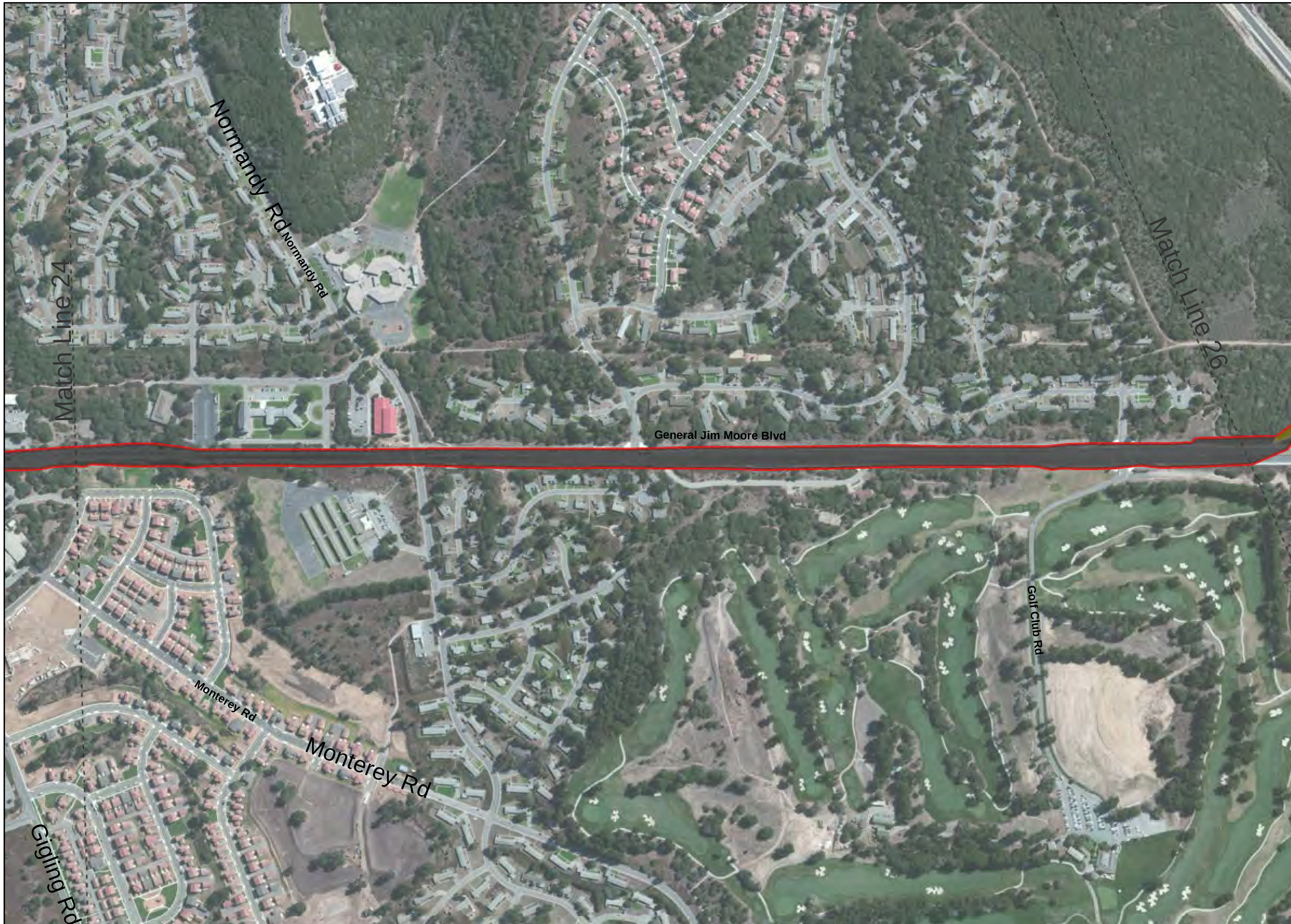


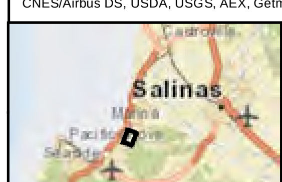

- Aquatic*
- Coastal Scrub
- Dune Scrub*
- Emergent Wetland*
- Eucalyptus Grove
- Maritime Chaparral*
- Non-native Grassland
- Oak Woodland
- Riparian*
- Ruderal/Developed/Active Agriculture
- Salt Marsh Wetland*
- Wastewater Ponds
- Biological Project Study Area

* Sensitive Habitat

0 150 300 600
Feet
0 50 100 200
Meters

N






Title: Habitat Classsification Within GWR PIA - 25

File: C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Habitat Booklet 20150323a.mxd

Date: 3/23/2015

Scale: 1 in = 530 feet

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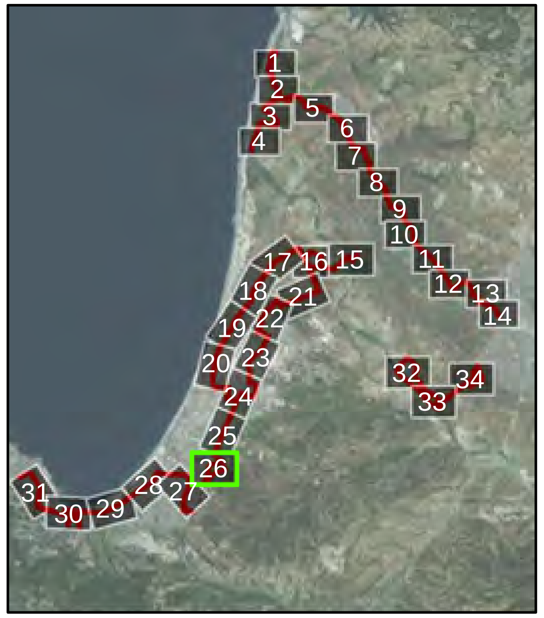


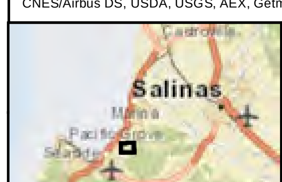

| | |
|---|---|
| | Aquatic* |
| | Coastal Scrub |
| | Dune Scrub* |
| | Emergent Wetland* |
| | Eucalyptus Grove |
| | Maritime Chaparral* |
| | Non-native Grassland |
| | Oak Woodland |
| | Riparian* |
| | Ruderal/Developed/Active Agriculture |
| | Salt Marsh Wetland* |
| | Wastewater Ponds |
| | Biological Project Study Area |

* Sensitive Habitat

0 150 300 600
Feet
0 50 100 200
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,


Title: Habitat Classsification Within GWR PIA - 26

File: C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Habitat Booklet 20150323a.mxd

Date: 3/23/2015

Scale: 1 in = 530 feet

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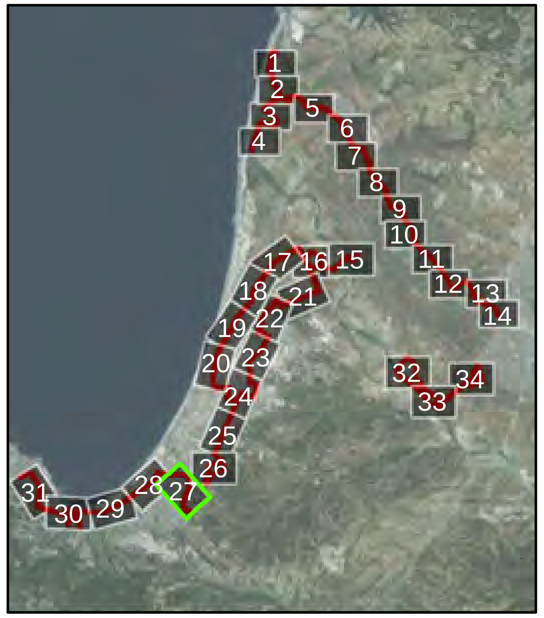
(831) 373-4341



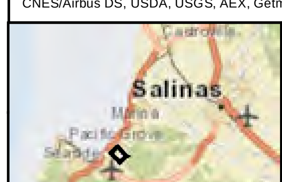

Aquatic*
Coastal Scrub
Dune Scrub*
Emergent Wetland*
Eucalyptus Grove
Maritime Chaparral*
Non-native Grassland
Oak Woodland
Riparian*
Ruderal/Developed/Active Agriculture
Salt Marsh Wetland*
Wastewater Ponds
Biological Project Study Area

* Sensitive Habitat

0 150 300 600
Feet
0 50 100 200
Meters

N

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo,


Title: Habitat Classsification Within GWR PIA - 27

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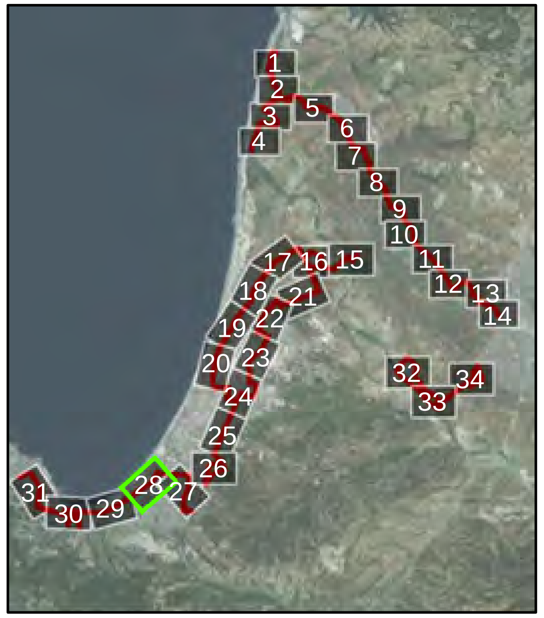



- Aquatic*
- Coastal Scrub
- Dune Scrub*
- Emergent Wetland*
- Eucalyptus Grove
- Maritime Chaparral*
- Non-native Grassland
- Oak Woodland
- Riparian*
- Ruderal/Developed/Active Agriculture
- Salt Marsh Wetland*
- Wastewater Ponds
- Biological Project Study Area

* Sensitive Habitat

0 150 300 600
Feet

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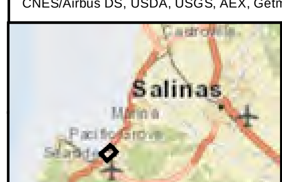


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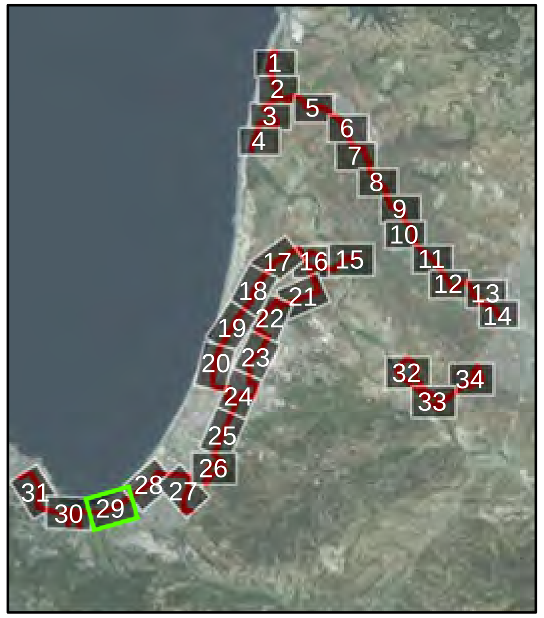


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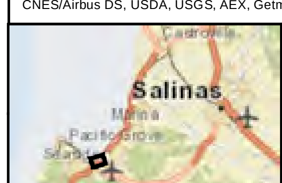


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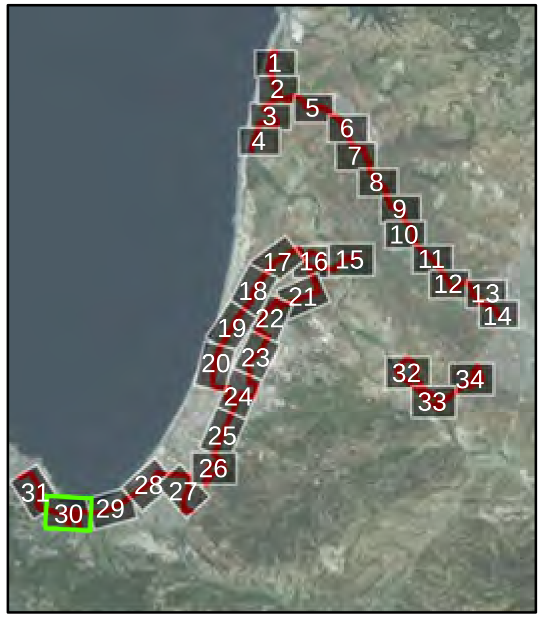



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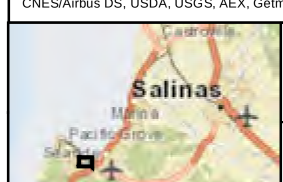


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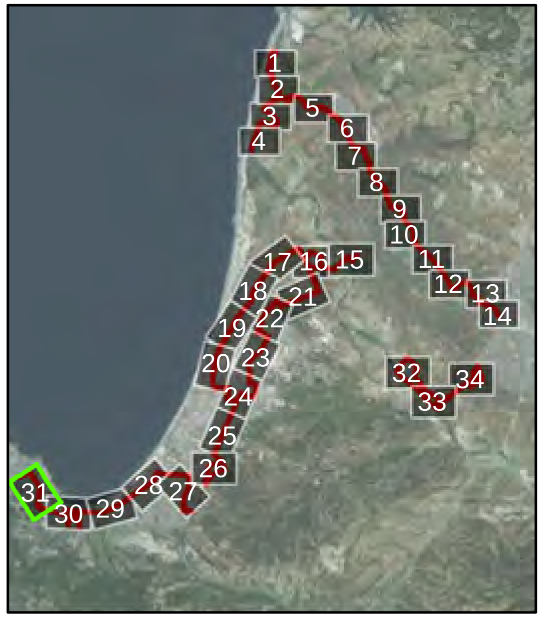


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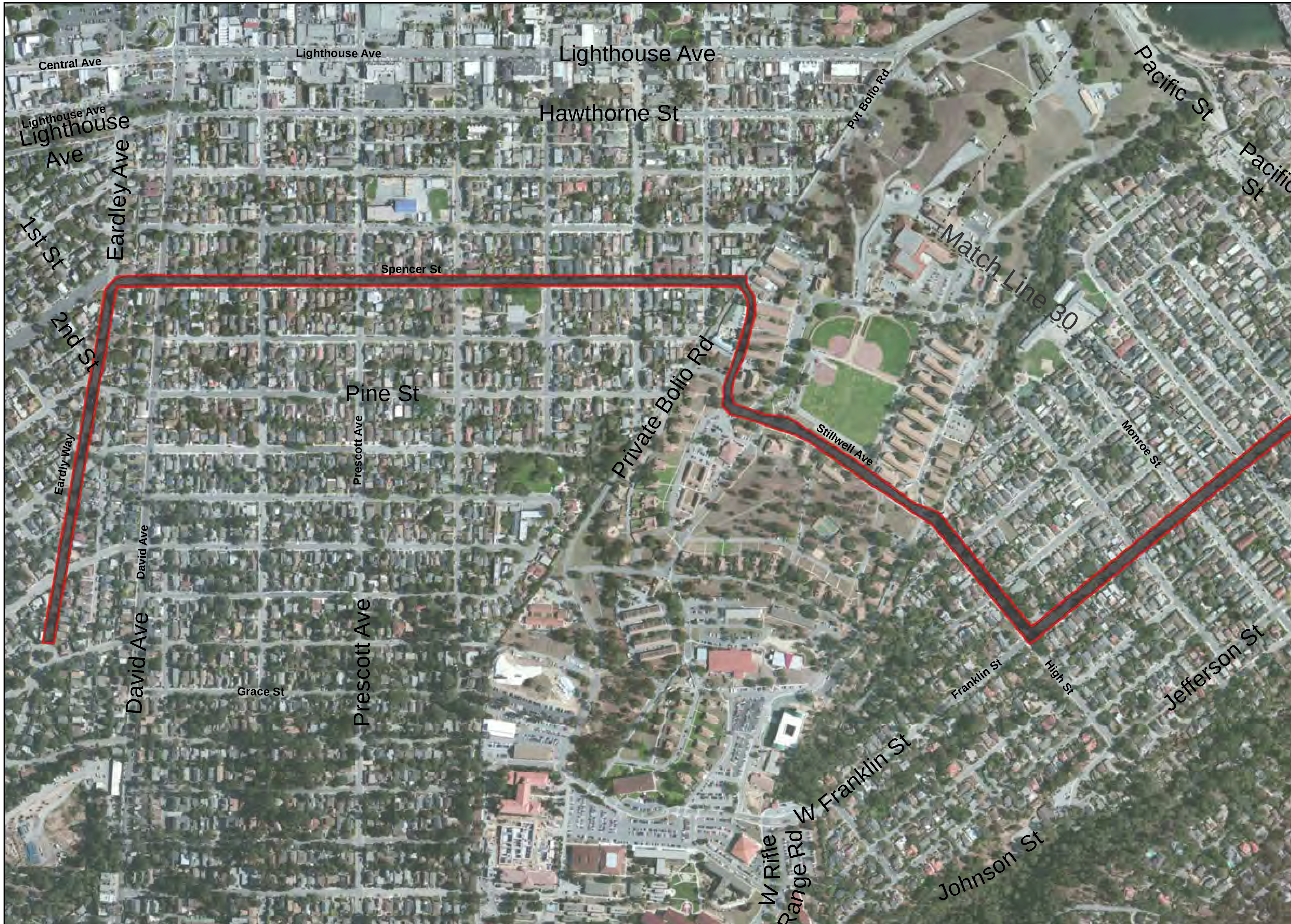


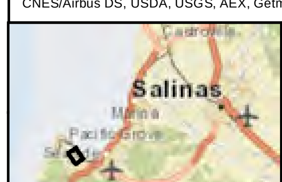


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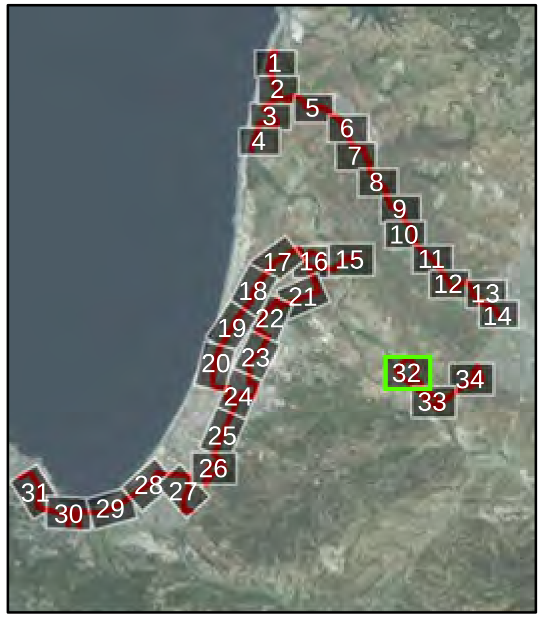


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- Wastewater Ponds
- Biological Project Study Area

* Sensitive Habitat

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Feet

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Meters

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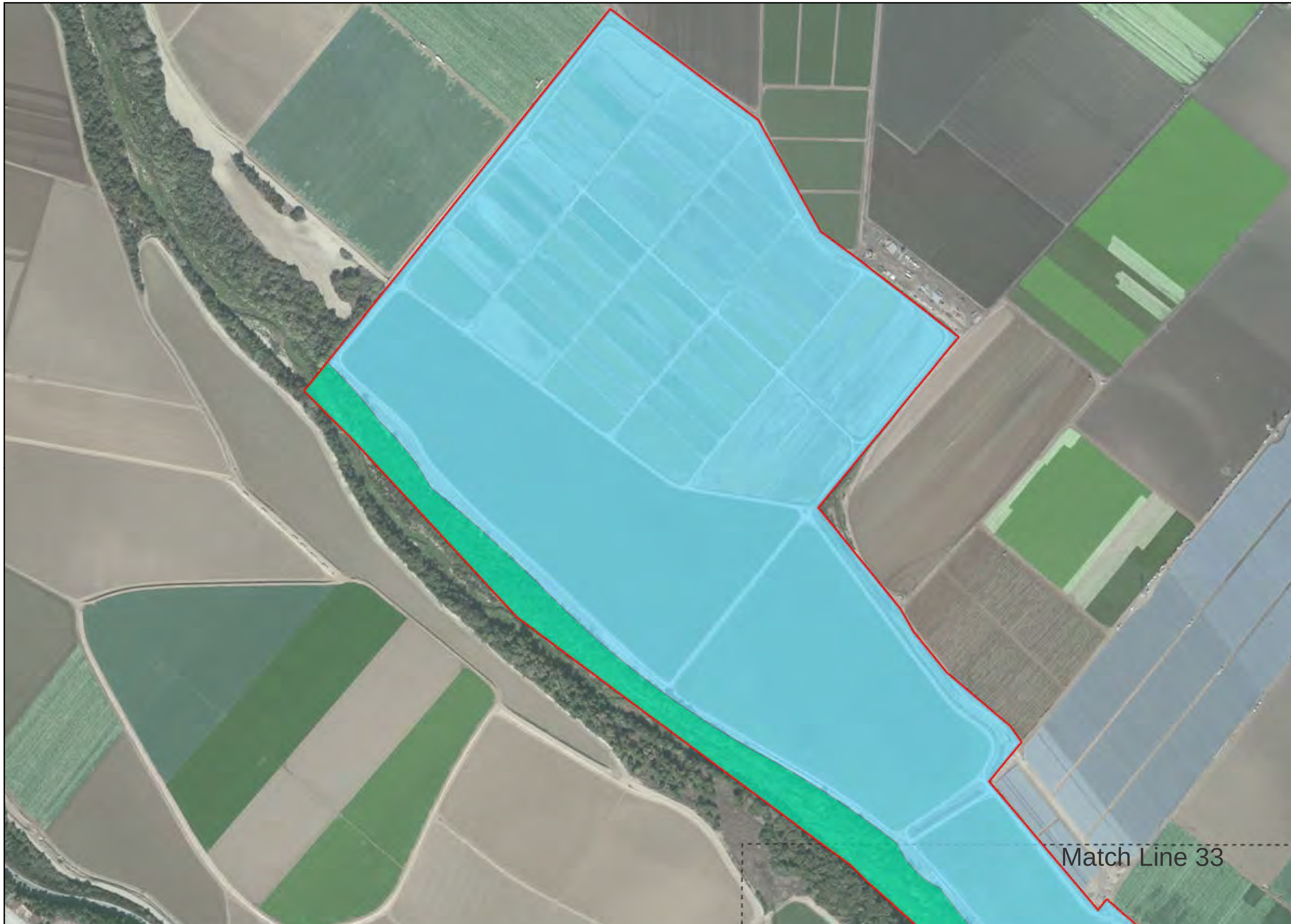


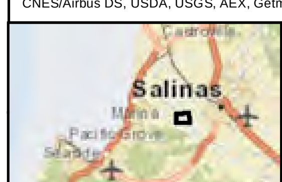


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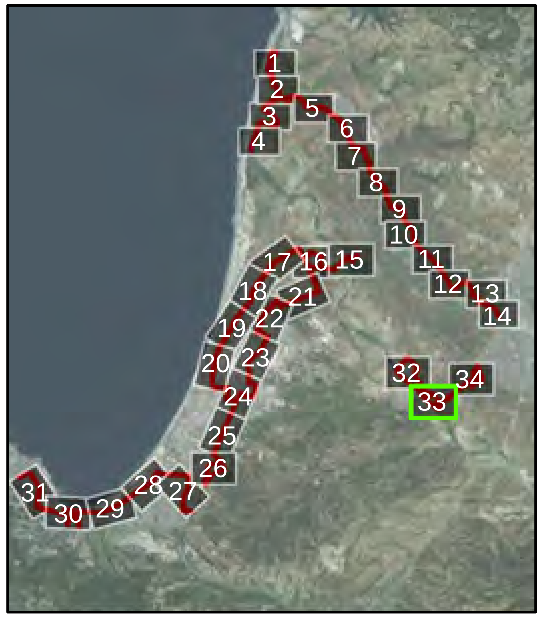


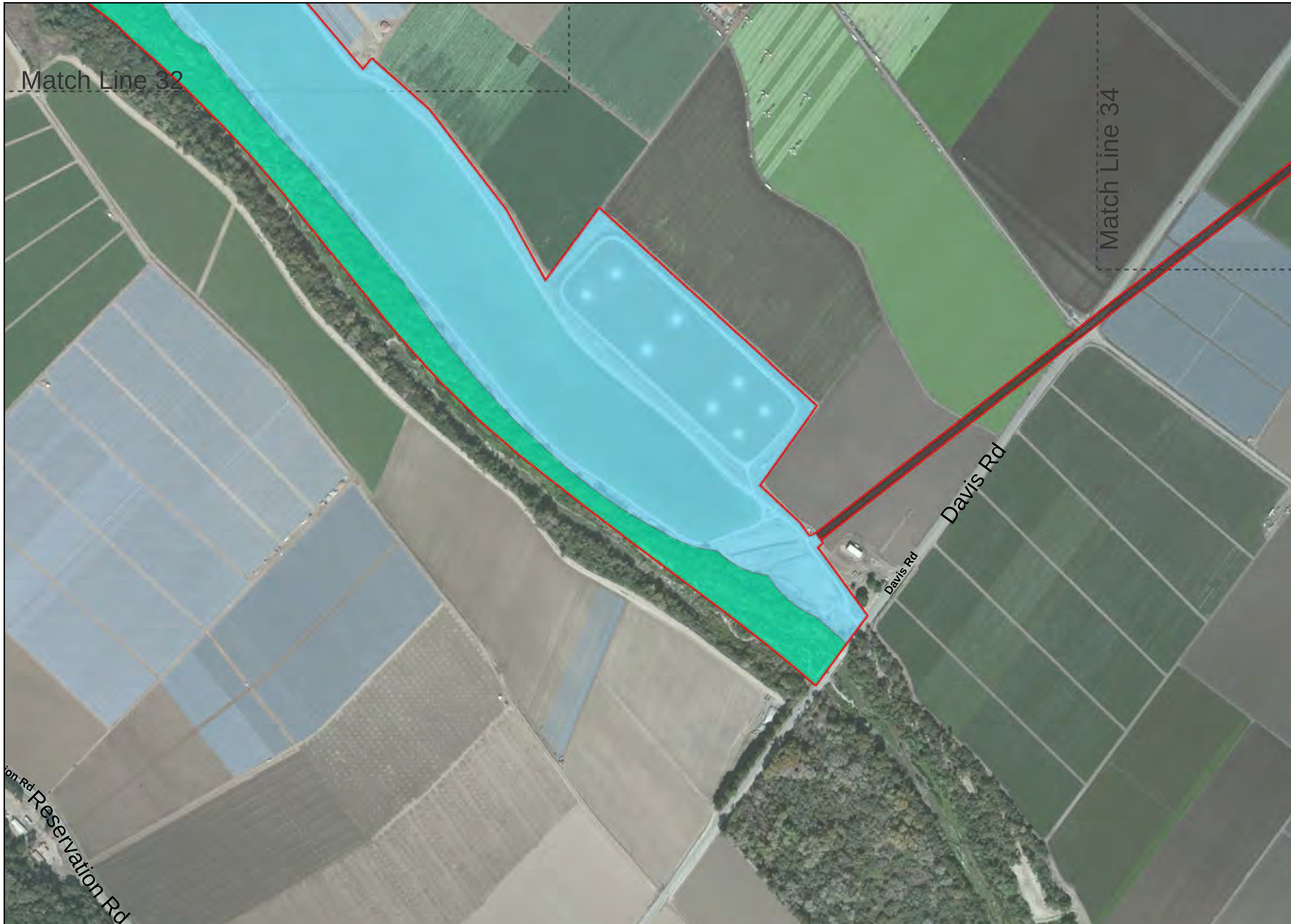


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- Salt Marsh Wetland*
- Wastewater Ponds
- Biological Project Study Area

* Sensitive Habitat

0 150 300 600
Feet
0 50 100 200
Meters

N

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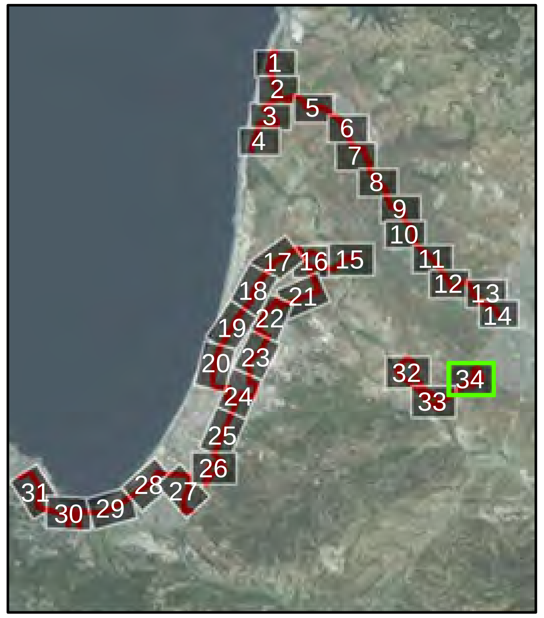


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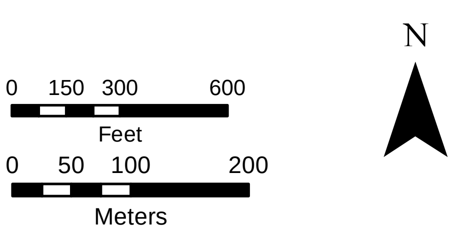


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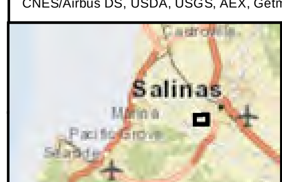


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# Appendix I

# Delineation of Potential Jurisdictional Wetlands and Other Waters Under Section 404 of the Clean Water Act and the California Coastal Act

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# PURE WATER MONTEREY GROUNDWATER REPLENISHMENT PROJECT

## Delineation of Potential Jurisdictional Wetlands and Other Waters Under Section 404 of the Clean Water Act and the California Coastal Act

**February 2015**


**Prepared for:**

**Monterey Regional Water Pollution Control Agency (MRWPCA)**
5 Harris Court, Bldg. D
Monterey, CA 93940

MRWPCA

**Prepared by:**

**Denise Duffy & Associates, Inc.**
**Contact: Matt Johnson**
947 Cass Street, Suite 5
Monterey, CA 93940

DD&A

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# 1 Introduction

## 1.1. Summary

The Proposed Pure Water Monterey Groundwater Replenishment Project (GWR Project) components, including the proposed water treatment plant, diversion and transmission pipelines, injection well locations, and potential staging areas, were evaluated to identify areas potentially supporting coastal wetlands, federal wetlands, and other waters. Six locations within the project area were identified as being within or adjacent to potentially jurisdictional wetlands: Reclamation Ditch Diversion site, Tembladero Slough Diversion site, Blanco Drain Diversion site, Locke Paddon Lake, Roberts Lake, and Lake El Estero Diversion site. In addition to the potential for direct impacts of the six locations, reaches downstream of the Reclamation Ditch and Tembladero Diversion sites were evaluated because the operation of the project has the potential to indirectly impact wetlands as a result of the proposed water diversion. This area is referred to as the "Ditch" throughout this report.

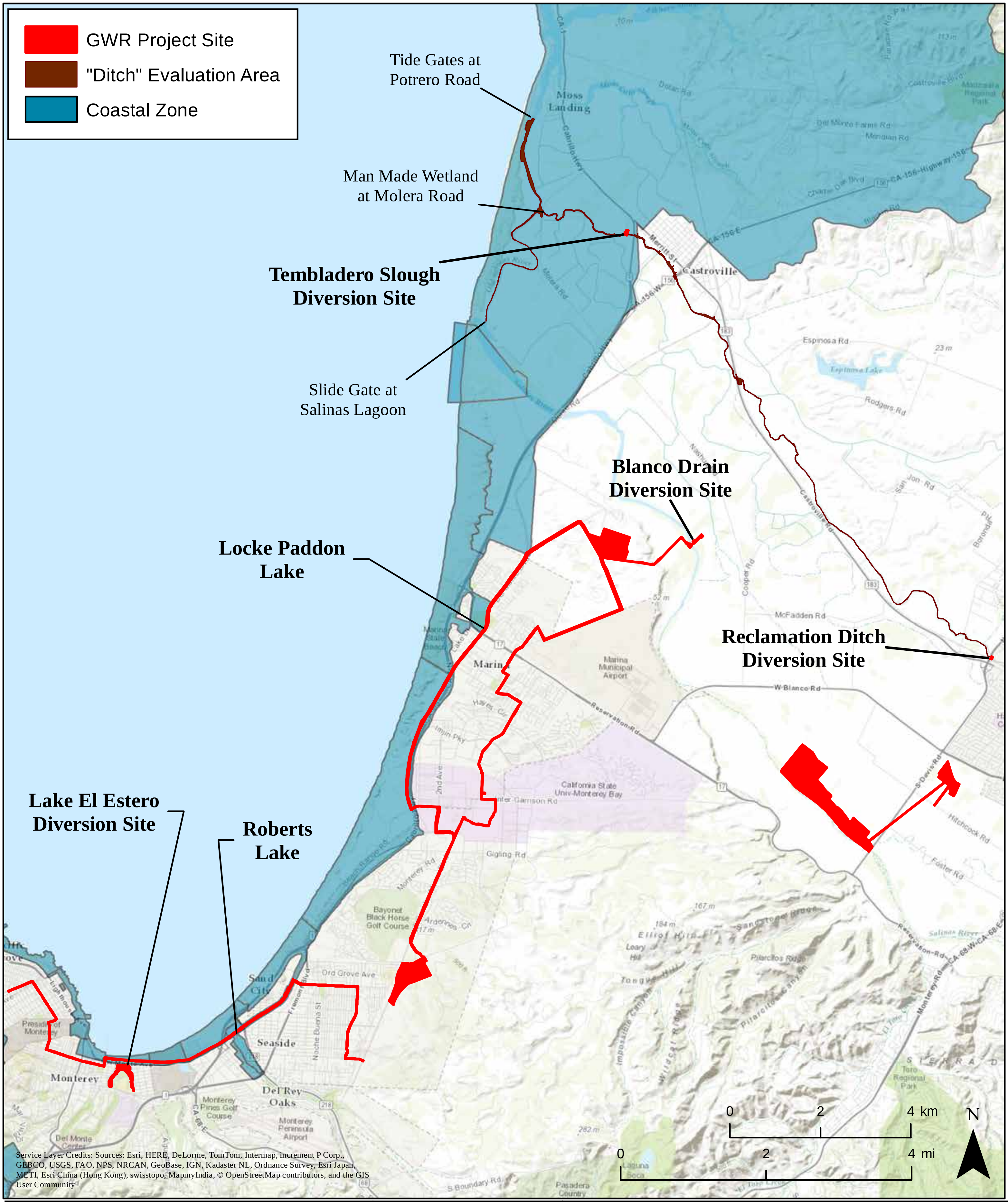
This wetland delineation was conducted in accordance with *The Field Guide for Wetland Delineation: 1987 Corps of Engineers Manual* (Wetland Training Institute, 2002) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (U.S. Army Corps of Engineers [ACOE], 2008) to identify the present of wetlands and other waters potentially under the jurisdiction of the ACOE and the California Coastal Commission (CCC). Wetlands and/or other waters were identified within five of the six locations and within the Ditch. Wetlands and other waters were not identified within the Lake El Estero Diversion site; however, wetlands and other waters observed within the adjacent Lake El Estero are identified within this report for reference. The following table summarizes the area of wetlands and other waters identified within the evaluation areas.

**Table 1-1: Wetlands and Other Waters in the Evaluation Area**

| **Evaluation Area** | *Potential Federal Wetland* | *Potential Coastal Wetland* | *Potential Other Waters of the U.S.* |
|---|---|---|---|
| *Reclamation Ditch Diversion* | 0 ac. | 0 ac. | 0.05 ac. |
| *Tembladero Slough Diversion* | 0 ac. | 0.01 ac. | 0.20 ac. |
| *Blanco Drain Diversion* | 0 ac. | 0 ac. | 0.30 ac. |
| *Locke Paddon Lake* | 0.26 ac. | 0.57 ac. | 0 ac. |
| *Roberts Lake* | 0.55 ac. | 0.57 ac. | 0.25 ac. |
| *Lake El Estero Diversion* | 0 ac. | 0 ac. | 0 ac. |
| *Ditch* | 14.48 ac. | 18.37 ac. | 51.15 ac. |

## 1.2. Project Description

This wetland delineation report was prepared for the GWR Project, located in Monterey County, California (**Figure 1**). The purpose of the GWR Project is to create a reliable source of water supply by taking highly-treated water from a new advanced water treatment plant, and injecting it into the Seaside Groundwater Basin (or Seaside Basin) using a series of shallow and deep injection wells. Once injected into the Seaside Basin, the treated water would mix with the existing groundwater in the aquifers and be stored for future use. Providing high quality replacement water to the Seaside Basin will allow California American Water Company (CalAm) to extract the same amount of water for delivery as it currently does to its customers in the Monterey District service area, while ceasing over-pumping of the Carmel River, as ordered by the state.




# Location Map

Date: 3/3/2015

Scale: 1 inch = 1.7 miles

Project: 2013-13

C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Combined Wetland Delineation Maps\Figure 1 Project Location (Combined).20150226.mxd

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Figure

1

The entire GWR Project, including the proposed water treatment plant, diversion and transmission pipelines, injection well locations, and potential staging areas, was evaluated to identify areas potentially supporting state or federal jurisdictional wetlands and other waters. Six locations within the project area were identified as being within or adjacent to potentially jurisdictional wetlands: Reclamation Ditch Diversion site, Tembladero Slough Diversion site, Blanco Drain Diversion site, Locke Paddon Lake, Roberts Lake, and Lake El Estero Diversion site (**Figure 1**). All four diversion sites are existing outfalls that will require the development of additional physical infrastructure. No diversion is proposed from Lock Paddon or Roberts Lake; however, they are included in this delineation because new transmission line alignments are proposed adjacent to them.

In addition to the potential for direct impacts of the six locations identified above, reaches downstream of the Reclamation Ditch and Tembladero Diversion sites were evaluated because the operation of the project has the potential to indirectly impact wetlands as a result of the proposed water diversion. For this evaluation, "Ditch" refers to the channel alignment downstream of the Reclamation Ditch Diversion to the tide gates at Potrero Road in Moss Landing, California, and includes portions of the Reclamation Ditch, Tembladero Slough, and the Old Salinas River Channel. Additionally, "Ditch" includes the Old Salinas River Channel upstream of the confluence with the Tembladero Slough to the slide gate on the Salinas Lagoon. The evaluation area does not include areas downstream of the tide gates as the proposed diversions would not appreciably change the hydrology or hydrologic regime beyond the gates, and would not result in impacts to wetlands beyond the tide gates. A delineation was not performed on the Salinas River downstream of the proposed Blanco Drain Diversion, as it was determined that the small amount of water proposed for diversion was negligible in the context of the existing flow and would have a less than significant impact on the wetlands or other waters below the diversion. This report also identifies wetlands and other waters present within Lake El Estero, adjacent to the Lake El Estero Diversion site; however, no impacts to this resource are expected as a result of the project. The City of Monterey actively manages the water level in Lake El Estero so that there is storage capacity for large storm events. Prior to a storm event, the lake level is lowered by pumping or gravity flow for discharge to Del Monte Beach. The Proposed Project would include improvements that would enable water that would otherwise be discharged to the beach to instead be conveyed to the Regional Treatment Plant to be recycled.

## 1.3. Regulatory Background

### 1.3.1. Federal Regulation

The U.S. Army Corps of Engineers (ACOE) is the primary federal agency responsible for regulating wetlands and waters of the United States (waters).

#### *1.3.1.1. Wetlands*

ACOE provides technical guidelines on wetland delineation in *The Field Guide for Wetland Delineation: 1987 Corps of Engineers Manual* (Wetland Manual) (Wetland Training Institute, 2002). The Wetland Manual defines wetlands and the three environmental diagnostics (or parameters) as:

a. *Definition.* The ACOE (ACOE 1982) and the EPA (EPA 1980) jointly define wetlands as: Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

b. *Diagnostic environmental characteristics.* Wetlands have the following general diagnostic environmental characteristics:

(1) *Vegetation.* The prevalent vegetation consists of macrophytes that are typically adapted to areas having hydrologic and soil conditions described in *a* above. Hydrophytic species, due to morphological, physiological, and/or reproductive adaptation(s), have the ability to grow, effectively compete, reproduce, and/or persist in anaerobic soil conditions.

(2) *Soil.* Soils are present and have been classified as hydric, or they possess characteristics that are associated with reducing soil conditions.

(3) *Hydrology.* The area is inundated either permanently or periodically at mean water depths ≤ 6.6 ft, or the soil is saturated to the surface at some time during the growing season of the prevalent vegetation, the average annual duration of inundation or soil saturation does not preclude the occurrence of plant species typically adapted for life in aerobic soil conditions.

For an area to be considered a wetland under ACOE guidelines, all three parameters (vegetation, soils, or hydrology, as defined by the ACOE) must be met. However, climatic and hydrologic conditions in the Arid West often make it difficult to identify wetland indicators. The 2008 *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0)* (Supplement) (ACOE, 2008) provides indicators for each parameter that are specific to the Arid West region and is used in conjunction with the Wetland Manual.

*1.3.1.2. Waters of the U.S.*

Waters are defined as:

1. All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide;
2. All interstate waters including interstate wetlands;
3. All "other waters" such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce including any such waters:
   i. Which are or could be used by interstate or foreign travelers for recreational or other purposes; or
   ii. From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or
   iii. Which are used or could be used for industrial purpose by industries in interstate commerce;
4. All impoundments of waters otherwise defined as waters of the United States under the definition;
5. Tributaries of waters identified in paragraphs [1-4] of this section;
6. The territorial seas;
7. Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in paragraphs [1-6] of this section (ACOE, 1982).

As noted above, "other waters," including lakes, ponds, and streams, are subject to ACOE jurisdiction. "Other waters" are characterized by an ordinary high water (OHW) mark, which is defined as:

> "that line on the shore established by the fluctuations of water and indicated by physical characteristics such as clear, natural line impressed on the bank, shelving, changes in the characteristics of the soil, destruction of terrestrial vegetation, the presence of litter and debris, or other appropriate means that consider the characteristics of the surrounding areas" (ACOE, 1982).

In the field, "other waters" are identified by the presence of a defined river or stream bed, a bank, and evidence of the flow of water.

#### *1.3.1.3. U.S. Army Corps of Engineers Jurisdiction*

On June 5, 2007, the ACOE and the EPA developed a Memorandum Regarding *Clean Water Act Jurisdiction Following Rapanos v. United States* which states that the agencies will assert jurisdiction over the following categories of water bodies:

- TNWs [traditional navigable waters] and wetlands adjacent to TNWs and
- Non-navigable tributaries of TNWs that are relatively permanent (i.e., the tributaries typically flow year-round or have continuous flow at least seasonally) and wetlands that directly abut such tributaries

> In addition, the following waters will also be found jurisdictional based on a fact-specific analysis that they have a significant nexus with a TNW:
>
> - Non-navigable tributaries that do not typically flow year-round or have continuous flow at least seasonally;
> - Wetlands adjacent to such tributaries; and
> - Wetlands adjacent to but that do not directly abut a relatively permanent non-navigable tributary
>
> A significant nexus exists if the tributary, in combination with all of its adjacent wetlands, has more than a speculative or an insubstantial effect on the chemical, physical, and/or biological integrity of a TNW. Principal considerations when evaluating significant nexus include the volume, duration, and frequency of the flow of water in the tributary and the proximity of the tributary to a TNW, plus the hydrologic, ecologic, and other functions performed by the tributary and all of its adjacent wetlands" (ACOE & EPA, 2007).

The term "navigable waters of the U.S." is defined to include:

> "all those waters that are subject to the ebb and flow of the tide, and/or are presently used, or have been used in the past, or may be susceptible for use to transport interstate or foreign commerce" (ACOE, 1982).

### 1.3.2. State Regulation

Although wetlands are typically under the jurisdiction of the ACOE, wetlands occurring within the coastal zone are regulated by the California Coastal Commission (CCC) under the California Coastal Act (CCA) of 1976 and the federal Coastal Zone Management Act (CZMA).

#### *1.3.2.1. Coastal Wetlands*

Section 30121 of the CCA broadly defines a wetland as:

> "…lands within the coastal zone which may be covered periodically or permanently with shallow water and include saltwater marshes, freshwater marshes, open or closed brackish water marshes, swamps, mudflats, or fens."

The California Code of Regulations Section 13577 (b)(1) of Title 14, Division 5.5, Article18, provides an expanded definition:

> "…Wetlands are lands where the water table is at, near, or above the land surface long enough to promote the formation of hydric soils or to support the growth of hydrophytes, and shall also include those types of wetlands where vegetation is lacking and soil is poorly developed or absent as a result of frequent or drastic fluctuations of surface water levels, wave action, water flow, turbidity or high concentrations of salt or other substance in the substrate. Such wetlands can be recognized by the presence of surface water or saturated substrate at some time during each year and their location within, or adjacent to, vegetated wetlands or deepwater habitats. …"

The Federal procedures to identify indicators and evaluate whether a site meets any of the three parameters is typically used to delineate coastal wetlands. For this delineation, data was collected and procedures followed in conformance with the ACOE's Wetland Manual and the Supplement. The presence of one or more parameters (vegetation, soils, or hydrology, as defined by the ACOE) was used to delineate a wetland under CCC jurisdiction.

# 2. Methods

This wetland delineation was conducted in accordance with the requirements set forth in the Wetland Manual and Supplement, as appropriate, to identify indicators and evaluate whether a site meets any or all of the three parameters. Prior to conducting field surveys, available reference materials were reviewed, including the National Wetlands Inventory Wetland Mapper (Service, 2014), the Web Soil Survey for Monterey County (USDA, 1978), the list of Hydric Soils of the United States (USDA NRCS, 2014), the Soil Survey Geographic Database (USDA-NRCS, 2003), the Source Water Alternative Site Locations Maps prepared by DD&A in December, 2013, the Area of Potential Effect (APE) Maps prepared by DD&A in April 2014, and aerial photographs of the site.

In addition, the following existing report was evaluated in preparation of this wetland delineation report[1]:

- Monterey Bay Regional Desalination Project Administrative Draft Delineation of Jurisdictional Wetlands and Waters under Section 404 of the Clean Water Act and California Coastal Act (DD&A 2011)

## 2.1. Field Methods

In July 2014, August 2014, and February 2015, DD&A biologists Matthew Johnson, Jami Davis, and Shaelyn Hession, conducted field surveys to confirm and update existing data from overlapping projects (identified above) and collect new data within areas of the evaluation area not previously evaluated. All data collected previously and not specific to this delineation was field checked to ensure site conditions had not changed. Field survey data were recorded on Wetland Determination Data Forms for the Arid West Region provided in the Supplement (Appendix A). Seventy-three (73) sampling points were taken within the evaluation areas. Each sampling point was mapped using a Trimble Pro XH GPS unit and a picture was taken of the area immediately surrounding the point. All points were subsequently displayed in GIS using ArcGIS software. Data collected at each sampling point was analyzed to determine if wetlands and/or waters were present. Vegetation, soils, and hydrology were assessed following the guidelines detailed in the Wetland Manual and Supplement. For an area to be considered a wetland under ACOE guidelines, all three parameters must be met.

For the El Estero Diversion site, data was collected only within the evaluation area, where direct impacts would occur. As noted above, the GWR Project would include improvements that would enable water that would otherwise be discharged to the beach to instead be conveyed to the Regional Treatment Plant to be recycled, and, therefore, will not result in indirect impacts to these resources as a result of water diversion. However, the location of wetlands and other waters within the adjacent Lake El Estero were mapped to show the location of these resources in relation to the GWR Project site. These resources were mapped using only aerial images, Google street view (Google, 2014), and personal knowledge of the resources.

### 2.1.1. Vegetation

Vegetation was categorized into four strata: tree, sapling/shrub, herb, and woody vines. Areas around sampling points were evaluated and vegetation plot sizes were selected to adequately describe the sample area. Dominant plant species, and their approximate percent cover within five to ten feet of the sampling point were recorded for sapling/shrub, herb, and woody vine layers, and within 10 feet for the tree layer.

[1] Existing data previously collected within the evaluation area were field checked and used for this report.

Plant species were identified using An Illustrated Field Key to the Flowering Plants of Monterey County (Matthews, 2006) and The Jepson Manual: Vascular Plants of California, Second Edition (Baldwin, et al., 2012), and were assigned a wetland status according to the *Arid West 2014 Regional Wetland Plant List* (Lichvar, et al., 2014). The wetland plant classification system is based on the expected frequency of occurrence in wetlands as described in Table 2-1.

**Table 2-1: Wetland Vegetation Classification System**

| Symbol | Indicator Category | Definition | Frequency of Occurrences |
|---|---|---|---|
| **OBL** | Obligate Wetland Plants | Always found in wetlands | >99% |
| **FACW** | Facultative Wetland Plants | Most often occur in wetlands | 67-99% |
| **FAC** | Facultative Plants | Equal likelihood of occurring in wetlands and non-wetlands | 33-67% |
| **FACU** | Facultative Upland Plants | Most often occur in non-wetlands | 1-33% |
| **UPL** | Obligate Upland Plants | Always found in non-wetlands | <1% |
| **NL** | Not Listed (Assumed Upland) | | |

The "dominance test", as described in the Supplement, was applied for each survey point. If more than 50 percent of the dominant plant species across all strata were in the indicator categories of OBL, FACW, or FAC, then the vegetation was considered hydrophytic. The other indicators of hydrophytic vegetation described by the Supplement (Prevalence Index and Morphological Adaptations) were not used.

### 2.1.2. Soils

The National Technical Committee for Hydric Soils (NTCHS) defines a hydric soil as:

> "A soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part" (USDA-NRCS, 1995).

The soil at each survey point was evaluated by digging an 18-inch hole, when possible, and identifying soil horizons, color, and texture, as well as any hydric soil indicators (as described in the Supplement). Soil color was evaluated by comparing a small wetted piece of soil to Munsell Soil Color Charts (Munsell, 2000). The ending value of the Munsell Soil Notation refers to the chroma of the sample. Measures of chroma consist of numbers beginning with 0 for neutral grays and increasing at equal intervals to a maximum of about 20.

### 2.1.3. Hydrology

The Wetland Manual defines "wetland hydrology" as:

> "Encompassing all hydrologic characteristics of areas that are periodically inundated or have soils saturated to the surface at some time during the growing season. Areas with evident characteristics of wetland hydrology are those where the presence of water has an overriding influence on characteristics of vegetation and soils due to anaerobic and reducing conditions, respectively. Such characteristics are usually present in areas that are inundated or have soils that are saturated to the surface for sufficient duration to

> develop hydric soils and support vegetation typically adapted for life in periodically anaerobic soil conditions."

Each survey point was evaluated for wetland hydrology using the indicators described in the Supplement. Evidence of one Primary Indicator sufficiently identified wetland hydrology. Two or more Secondary Indicators were necessary to identify wetland hydrology if no Primary Indicators were observed.

In the Arid West, the lack of a hydrologic indicator does not always signify the absence of wetland hydrology. As stated in the Supplement, the Arid West is characterized by extended dry seasons in most years and by extreme temporal and special variability in rainfall, causing many wetlands in the region to be dry for much of the year. During the extended dry season, hydrology indicators may be lacking altogether at a difficult or problematic site. Guidance is provided in the Supplement for difficult wetland situations such as this.

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# 3. Description of Evaluation Areas

The GWR Project was evaluated for the presence of potentially coastal wetlands, federal jurisdictional wetlands, and other waters of the U.S. Six locations were identified as potentially being directly impacted:

- Reclamation Ditch Diversion
- Tembladero Slough Diversion
- Blanco Drain Diversion
- Locke Paddon Lake
- Roberts Lake
- Lake El Estero Diversion

In addition, reaches downstream of the Reclamation Ditch and Tembladero Diversion sites were also evaluated, as wetlands in these reaches have the potential to be indirectly impacted as a result of the water diversion during operation of the GWR Project. Reaches downstream of the Blanco Drain Diversion within the Salinas River were not evaluated, as the amount of water proposed for diversion is too small to have significant impacts to any downstream wetlands. For this evaluation, "Ditch" refers to the channel alignment downstream of the Reclamation Ditch Diversion to the tide gates at Potrero Road in Moss Landing, California and the Old Salinas River Channel upstream of the confluence with Tembladero Slough, to the slide gate on the Salinas River Lagoon. The Ditch includes portions of the Reclamation Ditch and Tembladero Slough, as well as the entire Old Salinas River Channel. The Ditch was identified as having the potential to be indirectly impacted.

No formal delineation was conducted at Lake El Estero outside of the proposed diversion structure site as the proposed project is not anticipated to have direct or indirect impacts on the water level in Lake El Estero. Similarly, no formal delineation was conducted in the riparian area along the Salinas River within the Salinas Treatment Facility project study area as there are no anticipated direct impacts to this area and indirect impact are expected to be less than significant as a result of the proposed project.

## 3.1. Reclamation Ditch Diversion

The Reclamation Ditch Diversion evaluation area is located along the Reclamation Ditch adjacent to Davis Road, near the City of Salinas (**Figure 1**). This evaluation area is surrounded by development and the area is highly disturbed and maintained. Within this evaluation area, one sampling point was taken. The evaluation area is not located within the coastal zone.

### 3.1.1. Vegetation

The vegetation within the evaluation area is highly disturbed. Approximately half of the area is denuded and the other half is covered by thatch. The species composition of the thatch was not identifiable at the time of the survey; however, due to the disturbed nature of the site, it is likely that non-native species dominate.

### 3.1.2. Soils

The SSURGO Database (USDA-NRCS, 2003) identifies two map units within the Reclamation Ditch Diversion evaluation area (**Figure 2**). The SSURGO Database description of these units is provided below with an indication of whether the soil is classified as hydric or not on the USDA NRCS *Hydric Soils of the United States* list (2014).

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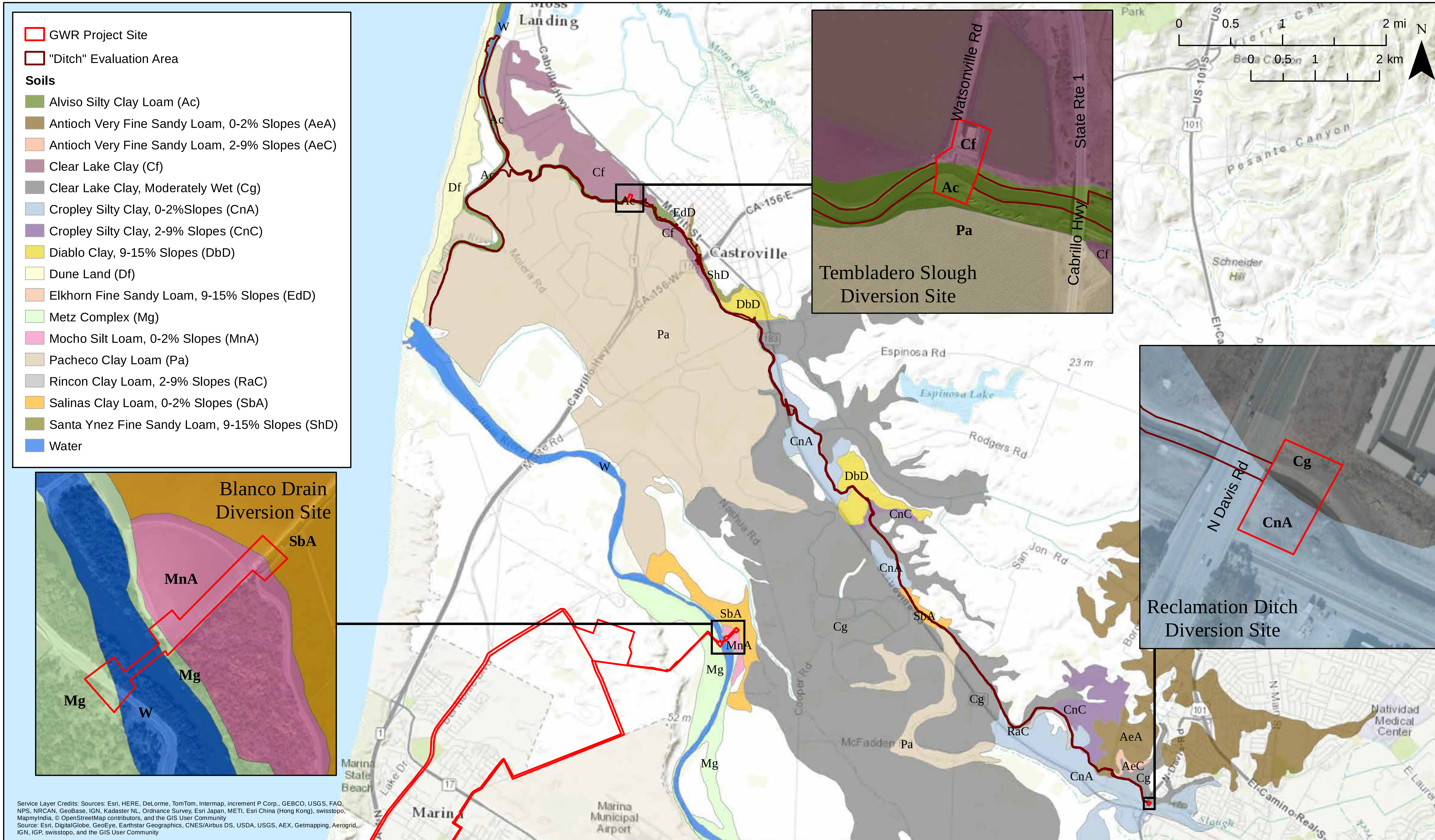


# Ditch and Tembladero Slough, Reclamation Ditch, and Blanco Drain Diversion Sites Soil Map

Date: 3/3/2015
Scale: 1 inch = 1 miles
Project: 2013-13

C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Combined Wetland Delineation Maps\Figure 2 Soils Map20150226.mxd

Monterey | San Jose
**Denise Duffy and Associates, Inc.**
Environmental Consultants Resource Planners
947 Cass Street, Suite 5
Monterey, CA 93940
(831) 373-4341

Figure 2

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*Alviso Silty Clay Loam (Drained).* This poorly drained soil is found in basins and on tidal flats, and was formed in alluvium derived from sedimentary rocks. In a representative profile, the surface layer is a gray, neutral silty clay loam approximately five inches thick. Below that, there is approximately nine inches of light gray, mildly alkaline silty clay loam which is underlain by approximately 31 inches of light gray to gray mildly alkaline silty clay. In areas where this soil is classified as "drained" the soil has been partially drained by structures such as levees, dikes, and gates used to control the inflow of tidewater. This soil is classified as a hydric soil for Monterey County.

*Clear Lake Clay.* This poorly-drained soil is found on flood plains and in basins, and was formed in alluvium derived from sedimentary rocks. In a representative profile, the top layer is an approximately 24-inch thick, dark gray, moderately alkaline clay. This soil is classified as hydric for Monterey County.

### 3.1.3. Hydrology

The Reclamation Ditch bisects the evaluation area. A detailed description of the hydrology associated with Reclamation Ditch is presented in Section 3.6.3.

## 3.2. Tembladero Slough Diversion

The Tembladero Slough Diversion evaluation area is located along the Tembladero Slough at Watsonville Road, west of Highway 1 near the City of Castroville (**Figure 1**). This evaluation area is surrounded by agriculture and the area is highly disturbed and maintained. Within this evaluation area, two sampling points were taken. The evaluation area is located within the coastal zone.

### 3.2.1. Vegetation

The vegetation within the evaluation area is highly disturbed. Approximately half of the area is denuded and the other half is covered by thatch. The species composition of the thatch was not identifiable at the time of the survey; however, due to the disturbed nature of the site, it is likely that non-native species dominate.

### 3.2.2. Soils

The SSURGO Database (USDA-NRCS, 2003) identifies two map units within the Tembladero Slough Diversion evaluation area (**Figure 2**). The SSURGO Database description of these units is provided below with an indication of whether the soil is classified as hydric or not on the USDA NRCS *Hydric Soils of the United States* list (2014).

*Clear Lake Clay (Moderately Wet).* Please see soil description provided in Section 3.1.2 for Reclamation Ditch Diversion soils. In areas where this soil is identified as "moderately wet" the soil is presently partly drained, but it was poorly drained when it formed. This soil is classified as hydric for Monterey County.

*Cropley Silty Clay, 0-2% Slopes.* These well-drained soils are found on alluvial fans, floodplains, basins, terraces, and terrace breaks, and were formed in alluvium derived from sedimentary rocks. In a representative profile, the surface layer is an approximately 36-inch thick, very dark gray, moderately alkaline silty clay. This soil is classified as hydric for Monterey County.

### 3.2.3. Hydrology

The Tembladero Slough bisects the evaluation area. A detailed description of the hydrology associated with Tembladero Slough is presented in Section 3.6.3. Additionally, a small drainage ditch is present within the evaluation area that drains water from adjacent agricultural fields into the Tembladero Slough.

## 3.3. Blanco Drain Diversion

The Blanco Drain system, commonly referred to as Blanco Drain, drains the surrounding agriculture surface run-off and tile drainage. The adjacent agricultural lands are used for growing table crops (e.g., leafy greens, berries, and artichokes). Agricultural practices, including the use of herbicides and pesticides, as well as fertilization, have contributed to the degraded hydrology associated with Blanco Drain. Following the installation of the Salinas River Diversion Facility (SRDF), approximately 1,000 feet downstream from Blanco Drain, culverts and flap gates were installed to prevent the Salinas River from back-filling Blanco Drain. The installation of the culverts and flap gates also prevented fish passage in Blanco Drain. The Blanco Drain Diversion evaluation area is approximately 3.7 acres, consisting of a 176 foot-long agricultural drainage ditch and approximately 52 linear feet of the Salinas River main channel and associated riparian habitat (**Figure 1**). Within this evaluation area, four sampling points were taken. Sampling points were taken in the drainage ditch, in sections of the Salinas River riparian corridor, and within a segment of degraded, historic riparian habitat located within the historic floodplain on the southern side of the Salinas River. An additional point (point 14) was taken near the evaluation area; however, after importing the GIS data, it was determined that this point is located outside of the evaluation area. This evaluation area is not located within the coastal zone.

### 3.3.1. Vegetation

The bank of the drainage ditch adjacent to agricultural fields is unvegetated. In the riparian corridor, vegetation cover includes a tree stratum dominated by arroyo willow, as well as herb stratum dominated by species including white sweetclover (*Melilotus albus*), rabbitfoot grass (*Polypogon monspeliensis*), and telegraph weed (*Heterotheca grandflora*). The vegetation in the degraded historic riparian habitat located on the historic floodplain on the southern side of the Salinas River and is significantly disturbed and dominated by a dead stand of poison hemlock (*Conium maculatum*).

### 3.3.2. Soils

The SSURGO Database (USDA-NRCS, 2003) identifies three map units within the Blanco Drain Diversion evaluation area (**Figure 2**). The SSURGO Database description of these units is provided below with an indication of whether the soil is classified as hydric or not on the USDA NRCS *Hydric Soils of the United States* list (2014).

*Salinas Clay Loam, 0-2% Slopes.* This well-drained soil is found on low terraces and was formed in mixed alluvium derived from sedimentary and granitic rocks. In a representative profile, the surface layer is clay loam, silty clay loam, heavy loam, or heavy silt loam, approximately 33 inches thick, very dark gray, and dark gray. This soil type is classified as hydric for Monterey County.

*Mocho Silt Loam, 0-2% Slopes.* This well-drained soil is found on floodplains and was formed in alluvium derived mostly from sedimentary rocks. In a representative profile, the surface is layer an approximately 12-inch thick, grayish brown, calcareous silt loam. The subsoil is a light brownish gray, calcareous silty clay loam and silt loam, which extends to a depth of 68 inches or more. This soil is classified as hydric for Monterey County.

*Metz Complex.* This somewhat excessively drained soil is found largely along drainage ways and on modified sand dunes, and was formed in alluvium derived mostly from sedimentary rocks. The texture of the surface layer is variable, as this complex consists of undulating to gently rolling soils that are intermingled. In a representative profile, the surface layer is approximately 12 inches thick. The texture of the surface layer can include sand, loamy sand, silt loam, and sandy loam that is gravelly or cobbly in areas. The subsoil material extends to a depth of more than 60 inches; it is light brownish gray, moderately alkaline, stratified fine sand, sand, and very sandy loam. This soil is not classified as hydric for Monterey County.

### 3.3.3. Hydrology

In 2009-2010, the MCWRA SRDF was constructed downstream of the Blanco Drain. The SRDF includes an inflatable rubber dam that impounds water during the summer months to supply the diversion pump station. To overcome the backwater into the Blanco Drain channel, the channel was re-graded and a pump station was installed at the lower end. The pump station lifts Blanco Drain flows past a slide gate and into the gravity portion of the channel. The Blanco Drain watershed is approximately 6,000 acres and collects surface runoff and agricultural tile-drain flows from the surrounding area. The Blanco Drain is tributary to the Salinas River.

In this evaluation area, hydrology is confined to a stretch of agricultural drainage ditch approximately 176 feet long with a width ranging from 23 to 30 feet, and a section of the main channel of the Salinas River approximately 50 feet long and 150 feet wide.

## 3.4. Locke Paddon Lake

The GWR Project alignment runs along the eastern border of Locke Paddon Lake, which is located within the City of Marina near the intersection of Del Monte Boulevard and Reservation Road (**Figure 1**). Eight sampling points were taken within the Locke Paddon Lake evaluation area. This evaluation area is located within the coastal zone.

### 3.4.1. Vegetation

Vegetation at the top of the slope, immediately adjacent to the railroad tracks, is maintained and highly disturbed. Dominant vegetation consists of non-native annual grasses, such as slender oat (*Avena barbata*), and iceplant (*Carpobrotus edulis*). The slope down to the lake is dominated by California blackberry (*Rubus ursinus*) and stinging nettle (*Urtica dioica*). As the topography flattens out, cattail (*Typha latifolia*) and Arroyo willow dominate the vegetation overall, although in some areas, California blackberry and common rush (*Juncus effusus*) are also dominants.

### 3.4.2. Soils

The SSURGO Database (USDA-NRCS, 2003) identifies one map unit within the Locke Paddon Lake evaluation area at Marina Greens Drive (**Figure 3**). The SSURGO Database description of this mapping unit is presented below with an indication of whether the soil is classified as hydric or not on the USDA NRCS *Hydric Soils of the United States* list (2014).

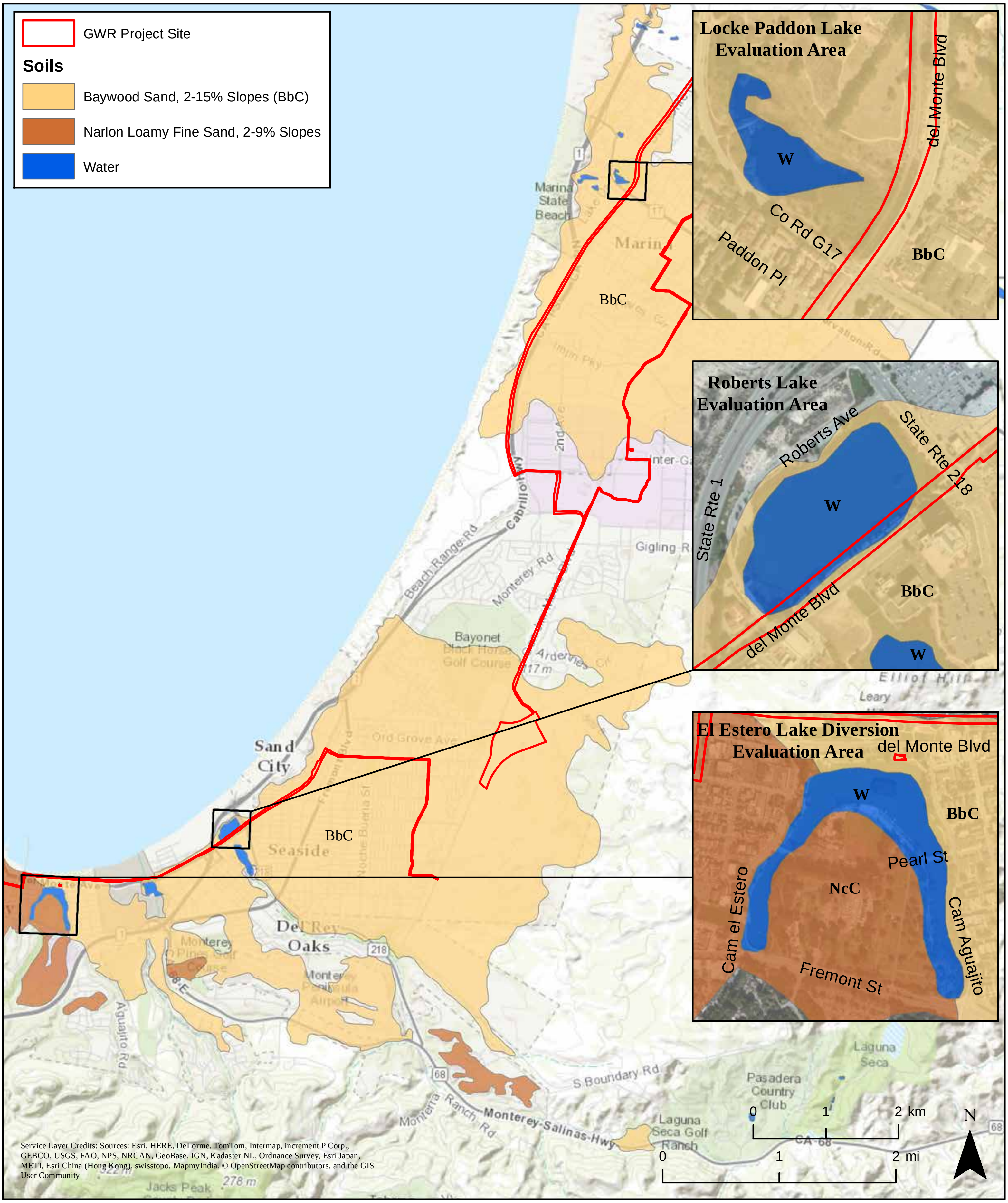
*Baywood Sand, 2-15% Slopes.* This somewhat excessively drained soil was formed in stabilized sand dunes. In a representative profile of this soil, the surface layer is approximately 21 inches thick, grayish brown and brown, slightly acidic and medium acid sand. Baywood sand is not classified as a hydric soil.

### 3.4.3. Hydrology

Lock Paddon Lake is a large vernal pond which is fed primarily by rainfall runoff. The lake is located within the Monterey Peninsula watershed.

## 3.5. Roberts Lake

The GWR Project alignment runs along the south-eastern border of Roberts Lake, which is located within the City of Seaside near the intersection of Del Monte Boulevard and Canyon Del Rey Boulevard (**Figure 1**). Within the Roberts Lake evaluation area, 10 sampling points were taken. This area is within the coastal zone.




# Locke Paddon Lake, Roberts Lake and El Estero Lake Evaluation Areas Soil Map

C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Combined Wetland Delineation Maps\Figure 3 Locke Paddon_Roberts_El Estero Soils20150226.mxd

Date: 3/3/2015

Scale: 1 inch = 1.06 miles

Project: 2013-13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Denise Duffy and Associates, Inc.
Environmental Consultants Resource Planners
947 Cass Street, Suite 5
Monterey, CA 93940
(831) 373-4341


Figure 3

### 3.5.1. Vegetation

Vegetation immediately adjacent to the railroad tracks is highly disturbed and maintained by mowing and several areas are completely devoid of vegetation. Dominant species within this area were ruderal, non-native species, including cheeseweed (*Malva parviflora*), ripgut brome (*Bromus diandrus*), fescue grass (*Vulpia* sp.), and black mustard. Closer to the water, dominant species included Arroyo willow, California blackberry, Indian melilot (*Melilotus indicus*), rabbitfoot grass, spearscale (*Atriplex triangularis*), and hardstem bulrush (*Schoenoplectus acutus*).

### 3.5.2. Soils

The SSURGO Database (USDA-NRCS, 2003) identifies one map unit within this evaluation area (**Figure 3**).

*Baywood Sand 2-15% Slopes.* Please refer to the description of this soil type in Section 3.3.2 for Locke Paddon Lake soils.

### 3.5.3. Hydrology

Roberts Lake is a perennial lagoon in which the outflow into the Monterey Bay is regulated by a water level control structure that maintains a fairly constant surface water elevation (Monterey Peninsula Water Management District, 2005). The lagoon is the terminus of a system that drains the Highway 68 corridor from Laguna Seca west to Canyon Del Rey Boulevard and portions of the City of Seaside. Several ephemeral drainages connect with a drainage channel that nearly parallels Highway 68 and Canyon Del Rey Boulevard before emptying into Laguna Del Rey Lake, which is connected directly with Roberts Lake under Del Monte Boulevard. The lake is located within the Monterey Peninsula watershed.

## 3.6. Lake El Estero Diversion

The Lake El Estero Diversion evaluation area is located at the northwest corner of El Estero Park near Del Monte Blvd in the City of Monterey. El Estero Park is a 45-acre multi-use recreation area, which includes walking trails, BBQ picnic areas, paddleboat rentals, an exercise course, restrooms, the Dennis the Menace Playground, a dog park, a skate park, and a ball park. The evaluation area is located within the cement pad of an existing pump station. Lake El Estero is located immediately adjacent to the evaluation area. Within the Lake El Estero Diversion evaluation area, one sampling point was taken. Additional points were not taken surrounding the lake as the project will not result in any direct impacts or indirect impacts from water diversion; however in order to show the location of resources at the lake, mapping was conducted using aerial images, Google street view images (Google, 2014), and personal knowledge of the area. This evaluation area is not located within the coastal zone.

### 3.6.1. Vegetation

The Lake El Estero Diversion evaluation area is completely devoid of vegetation and is located entirely within an existing cement pad. The surrounding area within El Estero Park is dominated by maintained turf and landscaping. Small areas of emergent bulrush (*Schoenoplectus* sp.) are present along the edge of the lake in some areas; however, these areas are not adjacent to the evaluation area.

### 3.6.2. Soils

The SSURGO Database (USDA-NRCS, 2003) identifies one map unit within this evaluation area (**Figure 3**).

*Baywood Sand 2-15% Slopes.* Please refer to the description of this soil type in Section 3.3.2 for Locke Paddon Lake soils.

Although not present within the Lake El Estero Diversion evaluation area, one additional soil type is present within El Estero Park, surrounding the lake:

*Narlon Loamy Fine Sand, 2-9% Slopes*. These soils are a gently to moderately sloping soil on dissected marine terraces. In a representative profile, the surface layer is a gray, medium acidic, loamy, fine sand about three inches thick. The subsurface layer is a white, mottled, slightly to medium acidic, loamy, fine sand approximately 10 inches thick. The subsoil is an approximately 40-inch thick light brownish gray to light gray, mottled, very strongly acidic clay. This soil is classified as hydric for Monterey County.

### 3.6.3. Hydrology

The following information was taken directly from the internal draft report *Groundwater Replenishment Project Urban Runoff Capture at Lake El Estero* prepared by Schaaf & Wheeler Consulting Civil Engineers (Schaaf & Wheeler) in April 2014:

Lake El Estero is an 18-acre lake located in the City of Monterey, less than one mile from the coast. It is fed by four tributary streams and a portion of the City's stormwater collection system. One tributary is a named stream (Majors Creek which runs through Dahvee Park), and the other three are unnamed streams. The Lake El Estero drainage basin is 2,418 acres, or approximately 3.78 square miles.

Lake El Estero was originally a brackish lagoon, connected by a surface stream to the Monterey Bay. The connection to the bay was changed to pipe culverts in the 1870s when the Monterey and Salinas Valley Railroad was constructed. Lake El Estero has been dredged several times during the last century to remove accumulated sediment. Until 1941, the drainage basin included 1,186-acres to the west, extending to Huckleberry Hill, which entered the Lake through a box culvert under Pearl Street. This portion of the City stormwater system was reconfigured with the addition of a box culvert under Figueroa Street, which now carries the flow from Pearl Street to discharge into the Monterey Bay at the Municipal Wharf. In 1968, the current stormwater pump station at the northeast corner of the lake and outfall pipeline were constructed to facilitate better management of water levels in the Lake El Estero.

## 3.7. Ditch

The Ditch is a highly degraded system that carries water primarily from urban and agricultural runoff, but also from tributaries that drain the northwestern slopes of the Gabilan Range. The Reclamation Ditch portion of the Ditch is a trapezoidal channel that was excavated between 1917 and 1920 to drain surface runoff, including several old lakes (Casagrande and Watson 2006). Within the urban areas of the City of Salinas, the Ditch has steep sides with numerous pipe culverts or bridges with lined inverts. The Tembladero Slough and Old Salinas River portions of the Ditch are natural features; however, they have also been highly manipulated and are similarly a trapezoidal channel with steep sides in most areas. Several portions of the Ditch have been armored with rip-rap to prevent erosion and vegetation has been removed to prevent flooding and minimize habitat for wildlife that may disturb the adjacent agricultural fields. The Ditch has been separated from the floodplain in all areas except for the stretch extending approximately 3,200 feet upstream of the tide gate at Potrero Road. A man-made wetland, designed for water treatment, abuts the Tembladero Slough and the Old Salinas River Channel, at the confluence of these waterways, and was included in the evaluation area (**Figure 1**). Within the Ditch evaluation area, 47 sampling points were taken. A portion of this evaluation area is located within the coastal zone.

### 3.7.1. Vegetation

The majority of the Ditch is surrounded by agricultural and urban areas, and consequently the vegetation within the evaluation area is highly degraded. The vegetation growing within the Ditch and along the banks is typically removed by use of herbicides, which enhances drainage flow and minimizes habitat for pest species adjacent to cropland (Casagrande and Watson 2006). Additionally, several areas of the Ditch are armored by rip-rap to prevent erosion, which also precludes the growth of much vegetation. In areas where the vegetation hasn't been removed, weedy species are typically dominant, such as watercress (*Nasturtium officinale*), saltbush (*Atriplex* sp.), bristly ox-tongue (*Picris echioides*), poison hemlock (*Conium maculatum*), black mustard (*Brassica nigra*), and wild radish (*Raphanus sativus*).

Although the majority of the Ditch is disturbed and degraded, some areas of native vegetation are still present. A few small areas of arroyo willow (*Salix lasiolepis*) are present along the Ditch. The floodplain adjacent to the lower reach of the Ditch, which extends from the tide gates at Potrero Road to approximately 3,200 feet upstream, is dominated by salt marsh. The floodplain extends from the bank of the channel to the toe of slope of the adjacent sand dunes and dune scrub habitat on the west side and to the toe of slope of the adjacent agricultural fields on the east side. The salt marsh is dominated by fleshy jaumea (*Jaumea carnosa*), alkali heath (*Frankenia salina*), gum-plant (*Grindelia stricta*), salt grass (*Distichlis spicata*), pacific silver-weed (*Potentilla anserina* ssp. *pacifica*), and pickleweed (*Salicornia pacifica*). Another area where significant native vegetation is present is at the man-made wetland where California bulrush (*Schoenoplectus californica*), alkali heath, fleshy jaumea, and salt grass are the dominant species. Native vegetation, consisting of species including Californiabulrush and fleshy jaumea, is also present along the Old Salinas River Channel upstream of the confluence with the Tembladero Slough.

### 3.7.2. Soils

The SSURGO Database (USDA-NRCS, 2003) identifies 16 map units within the Ditch evaluation area (**Figure 2**). The SSURGO Database description of these units is provided below with an indication of whether the soil is classified as hydric or not on the USDA NRCS *Hydric Soils of the United States* list (2014).

*Alviso Silty Clay Loam (Drained).* Please see soil description provided in Section 3.1.2 for Reclamation Ditch Diversion soils.

*Antioch Very Fine Sandy Loam, 0-2% Slopes and 2-9% Slopes.* These moderately well-drained soils, found on terraces and alluvial fans, were formed in alluvium derived from sedimentary rocks. In a representative profile, the surface layer is an approximately 15-inch thick, grayish-brown, strongly acid very fine sandy loam. The subsurface layer is an approximately six-inch thick, light gray, slightly acid, very fine sandy loam. These soils are not classified as hydric for Monterey County.

*Clear Lake Clay (Moderately Wet).* Please see soil description provided in Section 3.1.2 for Reclamation Ditch Diversion soils and Section 3.2.2 for Tembladero Slough soils.

*Cropley Silty Clay, 0-2% Slopes and 2-9% Slopes.* Please see soil description provided in Section 3.2.2 for Tembladero Slough soils. The soils on 0-2% slopes are classified as hydric for Monterey County; however, the soils on 2-9% slopes are not.

*Diablo Clay, 9-15% Slopes.* This well-drained soil is found in uplands and was formed in material underlain by calcareous sandstone and shale. In a representative profile, the surface layer is an approximately 30-inch thick, dark gray to very dark gray, slightly acidic, and neutral clay. This soil is not classified as hydric for Monterey County.

*Dune Land.* This soil is comprised of loose wind-deposited quartz and feldspar sand. It is found on gently sloping to steep areas of hummocks, mounds, and hills. This soil is classified as hydric for Monterey County.

*Elkhorn Fine Sandy Loam, 2-5% Slopes and 9-15% Slopes.* These well-drained soils are found on dune like marine terraces and on benches that have smooth, undulating slopes, and were formed in material underlain by weakly consolidated sandy sediments or ferruginous sandstone. In a representative profile, the top layer is an approximately 20- to 35-inch thick, gray or grayish brown, medium acid fine sandy loam. The soils on 2-5% slopes are classified as hydric for Monterey County; however, the soils on 9-15% slopes are not.

*Pacheco Clay Loam.* This poorly drained soil is found on nearly level floodplains and was formed in alluvium derived from sedimentary rocks. In a representative profile, the surface layer is an approximately 22-inch thick, dark gray, slightly acidic, and mildly alkaline clay loam. Pacheco clay loam is classified as hydric for Monterey County.

*Rincon Clay Loam, 2-9% Slopes.* This well-drained soil is found on alluvial fans and terraces, and was formed in alluvium derived from sandstone and shale. In a representative profile, the top layer is an approximately 14-inch thick, dark grayish brown, slightly acid clay loam. The surface layer can also consist of silty clay loam or sandy clay loam. The subsoil layer is an approximately 35-inch thick, dark grayish brown, brown, and light yellowish brown, neutral to moderately alkaline clay and heavy clay loam. This soil is not classified as hydric for Monterey County.

*Salinas Clay Loam, 0-2% Slopes.* Please see soil description provided in Section 3.3.2 for Blanco Drain soils.

*Santa Ynez Fine Sandy Loam, 9-15% Slopes.* This moderately well-drained soil is found on terraces and low hills, and was formed in alluvium derived from sandstone and granitic rock. In a representative profile, the top layer is an approximately 16- to 32-inch thick, grayish brown and gray, medium acid fine sandy loam. The subsurface layer is an approximately two-inch thick, light brownish gray, medium acid fine sandy loam. The subsoil layer is an approximately 25-inch thick, gray and grayish brown, medium acid to mildly alkaline clay and clay loam. This soil is not classified as hydric for Monterey County.

### 3.7.3. Hydrology

The Ditch is located in the Lower Salinas Valley Watershed and consists of the connected portions of the Reclamation Ditch, Tembladero Slough, and the Old Salinas River downstream of the Reclamation Ditch Diversion (approximately 12 miles total). The Reclamation Ditch is a drainage channel that flows westward from Carr Lake through the City of Salinas and the Salinas Valley and drains into Tembladero Slough, then the Old Salinas River Channel, and ultimately into Moss Landing Harbor through the tide gates at Potrero Road in Moss Landing. The tide gates are the downstream most control structure on the system. When the gates close during periods of high tide, water impounds behind the gates increasing the water surface elevations in the Old Salinas River Channel and the lower portion of the Tembladero Slough. When the tide gates open and water is allowed to flow into Elkhorn Slough the water surface elevation decreases. The effects of the tide and the tide gates dampen with distance from the gates. The majority of the water in the Ditch is from agricultural and urban runoff; however, some of the hydrology also originates from tributaries that drain the northwestern slopes of the Gabilan Range upstream of Carr Lake and Alisal Slough flows directly into the Ditch at the Tembladero Slough. Additionally, during the summer months, the Salinas River flows into the Old Salinas River Channel through a gated culvert at the Salinas Lagoon. Direct discharge from the Salinas River to the ocean is blocked by a seasonal sand bar which forms across the mouth of the Salinas Lagoon. During high winter flows in the Salinas River, the sand bar breaches and the river flows directly to the Bay. When the sand bar is breached, Monterey County Water Resources Agency (MCWRA) closes the slide gate to the Old Salinas River Channel.

A man-made wetland exists on the southern bank of the Tembladero Slough between the confluence of the Old Salinas River Channel and Molera Road. In this area, water is pumped from the Tembladero

Slough and deposited into the man-made wetland. The presence of wetland indicators at this location may be dependent upon the man-induced hydrology.

# 4. Results

## 4.1. Reclamation Ditch Diversion

### 4.1.1. Vegetation

No wetland vegetation was observed within the Reclamation Ditch Diversion evaluation area. The evaluation was approximately 50% denuded and the remaining 50% was covered by unidentifiable thatch.

### 4.1.2. Soils

No hydric soil indicators were present within the Reclamation Ditch Diversion evaluation area.

### 4.1.3. Hydrology

Hydrologic indicators were not observed at the sampling point (16) within the Reclamation Ditch evaluation area. However, approximately 115 feet of the Reclamation Ditch runs through this evaluation area. At this location, the Reclamation Ditch is approximately 15 to 17 feet wide (**Figure 4**).

## 4.2. Tembladero Slough Diversion

### 4.2.1. Vegetation

No wetland vegetation was observed within the Tembladero Slough Diversion evaluation area. The evaluation area was very sparsely vegetated spearscale and two other unidentifiable species.

### 4.2.2. Soils

No hydric soil indicators were present within the Tembladero Slough Diversion evaluation area.

### 4.2.3. Hydrology

The surface soil cracks hydrologic indicator was observed at one sampling point (9) within the Tembladero Slough evaluation area (**Figure 5**). Approximately 196 feet of the Tembladero Slough runs through this evaluation area. At this location, the Tembladero Slough is approximately 41 to 46 feet wide. Additionally approximately 50 feet of an agricultural drainage ditch connects with the Tembladero Slough within the evaluation area (**Figure 5**). At this location the drainage ditch is approximately 10 feet wide.

## 4.3. Blanco Drain Diversion

### 4.3.1. Vegetation

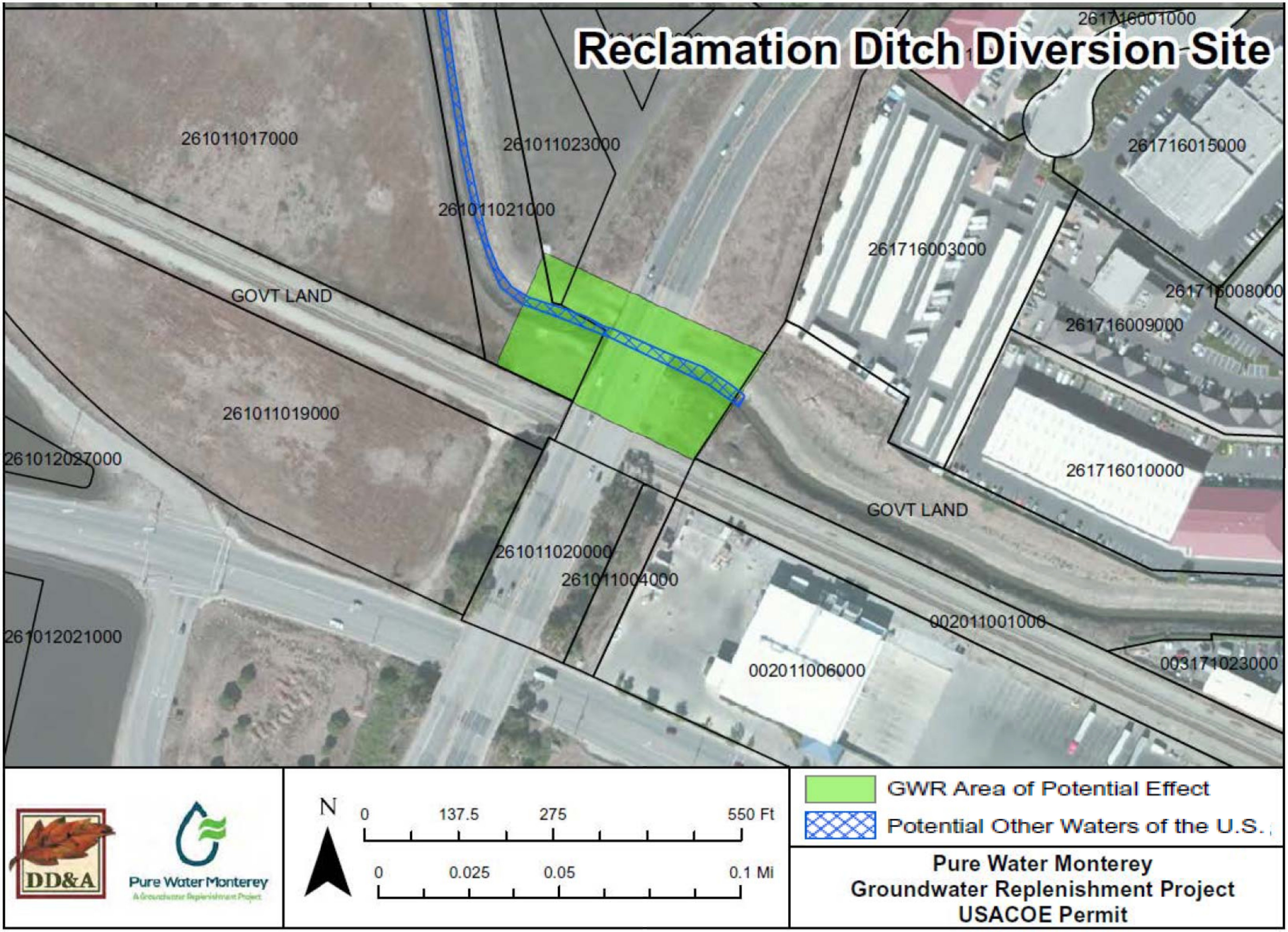
No wetland vegetation was observed within the Blanco Drain Diversion evaluation area. Although Arroyo willow (FAC) dominated the tree stratum at two of the sampling points, vegetation within the herb stratum was dominated by upland species and the sampling points did not pass the dominance test.

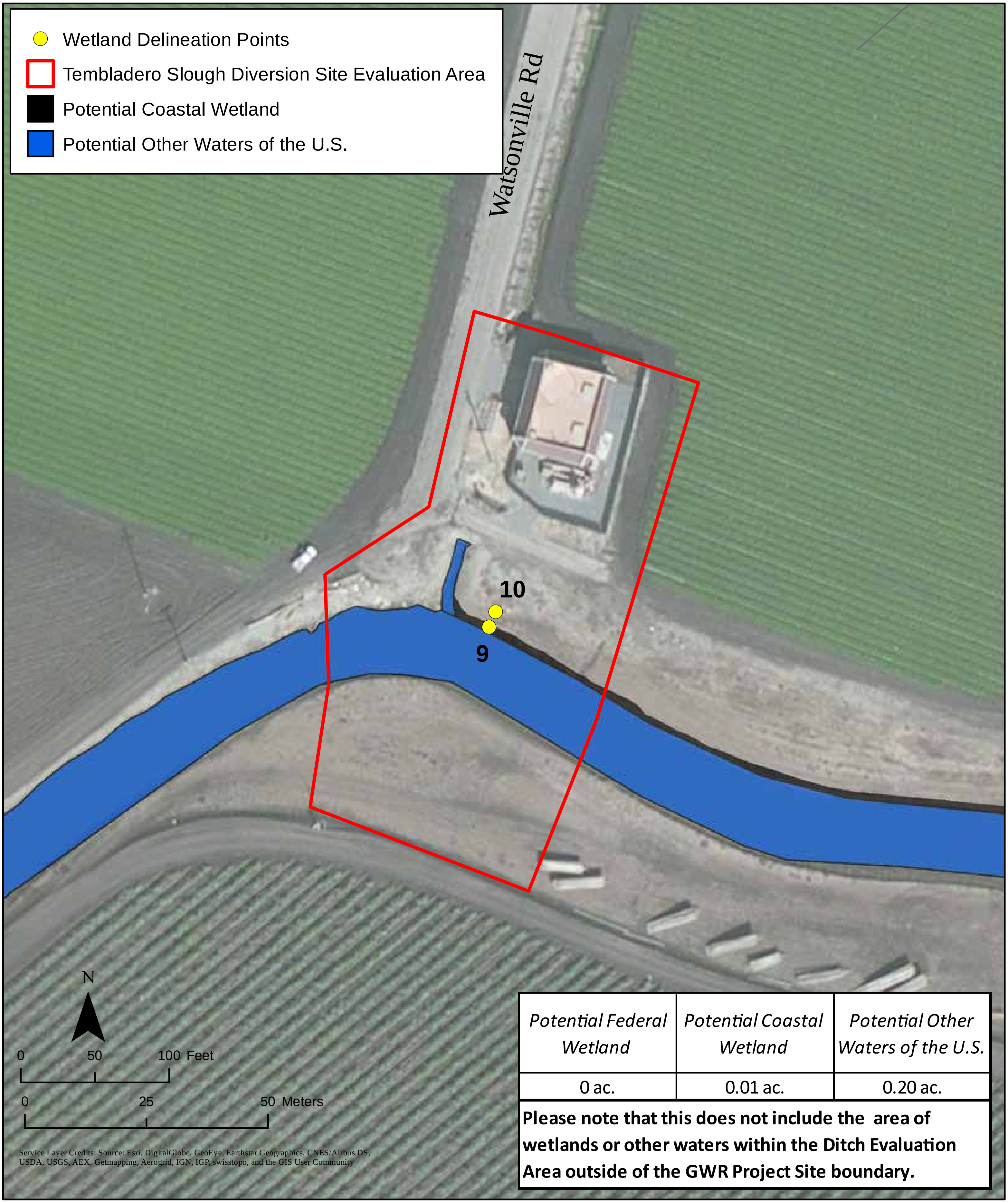
### 4.3.2. Soils

No hydric soil indicators were present within the Blanco Drain Diversion evaluation area.

### 4.3.3. Hydrology

Hydrologic indicators were observed at three sampling points within the Blanco Drain Diversion evaluation area. Riverine sediment deposits, riverine drift deposits, and drainage patterns were observed at sampling points 12 and 13, which were located just above OHW of the Salinas River main channel


Reclamation Ditch Diversion Site
261716001000
261011017000
261011023000
261716015000
261011021000
261716003000
GOVT LAND
261716008000
261716009000
261011019000
261012027000
261716010000
GOVT LAND
261011020000
261011004000
002011001000
261012021000
002011006000
003171023000
DD&A
Pure Water Monterey
N
0
137.5
275
550 Ft
0
0.025
0.05
0.1 Mi
GWR Area of Potential Effect
Potential Other Waters of the U.S.
Pure Water Monterey
Groundwater Replenishment Project
USACOE Permit




| *Potential Federal Wetland* | *Potential Coastal Wetland* | *Potential Other Waters of the U.S.* |
|---|---|---|
| 0 ac. | 0.01 ac. | 0.20 ac. |

**Please note that this does not include the area of wetlands or other waters within the Ditch Evaluation Area outside of the GWR Project Site boundary.**

# Tembladero Slough Water Diversion Site Wetland Delineation Map

C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Combined Wetland Delineation Maps\Figure 5 Tembladero Slough WD Map20150226.mxd

Date: 3/3/2015
Scale: 1 inch = 0.02 miles
Project: 2013-13

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947 Cass Street, Suite 5
Monterey, CA 93940
(831) 373-4341

Figure
5

(**Figure 6**). Additionally, although a sampling point was not taken below OHW; surface water was observed within the Salinas River main channel.

## 4.4. Locke Paddon Lake

### 4.4.1. Vegetation

Hydrophytic vegetation was observed at six sampling points within the Locke Paddon Lake evaluation area. Arroyo willow (FACW) dominated the tree stratum with an understory dominated by California blackberry (FAC), Santa Barbara sedge (*Carex barbarae* FACW), common rush (*Juncus effusus* OBL), and cattail (OBL).

### 4.4.2. Soils

Within the evaluation area the soils are completely sand, with the exception of the area at the southern end of the alignment. In this area, a woodchip fill has created sandy loam and loamy soils. The depleted matrix and sandy redox indicators were identified at three sampling points (37, 38, and 40) (**Figure 7**).

### 4.4.3. Hydrology

Within the evaluation area, indicators of wetland hydrology included saturation, presence of oxidized rhizospheres, and water-stained leaves. Additionally, presence of soil moisture (during the dry season) and topography were used as indicators of wetland hydrology at one sampling point (38) (**Figure 7**).

## 4.5. Roberts Lake

### 4.5.1. Vegetation

Hydrophytic vegetation was observed at six sampling points within the Roberts Lake evaluation area. Dominant species included Arroyo willow (FACW), bulrush (OBL), California blackberry (FAC), rabbitfoot grass (FACW), and Pacific silver-weed (OBL).

### 4.5.2. Soils

Within the evaluation area soils were either a sandy loam or a sandy silt fill with rock. The depleted matrix indicator was exhibited at four sampling points (48, 50, 52, and 53) and the gleyed matrix was exhibited at two sampling points (44 and 46) (**Figure 8**).

### 4.5.3. Hydrology

Within the evaluation area, hydrologic indicators included saturation at two sampling points (44 and 46) and a high water table at one point (44) (**Figure 8**). Additionally, presence of soil moisture (during the dry season) and topography were used as indicators of wetland hydrology for four sampling points (48, 50, 52, and 53).

## 4.6. Lake El Estero Diversion

### 4.6.1. Vegetation

No vegetation is present within the Lake El Estero Diversion evaluation area. Outside of the evaluation area within the lake, small areas of bulrush (OBL) are present at the edge of the lake. The remainder of vegetation at El Estero Park is dominated by turf and landscaping.


| *Potential Federal Wetland* | *Potential Coastal Wetland* | *Potential Other Waters of the U.S.* |
|---|---|---|
| 0 ac. | 0 ac. | 0.30 ac. |

# Blanco Drain Diversion Site Wetland Delineation Map

C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Combined Wetland Delineation Maps\Figure 6 Blanco Drain WD Map20150226.mxd

Date: 2/26/2015

Scale: 1 inch = 0.03 miles

Project: 2013-13

DD&A

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Figure

6


| *Potential Federal Wetland* | *Potential Coastal Wetland* | *Potential Other Waters of the U.S.* |
|---|---|---|
| 0.26 ac. | 0.57 ac. | 0 ac. |

# Locke Paddon Lake Wetland Delineation Map

C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Wetland Delineation Maps\Figure 7 Locke Paddon WD Map.mxd

Date: 2/26/2015

Scale: 1 inch = 0.03 miles

Project: 2013-13


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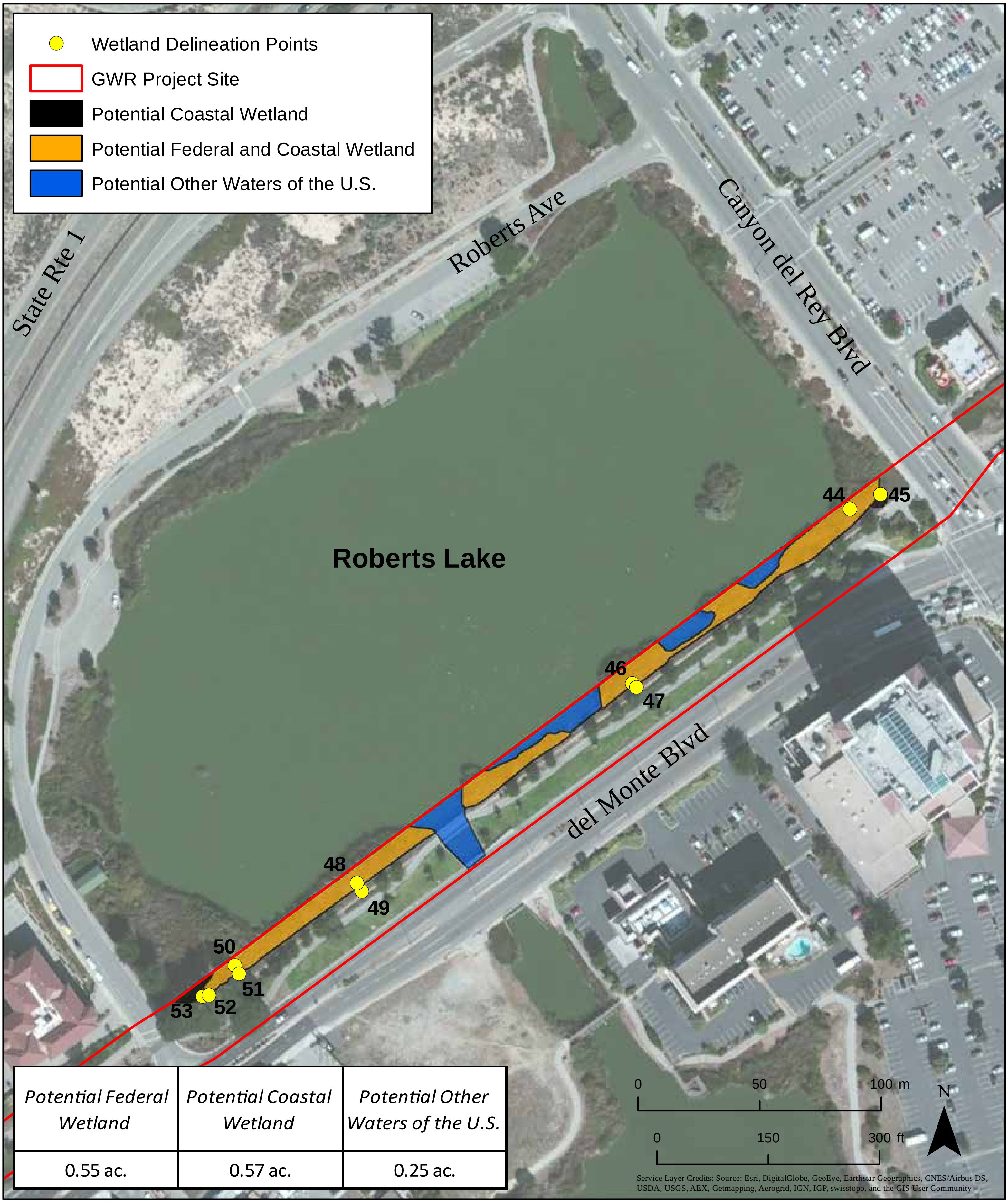
Figure 7




| *Potential Federal Wetland* | *Potential Coastal Wetland* | *Potential Other Waters of the U.S.* |
|---|---|---|
| 0.55 ac. | 0.57 ac. | 0.25 ac. |

# Roberts Lake
# Wetland Delineation Map

C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Combined Wetland Delineation Maps\Figure 8 Roberts Lake WD Map20150226.mxd

Date: 3/3/2015
Scale: 1 inch = 0.03 miles
Project: 2013-13

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947 Cass Street, Suite 5
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Figure
8

### 4.6.2. Soils

A soil pit was not dug within the Lake El Estero Diversion evaluation area, as the substrate is a cement pad.

### 4.6.3. Hydrology

The Lake El Estero Diversion evaluation area is located in the upland adjacent to Lake El Estero. No hydrologic indicators are present within the evaluation area. Surface water within the lake is visible on aerials, which was utilized to identify hydrology adjacent to the evaluation area (**Figure 9**).

## 4.7. Ditch

### 4.7.1. Vegetation

Vegetation within most of the Ditch evaluation area is significantly disturbed. As such, this delineation focused primarily on areas where potential wetland vegetation was present. Wetland vegetation was observed at 47 sampling points within the Ditch evaluation area. Sampling points 20, 23, 32, and 34 are located near where roads pass over the Ditch (**Figures 10a and 10b**). At these sampling points wetland vegetation consisted of a mix of native species, such as watercress (OBL), swamp knotweed (*Polygonum amphibium* var. *emersum* OBL), willow-herb (*Epilobium ciliatum* FACW), and salt heliotrope (*Heliotropium curassavicum* OBL); and non-native species, such as curly dock (*Rumex crispus* FACW), rabbitfoot grass (FACW), and poison hemlock (FACW). Sampling point 30 located just west of Highway 183, and sampling point 31 located just west of Boronda Road, are dominated by Arroyo willow (FAC) (**Figures 10a and 10b**). Sampling points 24, 25, 60, and 68-72 are located within the man-made wetland near Molera Road (**Figure 10a**). Dominant species present in the man-made wetland include alkali heath (OBL), fleshy jaumea (OBL), salt grass (FAC), and California bulrush (OBL). Sampling points 3, 4, 5, 8, 27, and 28 are located within the salt marsh area just upstream of the tide gates at Potrero Road (**Figure 10a**). Dominant species within the salt marsh included fleshy jaumea (OBL), alkali heath (OBL), gum-plant (FACW), salt grass (FAC), pacific silver-weed (OBL), and pickleweed (OBL). Sampling points 54-60 are located along the Old Salinas River Channel, upstream of the confluence with Tembladero Slough (**Figure 10a)**. At these sampling points dominant species present included bulrush (OBL), pacific silver-weed (OBL), mule fat (*Baccharis salicifolia* FAC), fleshy jaumea (OBL), and spearscale (FAC). The remaining sampling points taken at the Ditch were either unvegetated (five points) or dominated by non-native upland species (eight points) or coastal dune scrub species (two points).

### 4.7.2. Soils

Hydric soil indicators were observed at 17 sampling points within the Ditch evaluation area. Indicators observed included loamy gleyed matrix (points 3, 8, 33, 35, 61, and 72), sandy redox (point 4), 1 cm muck (point 5), depleted matrix (points 5, 34, 55, 64, 68, and 69), of redox dark surface (points 21 and 25), and depleted dark surface (point 28) (**Figures 10a and 10b**).

### 4.7.3. Hydrology

Hydrologic indicators were observed at 25 of the sampling points within the Ditch evaluation area. Primary indicators were observed at 12 sampling points (5, 25, 33, 35, 55, 57, 58, 59, 61-64, 67-69, 72) (**Figures 10a**). The primary indicators observed included surface water, high water table, saturation, oxidized rhizospheres along living roots, presence of reduced iron, and soil surface cracks. Two or more secondary indicators were observed at eight sampling points (3, 4, 8, 18, 20, 21, 23, 28, 57-59, and 65) (**Figures 10a and 10b**). The secondary indicators observe included riverine water marks, riverine drift deposits, and drainage patterns.


| *Potential Federal Wetland* | *Potential Coastal Wetland* | *Potential Other Waters of the U.S.* |
|---|---|---|
| 0 ac. | 0 ac. | 0 ac. |

**Please note that while 0.69 acres of potential federal wetland and 17.27 acre of potential other waters of the U.S. are present at El Estero Lake, these areas these areas are outside of the GWR Project site and will not be impacted by construction or water diversion resulting from the project.**

# El Estero Lake Diversion Site Wetland Delineation Map

C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Combined Wetland Delineation Maps\Figure 9 El Estero Lake WD Map 20150226.mxd

Date: 3/3/2015
Scale: 1 inch = 0.05 miles
Project: 2013-13

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Figure 9


| Potential Federal Wetland | Potential Coastal Wetland | Potential Other Waters of the U.S. |
|---|---|---|
| 14.41 ac. | 18.37 ac. | 51.15 ac. |

**Please note that this does not include the area of wetlands or other waters within the GWR Project Site boundary (diversion sites) that overlap with the Ditch Evaluation Area.**

# Ditch Evaluation Area Wetland Delineation Map

Date: 4/8/2015
Scale: 1 in = 1,700 feet
Project: 2013-13

Document Path: C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Combined Wetland Delineation Maps\Figure 10a Ditch WD Map 20150408.mxd

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947 Cass Street, Suite 5
Monterey, CA 93940
(831) 373-4341

Figure 10a


| *Potential Federal Wetland* | *Potential Coastal Wetland* | *Potential Other Waters of the U.S.* |
|---|---|---|
| 14.41 ac. | 18.37 ac. | 51.15 ac. |

**Please note that this does not include the area of wetlands or other waters within the GWR Project Site boundary (diversion sites) that overlap with the Ditch Evaluation Area.**

# Ditch Evaluation Area Wetland Delineation Map

Date: 4/9/2015

Scale: 1 in = 1,700 feet

Project: 2013-13

Document Path: C:\GIS\GIS_Projects\2013-13 GWR\Final Products\BIO\Combined Wetland Delineation Maps\Figure 10b Ditch WD Map 20150408.mxd

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947 Cass Street, Suite 5
Monterey, CA 93940
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Figure 10b

# 5. Jurisdiction

Sections within each evaluation area were identified as having the potential to support wetlands and/or other waters. Approximately 51.94 acres of other waters of the U.S. and 15.28 acres of federal wetlands potentially under the jurisdiction of the ACOE were identified within the evaluation areas. Of the federal wetlands potentially under the jurisdiction of the ACOE approximately 14.68 acres are located in the coastal zone and may also be under the jurisdiction of the CCC. Approximately 4.84 additional acres of potential coastal wetlands under the jurisdiction of the CCC were also identified.

## 5.1. Federal Jurisdiction

### 5.1.1. Reclamation Ditch Diversion

Approximately 0.05 acre of potential other waters of the U.S. were identified within the Reclamation Ditch Diversion evaluation area (**Figure 4**; **Appendix A**). No potentially federal wetlands were identified in this evaluation area.

### 5.1.2. Tembladero Slough Diversion

Approximately 0.20 acre of potential other waters of the U.S. were identified within the Tembladero Slough Diversion evaluation area (**Figure 5**; **Appendix A**). No potentially federal wetlands were identified in this evaluation area.

### 5.1.3. Blanco Drain Diversion

Approximately 0.12 acre of the agricultural drainage ditch and approximately 0.18 acre of the main channel of the Salinas River were identified as potential other waters of the U.S. within the Blanco Drain Diversion evaluation area (**Figure 6**; **Appendix A**). No potentially federal wetlands were identified in this evaluation area.

### 5.1.4. Locke Paddon Lake

Within the Locke Paddon Lake evaluation area, approximately 0.26 acre of federal wetlands potentially under ACOE jurisdiction was identified (**Figure 7**; **Appendix A**). Please note that the wetlands at Locke Paddon Lake extend beyond the evaluation area; however, due to access issues only the area within the GWR Project site were evaluated. No potential other waters of the U.S. were identified within the evaluation area.

### 5.1.5. Roberts Lake

Within the Roberts Lake evaluation area, approximately 0.55 acre of potential federal wetlands and 0.25 acre of potential other waters were identified (**Figure 8**; **Appendix A**). Please note that the wetlands at Roberts Lake extend beyond the evaluation area; however, due to access issues only the area within the GWR Project site was evaluated.

### 5.1.6. Lake El Estero Diversion

No potentially federal wetlands or other waters of the U.S. are present within the Lake El Estero Diversion evaluation area (**Figure 9**; **Appendix A**). Approximately 0.69 acre of potentially federal wetland and 17.27 acre of potential other waters are present within Lake El Estero; however, these areas will not be impacted by construction of water diversion as a result of the GWR Project.

#### 5.1.7. Ditch

Approximately 14.41 acres of federal wetlands potentially under the jurisdiction of the ACOE were identified within the Ditch evaluation area (**Figures 10a and 10b**; **Appendix A**). Additionally, approximately 51.15 acres of other waters were identified within this evaluation area.

### 5.2. CCC Jurisdiction

#### 5.2.1. Reclamation Ditch Diversion

The Reclamation Ditch Diversion evaluation area is not located in the coastal zone. As such, no potential coastal wetlands are present within this area.

#### 5.2.2. Tembladero Slough Diversion

Approximately 0.01 acre of wetlands potentially under the jurisdiction of the CCC was identified within the Tembladero Slough Diversion evaluation are (**Figure 5**; **Appendix A**).

#### 5.2.3. Blanco Drain Diversion

The Blanco Drain Diversion evaluation area is not located in the coastal zone. As such, no potential coastal wetlands are present within this area.

#### 5.2.4. Locke Paddon Lake

Approximately 0.57 acre of wetlands potentially under the jurisdiction of the CCC was identified within the Locke Paddon Lake evaluation area (**Figure 7**; **Appendix A**). This number includes potentially federally jurisdictional wetlands and additional areas that met only one or two parameters. Please note that the wetlands at Locke Paddon Lake extend beyond the evaluation area; however, due to access issues only the area within the GWR Project site were evaluated.

#### 5.2.5. Roberts Lake

Approximately 0.57 acre of wetlands potentially under the jurisdiction of the CCC was identified within the Roberts Lake evaluation area (**Figure 8**; **Appendix A**). This number includes potentially federally jurisdictional wetlands and additional areas that met only one or two parameters.

#### 5.2.6. Lake El Estero Diversion

The Lake El Estero Diversion evaluation area is not located in the coastal zone. As such, no potential coastal wetlands are present within this area.

#### 5.2.7. Ditch

Approximately 18.37 acres of wetlands potentially under the jurisdiction of the CCC were identified within the Ditch evaluation area (**Figures 10a and 10b**; **Appendix A**). This number includes 13.88 acres of potentially federally jurisdictional wetlands and 4.5 acres of additional areas that met only one or two parameters.

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# **Appendix A:** Wetland Determination Data Forms for the Arid West Region

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## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Ground Water Replenishment (GWR) City/County: Moss Landing / Monterey Sampling Date: 7-24-14

Applicant/Owner: MRWPCA State: CA Sampling Point: [illegible]

Investigator(s): [illegible] Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): [illegible] Local relief (concave, convex, none): [illegible] Slope (%): [illegible]

Subregion (LRR): LRRC Lat: 36°47'25.69"N Long: 121°47'28.09"W Datum: NAD83

Soil Map Unit Name: [illegible] NWI classification: Estuarine [illegible]

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation Y, Soil Y, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ | No X |
| Hydric Soil Present? | Yes ____ | No X |
| Wetland Hydrology Present? | Yes X | No ____ |

Is the Sampled Area within a Wetland? Yes ____ No X

Remarks:
[illegible]

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | | = Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | | = Total Cover | |
| **Herb Stratum** (Plot size: ____) | | | |
| 1. [illegible] | 70 | Y | NL |
| 2. [illegible] | 5 | N | FACW |
| 3. [illegible] | 5 | N | NL |
| 4. [illegible] | 2 | N | FAC |
| 5. [illegible] | 5 | N | FACW |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | [illegible] | = Total Cover | |
| **Woody Vine Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| | | = Total Cover | |

% Bare Ground in Herb Stratum [illegible] % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species ____ | x 1 = ____ |
| FACW species ____ | x 2 = ____ |
| FAC species ____ | x 3 = ____ |
| FACU species ____ | x 4 = ____ |
| UPL species ____ | x 5 = ____ |
| Column Totals: ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes ____ No X

Remarks:
[illegible]

## SOIL

Sampling Point: ________

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ________

Depth (inches): ________

**Hydric Soil Present?** Yes ____ No ✓

Remarks:

Large rip rap

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- X Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- X Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ____ No X Depth (inches): ________

Water Table Present? Yes ____ No X Depth (inches): ________

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ________

**Wetland Hydrology Present?** Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

adjacent to ... water marks @ 0 [illegible]

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: [illegible] City/County: [illegible] Sampling Date: [illegible]

Applicant/Owner: MBNPLA State: CA Sampling Point: 2

Investigator(s): [illegible], Marc Johnson Section, Township, Range: ______

Landform (hillslope, terrace, etc.): [illegible] bank Local relief (concave, convex, none): concave Slope (%): 1

Subregion (LRR): LRR C Lat: 36°47' 25.53 N Long: 121°47' 28.53 W Datum: NAD83

Soil Map Unit Name: [illegible] NWI classification: Estuarine Marine wetland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ______ No X (If no, explain in Remarks.)

Are Vegetation ? , Soil N , or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ______

Are Vegetation N , Soil N , or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ No X | Is the Sampled Area within a Wetland? Yes ______ No X |
| Hydric Soil Present? | Yes ____ No X | |
| Wetland Hydrology Present? | Yes ____ No X | |

Remarks:

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ______) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | ______ = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | ______ = Total Cover | | |
| **Herb Stratum** (Plot size: 5x5) | | | |
| 1. [illegible] | 100 | Y | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | ______ = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| | ______ = Total Cover | | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species ______ | x 1 = ______ |
| FACW species ______ | x 2 = ______ |
| FAC species ______ | x 3 = ______ |
| FACU species ______ | x 4 = ______ |
| UPL species ______ | x 5 = ______ |
| Column Totals: ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

- __ Dominance Test is >50%
- __ Prevalence Index is ≤3.0[1]
- __ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- __ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes ______ No X

Remarks:

## SOIL

Sampling Point: 1

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 2.5YR 6/2 | | | | | | Sand | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5) (**LRR C**)
- __ 1 cm Muck (A9) (**LRR D**)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1)
- __ Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)
- __ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- __ 1 cm Muck (A9) (**LRR C**)
- __ 2 cm Muck (A10) (**LRR B**)
- __ Reduced Vertic (F18)
- __ Red Parent Material (TF2)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ____________

Depth (inches): ____________

**Hydric Soil Present?** Yes ____ No ✓

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- __ Surface Water (A1)
- __ High Water Table (A2)
- __ Saturation (A3)
- __ Water Marks (B1) (**Nonriverine**)
- __ Sediment Deposits (B2) (**Nonriverine**)
- __ Drift Deposits (B3) (**Nonriverine**)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Water-Stained Leaves (B9)
- __ Salt Crust (B11)
- __ Biotic Crust (B12)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Thin Muck Surface (C7)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water Marks (B1) (**Riverine**)
- __ Sediment Deposits (B2) (**Riverine**)
- __ Drift Deposits (B3) (**Riverine**)
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ____ No ✓ Depth (inches): ________

Water Table Present? Yes ____ No ✓ Depth (inches): ________

Saturation Present? (includes capillary fringe) Yes ____ No ✓ Depth (inches): ________

**Wetland Hydrology Present?** Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: TNR  City/County: Moss Landing/Monterey  Sampling Date: 7-24-12

Applicant/Owner: MBNPLA  State: CA  Sampling Point: 3

Investigator(s): Sam, Dave, Marc, Janssen  Section, Township, Range: ______

Landform (hillslope, terrace, etc.): bank of channel  Local relief (concave, convex, none): concave  Slope (%): 5%

Subregion (LRR): LRC  Lat: 36°47'25.48 N  Long: 121°47'28.44 W  Datum: NAD83

Soil Map Unit Name: Alviso silty clay loam  NWI classification: Estuarine-Marine Wetland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed?  Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic?  (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X | No ____ |
| Hydric Soil Present? | Yes X | No ____ |
| Wetland Hydrology Present? | Yes X | No ____ |

Is the Sampled Area within a Wetland? Yes X No ____

Remarks:

## VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| = Total Cover | | | |
| **Sapling/Shrub Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| = Total Cover | | | |
| **Herb Stratum** (Plot size: ____) | | | |
| 1. Juncus lamosa | 50 | Y | OBL |
| 2. Frankenia salina | 50 | Y | FACW |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| = Total Cover | 100 | | |
| **Woody Vine Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| = Total Cover | | | |

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- __ Dominance Test is >50%
- __ Prevalence Index is ≤3.0[1]
- __ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- __ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ____

Remarks:

## SOIL

Sampling Point: 3

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-8 | G1 3N | 65% | 2.5YR 4/8 | 35% | | | silty clay | |
| 8-18 | G1 3N | 90% | 2.5YR 4/8 | 10% | | | silty clay | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- X Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ___________

Depth (inches): ___________

**Hydric Soil Present?** Yes X No ___

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- X Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- X Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ___________

Water Table Present? Yes ___ No X Depth (inches): ___________

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___________

**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
inside top of bank - staff gague on opposite side

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR City/County: Moss Landing / Monterey Sampling Date: 7-24-14

Applicant/Owner: MRWPCA State: CA Sampling Point: 4

Investigator(s): [illegible] Section, Township, Range: ______

Landform (hillslope, terrace, etc.): [illegible] Local relief (concave, convex, none): flat Slope (%): 0

Subregion (LRR): LRR C Lat: 36°47'23.83"N Long: 121°47'29.54"W Datum: NAD83

Soil Map Unit Name: [illegible] NWI classification: Estuarine [illegible]

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ______ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ______

Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ______ | Is the Sampled Area within a Wetland? Yes X No ______ |
| Hydric Soil Present? | Yes X No ______ | |
| Wetland Hydrology Present? | Yes X No ______ | |

Remarks:

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ______) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| = Total Cover | | | |
| **Sapling/Shrub Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| = Total Cover | | | |
| **Herb Stratum** (Plot size: ______) | | | |
| 1. Grindelia stricta | 40 | Y | FACW |
| 2. Frankenia salina | 50 | Y | FACW |
| 3. Jaumea carnosa | 5 | N | OBL |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| = Total Cover | 95 | | |
| **Woody Vine Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| = Total Cover | | | |

50% 47.5 20% 19

% Bare Ground in Herb Stratum 5% % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species ______ | x 1 = ______ |
| FACW species ______ | x 2 = ______ |
| FAC species ______ | x 3 = ______ |
| FACU species ______ | x 4 = ______ |
| UPL species ______ | x 5 = ______ |
| Column Totals: ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

- __ Dominance Test is >50%
- __ Prevalence Index is ≤3.0[1]
- __ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- __ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ______

Remarks:

## SOIL

Sampling Point: 4

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-10 | 10YR4/3 | 100% | | | | | coarse loamy sand | |
| 10-13 | 2.5Y5/2 | 70% | 2.5YR3/6 | 30% | C | M | sand | |
| 13-15 | 7.5YR5/1 | 100% | | | | | sand | |
| 15-18 | 5YR4/1 | 90% | 2.5YR3/6 | 10% | C | M | sand[illegible] | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- X Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ______________

Depth (inches): ______________

**Hydric Soil Present?** Yes X No ___

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- X Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- X Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ___ | No X | Depth (inches): ______ |
| Water Table Present? | Yes ___ | No X | Depth (inches): ______ |
| Saturation Present? (includes capillary fringe) | Yes ___ | No X | Depth (inches): ______ |

**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Sample #[illegible]

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GNR City/County: Moss Landing/Monterey Sampling Date: 7-24-14

Applicant/Owner: MRWPCA State: CA Sampling Point: 5

Investigator(s): [illegible] Section, Township, Range: ____

Landform (hillslope, terrace, etc.): Swale Local relief (concave, convex, none): [illegible] Slope (%): 0

Subregion (LRR): LRR C Lat: 36°47' [illegible] Long: 121°47' [illegible] W Datum: NAD83

Soil Map Unit Name: [illegible] NWI classification: Estuarine + Marine Wetland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X | No ____ |
| Hydric Soil Present? | Yes X | No ____ |
| Wetland Hydrology Present? | Yes X | No ____ |

Is the Sampled Area within a Wetland? Yes X No ____

Remarks:

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | = Total Cover | | |
| **Herb Stratum** (Plot size: 10x10) | | | |
| 1. Sarcocornia pacifica | 75 | Y | OBL |
| 2. [illegible] | 10 | N | FACW |
| 3. [illegible] | 5 | N | FAC |
| 4. Juncus carnosa | 10 | N | OBL |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | 100 = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| | = Total Cover | | |

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ____

Remarks:

## SOIL

Sampling Point: ______

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-1 | 5Y 2.5/1 | | | | | | Muck | [illegible] |
| 1-10 | 10YR 4/1 | 85% | 2.5YR 3/6 | 15% | M | PL | [illegible] | [illegible] |
| 10-18 | 2.5Y 3/1 | 75% | 5YR 4/6 | 25% | [illegible] | C | [illegible] | [illegible] |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- X 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** Yes X No ___

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ______

Water Table Present? Yes ___ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ______

**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR City/County: Moss Landing/Monterey Sampling Date: 7-[illegible]

Applicant/Owner: MRWPCA State: CA Sampling Point: 6

Investigator(s): Jami Davis, Matt Johnson Section, Township, Range: ______

Landform (hillslope, terrace, etc.): dual slope Local relief (concave, convex, none): concave Slope (%): 12

Subregion (LRR): LRR C Lat: 36°47'21.05" N Long: 121°47'31.89" W Datum: NAD 83

Soil Map Unit Name: [illegible] NWI classification: Estuarine + Marine Wetland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ No X | Is the Sampled Area within a Wetland? | Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | | |
| Wetland Hydrology Present? | Yes ____ No X | | |

Remarks:

### VEGETATION – Use scientific names of plants.

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| **Tree Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | ____ = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: [illegible]) | | | |
| 1. [illegible] | 5 | Y | NL |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | 5 = Total Cover | | |
| **Herb Stratum** (Plot size: 10x10) | | | |
| 1. [illegible] | 3 | N | FAC |
| 2. [illegible] | 80 | Y | NL |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | 90 = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| | ____ = Total Cover | | |

% Bare Ground in Herb Stratum 5 % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

- __ Dominance Test is >50%
- __ Prevalence Index is ≤3.0[1]
- __ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- __ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes ____ No X

Remarks:

## SOIL

Sampling Point: 6

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 6-18 | 2.5YR4/2 | | | | | | sand | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5) (**LRR C**)
- __ 1 cm Muck (A9) (**LRR D**)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1)
- __ Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)
- __ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- __ 1 cm Muck (A9) (**LRR C**)
- __ 2 cm Muck (A10) (**LRR B**)
- __ Reduced Vertic (F18)
- __ Red Parent Material (TF2)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** Yes ____ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- __ Surface Water (A1)
- __ High Water Table (A2)
- __ Saturation (A3)
- __ Water Marks (B1) (**Nonriverine**)
- __ Sediment Deposits (B2) (**Nonriverine**)
- __ Drift Deposits (B3) (**Nonriverine**)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Water-Stained Leaves (B9)
- __ Salt Crust (B11)
- __ Biotic Crust (B12)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Thin Muck Surface (C7)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water Marks (B1) (**Riverine**)
- __ Sediment Deposits (B2) (**Riverine**)
- __ Drift Deposits (B3) (**Riverine**)
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ____ No X Depth (inches): ______

Water Table Present? Yes ____ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ______

**Wetland Hydrology Present?** Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: [illegible] City/County: [illegible] Sampling Date: 7-24-14
Applicant/Owner: MRWPCA State: CA Sampling Point: 7
Investigator(s): [illegible] Section, Township, Range: ______
Landform (hillslope, terrace, etc.): top of berm Local relief (concave, convex, none): flat Slope (%): 0
Subregion (LRR): LRR C Lat: 36°47'14.80"N Long: 121°47'33.46"W Datum: NAD83
Soil Map Unit Name: [illegible] NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)
Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ No X | **Is the Sampled Area within a Wetland?** Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | |
| Wetland Hydrology Present? | Yes ____ No X | |

Remarks:

## VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ______) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | | = Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: 10x10) | | | |
| 1. [illegible] | 5 | Y | NL |
| 2. [illegible] | 5 | Y | NL |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | 10 | = Total Cover | |
| **Herb Stratum** (Plot size: 5x5) | | | |
| 1. [illegible] | 3 | N | FAC |
| 2. [illegible] | 2 | N | FACW |
| 3. Carpobrotus edulis | 85 | Y | NL |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | [illegible] | = Total Cover | |
| **Woody Vine Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| | | = Total Cover | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ______ | x 1 = ______ |
| FACW species | ______ | x 2 = ______ |
| FAC species | ______ | x 3 = ______ |
| FACU species | ______ | x 4 = ______ |
| UPL species | ______ | x 5 = ______ |
| Column Totals: | ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes ____ No X

Remarks:

## SOIL

Sampling Point: ________

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 7.5YR 3/2 | | | | | | Sandy loam | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ________

Depth (inches): ________

**Hydric Soil Present?** Yes ___ No ✓

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No ✓ Depth (inches): ________

Water Table Present? Yes ___ No ✓ Depth (inches): ________

Saturation Present? (includes capillary fringe) Yes ___ No ✓ Depth (inches): ________

**Wetland Hydrology Present?** Yes ___ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR City/County: Moss Landing / Monterey Sampling Date: 7-24-14

Applicant/Owner: MRWPCA State: CA Sampling Point: 8

Investigator(s): [illegible], Matt Johnson Section, Township, Range: ______

Landform (hillslope, terrace, etc.): bank of channel Local relief (concave, convex, none): concave Slope (%): 2

Subregion (LRR): LRR C Lat: 36°47'44.58"N Long: 121°47'33.23"W Datum: NAD83

Soil Map Unit Name: Alviso silty clay loam NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | Is the Sampled Area within a Wetland? Yes X No ____ |
| Hydric Soil Present? | Yes X No ____ | |
| Wetland Hydrology Present? | Yes X No ____ | |

Remarks:

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| = Total Cover | | | |
| **Sapling/Shrub Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| = Total Cover | | | |
| **Herb Stratum** (Plot size: 5x5) | | | |
| 1. Jaumea carnosa | 80 | Y | OBL |
| 2. Frankenia salina | 20 | Y | FACW |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| = Total Cover | 100% | | |
| **Woody Vine Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| = Total Cover | | | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ____

Remarks:

## SOIL

Sampling Point: 6

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-6 | 7.5YR 3/3 | 100% | | | | | sandy clay | |
| 6-18 | G2 3/10BG | 70% | 2.5Y 3/2 | 10 | | M | clay | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- X Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ____________

Depth (inches): ____________

**Hydric Soil Present?** Yes X No ___

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- X Drift Deposits (B3) (**Riverine**)
- X Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ______

Water Table Present? Yes X No ___ Depth (inches): 15

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): 14

**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: [illegible] City/County: [illegible] Sampling Date: 7-24-[illegible]

Applicant/Owner: MRWPCA State: [illegible] Sampling Point: 9

Investigator(s): [illegible] Section, Township, Range: ______

Landform (hillslope, terrace, etc.): [illegible] bank Local relief (concave, convex, none): convex Slope (%): 1

Subregion (LRR): LRR C Lat: 36° 46' 6.49" N Long: 121° 46' 1.06" W Datum: NAD83

Soil Map Unit Name: ______ NWI classification: [illegible]

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation Y, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ No X | Is the Sampled Area within a Wetland? Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | |
| Wetland Hydrology Present? | Yes X No ____ | |

Remarks:

### VEGETATION – Use scientific names of plants.

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| **Tree Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| = Total Cover | | | |
| **Sapling/Shrub Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| = Total Cover | | | |
| **Herb Stratum** (Plot size: 5x5) | | | |
| 1. Atriplex sp. | 3 | Y | |
| 2. [illegible] | 2 | Y | |
| 3. [illegible] | 1 | N | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| = Total Cover | 6 | | |
| **Woody Vine Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| [illegible] | | | |
| = Total Cover | | | |

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- __ Dominance Test is >50%
- __ Prevalence Index is ≤3.0[1]
- __ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- __ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes ____ No ____

Remarks: Vegetation significantly disturbed - active vegetation manipulation [illegible] to [illegible] of [illegible] channel

## SOIL

Sampling Point: 1

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 5YR 3/1 | | | | | | Silty clay | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5) (**LRR C**)
- __ 1 cm Muck (A9) (**LRR D**)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1)
- __ Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)
- __ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- __ 1 cm Muck (A9) (**LRR C**)
- __ 2 cm Muck (A10) (**LRR B**)
- __ Reduced Vertic (F18)
- __ Red Parent Material (TF2)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** Yes ____ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- __ Surface Water (A1)
- __ High Water Table (A2)
- __ Saturation (A3)
- __ Water Marks (B1) (**Nonriverine**)
- __ Sediment Deposits (B2) (**Nonriverine**)
- __ Drift Deposits (B3) (**Nonriverine**)
- X Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Water-Stained Leaves (B9)
- __ Salt Crust (B11)
- __ Biotic Crust (B12)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Thin Muck Surface (C7)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water Marks (B1) (**Riverine**)
- __ Sediment Deposits (B2) (**Riverine**)
- __ Drift Deposits (B3) (**Riverine**)
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ____ No X Depth (inches): ______

Water Table Present? Yes ____ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ______

**Wetland Hydrology Present?** Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

1st bank - ~2-4 ft from channel edge

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR City/County: [illegible]/Monterey Sampling Date: 7-24-14

Applicant/Owner: MRWPCA State: CA Sampling Point: 13

Investigator(s): [illegible] Section, Township, Range: ______

Landform (hillslope, terrace, etc.): [illegible] bank Local relief (concave, convex, none): [illegible] Slope (%): 1

Subregion (LRR): [illegible] Lat: 36°46' 6.60" N Long: 121°46' 1.08" W Datum: NAD 83

Soil Map Unit Name: ______ NWI classification: [illegible]

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation Y, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ No X | Is the Sampled Area within a Wetland? Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | |
| Wetland Hydrology Present? | Yes ____ No X | |

Remarks: 3rd year of drought

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | ____ = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | ____ = Total Cover | | |
| **Herb Stratum** (Plot size: 5x5) | | | |
| 1. Unknown 1 | 10 | Y | |
| 2. Unknown 2 | 1 | N | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | 11 = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 50% 5.5 20% 2.2 | ____ = Total Cover | | |

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- __ Dominance Test is >50%
- __ Prevalence Index is ≤3.0[1]
- __ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- __ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes ____ No X

Remarks: [illegible] unknown [illegible]

## SOIL

Sampling Point: 16

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 5YR 3/1 | | | | | | Silt loam | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5) (**LRR C**)
- __ 1 cm Muck (A9) (**LRR D**)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1)
- __ Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)
- __ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- __ 1 cm Muck (A9) (**LRR C**)
- __ 2 cm Muck (A10) (**LRR B**)
- __ Reduced Vertic (F18)
- __ Red Parent Material (TF2)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ____

Depth (inches): ____

**Hydric Soil Present?** **Yes** ____ **No** ✓

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- __ Surface Water (A1)
- __ High Water Table (A2)
- __ Saturation (A3)
- __ Water Marks (B1) (**Nonriverine**)
- __ Sediment Deposits (B2) (**Nonriverine**)
- __ Drift Deposits (B3) (**Nonriverine**)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Water-Stained Leaves (B9)
- __ Salt Crust (B11)
- __ Biotic Crust (B12)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Thin Muck Surface (C7)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water Marks (B1) (**Riverine**)
- __ Sediment Deposits (B2) (**Riverine**)
- __ Drift Deposits (B3) (**Riverine**)
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ____ No ✓ Depth (inches): ____

Water Table Present? Yes ____ No ✓ Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No ✓ Depth (inches): ____

**Wetland Hydrology Present?** **Yes** ____ **No** ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR City/County: Marina/Monterey Sampling Date: 7-24-14

Applicant/Owner: MRWPCA State: CA Sampling Point: 11

Investigator(s): [illegible] Section, Township, Range: ______

Landform (hillslope, terrace, etc.): [illegible] Local relief (concave, convex, none): [illegible] Slope (%): 0

Subregion (LRR): LRR C Lat: 36°42'23.11"N Long: 121°44'57.26"W Datum: NAD 83

Soil Map Unit Name: Metz Complex NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ______ No X (If no, explain in Remarks.)

Are Vegetation Y, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ______

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ______ No X | Is the Sampled Area within a Wetland? Yes ______ No X |
| Hydric Soil Present? | Yes ______ No X | |
| Wetland Hydrology Present? | Yes ______ No X | |

Remarks:
[illegible]

## VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ______) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | ______ = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | ______ = Total Cover | | |
| **Herb Stratum** (Plot size: 5x5) | | | |
| 1. [illegible] | 3 | N | |
| 2. [illegible] | [illegible] | N | |
| 3. [illegible] | 5 | Y | |
| 4. [illegible] | 1 | N | |
| 5. [illegible] | 4 | Y | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | [illegible] = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| | ______ = Total Cover | | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: ______ (A)

Total Number of Dominant Species Across All Strata: ______ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ______ (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ______ | x 1 = ______ |
| FACW species | ______ | x 2 = ______ |
| FAC species | ______ | x 3 = ______ |
| FACU species | ______ | x 4 = ______ |
| UPL species | ______ | x 5 = ______ |
| Column Totals: | ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes ______ No ______

Remarks:
[illegible]

## SOIL

Sampling Point: 11

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 10YR 4/3 | | | | | | Loamy silt | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5) (**LRR C**)
- __ 1 cm Muck (A9) (**LRR D**)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1)
- __ Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)
- __ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- __ 1 cm Muck (A9) (**LRR C**)
- __ 2 cm Muck (A10) (**LRR B**)
- __ Reduced Vertic (F18)
- __ Red Parent Material (TF2)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** Yes ____ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- __ Surface Water (A1)
- __ High Water Table (A2)
- __ Saturation (A3)
- __ Water Marks (B1) (**Nonriverine**)
- __ Sediment Deposits (B2) (**Nonriverine**)
- __ Drift Deposits (B3) (**Nonriverine**)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Water-Stained Leaves (B9)
- __ Salt Crust (B11)
- __ Biotic Crust (B12)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Thin Muck Surface (C7)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water Marks (B1) (**Riverine**)
- __ Sediment Deposits (B2) (**Riverine**)
- __ Drift Deposits (B3) (**Riverine**)
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ____ No X Depth (inches): ______

Water Table Present? Yes ____ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ______

**Wetland Hydrology Present?** Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: SNR  City/County: Monterey County  Sampling Date: 7-21-14

Applicant/Owner: MRWPCA  State: CA  Sampling Point: 17

Investigator(s): Jam Dow? Nam Inson  Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Swale  Local relief (concave, convex, none): Concave  Slope (%): 2

Subregion (LRR): LRR C  Lat: 36°42'24.99" Long: 1?°44'53.12"  Datum: NAD83

Soil Map Unit Name: Mocho Silt loam, 0 to 2 % slopes  NWI classification: Freshwater forested/shrub wetland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ______ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed?  Are "Normal Circumstances" present? Yes X No ______

Are Vegetation N, Soil N, or Hydrology N naturally problematic?  (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | | |
|---|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes ______ | No X | Is the Sampled Area within a Wetland? | Yes ______ No X |
| Hydric Soil Present? | Yes ______ | No X | | |
| Wetland Hydrology Present? | Yes X | No ______ | | |

Remarks:

## VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: 10x10) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. [illegible] | 40 | Y | FACW |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | Y | = Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | | = Total Cover | |
| **Herb Stratum** (Plot size: 5x5) | | | |
| 1. [illegible] | 4 | Y | FACU |
| 2. [illegible] | 2 | Y | FACW |
| 3. [illegible] | 3 | Y | NL |
| 4. [illegible] | 7 | N | FACU |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | 12 | = Total Cover | |
| **Woody Vine Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| 50% = 5 20% = 2 | | = Total Cover | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ______ | x 1 = ______ |
| FACW species | ______ | x 2 = ______ |
| FAC species | ______ | x 3 = ______ |
| FACU species | ______ | x 4 = ______ |
| UPL species | ______ | x 5 = ______ |
| Column Totals: | ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes ______ No X

Remarks:

## SOIL

Sampling Point: ______

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 2.5Y 5/2 | | | | | | Sand | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** Yes ___ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- X Sediment Deposits (B2) (**Riverine**)
- X Drift Deposits (B3) (**Riverine**)
- X Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ______

Water Table Present? Yes ___ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ______

**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Sand wet @ ~8in but not saturated

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GNR City/County: [illegible] Sampling Date: 7-24-14

Applicant/Owner: MRWPCA State: — Sampling Point: 13

Investigator(s): [illegible] Section, Township, Range: ______

Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): ______ Slope (%): ______

Subregion (LRR): LRRC Lat: 36°42' [illegible] N Long: 121°44' 54.95" W Datum: NAD83

Soil Map Unit Name: WATER NWI classification: [illegible]

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ______ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes ✓ No ______

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ______ No ______ | Is the Sampled Area within a Wetland? Yes ______ No ______ |
| Hydric Soil Present? | Yes ______ No X | |
| Wetland Hydrology Present? | Yes ______ No ______ | |

Remarks:
berm [illegible] high [illegible] w/ [illegible]
riparian [illegible] side of berm [illegible], [illegible] point [illegible]

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ______) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Salix [illegible] | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | = Total Cover | | |
| **Herb Stratum** (Plot size: ______) | | | |
| 1. [illegible] | | | |
| 2. [illegible] | | | |
| 3. [illegible] | | | |
| 4. [illegible] | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| | = Total Cover | | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: ______ (A)

Total Number of Dominant Species Across All Strata: ______ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ______ (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ______ | x 1 = ______ |
| FACW species | ______ | x 2 = ______ |
| FAC species | ______ | x 3 = ______ |
| FACU species | ______ | x 4 = ______ |
| UPL species | ______ | x 5 = ______ |
| Column Totals: | ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

- __ Dominance Test is >50%
- __ Prevalence Index is ≤3.0[1]
- __ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- __ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes ______ No X

Remarks:

## SOIL

Sampling Point: 13

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ______________

Depth (inches): ______________

**Hydric Soil Present?** Yes ___ No ___

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- X Sediment Deposits (B2) (**Riverine**)
- X Drift Deposits (B3) (**Riverine**)
- X Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No ___ Depth (inches): ______

Water Table Present? Yes ___ No ___ Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ___ No ___ Depth (inches): ______

**Wetland Hydrology Present? Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: SMR  City/County: [illegible] Co  Sampling Date: 7-24-14

Applicant/Owner: [illegible]  State: CA  Sampling Point: 14

Investigator(s): [illegible]  Section, Township, Range: ______

Landform (hillslope, terrace, etc.): [illegible] bank of channel  Local relief (concave, convex, none): [illegible]  Slope (%): 1

Subregion (LRR): LRR C  Lat: 32°42'26.14" N  Long: 121° 44' 51.97" W  Datum: [illegible]

Soil Map Unit Name: [illegible] loam, 0-2 % slope  NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ______ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed?  Are "Normal Circumstances" present? Yes X No ______

Are Vegetation N, Soil N, or Hydrology N naturally problematic?  (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X | No ______ |
| Hydric Soil Present? | Yes X | No ______ |
| Wetland Hydrology Present? | Yes X | No ______ |

Is the Sampled Area within a Wetland? Yes X No ______

Remarks:

## VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ______) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | | = Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: 5x5) | | | |
| 1. Salix [illegible] | 5 | Y | FACW |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | 5 | = Total Cover | |
| **Herb Stratum** (Plot size: 5x5) | | | |
| 1. [illegible] | 40 | Y | FACW |
| 2. [illegible] | 2 | N | |
| 3. [illegible] | 1 | N | |
| 4. [illegible] | 3 | N | |
| 5. [illegible] | 1 | N | |
| 6. Rumex sp. | 40 | Y | FAC |
| 7. [illegible] | 1 | N | |
| 8. | | | |
| | 88 | = Total Cover | |
| **Woody Vine Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| | | = Total Cover | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ______ | x 1 = ______ |
| FACW species | ______ | x 2 = ______ |
| FAC species | ______ | x 3 = ______ |
| FACU species | ______ | x 4 = ______ |
| UPL species | ______ | x 5 = ______ |
| Column Totals: | ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

X Dominance Test is >50%
__ Prevalence Index is ≤3.0[1]
__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ______

Remarks:

## SOIL

Sampling Point: ______

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-9 | 10YR4/2 | 100% | | | | | Sand | |
| 9-18 | 10YR4/2 | 75% | 2.5YR3/6 | 25% | C | M | Sand | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- X Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** Yes X No ___

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- X Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- X Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ______

Water Table Present? Yes ___ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): 15

**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Jang@Oin

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR City/County: Monterey Co Sampling Date: 3-24-11

Applicant/Owner: MRWPCA State: CA Sampling Point: 15

Investigator(s): [illegible] Section, Township, Range: ______

Landform (hillslope, terrace, etc.): [illegible] Local relief (concave, convex, none): concave Slope (%): 1

Subregion (LRR): LRR C Lat: 36°42'26.26"N Long: 121°44'51.21"W Datum: NAD83

Soil Map Unit Name: Mocho silt loam, 0-2% slope NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ No X | Is the Sampled Area within a Wetland? | Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | | |
| Wetland Hydrology Present? | Yes ____ No X | | |

Remarks:

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | = Total Cover | | |
| **Sapling/Shrub Stratum (Plot size: ____)** | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | = Total Cover | | |
| **Herb Stratum (Plot size: ____)** | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | = Total Cover | | |
| **Woody Vine Stratum (Plot size: ____)** | | | |
| 1. | | | |
| 2. | | | |
| | = Total Cover | | |

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- __ Dominance Test is >50%
- __ Prevalence Index is ≤3.0[1]
- __ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- __ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes ____ No X

Remarks:
unvegetated

## SOIL

Sampling Point: 10

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 10YR 4/2 | | | | | | Sand | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

__ Histosol (A1)
__ Histic Epipedon (A2)
__ Black Histic (A3)
__ Hydrogen Sulfide (A4)
__ Stratified Layers (A5) (**LRR C**)
__ 1 cm Muck (A9) (**LRR D**)
__ Depleted Below Dark Surface (A11)
__ Thick Dark Surface (A12)
__ Sandy Mucky Mineral (S1)
__ Sandy Gleyed Matrix (S4)
__ Sandy Redox (S5)
__ Stripped Matrix (S6)
__ Loamy Mucky Mineral (F1)
__ Loamy Gleyed Matrix (F2)
__ Depleted Matrix (F3)
__ Redox Dark Surface (F6)
__ Depleted Dark Surface (F7)
__ Redox Depressions (F8)
__ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

__ 1 cm Muck (A9) (**LRR C**)
__ 2 cm Muck (A10) (**LRR B**)
__ Reduced Vertic (F18)
__ Red Parent Material (TF2)
__ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ____________

Depth (inches): ____________

**Hydric Soil Present?** Yes ____ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

__ Surface Water (A1)
__ High Water Table (A2)
__ Saturation (A3)
__ Water Marks (B1) (**Nonriverine**)
__ Sediment Deposits (B2) (**Nonriverine**)
__ Drift Deposits (B3) (**Nonriverine**)
__ Surface Soil Cracks (B6)
__ Inundation Visible on Aerial Imagery (B7)
__ Water-Stained Leaves (B9)
__ Salt Crust (B11)
__ Biotic Crust (B12)
__ Aquatic Invertebrates (B13)
__ Hydrogen Sulfide Odor (C1)
__ Oxidized Rhizospheres along Living Roots (C3)
__ Presence of Reduced Iron (C4)
__ Recent Iron Reduction in Tilled Soils (C6)
__ Thin Muck Surface (C7)
__ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

__ Water Marks (B1) (**Riverine**)
__ Sediment Deposits (B2) (**Riverine**)
__ Drift Deposits (B3) (**Riverine**)
X Drainage Patterns (B10)
__ Dry-Season Water Table (C2)
__ Crayfish Burrows (C8)
__ Saturation Visible on Aerial Imagery (C9)
__ Shallow Aquitard (D3)
__ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes ____ No X Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

**Wetland Hydrology Present?** Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR  City/County: Salinas/Monterey Co  Sampling Date: ~~[illegible]~~ 7-24-14

Applicant/Owner: [illegible]  State: CA  Sampling Point: 16

Investigator(s): [illegible]  Section, Township, Range: ______

Landform (hillslope, terrace, etc.): 1st bank  Local relief (concave, convex, none): Concave  Slope (%): 1

Subregion (LRR): LRRC  Lat: 36°41'8.53"N  Long: 121°40'24"18 W  Datum: NAD83

Soil Map Unit Name: CROPLEY SILTY CLAY, 0-2% SLOPES  NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation Y, Soil N, or Hydrology N significantly disturbed?  Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic?  (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ No X | Is the Sampled Area within a Wetland? | Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | | |
| Wetland Hydrology Present? | Yes ____ No X | | |

Remarks:

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| = Total Cover | | | |
| **Sapling/Shrub Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| = Total Cover | | | |
| **Herb Stratum** (Plot size: ____) | | | |
| 1. Conyza canadensis | 1 | | |
| 2. Malva | 1 | | |
| 3. | | | |
| 4. Thach - dead unidentifiable veg | 50% | Y | NL |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| = Total Cover | 52 | | |
| **Woody Vine Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| = Total Cover | | | |

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- __ Dominance Test is >50%
- __ Prevalence Index is ≤3.0[1]
- __ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- __ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes ____ No X

Remarks:

## SOIL

Sampling Point: 16

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 10YR4/3 | | | | | | loamy silt | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

__ Histosol (A1)
__ Histic Epipedon (A2)
__ Black Histic (A3)
__ Hydrogen Sulfide (A4)
__ Stratified Layers (A5) (**LRR C**)
__ 1 cm Muck (A9) (**LRR D**)
__ Depleted Below Dark Surface (A11)
__ Thick Dark Surface (A12)
__ Sandy Mucky Mineral (S1)
__ Sandy Gleyed Matrix (S4)
__ Sandy Redox (S5)
__ Stripped Matrix (S6)
__ Loamy Mucky Mineral (F1)
__ Loamy Gleyed Matrix (F2)
__ Depleted Matrix (F3)
__ Redox Dark Surface (F6)
__ Depleted Dark Surface (F7)
__ Redox Depressions (F8)
__ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

__ 1 cm Muck (A9) (**LRR C**)
__ 2 cm Muck (A10) (**LRR B**)
__ Reduced Vertic (F18)
__ Red Parent Material (TF2)
__ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ____________

Depth (inches): ____________

**Hydric Soil Present?** Yes ____ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

__ Surface Water (A1)
__ High Water Table (A2)
__ Saturation (A3)
__ Water Marks (B1) (**Nonriverine**)
__ Sediment Deposits (B2) (**Nonriverine**)
__ Drift Deposits (B3) (**Nonriverine**)
__ Surface Soil Cracks (B6)
__ Inundation Visible on Aerial Imagery (B7)
__ Water-Stained Leaves (B9)
__ Salt Crust (B11)
__ Biotic Crust (B12)
__ Aquatic Invertebrates (B13)
__ Hydrogen Sulfide Odor (C1)
__ Oxidized Rhizospheres along Living Roots (C3)
__ Presence of Reduced Iron (C4)
__ Recent Iron Reduction in Tilled Soils (C6)
__ Thin Muck Surface (C7)
__ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

__ Water Marks (B1) (**Riverine**)
__ Sediment Deposits (B2) (**Riverine**)
__ Drift Deposits (B3) (**Riverine**)
__ Drainage Patterns (B10)
__ Dry-Season Water Table (C2)
__ Crayfish Burrows (C8)
__ Saturation Visible on Aerial Imagery (C9)
__ Shallow Aquitard (D3)
__ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes ____ No X Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

**Wetland Hydrology Present?** Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR City/County: Salinas/Monterey Co Sampling Date: 8-5-14

Applicant/Owner: MRWPCA State: CA Sampling Point: 17

Investigator(s): Kari Davis, Matt Johnson, Shae Hession Section, Township, Range: ______

Landform (hillslope, terrace, etc.): top of bank Local relief (concave, convex, none): concave Slope (%): 5

Subregion (LRR): LRR C Lat: 36°41'26.51"N Long: 121°40'49.72"W Datum: NAD 83

Soil Map Unit Name: Antioch very fine sandy loam, 0-2% slopes NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation Y, Soil Y, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ No X | Is the Sampled Area within a Wetland? Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | |
| Wetland Hydrology Present? | Yes ____ No X | |

Remarks: 3rd year of statewide drought

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | = Total Cover | | |
| **Herb Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| | = Total Cover | | |

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species ____ | x 1 = ____ |
| FACW species ____ | x 2 = ____ |
| FAC species ____ | x 3 = ____ |
| FACU species ____ | x 4 = ____ |
| UPL species ____ | x 5 = ____ |
| Column Totals: ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes ____ No X

Remarks: Unvegetated

## SOIL

Sampling Point: 17

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 10YR 3/1 | | | | | | silty clay | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ___________

Depth (inches): ___________

**Hydric Soil Present?** Yes ___ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

**Wetland Hydrology Present?** Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR City/County: Soledad/Monterey Co Sampling Date: 8-5-14

Applicant/Owner: [illegible] State: CA Sampling Point: 18

Investigator(s): [illegible] Section, Township, Range: ______

Landform (hillslope, terrace, etc.): edge of channel Local relief (concave, convex, none): Convex Slope (%): 60%

Subregion (LRR): LRRC Lat: 36°41'25.42"N Long: 121°40'49.81"W Datum: NAD 83

Soil Map Unit Name: Antioch VERY FINE SANDY [illegible] NWI classification: Riverine

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation Y, Soil Y, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ No X | Is the Sampled Area within a Wetland? Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | |
| Wetland Hydrology Present? | Yes X No ____ | |

Remarks:
Potential waters

## VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| = Total Cover | | | |
| **Sapling/Shrub Stratum (Plot size: ____)** | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| = Total Cover | | | |
| **Herb Stratum (Plot size: ____)** | | | |
| 1. Unknown grass | 2 | | |
| 2. Cheeseweed | 1 | | |
| 3. Polypogon | 1 | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| = Total Cover | 4 | | |
| **Woody Vine Stratum (Plot size: ____)** | | | |
| 1. | | | |
| 2. | | | |
| = Total Cover | | | |

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species ____ | x 1 = ____ |
| FACW species ____ | x 2 = ____ |
| FAC species ____ | x 3 = ____ |
| FACU species ____ | x 4 = ____ |
| UPL species ____ | x 5 = ____ |
| Column Totals: ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- __ Dominance Test is >50%
- __ Prevalence Index is ≤3.0[1]
- __ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- __ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes ____ No X

Remarks:
~6-12in of vegetation along edge <5% = not wetland

## SOIL

Sampling Point 18

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | % | Redox Features Color (moist) | % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5) (**LRR C**)
- __ 1 cm Muck (A9) (**LRR D**)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1)
- __ Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)
- __ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- __ 1 cm Muck (A9) (**LRR C**)
- __ 2 cm Muck (A10) (**LRR B**)
- __ Reduced Vertic (F18)
- __ Red Parent Material (TF2)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ____________

Depth (inches): ____________

**Hydric Soil Present?** Yes ____ No X

Remarks:
No hole dug due to steep slope - assume same as #17

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- __ Surface Water (A1)
- __ High Water Table (A2)
- __ Saturation (A3)
- __ Water Marks (B1) (**Nonriverine**)
- __ Sediment Deposits (B2) (**Nonriverine**)
- __ Drift Deposits (B3) (**Nonriverine**)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Water-Stained Leaves (B9)
- __ Salt Crust (B11)
- __ Biotic Crust (B12)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Thin Muck Surface (C7)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- X Water Marks (B1) (**Riverine**)
- __ Sediment Deposits (B2) (**Riverine**)
- X Drift Deposits (B3) (**Riverine**)
- X Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes ____ No ____ Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No ____ Depth (inches): ____

**Wetland Hydrology Present?** Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR City/County: Salinas/ Monterey Co Sampling Date: 8-5-14

Applicant/Owner: MRWPCA State: CA Sampling Point: 19

Investigator(s): [illegible] Section, Township, Range: ____

Landform (hillslope, terrace, etc.): top of bank Local relief (concave, convex, none): Concave Slope (%): 20%

Subregion (LRR): LRR C Lat: 36°42'17.88"N Long: 121°42'18.82"W Datum: NAD83

Soil Map Unit Name: CLEAR LAKE CLAY, MODERATELY WET NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation Y, Soil Y, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes Y No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ No X | Is the Sampled Area within a Wetland? Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | |
| Wetland Hydrology Present? | Yes ____ No X | |

Remarks:

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| = Total Cover | | | |
| **Sapling/Shrub Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| = Total Cover | | | |
| **Herb Stratum** (Plot size: ____) | | | |
| 1. Conium maculatum | 10 | Y | FACW |
| 2. Brassica nigra | 10 | Y | NL |
| 3. Raphanus sativus | 20 | Y | NL |
| 4. Picris echioides | 1 | N | FACU |
| 5. Urtica dioica ssp holosericea | 2 | N | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| = Total Cover | 43 | | |
| **Woody Vine Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| = Total Cover | | | |

50%=21.5 20%=8.6

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 33% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes ____ No X

Remarks:

## SOIL

Sampling Point: 14

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 10YR2/2 | | | | | | Sandy clay | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5) (**LRR C**)
- __ 1 cm Muck (A9) (**LRR D**)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1)
- __ Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)
- __ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- __ 1 cm Muck (A9) (**LRR C**)
- __ 2 cm Muck (A10) (**LRR B**)
- __ Reduced Vertic (F18)
- __ Red Parent Material (TF2)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** Yes ____ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- __ Surface Water (A1)
- __ High Water Table (A2)
- __ Saturation (A3)
- __ Water Marks (B1) (**Nonriverine**)
- __ Sediment Deposits (B2) (**Nonriverine**)
- __ Drift Deposits (B3) (**Nonriverine**)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Water-Stained Leaves (B9)
- __ Salt Crust (B11)
- __ Biotic Crust (B12)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Thin Muck Surface (C7)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water Marks (B1) (**Riverine**)
- __ Sediment Deposits (B2) (**Riverine**)
- __ Drift Deposits (B3) (**Riverine**)
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ____ No ✓ Depth (inches): ______

Water Table Present? Yes ____ No ✓ Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ____ No ✓ Depth (inches): ______

**Wetland Hydrology Present?** **Yes** ____ **No** ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

edge of ag field

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR City/County: Salinas / Monterey Co Sampling Date: 8-5-14

Applicant/Owner: MRWPCA State: CA Sampling Point: 20

Investigator(s): [illegible] Section, Township, Range: ______

Landform (hillslope, terrace, etc.): top of slope Local relief (concave, convex, none): Cocave Slope (%): 1

Subregion (LRR): LRR C Lat: 36° 42' 18.70"N Long: 121° 42' 18.56"W Datum: NAD83

Soil Map Unit Name: Clear Lake Clay, moderately wet NWI classification: Riverine

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation Y, Soil Y, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil Y, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | Is the Sampled Area within a Wetland? Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | |
| Wetland Hydrology Present? | Yes X No ____ | |

Remarks: This point could be considered a wetland if soils were [illegible] due to sampling [illegible] however the type of environment is so [illegible] in the Rec Ditch that [illegible] it seems [illegible]. Better option is to lump in with waters

## VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| = Total Cover | | | |
| **Sapling/Shrub Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| = Total Cover | | | |
| **Herb Stratum** (Plot size: 5x5) | | | |
| 1. Nasturtium officionale | 60 | Y | OBL |
| 2. Atriplex | 20 | Y | FAC |
| 3. Picris echioides | 2 | N | FACU |
| 4. Polypogon monspeliensis | 5 | N | |
| 5. Rumex crispus | 1 | N | |
| 6. Polygonum | 2 | N | OBL |
| 7. | | | |
| 8. | | | |
| = Total Cover | 90 | | |
| **Woody Vine Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 50% = 45 20% = 18 = Total Cover | | | |

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ____

Remarks: Most species growing in a 6in-12in band of vegetation. Nasturtium only plant growing in the water

US Army Corps of Engineers Arid West – Version 2.0

## SOIL

Sampling Point: ____

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5) (**LRR C**)
- __ 1 cm Muck (A9) (**LRR D**)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1)
- __ Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)
- __ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- __ 1 cm Muck (A9) (**LRR C**)
- __ 2 cm Muck (A10) (**LRR B**)
- __ Reduced Vertic (F18)
- __ Red Parent Material (TF2)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ____

Depth (inches): ____

**Hydric Soil Present?** Yes ____ No ✓

Remarks:

Rip rap substrate - unable to dig a hole

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- __ Surface Water (A1)
- __ High Water Table (A2)
- __ Saturation (A3)
- __ Water Marks (B1) (**Nonriverine**)
- __ Sediment Deposits (B2) (**Nonriverine**)
- __ Drift Deposits (B3) (**Nonriverine**)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Water-Stained Leaves (B9)
- __ Salt Crust (B11)
- __ Biotic Crust (B12)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Thin Muck Surface (C7)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ✓ Water Marks (B1) (**Riverine**)
- __ Sediment Deposits (B2) (**Riverine**)
- X Drift Deposits (B3) (**Riverine**)
- X Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes X No ____ Depth (inches): ____

Water Table Present? Yes ✓ No ____ Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes X No ____ Depth (inches): ____

**Wetland Hydrology Present?** Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

very edge of channel

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR City/County: Salinas/Monterey Co Sampling Date: 8-5-14

Applicant/Owner: MRWPCA State: CA Sampling Point: 21

Investigator(s): [illegible] Davis, Matt Johnson, [illegible] Section, Township, Range: ______

Landform (hillslope, terrace, etc.): 1st bank Local relief (concave, convex, none): concave Slope (%): ______

Subregion (LRR): LRR C Lat: 36° 44' 24.81" N Long: 121° 41' [illegible]" W Datum: NAD83

Soil Map Unit Name: CLEAR LAKE CLAY, MODERATELY WET NWI classification: Freshwater Emergent Wet

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ______ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ______

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | |
|---|---|
| Hydrophytic Vegetation Present? Yes X No ___<br>Hydric Soil Present? Yes X No ___<br>Wetland Hydrology Present? Yes X No ___ | Is the Sampled Area within a Wetland? Yes ___ No X |

Remarks: Although all three parameters have been met at this location the presence of vegetation is subject to the agricultural practices. Additionally the scale at which this point was evaluated does not coincide with the evaluation as a whole.

## VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ______) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| = Total Cover | | | |
| **Sapling/Shrub Stratum** (Plot size: 2x20) | | | |
| 1. Salix lasiolepis | 80 | Y | FACW |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| = Total Cover | 80% | | |
| **Herb Stratum** (Plot size: 2x20) | | | |
| 1. Picris echioides | 2 | Y | FACU |
| 2. Atriplex sp. | 4 | Y | FAC |
| 3. Raphanus sativus | 1 | N | NL |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| = Total Cover | 7 | | |
| **Woody Vine Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| = Total Cover | | | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 66% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: | |
|---|---|---|---|
| OBL species | | x 1 = | |
| FACW species | | x 2 = | |
| FAC species | | x 3 = | |
| FACU species | | x 4 = | |
| UPL species | | x 5 = | |
| Column Totals: | (A) | | (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes Y No ______

Remarks: ~2ft band along 1st bank edge of channel dominated by willows. The scale at which this point was evaluated is not consistent with the rest of the evaluation and not within the context of the project. The vegetation cover would not be sufficient (>50%) if this area was evaluated at a similar scale

## SOIL

Sampling Point: 21

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-6 | 10YR 2/2 | 100% | | | | | | |
| 6-18 | 10YR 2/1 | 90% | 2.5YR 4/8 | 10% | C | M | Sandy clay | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains [2]Location: PL=Pore Lining, M=Matrix

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5) (**LRR C**)
- __ 1 cm Muck (A9) (**LRR D**)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1)
- __ Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)
- __ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- __ 1 cm Muck (A9) (**LRR C**)
- __ 2 cm Muck (A10) (**LRR B**)
- __ Reduced Vertic (F18)
- __ Red Parent Material (TF2)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ____

Depth (inches): ____

**Hydric Soil Present?** Yes X No ____

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- __ Surface Water (A1)
- __ High Water Table (A2)
- __ Saturation (A3)
- __ Water Marks (B1) (**Nonriverine**)
- __ Sediment Deposits (B2) (**Nonriverine**)
- __ Drift Deposits (B3) (**Nonriverine**)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Water-Stained Leaves (B9)
- __ Salt Crust (B11)
- __ Biotic Crust (B12)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Thin Muck Surface (C7)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water Marks (B1) (**Riverine**)
- __ Sediment Deposits (B2) (**Riverine**)
- X Drift Deposits (B3) (**Riverine**)
- X Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ____ | No X | Depth (inches): ____ |
| Water Table Present? | Yes ____ | No X | Depth (inches): ____ |
| Saturation Present? (includes capillary fringe) | Yes ____ | No X | Depth (inches): ____ |

**Wetland Hydrology Present?** Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR City/County: Salinas/Monterey Co Sampling Date: 8-5-14

Applicant/Owner: MRWPCA State: CA Sampling Point: 22

Investigator(s): Jami Davis, Matt Johnson, Sharlyn Hess Section, Township, Range: ____

Landform (hillslope, terrace, etc.): top of bank Local relief (concave, convex, none): concave Slope (%): 5

Subregion (LRR): LRRC Lat: 36°44'31.61"N Long: 121°44'16.35"W Datum: NAD83

Soil Map Unit Name: CLEAR LAKE CLAY, MODERATELY WET NWI classification: Freshwater Emergent Wetland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation Y, Soil Y, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | | |
|---|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ | No X | Is the Sampled Area within a Wetland? | Yes ____ No X |
| Hydric Soil Present? | Yes ____ | No X | | |
| Wetland Hydrology Present? | Yes ____ | No X | | |

Remarks:

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| = Total Cover | | | |
| **Sapling/Shrub Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| = Total Cover | | | |
| **Herb Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| = Total Cover | | | |
| **Woody Vine Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| = Total Cover | | | |

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: ____ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes ____ No ____

Remarks:

Unvegetated

## SOIL

Sampling Point: 12

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 10YR 2/2 | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ___

Depth (inches): ___

**Hydric Soil Present?** Yes ___ No X

Remarks:

edge of ag field

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

**Wetland Hydrology Present?** Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR City/County: Castroville/Monterey Co Sampling Date: 8-5-14

Applicant/Owner: MRWPCA State: CA Sampling Point: 23

Investigator(s): J. Davis, M. Johnson, S. Hoss Section, Township, Range: ______

Landform (hillslope, terrace, etc.): top of bank Local relief (concave, convex, none): flat Slope (%): 3

Subregion (LRR): LRR C Lat: 36°45'35.00"N Long: 121°45'15.66"W Datum: NAD83

Soil Map Unit Name: CLEAR LAKE CLAY NWI classification: Freshwater Forested Shrub Wetland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation Y, Soil Y, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | Is the Sampled Area within a Wetland? | Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | | |
| Wetland Hydrology Present? | Yes X No ____ | | |

Remarks:

## VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | ____ = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | ____ = Total Cover | | |
| **Herb Stratum** (Plot size: 5x5) | | | |
| 1. Hydrocotyle ranunculoides (?) / Polygonum amphibium var. emersum | 100 | Y | OBL |
| 2. | | | |
| 3. | | | |
| 4. ~~Persicaria [illegible]~~ | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | 100 = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| | ____ = Total Cover | | |

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ____

Remarks:

## SOIL

Sampling Point: 23

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | % | Redox Features Color (moist) | % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 7.5YR 2/1 | | | | | | Sandy loam | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** Yes ___ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- X Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- X Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ______

Water Table Present? Yes ___ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ______

**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR City/County: Monterey Co Sampling Date: 8-5-14
Applicant/Owner: MRWPCA State: CA Sampling Point: 24
Investigator(s): J Davis / M [illegible] / S [illegible] Section, Township, Range: ____
Landform (hillslope, terrace, etc.): [illegible] Local relief (concave, convex, none): [illegible] Slope (%): 0
Subregion (LRR): LRR C Lat: 36°46'90.22"N Long: 121°47'13.97"W Datum: NAD83
Soil Map Unit Name: PACHGLO CLAY LOAM NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)
Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? Yes X No ____ | Is the Sampled Area within a Wetland? | Yes ____ No X |
| Hydric Soil Present? Yes ____ No X | | |
| Wetland Hydrology Present? Yes ____ No X | | |

Remarks:
Area is part of manipulated wetland

## VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | | = Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | | = Total Cover | |
| **Herb Stratum** (Plot size: ____) | | | |
| 1. Juncus | 70 | Y | OBL |
| 2. Frankenia | 30 | Y | FACW |
| 3. Baccharis salicifolia | 1 | N | FAC |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| | | | |
| | | | |
| | 101 | = Total Cover | |
| **Woody Vine Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| | | = Total Cover | |

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ____

Remarks:

## SOIL

Sampling Point: 2-1

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-5 | 10YR 2/2 | | | | | | Clay loam | |
| 5-9 | 10YR 3/4 | | | | | | Sand | |
| 9-18 | 7.5YR 5/1 | | | | | | Clay | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ___

Depth (inches): ___

**Hydric Soil Present?** Yes ___ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

**Wetland Hydrology Present?** Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR City/County: Monterey Co Sampling Date: 8-5-14

Applicant/Owner: MRWPCA State: CA Sampling Point: 25

Investigator(s): [illegible] Section, Township, Range: ____

Landform (hillslope, terrace, etc.): top of bank Local relief (concave, convex, none): flat Slope (%): 0

Subregion (LRR): LRRC Lat: 36°46'10.20"N Long: 121°47'47.13"W Datum: NAD83

Soil Map Unit Name: PACHECO CLAY LOAM NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | Is the Sampled Area within a Wetland? Yes X No ____ |
| Hydric Soil Present? | Yes X No ____ | |
| Wetland Hydrology Present? | Yes X No ____ | |

Remarks: Area is part of a manipulated wetland

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | | = Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | | = Total Cover | |
| **Herb Stratum** (Plot size: 5x5) | | | |
| 1. Distichlis spicata | 70 | Y | FAC |
| 2. Baccharis salicifolia | 2 | N | FAC |
| 3. Juncus balticus | 20 | Y | OBL |
| 4. Frankenia | 8 | N | FACW |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | 100% | = Total Cover | |
| **Woody Vine Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| | | = Total Cover | |

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ____

Remarks:

## SOIL

Sampling Point: 2

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-7 | 2.5Y3/1 | | | | | | clay | |
| 7-8 | 10YR3/1 | 98% | 2.5YR5/8 | 2% | | | Sand | |
| 8-18 | 2.5Y3/1 | 95% | 5YR 5/8 | 5% | | | clay | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- X Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ______________

Depth (inches): ______________

**Hydric Soil Present?** Yes X No ___

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- X Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ______

Water Table Present? Yes X No ___ Depth (inches): 12 in

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): 11 in

**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR City/County: Marina, CO Sampling Date: 8-5-14

Applicant/Owner: MRWPCA State: CA Sampling Point: 26

Investigator(s): J. Davis, M. Johnson, S. Hesson Section, Township, Range: N/A

Landform (hillslope, terrace, etc.): top of berm Local relief (concave, convex, none): flat Slope (%): 0

Subregion (LRR): LRR C Lat: 36° 46' 20.29" N Long: 121° 47' 16.05" W Datum: NAD83

Soil Map Unit Name: PACHECO CLAY LOAM NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? Yes ____ No X | Is the Sampled Area within a Wetland? | Yes ____ No X |
| Hydric Soil Present? Yes ____ No X | | |
| Wetland Hydrology Present? Yes ____ No X | | |

Remarks:

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | | = Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | | = Total Cover | |
| **Herb Stratum** (Plot size: 5x5) | | | |
| 1. Brassica nigra | 5 | Y | NL |
| 2. Picris echioides | 10 | Y | FACU |
| 3. Bare ground | 5 | Y | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | 20 | = Total Cover | |
| **Woody Vine Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| | | = Total Cover | |

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ____ (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes ____ No X

Remarks:

## SOIL

Sampling Point: 2

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 10YR 2/2 | | | | | | clay loam | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ___

Depth (inches): ___

**Hydric Soil Present?** Yes ___ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

**Wetland Hydrology Present?** Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR Tembladero Slough City/County: Monterey Co. Sampling Date: 8/21/2014

Applicant/Owner: MRWPCA State: CA Sampling Point: 27

Investigator(s): M. Johnson, E. Hopkins Section, Township, Range: ______

Landform (hillslope, terrace, etc.): flood plain Local relief (concave, convex, none): none Slope (%): 0%

Subregion (LRR): LRR C Lat: 36°46'55.52"N Long: 121°47'34.57"W Datum: NAD83

Soil Map Unit Name: ALVISO SILTY CLAY LOAM NWI classification: Estuarine Marine Wetland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | Is the Sampled Area within a Wetland? Yes ____ No ____ |
| Hydric Soil Present? | Yes ____ No ____ | |
| Wetland Hydrology Present? | Yes ____ No X | |

Remarks: Third year of drought

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | ____ = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | ____ = Total Cover | | |
| **Herb Stratum** (Plot size: 5x5) | | | |
| 1. Jaumea carnosa | 2 | N | OBL |
| 2. Frankenia salina | 10 | Y | FACW |
| 3. Dead veg | 2 | N | |
| 4. Bare | 3 | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | ____ = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| | ____ = Total Cover | | |

% Bare Ground in Herb Stratum: 1 % Cover of Biotic Crust: ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: ____ (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ____

Remarks:

Sampling Point: 27

## SOIL

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| A 0-13 | 10YR 3/2 | 100 | | | | | Clay | |
| B 13-15 | 5Y 4/1 | 75 | 2.5YR 4/8 | 25 | C | M | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5) (**LRR C**)
- __ 1 cm Muck (A9) (**LRR D**)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1)
- __ Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)
- __ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- __ 1 cm Muck (A9) (**LRR C**)
- __ 2 cm Muck (A10) (**LRR B**)
- __ Reduced Vertic (F18)
- __ Red Parent Material (TF2)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** Yes ____ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- __ Surface Water (A1)
- __ High Water Table (A2)
- __ Saturation (A3)
- __ Water Marks (B1) (**Nonriverine**)
- __ Sediment Deposits (B2) (**Nonriverine**)
- __ Drift Deposits (B3) (**Nonriverine**)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Water-Stained Leaves (B9)
- __ Salt Crust (B11)
- __ Biotic Crust (B12)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Thin Muck Surface (C7)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water Marks (B1) (**Riverine**)
- __ Sediment Deposits (B2) (**Riverine**)
- __ Drift Deposits (B3) (**Riverine**)
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ____ No X Depth (inches): ______

Water Table Present? Yes ____ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ______

**Wetland Hydrology Present?** Yes ____ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: [illegible] City/County: [illegible] Co Sampling Date: 8-[illegible]

Applicant/Owner: [illegible] State: CA Sampling Point: 28

Investigator(s): [illegible] Section, Township, Range: ____

Landform (hillslope, terrace, etc.): [illegible] Local relief (concave, convex, none): [illegible] Slope (%): [illegible]

Subregion (LRR): LRRC Lat: 36°46'58.4"N Long: 121°47'37.4"W Datum: NAD83

Soil Map Unit Name: DUNELAND NWI classification: N/A

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | **Is the Sampled Area within a Wetland?** Yes ____ No X |
| Hydric Soil Present? | Yes X No ____ | |
| Wetland Hydrology Present? | Yes X No ____ | |

Remarks: [illegible] year [illegible]

## VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | = Total Cover | | |
| **Herb Stratum** (Plot size: [illegible]) | | | |
| 1. [illegible] anserina ssp. pacifica | 15 | Y | OBL |
| 2. [illegible] spirata | 15 | Y | FAC |
| 3. Juncus [illegible] | 20 | Y | OBL |
| 4. Frankenia Salina | 20 | Y | FACW |
| 5. Rumex acetosella | 3 | | FACU |
| 6. Carex barbarae | 5 | | |
| 7. | | | |
| 8. | | | |
| | = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| | = Total Cover | | |

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

**Dominance Test worksheet:**

| | | |
|---|---|---|
| Number of Dominant Species That Are OBL, FACW, or FAC: | 4 | (A) |
| Total Number of Dominant Species Across All Strata: | 4 | (B) |
| Percent of Dominant Species That Are OBL, FACW, or FAC: | 100 | (A/B) |

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | | x 1 = |
| FACW species | | x 2 = |
| FAC species | | x 3 = |
| FACU species | | x 4 = |
| UPL species | | x 5 = |
| Column Totals: | (A) | (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- __ Dominance Test is >50%
- __ Prevalence Index is ≤3.0[1]
- __ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- __ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ____

Remarks:

## SOIL

Sampling Point: 26

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-3 | 10YR 2/1 | [illegible] | | | | | Silt loam | Dead Plant Material |
| 3-7 | 10YR 2/1 | 95 | 2.5YR 4/8 | 5 | C | M | Fine Clay | |
| 7-15 | 5Y 4/1 | 70 | 2.5YR 4/8 | 30 | C | M | Silty Clay | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- X Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** **Yes** X **No** ___

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- X Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- X Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ______

Water Table Present? Yes X No ___ Depth (inches): 17

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): 16.5

**Wetland Hydrology Present?** **Yes** X **No** ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR Tembladero [illegible] City/County: Monterey Sampling Date: 8-21-14
Applicant/Owner: [illegible] State: CA Sampling Point: 39
Investigator(s): [illegible] Section, Township, Range: ______
Landform (hillslope, terrace, etc.): [illegible] Local relief (concave, convex, none): Convex Slope (%): 8
Subregion (LRR): LRR C Lat: 36°46'58.51N Long: 121°47'37.39"W Datum: NAD83
Soil Map Unit Name: DUNE LAND NWI classification: N/A
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)
Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ No X | Is the Sampled Area within a Wetland? Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | |
| Wetland Hydrology Present? | Yes ____ No X | |

Remarks: 3rd year drought

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: 10'x10') | | | |
| 1. Baccharis pilularis | 75 | Y | NL |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | = Total Cover | | |
| **Herb Stratum** (Plot size: 5'x5') | | | |
| 1. Rubus ursinus | 15 | | FAC |
| 2. Carex [illegible] | 90 | Y | FACU |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| | = Total Cover | | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: ______ (A)

Total Number of Dominant Species Across All Strata: ______ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ______ (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

__ Dominance Test is >50%
__ Prevalence Index is ≤3.0[1]
__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes ____ No X

Remarks:

## SOIL

Sampling Point: 29

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Redox Features Type[1] | Redox Features Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-17 | 10YR 5/2 | | | | | | Sand | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

__ Histosol (A1)
__ Histic Epipedon (A2)
__ Black Histic (A3)
__ Hydrogen Sulfide (A4)
__ Stratified Layers (A5) (**LRR C**)
__ 1 cm Muck (A9) (**LRR D**)
__ Depleted Below Dark Surface (A11)
__ Thick Dark Surface (A12)
__ Sandy Mucky Mineral (S1)
__ Sandy Gleyed Matrix (S4)
__ Sandy Redox (S5)
__ Stripped Matrix (S6)
__ Loamy Mucky Mineral (F1)
__ Loamy Gleyed Matrix (F2)
__ Depleted Matrix (F3)
__ Redox Dark Surface (F6)
__ Depleted Dark Surface (F7)
__ Redox Depressions (F8)
__ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

__ 1 cm Muck (A9) (**LRR C**)
__ 2 cm Muck (A10) (**LRR B**)
__ Reduced Vertic (F18)
__ Red Parent Material (TF2)
__ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** **Yes** ____ **No** X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

__ Surface Water (A1)
__ High Water Table (A2)
__ Saturation (A3)
__ Water Marks (B1) (**Nonriverine**)
__ Sediment Deposits (B2) (**Nonriverine**)
__ Drift Deposits (B3) (**Nonriverine**)
__ Surface Soil Cracks (B6)
__ Inundation Visible on Aerial Imagery (B7)
__ Water-Stained Leaves (B9)
__ Salt Crust (B11)
__ Biotic Crust (B12)
__ Aquatic Invertebrates (B13)
__ Hydrogen Sulfide Odor (C1)
__ Oxidized Rhizospheres along Living Roots (C3)
__ Presence of Reduced Iron (C4)
__ Recent Iron Reduction in Tilled Soils (C6)
__ Thin Muck Surface (C7)
__ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

__ Water Marks (B1) (**Riverine**)
__ Sediment Deposits (B2) (**Riverine**)
__ Drift Deposits (B3) (**Riverine**)
__ Drainage Patterns (B10)
__ Dry-Season Water Table (C2)
__ Crayfish Burrows (C8)
__ Saturation Visible on Aerial Imagery (C9)
__ Shallow Aquitard (D3)
__ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ____ No X Depth (inches): ______
Water Table Present? Yes ____ No X Depth (inches): ______
Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ______

**Wetland Hydrology Present?** **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR Rec Ditch City/County: Monterey Sampling Date: 8-21-14

Applicant/Owner: MRWPCA State: CA Sampling Point: 30

Investigator(s): M. Johnson, S. Hessian Section, Township, Range: ______

Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): concave Slope (%): 2

Subregion (LRR): LRR C Lat: 36°44'23.02" N Long: 121°44'14.17" W Datum: NAD 83

Soil Map Unit Name: CLEAR LAKE CLAY, MODERATELY WET NWI classification: Freshwater forested/wetland

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | Is the Sampled Area within a Wetland? Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | |
| Wetland Hydrology Present? | Yes ____ No X | |

Remarks: 3rd year of drought

### VEGETATION – Use scientific names of plants.

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| **Tree Stratum** (Plot size: ____) | | | |
| 1. Salix lasiolepis | 90% | Y | FACW |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | | = Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | | = Total Cover | |
| **Herb Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | | = Total Cover | |
| **Woody Vine Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| | | = Total Cover | |

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species ____ | x 1 = ____ |
| FACW species ____ | x 2 = ____ |
| FAC species ____ | x 3 = ____ |
| FACU species ____ | x 4 = ____ |
| UPL species ____ | x 5 = ____ |
| Column Totals: ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ____

Remarks:

## SOIL

Sampling Point: ____________

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-12 | 2.5Y 3/2 | | | | | | Sandy loam | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

__ Histosol (A1)
__ Histic Epipedon (A2)
__ Black Histic (A3)
__ Hydrogen Sulfide (A4)
__ Stratified Layers (A5) (**LRR C**)
__ 1 cm Muck (A9) (**LRR D**)
__ Depleted Below Dark Surface (A11)
__ Thick Dark Surface (A12)
__ Sandy Mucky Mineral (S1)
__ Sandy Gleyed Matrix (S4)
__ Sandy Redox (S5)
__ Stripped Matrix (S6)
__ Loamy Mucky Mineral (F1)
__ Loamy Gleyed Matrix (F2)
__ Depleted Matrix (F3)
__ Redox Dark Surface (F6)
__ Depleted Dark Surface (F7)
__ Redox Depressions (F8)
__ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

__ 1 cm Muck (A9) (**LRR C**)
__ 2 cm Muck (A10) (**LRR B**)
__ Reduced Vertic (F18)
__ Red Parent Material (TF2)
__ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ____________

Depth (inches): ____________

**Hydric Soil Present?** **Yes** ____ **No** ✓

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

__ Surface Water (A1)
__ High Water Table (A2)
__ Saturation (A3)
__ Water Marks (B1) (**Nonriverine**)
__ Sediment Deposits (B2) (**Nonriverine**)
__ Drift Deposits (B3) (**Nonriverine**)
__ Surface Soil Cracks (B6)
__ Inundation Visible on Aerial Imagery (B7)
__ Water-Stained Leaves (B9)
__ Salt Crust (B11)
__ Biotic Crust (B12)
__ Aquatic Invertebrates (B13)
__ Hydrogen Sulfide Odor (C1)
__ Oxidized Rhizospheres along Living Roots (C3)
__ Presence of Reduced Iron (C4)
__ Recent Iron Reduction in Tilled Soils (C6)
__ Thin Muck Surface (C7)
__ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

__ Water Marks (B1) (**Riverine**)
__ Sediment Deposits (B2) (**Riverine**)
__ Drift Deposits (B3) (**Riverine**)
__ Drainage Patterns (B10)
__ Dry-Season Water Table (C2)
__ Crayfish Burrows (C8)
__ Saturation Visible on Aerial Imagery (C9)
__ Shallow Aquitard (D3)
__ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ____ No X Depth (inches): ____________

Water Table Present? Yes ____ No X Depth (inches): ____________

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____________

**Wetland Hydrology Present?** **Yes** ____ **No** X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR REC DITCH City/County: Monterey CO Sampling Date: 8-21-[illegible]
Applicant/Owner: MRWPCA State: CA Sampling Point: 31
Investigator(s): M. Johnson S. [illegible] Section, Township, Range: N/A
Landform (hillslope, terrace, etc.): FLOODPLAIN Local relief (concave, convex, none): CONVEX Slope (%): 3
Subregion (LRR): LRR C Lat: 36°41'23.52"N Long: 121°42'46.97"W Datum: NAD83
Soil Map Unit Name: ANTIOCH VERY FINE SANDY LOAM, 2-9% NWI classification: Freshwater Emergent Wetland
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)
Are Vegetation X, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | Is the Sampled Area within a Wetland? Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | |
| Wetland Hydrology Present? | Yes ____ No X | |

Remarks: [illegible] fill material

## VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. [illegible] | 90 | Y | FAC |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| = Total Cover | | | |
| **Sapling/Shrub Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| = Total Cover | | | |
| **Herb Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| = Total Cover | | | |
| **Woody Vine Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| = Total Cover | | | |

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ____

Remarks:

Sampling Point: 31

## SOIL

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 2.5Y 3/1 | 100 | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

__ Histosol (A1)
__ Histic Epipedon (A2)
__ Black Histic (A3)
__ Hydrogen Sulfide (A4)
__ Stratified Layers (A5) (**LRR C**)
__ 1 cm Muck (A9) (**LRR D**)
__ Depleted Below Dark Surface (A11)
__ Thick Dark Surface (A12)
__ Sandy Mucky Mineral (S1)
__ Sandy Gleyed Matrix (S4)
__ Sandy Redox (S5)
__ Stripped Matrix (S6)
__ Loamy Mucky Mineral (F1)
__ Loamy Gleyed Matrix (F2)
__ Depleted Matrix (F3)
__ Redox Dark Surface (F6)
__ Depleted Dark Surface (F7)
__ Redox Depressions (F8)
__ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

__ 1 cm Muck (A9) (**LRR C**)
__ 2 cm Muck (A10) (**LRR B**)
__ Reduced Vertic (F18)
__ Red Parent Material (TF2)
__ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** Yes ____ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

__ Surface Water (A1)
__ High Water Table (A2)
__ Saturation (A3)
__ Water Marks (B1) (**Nonriverine**)
__ Sediment Deposits (B2) (**Nonriverine**)
__ Drift Deposits (B3) (**Nonriverine**)
__ Surface Soil Cracks (B6)
__ Inundation Visible on Aerial Imagery (B7)
__ Water-Stained Leaves (B9)
__ Salt Crust (B11)
__ Biotic Crust (B12)
__ Aquatic Invertebrates (B13)
__ Hydrogen Sulfide Odor (C1)
__ Oxidized Rhizospheres along Living Roots (C3)
__ Presence of Reduced Iron (C4)
__ Recent Iron Reduction in Tilled Soils (C6)
__ Thin Muck Surface (C7)
__ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

__ Water Marks (B1) (**Riverine**)
__ Sediment Deposits (B2) (**Riverine**)
__ Drift Deposits (B3) (**Riverine**)
__ Drainage Patterns (B10)
__ Dry-Season Water Table (C2)
__ Crayfish Burrows (C8)
__ Saturation Visible on Aerial Imagery (C9)
__ Shallow Aquitard (D3)
__ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ____ No X Depth (inches): ______

Water Table Present? Yes ____ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ______

**Wetland Hydrology Present?** Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Monterey Peninsula Fixed Guideway City/County: Castroville/Monterey Sampling Date: 10-19-09

Applicant/Owner: TAMC State: CA Sampling Point: 8 32

Investigator(s): JD & JH Section, Township, Range: ______

Landform (hillslope, terrace, etc.): top of berm Local relief (concave, convex, none): [illegible] Slope (%): 2%

Subregion (LRR): LRR C Lat: ______ Long: ______ Datum: ______

Soil Map Unit Name: Pacheco Clay Loam NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation Y, Soil Y, or Hydrology Y significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ___ | Is the Sampled Area within a Wetland? | Yes ___ No X |
| Hydric Soil Present? | Yes X No ___ | | |
| Wetland Hydrology Present? | Yes ___ No X | | |

Remarks:
adjacent ag field

## VEGETATION

| Tree Stratum (Use scientific names.) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| Total Cover: | | | |
| **Sapling/Shrub Stratum** | | | |
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| Total Cover: | | | |
| **Herb Stratum** | | | |
| 1. Heliotropium curassavicum | 10% | Y | OBL |
| 2. Atriplex triangularis | 40% | Y | NL |
| 3. Epilobium ciliatum | 10% | Y | FACW |
| 4. Rumex crispus | 30% | Y | FACW |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| Total Cover: | | | |
| **Woody Vine Stratum** | | | |
| 1. | | | |
| 2. | | | |
| Total Cover: | | | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 75% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species ______ | x 1 = ______ |
| FACW species ______ | x 2 = ______ |
| FAC species ______ | x 3 = ______ |
| FACU species ______ | x 4 = ______ |
| UPL species ______ | x 5 = ______ |
| Column Totals: ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

**Hydrophytic Vegetation Present?** Yes X No ___

Remarks:
veg. likely regularly maintained

## SOIL

Sampling Point: 8

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-20 | 10YR 3/1 | | | | | | Silt | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** Yes X No ___

Remarks:
Soil disturbed - not a native soil in its native condition. Soil turned many times

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ______

Water Table Present? Yes ___ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ______

**Wetland Hydrology Present?** Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Monterey Peninsula Fixed Guideway City/County: Castroville/Monterey Sampling Date: 10-19-09

Applicant/Owner: TAMC State: CA Sampling Point: 9 33

Investigator(s): JD & JH Section, Township, Range: ______

Landform (hillslope, terrace, etc.): bottom of channel Local relief (concave, convex, none): concave Slope (%): [illegible]

Subregion (LRR): LRR C Lat: ______ Long: ______ Datum: ______

Soil Map Unit Name: Pacheco Clay Loam NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation Y, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ No X | Is the Sampled Area within a Wetland? Yes ____ No X |
| Hydric Soil Present? | Yes X No ____ | |
| Wetland Hydrology Present? | Yes X No ____ | |

Remarks:
area is waters

### VEGETATION

| Tree Stratum (Use scientific names.) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| Total Cover: | | | |
| **Sapling/Shrub Stratum** | | | |
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| Total Cover: | | | |
| **Herb Stratum** | | | |
| 1. Cardamine oligosperma | 2% | N/A | FACW |
| 2. Rumex crispus | 5% | N/A | FACW |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| Total Cover: | | | |
| **Woody Vine Stratum** | | | |
| 1. | | | |
| 2. | | | |
| Total Cover: | | | |

% Bare Ground in Herb Stratum 93% % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: ______ (A)

Total Number of Dominant Species Across All Strata: ______ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: N/A (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ______ | x 1 = ______ |
| FACW species | ______ | x 2 = ______ |
| FAC species | ______ | x 3 = ______ |
| FACU species | ______ | x 4 = ______ |
| UPL species | ______ | x 5 = ______ |
| Column Totals: | ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

**Hydrophytic Vegetation Present?** Yes ____ No X

Remarks:
veg mostly up on bank - point taken at bottom of bank
↳ some stretching down but not present - veg likely maintained over whole area

## SOIL

Sampling Point: 9

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-4 | 10YR3/2 | | | 10% | | | sandy silt | |
| 4-16 | Gley 1 2.5/N | | | | | | silt | muck w/ organics |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (LRR C)
- ___ 1 cm Muck (A9) (LRR D)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- X Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (LRR C)
- ___ 2 cm Muck (A10) (LRR B)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** Yes X No ___

Remarks:

organic streaking in 2nd layer

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (any one indicator is sufficient)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) (Nonriverine)
- ___ Sediment Deposits (B2) (Nonriverine)
- ___ Drift Deposits (B3) (Nonriverine)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (Riverine)
- ___ Sediment Deposits (B2) (Riverine)
- ___ Drift Deposits (B3) (Riverine)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes X | No ___ | Depth (inches): 3in |
| Water Table Present? | Yes X | No ___ | Depth (inches): 0 |
| Saturation Present? (includes capillary fringe) | Yes X | No ___ | Depth (inches): 0 |

**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Monterey Peninsula Fixed Guideway City/County: Castroville/Monterey Sampling Date: 10-19-09

Applicant/Owner: TAMC State: CA Sampling Point: 10 [illegible]

Investigator(s): JD&JH Section, Township, Range: ____

Landform (hillslope, terrace, etc.): ____ Local relief (concave, convex, none): concave Slope (%): ____

Subregion (LRR): LRR C Lat: ____ Long: ____ Datum: ____

Soil Map Unit Name: Pacheco Clay Loam NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation Y, Soil Y, or Hydrology Y significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | Is the Sampled Area within a Wetland? Yes ____ No X |
| Hydric Soil Present? | Yes X No ____ | |
| Wetland Hydrology Present? | Yes ____ No X | |

Remarks:
disturbed by maintaining [illegible] channel - near ag. fields

### VEGETATION

| Tree Stratum (Use scientific names.) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| Total Cover: | | | |
| **Sapling/Shrub Stratum** | | | |
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| Total Cover: | | | |
| **Herb Stratum** | | | |
| 1. Polypogon monspeliensis | 20% | Y | FACW |
| 2. Conium maculatum | 40% | Y | FACW |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| Total Cover: | | | |
| **Woody Vine Stratum** | | | |
| 1. | | | |
| 2. | | | |
| Total Cover: | | | |

% Bare Ground in Herb Stratum 20 % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

**Hydrophytic Vegetation Present?** Yes X No ____

Remarks:
Next to open water

## SOIL

Sampling Point: 10

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-20 | 10YR 3/1 | | | | | | Silt | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5) (**LRR C**)
- __ 1 cm Muck (A9) (**LRR D**)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1)
- __ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)
- __ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- __ 1 cm Muck (A9) (**LRR C**)
- __ 2 cm Muck (A10) (**LRR B**)
- __ Reduced Vertic (F18)
- __ Red Parent Material (TF2)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

**Restrictive Layer (if present):**
Type: ____
Depth (inches): ____

**Hydric Soil Present?** Yes X No ____

Remarks:
soil disturbed - not a native soil in its native condition - soil turned many times

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (any one indicator is sufficient)

- __ Surface Water (A1)
- __ High Water Table (A2)
- __ Saturation (A3)
- __ Water Marks (B1) (**Nonriverine**)
- __ Sediment Deposits (B2) (**Nonriverine**)
- __ Drift Deposits (B3) (**Nonriverine**)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Water-Stained Leaves (B9)
- __ Salt Crust (B11)
- __ Biotic Crust (B12)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Plowed Soils (C6)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water Marks (B1) (**Riverine**)
- __ Sediment Deposits (B2) (**Riverine**)
- __ Drift Deposits (B3) (**Riverine**)
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Thin Muck Surface (C7)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ____ No X Depth (inches): ____
Water Table Present? Yes ____ No X Depth (inches): ____
Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

**Wetland Hydrology Present?** Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Monterey Peninsula Fixed Guideway City/County: Castroville/Monterey Sampling Date: 6-19-09
Applicant/Owner: TAMC State: CA Sampling Point: 1135
Investigator(s): JD & JH Section, Township, Range: ______
Landform (hillslope, terrace, etc.): bottom of channel Local relief (concave, convex, none): concave Slope (%): 2%
Subregion (LRR): LRR C Lat: ______ Long: ______ Datum: ______
Soil Map Unit Name: Pacheco Clay Loam NWI classification: ______
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)
Are Vegetation Y, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

**SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.**

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? Yes ___ No X | Is the Sampled Area within a Wetland? Yes ___ No X | |
| Hydric Soil Present? Yes X No ___ | | |
| Wetland Hydrology Present? Yes X No ___ | | |

Remarks:
area is waters

### VEGETATION

| Tree Stratum (Use scientific names.) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| Total Cover: | | | |
| **Sapling/Shrub Stratum** | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| Total Cover: | | | |
| **Herb Stratum** | | | |
| 1. Atriplex triangularis | 5% | N/A | NL |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| Total Cover: | | | |
| **Woody Vine Stratum** | | | |
| 1. | | | |
| 2. | | | |
| Total Cover: | | | |

% Bare Ground in Herb Stratum 95% % Cover of Biotic Crust ______

**Dominance Test worksheet:**
Number of Dominant Species That Are OBL, FACW, or FAC: ______ (A)
Total Number of Dominant Species Across All Strata: ______ (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: N/A (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species ______ | x 1 = ______ |
| FACW species ______ | x 2 = ______ |
| FAC species ______ | x 3 = ______ |
| FACU species ______ | x 4 = ______ |
| UPL species ______ | x 5 = ______ |
| Column Totals ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**
___ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

**Hydrophytic Vegetation Present?** Yes ___ No X

Remarks:
mostly unvegetated - very likely maintained over whole area

## SOIL

Sampling Point: 11

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-4 | 10YR 3/2 | | | 10% | | | Sandy silt | |
| 4-16 | Gley 1 2.5/N | | | | | | Silt | muck w/organics |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- X Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

**Restrictive Layer (if present):**

Type: ___

Depth (inches): ___

**Hydric Soil Present?** Yes X No ___

Remarks:

organic streaking in 2nd layer.

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (any one indicator is sufficient)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes X No ___ Depth (inches): 3in

Water Table Present? Yes X No ___ Depth (inches): 0in

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): 0in

**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Monterey Peninsula Fixed Guideway City/County: Marina / Monterey Sampling Date: 10-19-09

Applicant/Owner: TAMC State: CA Sampling Point: 34 36

Investigator(s): JD & JH Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Slope Local relief (concave, convex, none): concave Slope (%): 5%

Subregion (LRR): LRR C Lat: ______ Long: ______ Datum: ______

Soil Map Unit Name: Baywood Sand 2-15% slopes NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation N , Soil N , or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N , Soil N , or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ No X | Is the Sampled Area within a Wetland? Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | |
| Wetland Hydrology Present? | Yes ____ No X | |

Remarks:

## VEGETATION

| Tree Stratum (Use scientific names.) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| Total Cover: | | | |
| **Sapling/Shrub Stratum** | | | |
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| Total Cover: | | | |
| **Herb Stratum** | | | |
| 1. Bromus diandrus | 75% | Y | NL |
| 2. Rubus ursinus | 5% | N | FAC |
| 3. other grasses | 15% | N | NL |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| Total Cover: | | | |
| **Woody Vine Stratum** | | | |
| 1. | | | |
| 2. | | | |
| Total Cover: | | | |

% Bare Ground in Herb Stratum 5% % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ____ No X

Remarks:

## SOIL

Sampling Point: 34/36

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | % | Redox Features Color (moist) | % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-20 | 10YR 3/3 | | | | | | Sand | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (LRR C)
- ___ 1 cm Muck (A9) (LRR D)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (LRR C)
- ___ 2 cm Muck (A10) (LRR B)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

**Restrictive Layer (if present):**

Type: ___

Depth (inches): ___

**Hydric Soil Present?** Yes ___ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (Nonriverine)
- ___ Sediment Deposits (B2) (Nonriverine)
- ___ Drift Deposits (B3) (Nonriverine)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (Riverine)
- ___ Sediment Deposits (B2) (Riverine)
- ___ Drift Deposits (B3) (Riverine)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No ___ Depth (inches): ___

Water Table Present? Yes ___ No ___ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No ___ Depth (inches): ___

**Wetland Hydrology Present?** Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No indicators

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Monterey Peninsula Fixed Guideway City/County: Marina/Monterey Sampling Date: 6-19-09
Applicant/Owner: TAMC State: CA Sampling Point: 3537
Investigator(s): JD&JH Section, Township, Range: ____
Landform (hillslope, terrace, etc.): ____ Local relief (concave, convex, none): concave Slope (%): 2%
Subregion (LRR): LRR C Lat: ____ Long: ____ Datum: ____
Soil Map Unit Name: Baywood sand 2-15% slopes NWI classification: ____
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | Is the Sampled Area within a Wetland? Yes X No ____ |
| Hydric Soil Present? | Yes X No ____ | |
| Wetland Hydrology Present? | Yes X No ____ | |

Remarks:

## VEGETATION

| Tree Stratum (Use scientific names.) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| Total Cover: | | | |
| **Sapling/Shrub Stratum** | | | |
| 1. Salix lasiolepis | 1% | N | FACW |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| Total Cover: | | | |
| **Herb Stratum** | | | |
| 1. Typha latifolia | 30% | Y | OBL |
| 2. Rubus ursinus | 50% | Y | FAC |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| Total Cover: | | | |
| **Woody Vine Stratum** | | | |
| 1. | | | |
| 2. | | | |
| Total Cover: | | | |

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes X No ____

Remarks:

## SOIL

Sampling Point: ~~38~~ 37

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | % | Redox Features Color (moist) | % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-7 | 10YR 2/2 | | | | | | loamy sand | |
| 7-20 | 2.5Y 3/1 | | | | | | sand | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (LRR C)
- ___ 1 cm Muck (A9) (LRR D)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (LRR C)
- ___ 2 cm Muck (A10) (LRR B)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

**Restrictive Layer (if present):**

Type: ___________

Depth (inches): ___________

**Hydric Soil Present?** Yes X No ___

Remarks:

No mottling

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) (Nonriverine)
- ___ Sediment Deposits (B2) (Nonriverine)
- ___ Drift Deposits (B3) (Nonriverine)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (Riverine)
- ___ Sediment Deposits (B2) (Riverine)
- ___ Drift Deposits (B3) (Riverine)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): 7in

**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

oxidized rizospheres in 1st horizon

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Monterey Peninsula Fixed Guideway City/County: Marina/Monterey Sampling Date: 6-19-09
Applicant/Owner: TAMC State: CA Sampling Point: 36 38
Investigator(s): JD & JH Section, Township, Range: ______
Landform (hillslope, terrace, etc.): flat area after toe of slope Local relief (concave, convex, none): Concave Slope (%): 0%
Subregion (LRR): LRR C Lat: ______ Long: ______ Datum: ______
Soil Map Unit Name: Baywood Sand 2-15% slopes NWI classification: ______
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ______ (If no, explain in Remarks.)
Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ______
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X | No ______ |
| Hydric Soil Present? | Yes X | No ______ |
| Wetland Hydrology Present? | Yes X | No ______ |

Is the Sampled Area within a Wetland? Yes X No ______

Remarks:

### VEGETATION

| Tree Stratum (Use scientific names.) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Salix lasiolepis | 70% | Y | FACW |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| Total Cover: | | | |
| **Sapling/Shrub Stratum** | | | |
| 1. Salix lasiolepis | 10% | N | FACW |
| 2. Rubus ursinus | 20% | Y | FAC |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| Total Cover: | | | |
| **Herb Stratum** | | | |
| 1. | | | |
| 2. Juncus effusus | 40% | Y | OBL |
| 3. Baccharis salicifolia | 10% | N | FACW |
| 4. Potentilla anserina | 1% | N | OBL |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| Total Cover: | | | |
| **Woody Vine Stratum** | | | |
| 1. | | | |
| 2. | | | |
| Total Cover: | | | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ______ | x 1 = ______ |
| FACW species | ______ | x 2 = ______ |
| FAC species | ______ | x 3 = ______ |
| FACU species | ______ | x 4 = ______ |
| UPL species | ______ | x 5 = ______ |
| Column Totals: | ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

___ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes X No ______

Remarks:

## SOIL

Sampling Point: 26 38

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-12 | 10YR 2/2 | | | | | | Sand | |
| 12-20 | 10YR 2/1 | | 2.5YR 4/6 | 10% mottles | | | sand | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5) (LRR C)
- __ 1 cm Muck (A9) (LRR D)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- X Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1)
- __ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)
- __ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- __ 1 cm Muck (A9) (LRR C)
- __ 2 cm Muck (A10) (LRR B)
- __ Reduced Vertic (F18)
- __ Red Parent Material (TF2)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

**Restrictive Layer (if present):**

Type: ____________

Depth (inches): ____________

**Hydric Soil Present?** Yes X No ____

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (any one indicator is sufficient)

- __ Surface Water (A1)
- __ High Water Table (A2)
- __ Saturation (A3)
- __ Water Marks (B1) (Nonriverine)
- __ Sediment Deposits (B2) (Nonriverine)
- __ Drift Deposits (B3) (Nonriverine)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Water-Stained Leaves (B9)
- __ Salt Crust (B11)
- __ Biotic Crust (B12)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Plowed Soils (C6)
- X Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water Marks (B1) (Riverine)
- __ Sediment Deposits (B2) (Riverine)
- __ Drift Deposits (B3) (Riverine)
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Thin Muck Surface (C7)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes ____ No X Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

**Wetland Hydrology Present?** Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
Moist but not saturated - personal observation of lake level
↳ in the dry season

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Monterey Peninsula Fixed Guideway City/County: Marina/Monterey Sampling Date: 6-19-09
Applicant/Owner: TAMC State: C Sampling Point: 39
Investigator(s): JD&JH Section, Township, Range: ____
Landform (hillslope, terrace, etc.): toe of slope Local relief (concave, convex, none): concave Slope (%): 5%
Subregion (LRR): LRR C Lat: ____ Long: ____ Datum: ____
Soil Map Unit Name: Baywood sand 2-15% slopes NWI classification: ____
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | Is the Sampled Area within a Wetland? Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | |
| Wetland Hydrology Present? | Yes ____ No X | |

Remarks:

### VEGETATION

| Tree Stratum (Use scientific names.) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Salix lasiolepis | 70% | Y | FACW |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| Total Cover: | | | |
| **Sapling/Shrub Stratum** | | | |
| 1. Rubus ursinus | 50% | Y | FAC |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| Total Cover: | | | |
| **Herb Stratum** | | | |
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| Total Cover: | | | |
| **Woody Vine Stratum** | | | |
| 1. | | | |
| 2. | | | |
| Total Cover: | | | |

% Bare Ground in Herb Stratum 50 % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | | x 1 = |
| FACW species | | x 2 = |
| FAC species | | x 3 = |
| FACU species | | x 4 = |
| UPL species | | x 5 = |
| Column Totals: | (A) | (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes X No ____

Remarks:

## SOIL

Sampling Point: ~~34~~ 39

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | % | Redox Features Color (moist) | % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-20 | 10YR 2/2 | | | | | | Sand | |
| 20-22 | 10YR 2/1 | | | | | | Sand | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (LRR C)
- ___ 1 cm Muck (A9) (LRR D)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (LRR C)
- ___ 2 cm Muck (A10) (LRR B)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

**Restrictive Layer (if present):**

Type: ___________

Depth (inches): ___________

**Hydric Soil Present?** Yes ___ No _X_

Remarks:

Depleted matrix only in deep layer - not an indicator

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (Nonriverine)
- ___ Sediment Deposits (B2) (Nonriverine)
- ___ Drift Deposits (B3) (Nonriverine)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (Riverine)
- ___ Sediment Deposits (B2) (Riverine)
- ___ Drift Deposits (B3) (Riverine)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No _X_ Depth (inches): ___

Water Table Present? Yes ___ No _X_ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No _X_ Depth (inches): ___

**Wetland Hydrology Present?** Yes ___ No _X_

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

soil dry

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Monterey Peninsula Fixed Guideway City/County: Marina/Monterey Sampling Date: 6-19-09
Applicant/Owner: TAMC State: CA Sampling Point: 38 40
Investigator(s): JD&JH Section, Township, Range: ______
Landform (hillslope, terrace, etc.): top of hill Local relief (concave, convex, none): flat Slope (%): 0%
Subregion (LRR): LRR C Lat: ______ Long: ______ Datum: ______
Soil Map Unit Name: Baywood sand 2-15% slopes NWI classification: ______
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)
Are Vegetation Y, Soil Y, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

**SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.**

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes ___ No X | Is the Sampled Area within a Wetland? | Yes ___ No X |
| Hydric Soil Present? | Yes ___ No X | | |
| Wetland Hydrology Present? | Yes ___ No X | | |

Remarks:
on traintracks at top of hill

**VEGETATION**

| Tree Stratum (Use scientific names.) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| Total Cover: | | | |
| **Sapling/Shrub Stratum** | | | |
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| Total Cover: | | | |
| **Herb Stratum** | | | |
| 1. Carpobrotus edulis | 5% | Y | NL |
| 2. Rubus ursinus | 1% | Y | FAC |
| 3. Avena barbata | 5% | Y | NL |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| Total Cover: | | | |
| **Woody Vine Stratum** | | | |
| 1. | | | |
| 2. | | | |
| Total Cover: | | | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 3 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 33% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species ___ | x 1 = ___ |
| FACW species ___ | x 2 = ___ |
| FAC species ___ | x 3 = ___ |
| FACU species ___ | x 4 = ___ |
| UPL species ___ | x 5 = ___ |
| Column Totals: ___ (A) | ___ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

**Hydrophytic Vegetation Present?** Yes ___ No X

Remarks:
disturbed by veg maintenance along railroad

## SOIL

Sampling Point: 38 40

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

**Restrictive Layer (if present):**

Type: ____________

Depth (inches): ____________

**Hydric Soil Present?** Yes _____ No X

Remarks:

fill associated w/railroad - rocks - not able to dig

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes _____ No X Depth (inches): ________

Water Table Present? Yes _____ No X Depth (inches): ________

Saturation Present? (includes capillary fringe) Yes _____ No X Depth (inches): ________

**Wetland Hydrology Present?** Yes _____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No hydrology

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Monterey Peninsula Fixed Guideway City/County: Marina/Monterey Sampling Date: 6/22/09

Applicant/Owner: TAMC State: CA Sampling Point: 3941

Investigator(s): JD&JH Section, Township, Range: ______

Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): Concave Slope (%): 20

Subregion (LRR): LRR C Lat: ______ Long: ______ Datum: ______

Soil Map Unit Name: Baywood Sand 2-15% slopes NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ___ | Is the Sampled Area within a Wetland? Yes X No ___ |
| Hydric Soil Present? | Yes X No ___ | |
| Wetland Hydrology Present? | Yes X No ___ | |

Remarks:

### VEGETATION

| Tree Stratum (Use scientific names.) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Salix lasiolepis | 100% | Y | FACW |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| Total Cover: | | | |
| **Sapling/Shrub Stratum** | | | |
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| Total Cover: | | | |
| **Herb Stratum** | | | |
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| Total Cover: | | | |
| **Woody Vine Stratum** | | | |
| 1. | | | |
| 2. | | | |
| Total Cover: | | | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ______ | x 1 = ______ |
| FACW species | ______ | x 2 = ______ |
| FAC species | ______ | x 3 = ______ |
| FACU species | ______ | x 4 = ______ |
| UPL species | ______ | x 5 = ______ |
| Column Totals: | ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

**Hydrophytic Vegetation Present?** Yes X No ___

Remarks:

## SOIL

Sampling Point: ~~2~~ 41

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | % | Redox Features Color (moist) | % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-20 | 10YR 2/1 | | | | | | loam | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (LRR C)
- ___ 1 cm Muck (A9) (LRR D)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (LRR C)
- ___ 2 cm Muck (A10) (LRR B)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

**Restrictive Layer (if present):**

Type: ___

Depth (inches): ___

**Hydric Soil Present?** Yes X No ___

Remarks:

wood chip fill total - No sand

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (Nonriverine)
- ___ Sediment Deposits (B2) (Nonriverine)
- ___ Drift Deposits (B3) (Nonriverine)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- X Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (Riverine)
- ___ Sediment Deposits (B2) (Riverine)
- ___ Drift Deposits (B3) (Riverine)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

t

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Monterey Peninsula Fixed Guideway City/County: Marina/Monterey Sampling Date: 6-22-09
Applicant/Owner: TAMC State: CA Sampling Point: 4042
Investigator(s): JD&JH Section, Township, Range: ____
Landform (hillslope, terrace, etc.): ____ Local relief (concave, convex, none): concave Slope (%): 35%
Subregion (LRR): LRR C Lat: ____ Long: ____ Datum: ____
Soil Map Unit Name: Baywood sand 2-15% slopes NWI classification: ____
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

**SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.**

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | Is the Sampled Area within a Wetland? Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | |
| Wetland Hydrology Present? | Yes ____ No X | |

Remarks: point @ toe of slope - not GPS'd due to high tree cover. Does not meet ACOE definition of a wetland, Riparian veg. may be under CA Coastal Commission jurisdiction.

**VEGETATION**

| Tree Stratum (Use scientific names.) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Salix lasiolepis | 100% | Y | FACW |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| Total Cover: | | | |
| **Sapling/Shrub Stratum** | | | |
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| Total Cover: | | | |
| **Herb Stratum** | | | |
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| Total Cover: | | | |
| **Woody Vine Stratum** | | | |
| 1. | | | |
| 2. | | | |
| Total Cover: | | | |

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species ____ | x 1 = ____ |
| FACW species ____ | x 2 = ____ |
| FAC species ____ | x 3 = ____ |
| FACU species ____ | x 4 = ____ |
| UPL species ____ | x 5 = ____ |
| Column Totals: ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes X No ____

Remarks:

## SOIL

Sampling Point: 48'42

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-20 | 10YR 2/2 | | | | | | loam | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5) (LRR C)
___ 1 cm Muck (A9) (LRR D)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

___ 1 cm Muck (A9) (LRR C)
___ 2 cm Muck (A10) (LRR B)
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

**Restrictive Layer (if present):**

Type: ___

Depth (inches): ___

**Hydric Soil Present?** Yes ___ No X

Remarks:

@ toe of slope - woodchip fill

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (any one indicator is sufficient)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1) (Nonriverine)
___ Sediment Deposits (B2) (Nonriverine)
___ Drift Deposits (B3) (Nonriverine)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-Stained Leaves (B9)
___ Salt Crust (B11)
___ Biotic Crust (B12)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Plowed Soils (C6)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water Marks (B1) (Riverine)
___ Sediment Deposits (B2) (Riverine)
___ Drift Deposits (B3) (Riverine)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Thin Muck Surface (C7)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

**Wetland Hydrology Present?** Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Monterey Peninsula Fixed Guideway City/County: Marina/Monterey Sampling Date: 6-22-09
Applicant/Owner: TAMC State: ______ Sampling Point: 4K43
Investigator(s): JD & JH Section, Township, Range: ______
Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): concave Slope (%): 20%
Subregion (LRR): LRRC Lat: ______ Long: ______ Datum: ______
Soil Map Unit Name: Baywood sand 2-15% slopes NWI classification: ______
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)
Are Vegetation N , Soil N , or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation N , Soil N , or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X | No ___ |
| Hydric Soil Present? | Yes ___ | No X |
| Wetland Hydrology Present? | Yes ___ | No X |
| Is the Sampled Area within a Wetland? | Yes ___ | No X |

Remarks: Does not meet ACOE definition of a wetland. Riparian vegetation may be under CA Coastal Commission jurisdiction.

## VEGETATION

| Tree Stratum (Use scientific names.) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Salix lasiolepis | 70% | Y | FACW |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| Total Cover: | | | |
| **Sapling/Shrub Stratum** | | | |
| 1. Rubus ursinus | 20% | Y | FAC |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| Total Cover: | | | |
| **Herb Stratum** | | | |
| 1. Carex barbarae | 10% | Y | FACW |
| 2. Bromus diandrus | 40% | Y | NL |
| 3. Raphanus sativus | 10% | Y | UPL |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| Total Cover: | | | |
| **Woody Vine Stratum** | | | |
| 1. | | | |
| 2. | | | |
| Total Cover: | | | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)
Total Number of Dominant Species Across All Strata: 5 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 60% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ______ | x 1 = ______ |
| FACW species | ______ | x 2 = ______ |
| FAC species | ______ | x 3 = ______ |
| FACU species | ______ | x 4 = ______ |
| UPL species | ______ | x 5 = ______ |
| Column Totals: | ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

___ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes X No ___

Remarks:

## SOIL

Sampling Point: 4K43

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-20 | 10YR 3/3 | | | | | | Sandy loam | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5) (LRR C)
- __ 1 cm Muck (A9) (LRR D)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1)
- __ Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)
- __ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- __ 1 cm Muck (A9) (LRR C)
- __ 2 cm Muck (A10) (LRR B)
- __ Reduced Vertic (F18)
- __ Red Parent Material (TF2)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

**Restrictive Layer (if present):**

Type: ____________

Depth (inches): ____________

**Hydric Soil Present?** Yes ____ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (any one indicator is sufficient)

- __ Surface Water (A1)
- __ High Water Table (A2)
- __ Saturation (A3)
- __ Water Marks (B1) (Nonriverine)
- __ Sediment Deposits (B2) (Nonriverine)
- __ Drift Deposits (B3) (Nonriverine)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Water-Stained Leaves (B9)
- __ Salt Crust (B11)
- __ Biotic Crust (B12)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Plowed Soils (C6)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water Marks (B1) (Riverine)
- __ Sediment Deposits (B2) (Riverine)
- __ Drift Deposits (B3) (Riverine)
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Thin Muck Surface (C7)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ____ No X Depth (inches): ________

Water Table Present? Yes ____ No X Depth (inches): ________

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ________

**Wetland Hydrology Present?** Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Monterey Peninsula Fixed Guideway City/County: Monterey / Monterey Sampling Date: 6-22-09

Applicant/Owner: TAMC State: CA Sampling Point: WC-44

Investigator(s): JD & JH Section, Township, Range: ______

Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): concave Slope (%): 5%

Subregion (LRR): LRR C Lat: ______ Long: ______ Datum: ______

Soil Map Unit Name: Baywood Sand 2-15% slopes NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? Yes X No ____ | Is the Sampled Area within a Wetland? Yes X No ____ | |
| Hydric Soil Present? Yes ____ No ____ | | |
| Wetland Hydrology Present? Yes ____ No ____ | | |

Remarks:

## VEGETATION

| Tree Stratum (Use scientific names.) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Salix lasiolepis | 80% | Y | FACW |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| Total Cover: | | | |
| **Sapling/Shrub Stratum** | | | |
| 1. Scirpus acutus | 30% | Y | OBL |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| Total Cover: | | | |
| **Herb Stratum** | | | |
| 1. Potentilla anserina | 20% | Y | OBL |
| 2. Melilotus indicus | 30% | Y | FAC |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| Total Cover: | | | |
| **Woody Vine Stratum** | | | |
| 1. | | | |
| 2. | | | |
| Total Cover: | | | |

% Bare Ground in Herb Stratum 10% % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species ____ | x 1 = ____ |
| FACW species ____ | x 2 = ____ |
| FAC species ____ | x 3 = ____ |
| FACU species ____ | x 4 = ____ |
| UPL species ____ | x 5 = ____ |
| Column Totals: ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

**Hydrophytic Vegetation Present?** Yes X No ____

Remarks:

## SOIL

Sampling Point: wl 44

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-6 | 10 YR 3/2 | | | | | | Sandy loam | |
| 6-20 | gley 1 3/10Y | | | | | | Sandy loam w/gravel | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (LRR C)
- ___ 1 cm Muck (A9) (LRR D)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- X Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (LRR C)
- ___ 2 cm Muck (A10) (LRR B)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

**Restrictive Layer (if present):**

Type: ____________

Depth (inches): ____________

**Hydric Soil Present?** Yes X No ___

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) (Nonriverine)
- ___ Sediment Deposits (B2) (Nonriverine)
- ___ Drift Deposits (B3) (Nonriverine)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (Riverine)
- ___ Sediment Deposits (B2) (Riverine)
- ___ Drift Deposits (B3) (Riverine)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ______

Water Table Present? Yes ___ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): 6in

**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Monterey Peninsula Fixed Guideway City/County: Monterey/Monterey Sampling Date: 6-22-09
Applicant/Owner: TAMC State: CA Sampling Point: ~~48~~ 45
Investigator(s): JD & JH Section, Township, Range: ______
Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): concave Slope (%): 5%
Subregion (LRR): LRR C Lat: ______ Long: ______ Datum: ______
Soil Map Unit Name: Baywood sand 2-15% slopes NWI classification: ______
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)
Are Vegetation N, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ___ | Is the Sampled Area within a Wetland? Yes ___ No X |
| Hydric Soil Present? | Yes ___ No X | |
| Wetland Hydrology Present? | Yes ___ No X | |

Remarks:
Does not meet ACOE definition of a wetland. Riparian vegetation may be under CA Coastal Commission jurisdiction

## VEGETATION

| Tree Stratum (Use scientific names.) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Salix lasiolepis | 90% | Y | FACW |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| Total Cover: | | | |
| **Sapling/Shrub Stratum** | | | |
| 1. Rubus ursinus | 30% | Y | FAC |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| Total Cover: | | | |
| **Herb Stratum** | | | |
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| Total Cover: | | | |
| **Woody Vine Stratum** | | | |
| 1. | | | |
| 2. | | | |
| Total Cover: | | | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ______ | x 1 = ______ |
| FACW species | ______ | x 2 = ______ |
| FAC species | ______ | x 3 = ______ |
| FACU species | ______ | x 4 = ______ |
| UPL species | ______ | x 5 = ______ |
| Column Totals: | ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

___ Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes X No ___

Remarks:

## SOIL

Sampling Point: ~~4B~~ 45

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-20 | 10YR 3/2 | | | | | | Sandy silt | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (LRR C)
- ___ 1 cm Muck (A9) (LRR D)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (LRR C)
- ___ 2 cm Muck (A10) (LRR B)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

**Restrictive Layer (if present):**

Type: ____________

Depth (inches): ____________

**Hydric Soil Present?** Yes ____ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (Nonriverine)
- ___ Sediment Deposits (B2) (Nonriverine)
- ___ Drift Deposits (B3) (Nonriverine)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (Riverine)
- ___ Sediment Deposits (B2) (Riverine)
- ___ Drift Deposits (B3) (Riverine)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes ____ No X Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

**Wetland Hydrology Present?** Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

No indicators

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Montery Peninsula Fixed Guideway City/County: Monterey | Monterey Sampling Date: 10-22-09
Applicant/Owner: TAMC State: CA Sampling Point: 4446
Investigator(s): JD & JH Section, Township, Range: ____
Landform (hillslope, terrace, etc.): ____ Local relief (concave, convex, none): Concave Slope (%): 1
Subregion (LRR): LRR C Lat: ____ Long: ____ Datum: ____
Soil Map Unit Name: Baywood sand 2-15% slopes NWI classification: ____
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

**SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.**

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? Yes X No ____ | Is the Sampled Area within a Wetland? | Yes X No ____ |
| Hydric Soil Present? Yes X No ____ | | |
| Wetland Hydrology Present? Yes X No ____ | | |

Remarks:
@ tow of Slope

**VEGETATION**

| Tree Stratum (Use scientific names.) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| Total Cover: | | | |
| **Sapling/Shrub Stratum** | | | |
| 1. Rubus ursinus | 50% | Y | FAC |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| Total Cover: | | | |
| **Herb Stratum** | | | |
| 1. Scirpus acutus | 50% | Y | OBL |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| Total Cover: | | | |
| **Woody Vine Stratum** | | | |
| 1. | | | |
| 2. | | | |
| Total Cover: | | | |

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species ____ | x 1 = ____ |
| FACW species ____ | x 2 = ____ |
| FAC species ____ | x 3 = ____ |
| FACU species ____ | x 4 = ____ |
| UPL species ____ | x 5 = ____ |
| Column Totals: ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

**Hydrophytic Vegetation Present?** Yes X No ____

Remarks:

## SOIL

Sampling Point: 4X46

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-20 | gley 1 3/10Y | | | | | | Sandy loam w/gravel & cobble | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- X Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** Yes X No ___

Remarks:

Fill

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ______

Water Table Present? Yes X No ___ Depth (inches): 2in

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): 0in

**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Monterey Peninsula Fixed Guideway City/County: Monterey / Monterey Sampling Date: 6-22-09

Applicant/Owner: TAMC State: CA Sampling Point: 47

Investigator(s): JD & JH Section, Township, Range: ______

Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): Concave Slope (%): 30%

Subregion (LRR): LRR C Lat: ______ Long: ______ Datum: ______

Soil Map Unit Name: Baywood sand 2-15% slopes NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ No X | Is the Sampled Area within a Wetland? Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | |
| Wetland Hydrology Present? | Yes ____ No X | |

Remarks: vegetation maintained along railroad tracks next to Roberts Lake

### VEGETATION

| Tree Stratum (Use scientific names.) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| Total Cover: | | | |
| **Sapling/Shrub Stratum** | | | |
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| Total Cover: | | | |
| **Herb Stratum** | | | |
| 1. Brassica nigra | 5% | Y | NL |
| 2. Vulpia sp | 20% | Y | NL |
| 3. Bromus hordaceus | 5% | Y | UPL |
| 4. Malva parviflora | 5% | Y | NL |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| Total Cover: | | | |
| **Woody Vine Stratum** | | | |
| 1. | | | |
| 2. | | | |
| Total Cover: | | | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species ____ | x 1 = ____ |
| FACW species ____ | x 2 = ____ |
| FAC species ____ | x 3 = ____ |
| FACU species ____ | x 4 = ____ |
| UPL species ____ | x 5 = ____ |
| Column Totals: ____ (A) | ____ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

**Hydrophytic Vegetation Present?** Yes ____ No X

Remarks:

## SOIL

Sampling Point: 4547

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-20 | 10YR 3/2 | | | | | | Sandy Silt | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

**Restrictive Layer (if present):**

Type: ______________

Depth (inches): ______________

**Hydric Soil Present?** Yes ____ No X

Remarks:

Fill with rock

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (Nonriverine)
- ___ Sediment Deposits (B2) (Nonriverine)
- ___ Drift Deposits (B3) (Nonriverine)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ____ | No X | Depth (inches): ______ |
| Water Table Present? | Yes ____ | No X | Depth (inches): ______ |
| Saturation Present? (includes capillary fringe) | Yes ____ | No X | Depth (inches): ______ |

**Wetland Hydrology Present?** Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Monterey Peninsula Fixed Guideway City/County: Monterey / Monterey Sampling Date: 6-22-09

Applicant/Owner: TAMC State: ______ Sampling Point: 46 48

Investigator(s): JD & JH Section, Township, Range: ______

Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): concave Slope (%): 20%

Subregion (LRR): LRR C Lat: ______ Long: ______ Datum: ______

Soil Map Unit Name: Baywood Sand 2-15% slopes NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ______ (If no, explain in Remarks.)

Are Vegetation N , Soil N , or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ______

Are Vegetation N , Soil N , or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? Yes X No ___ | | Is the Sampled Area within a Wetland? Yes X No ___ |
| Hydric Soil Present? Yes X No ___ | | |
| Wetland Hydrology Present? Yes X No ___ | | |

Remarks:

### VEGETATION

| Tree Stratum (Use scientific names.) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Salix lasiolepis | 70% | Y | FACW |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| Total Cover: | | | |
| **Sapling/Shrub Stratum** | | | |
| 1. Rubus ursinus | 20% | Y | FAC |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| Total Cover: | | | |
| **Herb Stratum** | | | |
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| Total Cover: | | | |
| **Woody Vine Stratum** | | | |
| 1. | | | |
| 2. | | | |
| Total Cover: | | | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species ______ | x 1 = ______ |
| FACW species ______ | x 2 = ______ |
| FAC species ______ | x 3 = ______ |
| FACU species ______ | x 4 = ______ |
| UPL species ______ | x 5 = ______ |
| Column Totals: ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a seperate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

**Hydrophytic Vegetation Present?** Yes X No ______

Remarks:

## SOIL

Sampling Point: 4b48

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-20 | 10YR 2/1 | | | | | | loamy sand | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (LRR C)
- ___ 1 cm Muck (A9) (LRR D)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

**Restrictive Layer (if present):**

Type: ____________

Depth (inches): ____________

**Hydric Soil Present?** Yes X No ___

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (Nonriverine)
- ___ Sediment Deposits (B2) (Nonriverine)
- ___ Drift Deposits (B3) (Nonriverine)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- X Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ______

Water Table Present? Yes ___ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ______

**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

moist in dry season

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Monterey Peninsula Fixed Guideway City/County: Monterey/Monterey Sampling Date: 6-22-09
Applicant/Owner: TAMC State: CA Sampling Point: SP49
Investigator(s): JD&JH Section, Township, Range: ______
Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): concave Slope (%): 10%
Subregion (LRR): LRR C Lat: ______ Long: ______ Datum: ______
Soil Map Unit Name: Baywood sand 2-15% slopes NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No ____ (If no, explain in Remarks.)
Are Vegetation Y, Soil Y, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | | |
|---|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes ____ No X | Is the Sampled Area within a Wetland? | Yes ____ | No X |
| Hydric Soil Present? | Yes ____ No X | | | |
| Wetland Hydrology Present? | Yes ____ No X | | | |

Remarks:

## VEGETATION

| Tree Stratum (Use scientific names.) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| Total Cover: | | | |
| **Sapling/Shrub Stratum** | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| Total Cover: | | | |
| **Herb Stratum** | | | |
| 1. Brassica nigra | 1% | N | NL |
| 2. rubus ursinus | 1% | N | FAC |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| Total Cover: | | | |
| **Woody Vine Stratum** | | | |
| 1. | | | |
| 2. | | | |
| Total Cover: | | | |

% Bare Ground in Herb Stratum 98% % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)
Total Number of Dominant Species Across All Strata: 0 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

**Hydrophytic Vegetation Present?** Yes ____ No X

Remarks:
unvegetated -

## SOIL

Sampling Point: 4X49

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | % | Redox Features Color (moist) | % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-20 | 10 YR 3/2 | | | | | | Sandy silt | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

__ Histosol (A1)
__ Histic Epipedon (A2)
__ Black Histic (A3)
__ Hydrogen Sulfide (A4)
__ Stratified Layers (A5) (LRR C)
__ 1 cm Muck (A9) (LRR D)
__ Depleted Below Dark Surface (A11)
__ Thick Dark Surface (A12)
__ Sandy Mucky Mineral (S1)
__ Sandy Gleyed Matrix (S4)
__ Sandy Redox (S5)
__ Stripped Matrix (S6)
__ Loamy Mucky Mineral (F1)
__ Loamy Gleyed Matrix (F2)
__ Depleted Matrix (F3)
__ Redox Dark Surface (F6)
__ Depleted Dark Surface (F7)
__ Redox Depressions (F8)
__ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

__ 1 cm Muck (A9) (LRR C)
__ 2 cm Muck (A10) (LRR B)
__ Reduced Vertic (F18)
__ Red Parent Material (TF2)
__ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** Yes ____ No X

Remarks:
fill w/rock

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (any one indicator is sufficient)

__ Surface Water (A1)
__ High Water Table (A2)
__ Saturation (A3)
__ Water Marks (B1) (Nonriverine)
__ Sediment Deposits (B2) (Nonriverine)
__ Drift Deposits (B3) (Nonriverine)
__ Surface Soil Cracks (B6)
__ Inundation Visible on Aerial Imagery (B7)
__ Water-Stained Leaves (B9)
__ Salt Crust (B11)
__ Biotic Crust (B12)
__ Aquatic Invertebrates (B13)
__ Hydrogen Sulfide Odor (C1)
__ Oxidized Rhizospheres along Living Roots (C3)
__ Presence of Reduced Iron (C4)
__ Recent Iron Reduction in Plowed Soils (C6)
__ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

__ Water Marks (B1) (Riverine)
__ Sediment Deposits (B2) (Riverine)
__ Drift Deposits (B3) (Riverine)
__ Drainage Patterns (B10)
__ Dry-Season Water Table (C2)
__ Thin Muck Surface (C7)
__ Crayfish Burrows (C8)
__ Saturation Visible on Aerial Imagery (C9)
__ Shallow Aquitard (D3)
__ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ____ No X Depth (inches): ______

Water Table Present? Yes ____ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ______

**Wetland Hydrology Present?** Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Monterey Peninsula Fixed Guideway City/County: Monterey / Monterey Sampling Date: 6-22-09

Applicant/Owner: TAMC State: CA Sampling Point: 48 50

Investigator(s): JDR/JH Section, Township, Range: ____

Landform (hillslope, terrace, etc.): ____ Local relief (concave, convex, none): Concave Slope (%): 5%

Subregion (LRR): LRR C Lat: ____ Long: ____ Datum: ____

Soil Map Unit Name: Baywood sand 2-15% slopes NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ____ (If no, explain in Remarks.)

Are Vegetation Y, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | Is the Sampled Area within a Wetland? Yes X No ____ |
| Hydric Soil Present? | Yes X No ____ | |
| Wetland Hydrology Present? | Yes X No ____ | |

Remarks:

### VEGETATION

| Tree Stratum (Use scientific names.) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| Total Cover: | | | |
| **Sapling/Shrub Stratum** | | | |
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| Total Cover: | | | |
| **Herb Stratum** | | | |
| 1. Melilotus indicus | 60% | Y | FAC |
| 2. Polypogon monspeliensis | 5% | Y | FACW |
| 3. Atriplex triangularis | 20% | Y | NL |
| 4. Scirpus acutus | 5% | Y | OBL |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| Total Cover: | | | |
| **Woody Vine Stratum** | | | |
| 1. | | | |
| 2. | | | |
| Total Cover: | | | |

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes X No ____

Remarks:
Vegetation disturbed by regular maintenance
presence of Obligate wetland species & wetland soil & hydrology - Atriplex only found in wetter portions of the site

## SOIL

Sampling Point: 4 of 50

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

| Depth (inches) | Matrix Color (moist) | % | Redox Features Color (moist) | % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-20 | 10YR 2/1 | | | | | | loamy Sand | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (LRR C)
- ___ 1 cm Muck (A9) (LRR D)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- _X_ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (LRR C)
- ___ 2 cm Muck (A10) (LRR B)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** Yes _X_ No ___

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (Nonriverine)
- ___ Sediment Deposits (B2) (Nonriverine)
- ___ Drift Deposits (B3) (Nonriverine)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- _X_ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (Riverine)
- ___ Sediment Deposits (B2) (Riverine)
- ___ Drift Deposits (B3) (Riverine)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No _X_ Depth (inches): ______

Water Table Present? Yes ___ No _X_ Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ___ No _X_ Depth (inches): ______

**Wetland Hydrology Present?** Yes _X_ No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

Moist but not saturated – topo & moist soils in dry season

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Monterey Peninsula Fixed Guideway City/County: Monterey/Monterey Sampling Date: 6-22-09

Applicant/Owner: TAMC State: CA Sampling Point: 4951

Investigator(s): JD & JH Section, Township, Range: ______

Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): concave Slope (%): 2

Subregion (LRR): LRR C Lat: ______ Long: ______ Datum: ______

Soil Map Unit Name: Baywood Sand 2-15 % slopes NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ______ (If no, explain in Remarks.)

Are Vegetation Y, Soil ______, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes X No ______

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ______ No X | Is the Sampled Area within a Wetland? Yes ______ No X |
| Hydric Soil Present? | Yes ______ No X | |
| Wetland Hydrology Present? | Yes ______ No X | |

Remarks:

### VEGETATION

| Tree Stratum (Use scientific names.) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| Total Cover: | | | |
| **Sapling/Shrub Stratum** | | | |
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| Total Cover: | | | |
| **Herb Stratum** | | | |
| 1. Bromus diandrus | 20% | Y | NL |
| 2. Lactuca serriola | 5% | Y | FAC |
| 3. Brassica nigra | 5% | Y | NL |
| 4. Melilotus indicus | 10% | Y | FAC |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| Total Cover: | | | |
| **Woody Vine Stratum** | | | |
| 1. | | | |
| 2. | | | |
| Total Cover: | | | |

% Bare Ground in Herb Stratum 62% % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 4 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ______ | x 1 = ______ |
| FACW species | ______ | x 2 = ______ |
| FAC species | ______ | x 3 = ______ |
| FACU species | ______ | x 4 = ______ |
| UPL species | ______ | x 5 = ______ |
| Column Totals: | ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

**Hydrophytic Vegetation Present?** Yes ______ No X

Remarks:

## SOIL

Sampling Point: 4957

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-26 | 10YR3/2 | | | | | | Sandy loam | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (LRR C)
- ___ 1 cm Muck (A9) (LRR D)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (LRR C)
- ___ 2 cm Muck (A10) (LRR B)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

**Restrictive Layer (if present):**

Type: ____________

Depth (inches): ____________

**Hydric Soil Present?** Yes ___ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (Nonriverine)
- ___ Sediment Deposits (B2) (Nonriverine)
- ___ Drift Deposits (B3) (Nonriverine)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (Riverine)
- ___ Sediment Deposits (B2) (Riverine)
- ___ Drift Deposits (B3) (Riverine)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ______

Water Table Present? Yes ___ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ______

**Wetland Hydrology Present?** Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Monterey Peninsula Fixed Guideway City/County: Monterey / Monterey Sampling Date: 10-22-09
Applicant/Owner: TAMC State: CA Sampling Point: SD 52
Investigator(s): JD & JH Section, Township, Range: ______
Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): concave Slope (%): 2%
Subregion (LRR): LRR C Lat: ______ Long: ______ Datum: ______
Soil Map Unit Name: Baywood Sand 2-15% Slopes NWI classification: ______
Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)
Are Vegetation Y, Soil N, or Hydrology N significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ___ | Is the Sampled Area within a Wetland? Yes ___ No ___ |
| Hydric Soil Present? | Yes X No ___ | |
| Wetland Hydrology Present? | Yes X No ___ | |

Remarks:

## VEGETATION

| Tree Stratum (Use scientific names.) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| Total Cover: | | | |
| **Sapling/Shrub Stratum** | | | |
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| Total Cover: | | | |
| **Herb Stratum** | | | |
| 1. Atriplex triangularis | 80% | Y | NL |
| 2. lavatera sp. | 1% | N | NL |
| 3. Polypogon monspeliensis | 2% | N | FACW |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| Total Cover: | | | |
| **Woody Vine Stratum** | | | |
| 1. | | | |
| 2. | | | |
| Total Cover: | | | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | | x 1 = |
| FACW species | | x 2 = |
| FAC species | | x 3 = |
| FACU species | | x 4 = |
| UPL species | | x 5 = |
| Column Totals: | (A) | (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes X No ___

Remarks:
Vegetation disturbed by regular maintenance – area has wetland soils and hydrology – Atriplex is only found in the wetter portions of the site

## SOIL

Sampling Point: 5052

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-20 | 10YR 2/1 | | | | | | Sandy loam | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (LRR C)
- ___ 1 cm Muck (A9) (LRR D)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (LRR C)
- ___ 2 cm Muck (A10) (LRR B)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

**Restrictive Layer (if present):**
Type: ____________
Depth (inches): ____________

**Hydric Soil Present?** Yes X No ___

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (Nonriverine)
- ___ Sediment Deposits (B2) (Nonriverine)
- ___ Drift Deposits (B3) (Nonriverine)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- X Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (Riverine)
- ___ Sediment Deposits (B2) (Riverine)
- ___ Drift Deposits (B3) (Riverine)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ___ | No X | Depth (inches): ______ |
| Water Table Present? | Yes ___ | No X | Depth (inches): ______ |
| Saturation Present? (includes capillary fringe) | Yes ___ | No X | Depth (inches): ______ |

**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:
moist during dry season - low point

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: Monterey Peninsula Fixed Guideway City/County: Monterey / Monterey Sampling Date: 6-22-09

Applicant/Owner: TAMC State: CA Sampling Point: SP53

Investigator(s): JD & JH Section, Township, Range: ______

Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): concave Slope (%): 1%

Subregion (LRR): LRR C Lat: ______ Long: ______ Datum: ______

Soil Map Unit Name: Baywood Sand 2-15% slopes NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes X No ___ (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation N, Soil N, or Hydrology N naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ___ | No X |
| Hydric Soil Present? | Yes X | No ___ |
| Wetland Hydrology Present? | Yes X | No ___ |

Is the Sampled Area within a Wetland? Yes ___ No X

Remarks:
Does not meet ACOE definition of a wetland. May be under CA Coastal Commission jurisdiction.

### VEGETATION

| Tree Stratum (Use scientific names.) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| Total Cover: | | | |
| **Sapling/Shrub Stratum** | | | |
| 1. None | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| Total Cover: | | | |
| **Herb Stratum** | | | |
| 1. Bromus diandrus | 20% | Y | NL |
| 2. Ehrharta erecta | 10% | Y | NL |
| 3. Lavatera sp. | 5% | N | NL |
| 4. Vulpia sp. | 25% | Y | NL |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| Total Cover: | | | |
| **Woody Vine Stratum** | | | |
| 1. | | | |
| 2. | | | |
| Total Cover: | | | |

% Bare Ground in Herb Stratum 20% % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 0 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 0% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ___ | x 1 = ___ |
| FACW species | ___ | x 2 = ___ |
| FAC species | ___ | x 3 = ___ |
| FACU species | ___ | x 4 = ___ |
| UPL species | ___ | x 5 = ___ |
| Column Totals: | ___ (A) | ___ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

___ Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present.

Hydrophytic Vegetation Present? Yes ___ No X

Remarks:

## SOIL

Sampling Point: 5X53

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-20 | 10YR2/1 | | - | | | | Sandy loam | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix. [2]Location: PL=Pore Lining, RC=Root Channel, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (LRR C)
- ___ 1 cm Muck (A9) (LRR D)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (LRR C)
- ___ 2 cm Muck (A10) (LRR B)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present.

**Restrictive Layer (if present):**

Type: ____________

Depth (inches): ____________

**Hydric Soil Present?** Yes X No ___

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (any one indicator is sufficient)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (Nonriverine)
- ___ Sediment Deposits (B2) (Nonriverine)
- ___ Drift Deposits (B3) (Nonriverine)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Plowed Soils (C6)
- X Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (Riverine)
- ___ Sediment Deposits (B2) (Riverine)
- ___ Drift Deposits (B3) (Riverine)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Thin Muck Surface (C7)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ______

Water Table Present? Yes ___ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ______

**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

moist but not saturated - low point - moist during dry season

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR (Old Salinas River) City/County: Monterey Sampling Date: 2-10-15

Applicant/Owner: MRWPCA State: CA Sampling Point: K54

Investigator(s): M. Johnson, S. Hession Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Bank Local relief (concave, convex, none): none Slope (%): 0

Subregion (LRR): Arid West (LRR C) Lat: ______ Long: ______ Datum: NAD83

Soil Map Unit Name: Alviso NWI classification: FEW

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | Is the Sampled Area within a Wetland? Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | |
| Wetland Hydrology Present? | Yes ____ No X | |

Remarks: 3rd year of drought conditions, statewide.

### VEGETATION – Use scientific names of plants.

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| **Tree Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| = Total Cover | | | |
| **Sapling/Shrub Stratum** (Plot size: 10'x10') | | | |
| 1. Scirpus californica | 80 | Y | OBL |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| = Total Cover | 80 | | |
| **Herb Stratum** (Plot size: 5'x5') | | | |
| 1. Potentilla Argentina pacifica | 15 | Y | OBL |
| 2. Juncus Carnosa | 5 | N | OBL |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| = Total Cover | 20 | | |
| **Woody Vine Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| = Total Cover | | | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species ______ | x 1 = ______ |
| FACW species ______ | x 2 = ______ |
| FAC species ______ | x 3 = ______ |
| FACU species ______ | x 4 = ______ |
| UPL species ______ | x 5 = ______ |
| Column Totals: ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

X Dominance Test is >50%

__ Prevalence Index is ≤3.0[1]

__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ____

Remarks:

## SOIL

Sampling Point: X54

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-9 | 10YR 2/1 | 100 | — | | | | Clay | |
| 9-18 | 10YR 3/1 | 100 | — | | | | Sandy Clay loam | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** Yes ___ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ______

Water Table Present? Yes X No ___ Depth (inches): 17

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): 17

**Wetland Hydrology Present?** Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR (Old Salinas River) City/County: Monterey Sampling Date: 2-10-15
Applicant/Owner: MRWPCA State: CA Sampling Point: 2 55
Investigator(s): M Johnson, S. Hession Section, Township, Range: ______
Landform (hillslope, terrace, etc.): Bank Local relief (concave, convex, none): None Slope (%): 0
Subregion (LRR): Arid west (LRR C) Lat: ______ Long: ______ Datum: NAD83
Soil Map Unit Name: Aluiso NWI classification: Freshwater Emergent Wetland
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)
Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes Y No ___ | Is the Sampled Area within a Wetland? Yes X No ___ |
| Hydric Soil Present? | Yes X No ___ | |
| Wetland Hydrology Present? | Yes X No ___ | |

Remarks: Drought Conditions

### VEGETATION – Use scientific names of plants.

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| **Tree Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| = Total Cover | | | |
| **Sapling/Shrub Stratum** (Plot size: 10'x10') | | | |
| 1. Scirpus californicus | 80 | Y | OBL |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| = Total Cover | 80 | | |
| **Herb Stratum** (Plot size: 5'x5') | | | |
| 1. Potentilla anserina ssp. pacifica | 10 | Y | OBL |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| = Total Cover | 10 | | |
| **Woody Vine Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| = Total Cover | | | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species ______ | x 1 = ______ |
| FACW species ______ | x 2 = ______ |
| FAC species ______ | x 3 = ______ |
| FACU species ______ | x 4 = ______ |
| UPL species ______ | x 5 = ______ |
| Column Totals: ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

X Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ___

Remarks:

## SOIL

Sampling Point: V55

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 10YR 4/1 | 100 | | | | | Clay | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5) (**LRR C**)
- __ 1 cm Muck (A9) (**LRR D**)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1)
- __ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)
- __ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- __ 1 cm Muck (A9) (**LRR C**)
- __ 2 cm Muck (A10) (**LRR B**)
- __ Reduced Vertic (F18)
- __ Red Parent Material (TF2)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ____________

Depth (inches): ____________

**Hydric Soil Present?** Yes X No ____

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- __ Surface Water (A1)
- __ High Water Table (A2)
- __ Saturation (A3)
- __ Water Marks (B1) (**Nonriverine**)
- __ Sediment Deposits (B2) (**Nonriverine**)
- __ Drift Deposits (B3) (**Nonriverine**)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Water-Stained Leaves (B9)
- __ Salt Crust (B11)
- __ Biotic Crust (B12)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- X Thin Muck Surface (C7)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water Marks (B1) (**Riverine**)
- __ Sediment Deposits (B2) (**Riverine**)
- __ Drift Deposits (B3) (**Riverine**)
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes X No ____ Depth (inches): 14

Saturation Present? (includes capillary fringe) Yes X No ____ Depth (inches): 0

**Wetland Hydrology Present?** Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR (Old Salinas River) City/County: Monterey Sampling Date: 2-10-15

Applicant/Owner: MRWPCA State: CA Sampling Point: 3 SW

Investigator(s): M. Johnson, S. Hession Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Bank Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): Arid West (LRR C) Lat: ______ Long: ______ Datum: NAD83

Soil Map Unit Name: Alviso NWI classification: FEW

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X | No [scribbled] |
| Hydric Soil Present? | Yes ____ | No X |
| Wetland Hydrology Present? | Yes ____ | No X |

Is the Sampled Area within a Wetland? Yes ____ No X

Remarks: Drought condition

## VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ______) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| = Total Cover | | | |
| **Sapling/Shrub Stratum** (Plot size: 10'x10') | | | |
| 1. Scirpus californicus | 90 | X | OBL |
| 2. Baccharis salicifolia | 5 | N | FAC |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| = Total Cover | 95 | | |
| **Herb Stratum** (Plot size: 5'x5') | | | |
| 1. Brassica nigra | 12% | X | NL |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| = Total Cover | 12 | | |
| **Woody Vine Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| = Total Cover | | | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 50 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes [scribbled] No X

Remarks:

## SOIL

Sampling Point: 3/56

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 10YR 3/2 | 100 | | | - | | Clay | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** Yes ___ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ______

Water Table Present? Yes ___ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ______

**Wetland Hydrology Present?** Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR (OLD Salinas River) City/County: Monterey Sampling Date: 2-10-15

Applicant/Owner: MRWPCA State: CA Sampling Point: WP4 57

Investigator(s): M. Johnson, S. Hession Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Bank Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): Arid West (LRR C) Lat: ______ Long: ______ Datum: NAD83

Soil Map Unit Name: Alviso NWI classification: FEW

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | Is the Sampled Area within a Wetland? Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | |
| Wetland Hydrology Present? | Yes X No ____ | |

Remarks:
Drought conditions

## VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ______) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | | = Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: 10' X 10') | | | |
| 1. Baccharis salicifolia | 40 | Y | FAC |
| 2. Scirpus californica | 35 | Y | OBL |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | | = Total Cover | |
| **Herb Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | | = Total Cover | |
| **Woody Vine Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| | | = Total Cover | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ______ | x 1 = ______ |
| FACW species | ______ | x 2 = ______ |
| FAC species | ______ | x 3 = ______ |
| FACU species | ______ | x 4 = ______ |
| UPL species | ______ | x 5 = ______ |
| Column Totals: | ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

- X Dominance Test is >50%
- __ Prevalence Index is ≤3.0[1]
- __ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- __ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ____

Remarks:

## SOIL

Sampling Point: X57

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 10YR 2/2 | | | | | | CLAY | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5) (**LRR C**)
- __ 1 cm Muck (A9) (**LRR D**)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1)
- __ Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)
- __ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- __ 1 cm Muck (A9) (**LRR C**)
- __ 2 cm Muck (A10) (**LRR B**)
- __ Reduced Vertic (F18)
- __ Red Parent Material (TF2)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ____

Depth (inches): ____

**Hydric Soil Present?** Yes ____ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- __ Surface Water (A1)
- __ High Water Table (A2)
- __ Saturation (A3)
- __ Water Marks (B1) (**Nonriverine**)
- __ Sediment Deposits (B2) (**Nonriverine**)
- __ Drift Deposits (B3) (**Nonriverine**)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Water-Stained Leaves (B9)
- __ Salt Crust (B11)
- __ Biotic Crust (B12)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Thin Muck Surface (C7)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- X Water Marks (B1) (**Riverine**)
- __ Sediment Deposits (B2) (**Riverine**)
- __ Drift Deposits (B3) (**Riverine**)
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes X No ____ Depth (inches): 12

Saturation Present? (includes capillary fringe) Yes X No ____ Depth (inches): 4

**Wetland Hydrology Present?** Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR (OLD Salinas River) City/County: Monterey Sampling Date: 2-10-15
Applicant/Owner: MRWPCA State: CA Sampling Point: 8 58
Investigator(s): M. Johnson, S. Hession Section, Township, Range: ______
Landform (hillslope, terrace, etc.): Bank Local relief (concave, convex, none): None Slope (%): 0
Subregion (LRR): Arid West (LRR C) Lat: ______ Long: ______ Datum: NAD83
Soil Map Unit Name: Aliso NWI classification: FEW
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)
Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ___ | Is the Sampled Area within a Wetland? Yes ___ No X |
| Hydric Soil Present? | Yes ___ No X | |
| Wetland Hydrology Present? | Yes X No ___ | |

Remarks:
Drought conditions

## VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ___) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | | = Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: 10'x10') | | | |
| 1. Scirpus californicus | 15 | Y | OBL |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | 15 | = Total Cover | |
| **Herb Stratum** (Plot size: 5x5') | | | |
| 1. Atriplex prostrata | 20 | Y | FACW |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | 20 | = Total Cover | |
| **Woody Vine Stratum** (Plot size: ___) | | | |
| 1. | | | |
| 2. | | | |
| | | = Total Cover | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | | x 1 = |
| FACW species | | x 2 = |
| FAC species | | x 3 = |
| FACU species | | x 4 = |
| UPL species | | x 5 = |
| Column Totals: | (A) | (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

X Dominance Test is >50%
__ Prevalence Index is ≤3.0[1]
__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ___

Remarks:

## SOIL

Sampling Point: 58

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 25YR 3/2 | | | | | | Clay | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** Yes ___ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- X Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ______

Water Table Present? Yes X No ___ Depth (inches): 8

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): 6

**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR (Old Salinas River) City/County: Monterey Sampling Date: 2-10-15

Applicant/Owner: MRWPCA State: CA Sampling Point: 6 59

Investigator(s): M. Johnson, S. Hession Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Bank Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): Arid West (LRR C) Lat: ______ Long: ______ Datum: NAD83

Soil Map Unit Name: Alviso NWI classification: FEW

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | Is the Sampled Area within a Wetland? Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | |
| Wetland Hydrology Present? | Yes X No ____ | |

Remarks:
Drought Conditions

## VEGETATION – Use scientific names of plants.

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| **Tree Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| = Total Cover | | | |
| **Sapling/Shrub Stratum** (Plot size: 10'x10') | | | |
| 1. Scirpus Californicus | 95 | Y | OBL |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| = Total Cover | | | |
| **Herb Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| = Total Cover | | | |
| **Woody Vine Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| = Total Cover | | | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ______ | x 1 = ______ |
| FACW species | ______ | x 2 = ______ |
| FAC species | ______ | x 3 = ______ |
| FACU species | ______ | x 4 = ______ |
| UPL species | ______ | x 5 = ______ |
| Column Totals: | ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

X Dominance Test is >50%

__ Prevalence Index is ≤3.0[1]

__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ____

Remarks:

## SOIL

Sampling Point: X59

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 10YR2/2 | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ___

Depth (inches): ___

**Hydric Soil Present?** Yes ___ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- X Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes X No ___ Depth (inches): 5

Saturation Present? (includes capillary fringe) Yes X No ___ Depth (inches): 0

**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR (OLD Salinas River) City/County: Monterey Sampling Date: 2-10-15

Applicant/Owner: MRWPCA State: CA Sampling Point: T 60

Investigator(s): M. Johnson, S. Hession Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Bank Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): Arid West (LRR C) Lat: ______ Long: ______ Datum: NAD83

Soil Map Unit Name: Alviso NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ___ | Is the Sampled Area within a Wetland? Yes ___ No X |
| Hydric Soil Present? | Yes ___ No X | |
| Wetland Hydrology Present? | Yes ___ No X | |

Remarks: 3rd year of statewide drought

## VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ___) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | | = Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: 10' x 10') | | | |
| 1. Scirpus californicus | 55 | Y | OBL |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | 55 | = Total Cover | |
| **Herb Stratum** (Plot size: 5' x 5') | | | |
| 1. Potentilla anserina ssp pacifica | 20 | Y | OBL |
| 2. Jaumea carnosa | 25 | Y | OBL |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | 45 | = Total Cover | |
| **Woody Vine Stratum** (Plot size: ___) | | | |
| 1. | | | |
| 2. | | | |
| | | = Total Cover | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 3 (A)

Total Number of Dominant Species Across All Strata: 3 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | | x 1 = |
| FACW species | | x 2 = |
| FAC species | | x 3 = |
| FACU species | | x 4 = |
| UPL species | | x 5 = |
| Column Totals: | (A) | (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

X Dominance Test is >50%

___ Prevalence Index is ≤3.0[1]

___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ___

Remarks:

## SOIL

Sampling Point: A60

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 10YR 2/1 | 95 | 2.5YR 4/8 | 5 | C | M | CLAY/Sandy | |
| | 10 [illegible] | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ____________

Depth (inches): ____________

**Hydric Soil Present?** Yes ____ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes ____ No X Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

**Wetland Hydrology Present?** Yes ____ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR Rec Ditch City/County: Monterey Sampling Date: 2-12-15
Applicant/Owner: MRWPCA State: CA Sampling Point: X101
Investigator(s): M Johnson Section, Township, Range: ____
Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): None Slope (%): 0
Subregion (LRR): Arid West (LRR C) Lat: ____ Long: ____ Datum: NAD83
Soil Map Unit Name: Pacheco NWI classification: ____
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | Is the Sampled Area within a Wetland? Yes X No ____ |
| Hydric Soil Present? | Yes X No ____ | |
| Wetland Hydrology Present? | Yes X No ____ | |

Remarks: 3rd year of state wide drought

## VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: 10'X10') | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. Salix lasiolepis | 20 | Y | FACW |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | 20 | = Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | | = Total Cover | |
| **Herb Stratum** (Plot size: 5'x5') | | | |
| 1. Conium maculatum | 70 | Y | FACW |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | 70 | = Total Cover | |
| **Woody Vine Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| | | = Total Cover | |

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

X Dominance Test is >50%
__ Prevalence Index is ≤3.0[1]
__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ____

Remarks:

## SOIL

Sampling Point: 6-1

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-2 | 10YR3/1 | 100 | | | | | | Muck |
| 2-18 | Gley 1 4/N | 100 | | | | | Clay | Gley |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5) (**LRR C**)
- X 1 cm Muck (A9) (**LRR D**)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1)
- X Loamy Gleyed Matrix (F2)
- __ Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)
- __ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- __ 1 cm Muck (A9) (**LRR C**)
- __ 2 cm Muck (A10) (**LRR B**)
- __ Reduced Vertic (F18)
- __ Red Parent Material (TF2)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ____________

Depth (inches): ____________

**Hydric Soil Present?** Yes X No ____

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- X Surface Water (A1)
- X High Water Table (A2)
- X Saturation (A3)
- __ Water Marks (B1) (**Nonriverine**)
- __ Sediment Deposits (B2) (**Nonriverine**)
- __ Drift Deposits (B3) (**Nonriverine**)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- __ Water-Stained Leaves (B9)
- __ Salt Crust (B11)
- __ Biotic Crust (B12)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Thin Muck Surface (C7)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water Marks (B1) (**Riverine**)
- __ Sediment Deposits (B2) (**Riverine**)
- __ Drift Deposits (B3) (**Riverine**)
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes X No ____ Depth (inches): 0

Water Table Present? Yes X No ____ Depth (inches): 0

Saturation Present? (includes capillary fringe) Yes X No ____ Depth (inches): 0

**Wetland Hydrology Present?** Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR Rec Ditch City/County: Monterey Sampling Date: 2.12.15
Applicant/Owner: MRWPCA State: CA Sampling Point: 2 102
Investigator(s): M. Johnson Section, Township, Range: ______
Landform (hillslope, terrace, etc.): Flood plain Local relief (concave, convex, none): Concave Slope (%): 2
Subregion (LRR): Arid West (LRRC) Lat: ______ Long: ______ Datum: NAD83
Soil Map Unit Name: Pacheco NWI classification: ______
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)
Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

**SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.**

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ___ | Is the Sampled Area within a Wetland? Yes ___ No X |
| Hydric Soil Present? | Yes ___ No X | |
| Wetland Hydrology Present? | Yes X No ___ | |

Remarks:
Drought Conditions

**VEGETATION – Use scientific names of plants.**

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| **Tree Stratum** (Plot size: 10'x10') | | | |
| 1. Salix lasiolepis | 25 | Y | FACW |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | ___ = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | ___ = Total Cover | | |
| **Herb Stratum** (Plot size: 5'x5') | | | |
| 1. Carex maculata | 20 | Y | FACW |
| 2. Brittle Ox tongue | 3 | N | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | ___ = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| | ___ = Total Cover | | |

% Bare Ground in Herb Stratum 70 % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)
Total Number of Dominant Species Across All Strata: 2 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ___ | x 1 = ___ |
| FACW species | ___ | x 2 = ___ |
| FAC species | ___ | x 3 = ___ |
| FACU species | ___ | x 4 = ___ |
| UPL species | ___ | x 5 = ___ |
| Column Totals: | ___ (A) | ___ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

- X Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ___

Remarks:

## SOIL

Sampling Point: G2

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 10YR 3/1 | 100 | | | | | Clay | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ___

Depth (inches): ___

**Hydric Soil Present?** Yes ___ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- X Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- X Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR Rec Ditch City/County: Monterey Sampling Date: 2-12-15

Applicant/Owner: MRWPCA State: CA Sampling Point: B103

Investigator(s): M Johnson Section, Township, Range: ____

Landform (hillslope, terrace, etc.): flood plain Local relief (concave, convex, none): concave Slope (%): 1

Subregion (LRR): Arid West (LRRC) Lat: ____ Long: ____ Datum: NAD83

Soil Map Unit Name: Pacheco NWI classification: ____

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | Is the Sampled Area within a Wetland? Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | |
| Wetland Hydrology Present? | Yes X No ____ | |

Remarks:
Drought conditions

### VEGETATION – Use scientific names of plants.

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| **Tree Stratum** (Plot size: 10'x10') | | | |
| 1. Salix lasiolepis | 70 | Y | FACW |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | 70 | = Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | | = Total Cover | |
| **Herb Stratum** (Plot size: 5'x5') | | | |
| 1. Vinca | 10 | N | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | | = Total Cover | |
| **Woody Vine Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| | | = Total Cover | |

% Bare Ground in Herb Stratum 75 % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

X Dominance Test is >50%

__ Prevalence Index is ≤3.0[1]

__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ____

Remarks:

## SOIL

Sampling Point: 103

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 2.5Y 3/1 | | | | | | Clay | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

__ Histosol (A1)
__ Histic Epipedon (A2)
__ Black Histic (A3)
__ Hydrogen Sulfide (A4)
__ Stratified Layers (A5) (**LRR C**)
__ 1 cm Muck (A9) (**LRR D**)
__ Depleted Below Dark Surface (A11)
__ Thick Dark Surface (A12)
__ Sandy Mucky Mineral (S1)
__ Sandy Gleyed Matrix (S4)
__ Sandy Redox (S5)
__ Stripped Matrix (S6)
__ Loamy Mucky Mineral (F1)
__ Loamy Gleyed Matrix (F2)
__ Depleted Matrix (F3)
__ Redox Dark Surface (F6)
__ Depleted Dark Surface (F7)
__ Redox Depressions (F8)
__ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

__ 1 cm Muck (A9) (**LRR C**)
__ 2 cm Muck (A10) (**LRR B**)
__ Reduced Vertic (F18)
__ Red Parent Material (TF2)
__ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ________

Depth (inches): ________

**Hydric Soil Present?** Yes ____ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

__ Surface Water (A1)
__ High Water Table (A2)
__ Saturation (A3)
__ Water Marks (B1) (**Nonriverine**)
__ Sediment Deposits (B2) (**Nonriverine**)
__ Drift Deposits (B3) (**Nonriverine**)
__ Surface Soil Cracks (B6)
__ Inundation Visible on Aerial Imagery (B7)
X Water-Stained Leaves (B9)
__ Salt Crust (B11)
__ Biotic Crust (B12)
__ Aquatic Invertebrates (B13)
__ Hydrogen Sulfide Odor (C1)
__ Oxidized Rhizospheres along Living Roots (C3)
__ Presence of Reduced Iron (C4)
__ Recent Iron Reduction in Tilled Soils (C6)
__ Thin Muck Surface (C7)
__ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

__ Water Marks (B1) (**Riverine**)
__ Sediment Deposits (B2) (**Riverine**)
__ Drift Deposits (B3) (**Riverine**)
__ Drainage Patterns (B10)
__ Dry-Season Water Table (C2)
__ Crayfish Burrows (C8)
__ Saturation Visible on Aerial Imagery (C9)
__ Shallow Aquitard (D3)
__ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes X No ____ Depth (inches): 9

Saturation Present? (includes capillary fringe) Yes X No ____ Depth (inches): 9

**Wetland Hydrology Present?** Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR Rec Ditch City/County: Monterey Sampling Date: 2-12-15
Applicant/Owner: MRWPCA State: CA Sampling Point: 64
Investigator(s): M. Johnson Section, Township, Range: ______
Landform (hillslope, terrace, etc.): Flood Plain Local relief (concave, convex, none): Concave Slope (%): 1
Subregion (LRR): Arid West (LRRC) Lat: ______ Long: ______ Datum: NAD83
Soil Map Unit Name: Pacheco NWI classification: ______
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)
Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? Yes X No ___ | Is the Sampled Area within a Wetland? Yes X No ___ | |
| Hydric Soil Present? Yes X No ___ | | |
| Wetland Hydrology Present? Yes X No ___ | | |

Remarks: Drought conditions

## VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: 10'x10') | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. S. lasiolepis | 70 | Y | FACW |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | 70 | = Total Cover | |
| Sapling/Shrub Stratum (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | | = Total Cover | |
| Herb Stratum (Plot size: 5'x5') | | | |
| 1. Vinca sp | 15 | N | NL |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | 15 | = Total Cover | |
| Woody Vine Stratum (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| | | = Total Cover | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)
Total Number of Dominant Species Across All Strata: 1 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | Multiply by: |
|---|---|
| OBL species ______ | x 1 = ______ |
| FACW species ______ | x 2 = ______ |
| FAC species ______ | x 3 = ______ |
| FACU species ______ | x 4 = ______ |
| UPL species ______ | x 5 = ______ |
| Column Totals: ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

X Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ___

Remarks:

## SOIL

Sampling Point: 64

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 2.5Y4/1 | 100 | | | | | Clay | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- __ Histosol (A1)
- __ Histic Epipedon (A2)
- __ Black Histic (A3)
- __ Hydrogen Sulfide (A4)
- __ Stratified Layers (A5) (**LRR C**)
- __ 1 cm Muck (A9) (**LRR D**)
- __ Depleted Below Dark Surface (A11)
- __ Thick Dark Surface (A12)
- __ Sandy Mucky Mineral (S1)
- __ Sandy Gleyed Matrix (S4)
- __ Sandy Redox (S5)
- __ Stripped Matrix (S6)
- __ Loamy Mucky Mineral (F1)
- __ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- __ Redox Dark Surface (F6)
- __ Depleted Dark Surface (F7)
- __ Redox Depressions (F8)
- __ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- __ 1 cm Muck (A9) (**LRR C**)
- __ 2 cm Muck (A10) (**LRR B**)
- __ Reduced Vertic (F18)
- __ Red Parent Material (TF2)
- __ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ____________

Depth (inches): ____________

**Hydric Soil Present?** Yes X No ____

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- __ Surface Water (A1)
- __ High Water Table (A2)
- __ Saturation (A3)
- __ Water Marks (B1) (**Nonriverine**)
- __ Sediment Deposits (B2) (**Nonriverine**)
- __ Drift Deposits (B3) (**Nonriverine**)
- __ Surface Soil Cracks (B6)
- __ Inundation Visible on Aerial Imagery (B7)
- X Water-Stained Leaves (B9)
- __ Salt Crust (B11)
- __ Biotic Crust (B12)
- __ Aquatic Invertebrates (B13)
- __ Hydrogen Sulfide Odor (C1)
- __ Oxidized Rhizospheres along Living Roots (C3)
- __ Presence of Reduced Iron (C4)
- __ Recent Iron Reduction in Tilled Soils (C6)
- __ Thin Muck Surface (C7)
- __ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- __ Water Marks (B1) (**Riverine**)
- __ Sediment Deposits (B2) (**Riverine**)
- __ Drift Deposits (B3) (**Riverine**)
- __ Drainage Patterns (B10)
- __ Dry-Season Water Table (C2)
- __ Crayfish Burrows (C8)
- __ Saturation Visible on Aerial Imagery (C9)
- __ Shallow Aquitard (D3)
- __ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes X No ____ Depth (inches): 0

Water Table Present? Yes X No ____ Depth (inches): 0

Saturation Present? (includes capillary fringe) Yes X No ____ Depth (inches): 0

**Wetland Hydrology Present?** Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR (Tembladero Slough) City/County: Castroville, Mty Sampling Date: 2-12-15
Applicant/Owner: MRWPCA State: CA Sampling Point: SL05
Investigator(s): M. Johnson Section, Township, Range: ______
Landform (hillslope, terrace, etc.): Bank Local relief (concave, convex, none): Convex Slope (%): 2
Subregion (LRR): Arid West (LRR C) Lat: ______ Long: ______ Datum: NAD83
Soil Map Unit Name: Clear Lake NWI classification: ______
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)
Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___
Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ___ | Is the Sampled Area within a Wetland? Yes ___ No X |
| Hydric Soil Present? | Yes ___ No X | |
| Wetland Hydrology Present? | Yes X No ___ | |

Remarks: Drought

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ___) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | ___ = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: ___) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | ___ = Total Cover | | |
| **Herb Stratum** (Plot size: 5'X5') | | | |
| 1. Polygonum amphibium v. emersum | 85 | Y | OBL |
| 2. Urtica dioica | 10 | N | FAC |
| 3. Conium maculatum | 5 | N | FACW |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | 100 = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ___) | | | |
| 1. | | | |
| 2. | | | |
| | ___ = Total Cover | | |

% Bare Ground in Herb Stratum 0 % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ___ | x 1 = ___ |
| FACW species | ___ | x 2 = ___ |
| FAC species | ___ | x 3 = ___ |
| FACU species | ___ | x 4 = ___ |
| UPL species | ___ | x 5 = ___ |
| Column Totals: | ___ (A) | ___ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

X Dominance Test is >50%
___ Prevalence Index is ≤3.0[1]
___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ___

Remarks:

## SOIL

Sampling Point: 105

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 7.5Y3/1 | 100 | | | | | Clay | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ___

Depth (inches): ___

**Hydric Soil Present?** Yes ___ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- X Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- X Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

**Field Observations:**

| | | | |
|---|---|---|---|
| Surface Water Present? | Yes ___ | No X | Depth (inches): ___ |
| Water Table Present? | Yes ___ | No X | Depth (inches): ___ |
| Saturation Present? (includes capillary fringe) | Yes X | No ___ | Depth (inches): 10 |

**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWP (T. Slough) City/County: Castroville, MTY Sampling Date: 7-2-15

Applicant/Owner: MRWPCA State: CA Sampling Point: 6L6

Investigator(s): M. Johnson Section, Township, Range: ______

Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): ______ Slope (%): ______

Subregion (LRR): LRR C Lat: ______ Long: ______ Datum: NAD83

Soil Map Unit Name: Clear Lake NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ______ No ______ (If no, explain in Remarks.)

Are Vegetation ______, Soil ______, or Hydrology ______ significantly disturbed? Are "Normal Circumstances" present? Yes X No ______

Are Vegetation ______, Soil ______, or Hydrology ______ naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X | No ___ | Is the Sampled Area within a Wetland? Yes ______ No X |
| Hydric Soil Present? | Yes ___ | No X | |
| Wetland Hydrology Present? | Yes ___ | No X | |

Remarks:

### VEGETATION – Use scientific names of plants.

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| **Tree Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | | = Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | | = Total Cover | |
| **Herb Stratum** (Plot size: 5'x5') | | | |
| 1. Urtica dioca | 5 | N | FAC |
| 2. Conium maculatum | 40 | Y | FACW |
| 3. Rubus ursinus | 30 | Y | FAC |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | 75 | = Total Cover | |
| **Woody Vine Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| | | = Total Cover | |

% Bare Ground in Herb Stratum 15 % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ______ | x 1 = ______ |
| FACW species | ______ | x 2 = ______ |
| FAC species | ______ | x 3 = ______ |
| FACU species | ______ | x 4 = ______ |
| UPL species | ______ | x 5 = ______ |
| Column Totals: | ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

- X Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ______

Remarks:

## SOIL

Sampling Point: 6-6

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 10YR 3/3 | 100 | | | | | Sandy Clay | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** Yes ___ No ___

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- ___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ______

Water Table Present? Yes ___ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ______

**Wetland Hydrology Present?** Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GNWR (T. Slough) City/County: Cuttonville, Marysville Sampling Date: 2-12-15

Applicant/Owner: MRWPCA State: CA Sampling Point: TP 67

Investigator(s): M. Johnson Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Bank Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRR C Lat: ______ Long: ______ Datum: NAD83

Soil Map Unit Name: ______ NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | Is the Sampled Area within a Wetland? Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | |
| Wetland Hydrology Present? | Yes X No ____ | |

Remarks: 3rd year of statewide drought

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: 10 x 10') | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. S. lasiolepis | 90 | Y | FACW |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | ____ = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | ____ = Total Cover | | |
| **Herb Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | ____ = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| | ____ = Total Cover | | |

% Bare Ground in Herb Stratum 70 % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 1 (A)

Total Number of Dominant Species Across All Strata: 1 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

X Dominance Test is >50%

__ Prevalence Index is ≤3.0[1]

__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ____

Remarks:

## SOIL

Sampling Point: 67

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 10YR 3/1 | 100 | | | | | clay | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ____________

Depth (inches): ____________

**Hydric Soil Present?** Yes ____ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- X Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ____ No X Depth (inches): ____

Water Table Present? Yes ____ No X Depth (inches): ____

Saturation Present? (includes capillary fringe) Yes ____ No X Depth (inches): ____

**Wetland Hydrology Present?** Yes X No ____

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR (T Slough) City/County: Monterey Sampling Date: 2-12-15

Applicant/Owner: MRWPCA State: CA Sampling Point: 8/28

Investigator(s): M. Johnson Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): none Slope (%): 0

Subregion (LRR): Arid West (LRRC) Lat: ______ Long: ______ Datum: NAD83

Soil Map Unit Name: Pacheco NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | Is the Sampled Area within a Wetland? Yes X No ____ |
| Hydric Soil Present? | Yes X No ____ | |
| Wetland Hydrology Present? | Yes X No ____ | |

Remarks:

Drought conditions

### VEGETATION – Use scientific names of plants.

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| Tree Stratum (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | | = Total Cover | |
| Sapling/Shrub Stratum (Plot size: 10' x 10') | | | |
| 1. S. salicifolia | 35 | Y | FAC |
| 2. S. californicus | 15 | N | OBL |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | 50 | = Total Cover | |
| Herb Stratum (Plot size: 5' x 5') | | | |
| 1. S. carnosa | 90 | Y | OBL |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | 90 | = Total Cover | |
| Woody Vine Stratum (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| | | = Total Cover | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ______ | x 1 = ______ |
| FACW species | ______ | x 2 = ______ |
| FAC species | ______ | x 3 = ______ |
| FACU species | ______ | x 4 = ______ |
| UPL species | ______ | x 5 = ______ |
| Column Totals: | ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

X Dominance Test is >50%

__ Prevalence Index is ≤3.0[1]

__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Hydrophytic Vegetation Present? Yes X No ____

Remarks:

## SOIL

Sampling Point: 108

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-2 | | | | | | | J. cornosa Plant material | |
| 2-16 | 10YR 4/1 | 80 | 2.5YR 4/6 | 20 | C | M | Clay Sandy | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** Yes X No ___

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ______

Water Table Present? Yes ___ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ______

**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR (T. Slough) City/County: MTY Sampling Date: 2-12-15
Applicant/Owner: MRWPCA State: CA Sampling Point: 9/(09)
Investigator(s): M. Johnson Section, Township, Range: ______
Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): Convex Slope (%): 1
Subregion (LRR): Arid West (LRR C) Lat: ______ Long: ______ Datum: NAD83
Soil Map Unit Name: Pacheco NWI classification: ______
Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)
Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____
Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | Is the Sampled Area within a Wetland? Yes X No ____ |
| Hydric Soil Present? | Yes X No ____ | |
| Wetland Hydrology Present? | Yes X No ____ | |

Remarks: Drought. This area is part of a manipulated wetland

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ______) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | | = Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: 10'x10') | | | |
| 1. S. californicus | 45 | y | OBL |
| 2. B. salicifolia | 20 | y | FAC |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | 65 | = Total Cover | |
| **Herb Stratum** (Plot size: 5'x5') | | | |
| 1. C. maculatum | 30 | y | FACW |
| 2. J. carnosa | 65 | y | OBL |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | 95 | = Total Cover | |
| **Woody Vine Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| | | = Total Cover | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 4 (A)
Total Number of Dominant Species Across All Strata: 4 (B)
Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ______ | x 1 = ______ |
| FACW species | ______ | x 2 = ______ |
| FAC species | ______ | x 3 = ______ |
| FACU species | ______ | x 4 = ______ |
| UPL species | ______ | x 5 = ______ |
| Column Totals: | ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

X Dominance Test is >50%
__ Prevalence Index is ≤3.0[1]
__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ____

Remarks:

## SOIL

Sampling Point: 69

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-2 | | | | | | | Scaerosa | Plant Material |
| 2-16 | 10YR 4/1 | 80 | 2.5YR4/6 | 20 | C | PM/M | Sandy Clay | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- X Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** Yes X No ___

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- X Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ______

Water Table Present? Yes ___ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ______

**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR (T. Slough) City/County: MTY Sampling Date: 2-12-15

Applicant/Owner: MRWPCA State: CA Sampling Point: 20 70

Investigator(s): M. Johnson Section, Township, Range: ______

Landform (hillslope, terrace, etc.): floodplain Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): Arid West LRRC Lat: ______ Long: ______ Datum: NAD83

Soil Map Unit Name: Pacheco NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | | |
|---|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | Is the Sampled Area within a Wetland? | Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | | |
| Wetland Hydrology Present? | Yes ____ No X | | |

Remarks: Drought

This area is part of a manipulated wetland

## VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ______) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | | = Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: 10'x10') | | | |
| 1. B. salicifolia | 80 | Y | FAC |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | 80 | = Total Cover | |
| **Herb Stratum** (Plot size: 5'x5') | | | |
| 1. F. salina | 40 | Y | OBL |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | 40 | = Total Cover | |
| **Woody Vine Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| | | = Total Cover | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ______ | x 1 = ______ |
| FACW species | ______ | x 2 = ______ |
| FAC species | ______ | x 3 = ______ |
| FACU species | ______ | x 4 = ______ |
| UPL species | ______ | x 5 = ______ |
| Column Totals: | ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

X Dominance Test is >50%

__ Prevalence Index is ≤3.0[1]

__ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)

__ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ____

Remarks:

## SOIL

Sampling Point: 70

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 10YR2/2 | 100 | | | | | sandy clay loam | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ___

Depth (inches): ___

**Hydric Soil Present?** Yes ___ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

**Wetland Hydrology Present?** Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

# WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR (T Slough) City/County: MTY Sampling Date: 2-12-15

Applicant/Owner: MRWPCA State: CA Sampling Point: 12 73

Investigator(s): M Johnson Section, Township, Range: ______

Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): ______ Slope (%): ______

Subregion (LRR): LRRC Lat: ______ Long: ______ Datum: NAD83

Soil Map Unit Name: ______ NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

## SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ___ No X | Is the Sampled Area within a Wetland? Waters Yes X No ___ |
| Hydric Soil Present? | Yes X No ___ | |
| Wetland Hydrology Present? | Yes X No ___ | |

Remarks: 3rd year of statewide drought. This area is part of a manipulated wetland.

## VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ______) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | ______ = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | ______ = Total Cover | | |
| **Herb Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | ______ = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| | ______ = Total Cover | | |

% Bare Ground in Herb Stratum ______ % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: ______ (A)

Total Number of Dominant Species Across All Strata: ______ (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ______ (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ______ | x 1 = ______ |
| FACW species | ______ | x 2 = ______ |
| FAC species | ______ | x 3 = ______ |
| FACU species | ______ | x 4 = ______ |
| UPL species | ______ | x 5 = ______ |
| Column Totals: | ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes ___ No X

Remarks: Unvegetated

## SOIL

Sampling Point: 72

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 10YR4/1 | 50 | | | | | Clay | |
| | G 2.5/5BG | 50 | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) (**LRR C**)
- ___ 1 cm Muck (A9) (**LRR D**)
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- X Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) (**LRR C**)
- ___ 2 cm Muck (A10) (**LRR B**)
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ______

Depth (inches): ______

**Hydric Soil Present?** Yes X No ___

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) (**Nonriverine**)
- ___ Sediment Deposits (B2) (**Nonriverine**)
- ___ Drift Deposits (B3) (**Nonriverine**)
- X Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- X Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) (**Riverine**)
- ___ Sediment Deposits (B2) (**Riverine**)
- ___ Drift Deposits (B3) (**Riverine**)
- X Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ______

Water Table Present? Yes ___ No X Depth (inches): ______

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ______

**Wetland Hydrology Present?** Yes X No ___

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: GWR (T Slough) City/County: MTY Sampling Date: 2-12-15

Applicant/Owner: MRWPCA State: CA Sampling Point: #71

Investigator(s): M Johnson Section, Township, Range: ______

Landform (hillslope, terrace, etc.): Berm Local relief (concave, convex, none): None Slope (%): 0

Subregion (LRR): LRRC Lat: ______ Long: ______ Datum: NAD83

Soil Map Unit Name: Pacheco NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ____ No X (If no, explain in Remarks.)

Are Vegetation ____, Soil ____, or Hydrology ____ significantly disturbed? Are "Normal Circumstances" present? Yes X No ____

Are Vegetation ____, Soil ____, or Hydrology ____ naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes X No ____ | Is the Sampled Area within a Wetland? Yes ____ No X |
| Hydric Soil Present? | Yes ____ No X | |
| Wetland Hydrology Present? | Yes ____ No X | |

Remarks: Drought. This area is part of a manipulated wetland

### VEGETATION – Use scientific names of plants.

| Tree Stratum (Plot size: ____) | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | = Total Cover | | |
| **Sapling/Shrub Stratum** (Plot size: 10'x10') | | | |
| 1. Carex sp. | 60 | Y | OBL/FACW |
| 2. S. californicus | 60 | Y | OBL |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | = Total Cover | | |
| **Herb Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | = Total Cover | | |
| **Woody Vine Stratum** (Plot size: ____) | | | |
| 1. | | | |
| 2. | | | |
| | = Total Cover | | |

% Bare Ground in Herb Stratum ____ % Cover of Biotic Crust ____

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: 2 (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: 100 (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ____ | x 1 = ____ |
| FACW species | ____ | x 2 = ____ |
| FAC species | ____ | x 3 = ____ |
| FACU species | ____ | x 4 = ____ |
| UPL species | ____ | x 5 = ____ |
| Column Totals: | ____ (A) | ____ (B) |

Prevalence Index = B/A = ____

**Hydrophytic Vegetation Indicators:**

- X Dominance Test is >50%
- __ Prevalence Index is ≤3.0[1]
- __ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- __ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes X No ____

Remarks:

## SOIL

Sampling Point: 71

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 10YR 2/2 | 100 | | | | | Sandy Loam | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

- ___ Histosol (A1)
- ___ Histic Epipedon (A2)
- ___ Black Histic (A3)
- ___ Hydrogen Sulfide (A4)
- ___ Stratified Layers (A5) **(LRR C)**
- ___ 1 cm Muck (A9) **(LRR D)**
- ___ Depleted Below Dark Surface (A11)
- ___ Thick Dark Surface (A12)
- ___ Sandy Mucky Mineral (S1)
- ___ Sandy Gleyed Matrix (S4)
- ___ Sandy Redox (S5)
- ___ Stripped Matrix (S6)
- ___ Loamy Mucky Mineral (F1)
- ___ Loamy Gleyed Matrix (F2)
- ___ Depleted Matrix (F3)
- ___ Redox Dark Surface (F6)
- ___ Depleted Dark Surface (F7)
- ___ Redox Depressions (F8)
- ___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

- ___ 1 cm Muck (A9) **(LRR C)**
- ___ 2 cm Muck (A10) **(LRR B)**
- ___ Reduced Vertic (F18)
- ___ Red Parent Material (TF2)
- ___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ___

Depth (inches): ___

**Hydric Soil Present?** Yes ___ No X

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

- ___ Surface Water (A1)
- ___ High Water Table (A2)
- ___ Saturation (A3)
- ___ Water Marks (B1) **(Nonriverine)**
- ___ Sediment Deposits (B2) **(Nonriverine)**
- ___ Drift Deposits (B3) **(Nonriverine)**
- ___ Surface Soil Cracks (B6)
- ___ Inundation Visible on Aerial Imagery (B7)
- ___ Water-Stained Leaves (B9)
- ___ Salt Crust (B11)
- ___ Biotic Crust (B12)
- ___ Aquatic Invertebrates (B13)
- ___ Hydrogen Sulfide Odor (C1)
- ___ Oxidized Rhizospheres along Living Roots (C3)
- ___ Presence of Reduced Iron (C4)
- ___ Recent Iron Reduction in Tilled Soils (C6)
- ___ Thin Muck Surface (C7)
- ___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

- ___ Water Marks (B1) **(Riverine)**
- ___ Sediment Deposits (B2) **(Riverine)**
- ___ Drift Deposits (B3) **(Riverine)**
- ___ Drainage Patterns (B10)
- ___ Dry-Season Water Table (C2)
- ___ Crayfish Burrows (C8)
- ___ Saturation Visible on Aerial Imagery (C9)
- ___ Shallow Aquitard (D3)
- X FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No X Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

**Wetland Hydrology Present?** Yes ___ No X

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## WETLAND DETERMINATION DATA FORM – Arid West Region

Project/Site: ______ City/County: Monterey Sampling Date: 2-12-15

Applicant/Owner: MRWPCA State: CA Sampling Point: 3 73

Investigator(s): Matt Johnson Section, Township, Range: ______

Landform (hillslope, terrace, etc.): ______ Local relief (concave, convex, none): ______ Slope (%): ______

Subregion (LRR): LRR C Lat: ______ Long: ______ Datum: NAD83

Soil Map Unit Name: ______ NWI classification: ______

Are climatic / hydrologic conditions on the site typical for this time of year? Yes ___ No X (If no, explain in Remarks.)

Are Vegetation ___, Soil ___, or Hydrology ___ significantly disturbed? Are "Normal Circumstances" present? Yes X No ___

Are Vegetation ___, Soil ___, or Hydrology ___ naturally problematic? (If needed, explain any answers in Remarks.)

### SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

| | | |
|---|---|---|
| Hydrophytic Vegetation Present? | Yes ___ No X | Is the Sampled Area within a Wetland? Yes ___ No X |
| Hydric Soil Present? | Yes ___ No X | |
| Wetland Hydrology Present? | Yes ___ No X | |

Remarks:
3rd year of statewide drought. This area is part of a manipulated wetland.

### VEGETATION – Use scientific names of plants.

| | Absolute % Cover | Dominant Species? | Indicator Status |
|---|---|---|---|
| **Tree Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| | | = Total Cover | |
| **Sapling/Shrub Stratum** (Plot size: 10'X10') | | | |
| 1. B. pilularis | 20 | Y | |
| 2. | | | |
| 3. | | | |
| 4. | | | |
| 5. | | | |
| | 20 | = Total Cover | |
| **Herb Stratum** (Plot size: 5'X5) | | | |
| 1. B. nigra | 12 | Y | NL |
| 2. C. mdewlatum | 5 | N | FACW |
| 3. Carex sp | 5 | N | OBL/FACW |
| 4. | | | |
| 5. | | | |
| 6. | | | |
| 7. | | | |
| 8. | | | |
| | 22 | = Total Cover | |
| **Woody Vine Stratum** (Plot size: ______) | | | |
| 1. | | | |
| 2. | | | |
| | | = Total Cover | |

% Bare Ground in Herb Stratum 45 % Cover of Biotic Crust ______

**Dominance Test worksheet:**

Number of Dominant Species That Are OBL, FACW, or FAC: ______ (A)

Total Number of Dominant Species Across All Strata: 2 (B)

Percent of Dominant Species That Are OBL, FACW, or FAC: ______ (A/B)

**Prevalence Index worksheet:**

| Total % Cover of: | | Multiply by: |
|---|---|---|
| OBL species | ______ | x 1 = ______ |
| FACW species | ______ | x 2 = ______ |
| FAC species | ______ | x 3 = ______ |
| FACU species | ______ | x 4 = ______ |
| UPL species | ______ | x 5 = ______ |
| Column Totals: | ______ (A) | ______ (B) |

Prevalence Index = B/A = ______

**Hydrophytic Vegetation Indicators:**

- ___ Dominance Test is >50%
- ___ Prevalence Index is ≤3.0[1]
- ___ Morphological Adaptations[1] (Provide supporting data in Remarks or on a separate sheet)
- ___ Problematic Hydrophytic Vegetation[1] (Explain)

[1]Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

**Hydrophytic Vegetation Present?** Yes ___ No ___

Remarks:

## SOIL

Sampling Point: 73

**Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)**

| Depth (inches) | Matrix Color (moist) | Matrix % | Redox Features Color (moist) | Redox Features % | Type[1] | Loc[2] | Texture | Remarks |
|---|---|---|---|---|---|---|---|---|
| 0-18 | 10YR 2/2 | 100 | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, CS=Covered or Coated Sand Grains. [2]Location: PL=Pore Lining, M=Matrix.

**Hydric Soil Indicators: (Applicable to all LRRs, unless otherwise noted.)**

___ Histosol (A1)
___ Histic Epipedon (A2)
___ Black Histic (A3)
___ Hydrogen Sulfide (A4)
___ Stratified Layers (A5) (**LRR C**)
___ 1 cm Muck (A9) (**LRR D**)
___ Depleted Below Dark Surface (A11)
___ Thick Dark Surface (A12)
___ Sandy Mucky Mineral (S1)
___ Sandy Gleyed Matrix (S4)
___ Sandy Redox (S5)
___ Stripped Matrix (S6)
___ Loamy Mucky Mineral (F1)
___ Loamy Gleyed Matrix (F2)
___ Depleted Matrix (F3)
___ Redox Dark Surface (F6)
___ Depleted Dark Surface (F7)
___ Redox Depressions (F8)
___ Vernal Pools (F9)

**Indicators for Problematic Hydric Soils[3]:**

___ 1 cm Muck (A9) (**LRR C**)
___ 2 cm Muck (A10) (**LRR B**)
___ Reduced Vertic (F18)
___ Red Parent Material (TF2)
___ Other (Explain in Remarks)

[3]Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

**Restrictive Layer (if present):**

Type: ___

Depth (inches): ___

**Hydric Soil Present?** Yes ___ No ✓

Remarks:

## HYDROLOGY

**Wetland Hydrology Indicators:**

Primary Indicators (minimum of one required; check all that apply)

___ Surface Water (A1)
___ High Water Table (A2)
___ Saturation (A3)
___ Water Marks (B1) (**Nonriverine**)
___ Sediment Deposits (B2) (**Nonriverine**)
___ Drift Deposits (B3) (**Nonriverine**)
___ Surface Soil Cracks (B6)
___ Inundation Visible on Aerial Imagery (B7)
___ Water-Stained Leaves (B9)
___ Salt Crust (B11)
___ Biotic Crust (B12)
___ Aquatic Invertebrates (B13)
___ Hydrogen Sulfide Odor (C1)
___ Oxidized Rhizospheres along Living Roots (C3)
___ Presence of Reduced Iron (C4)
___ Recent Iron Reduction in Tilled Soils (C6)
___ Thin Muck Surface (C7)
___ Other (Explain in Remarks)

Secondary Indicators (2 or more required)

___ Water Marks (B1) (**Riverine**)
___ Sediment Deposits (B2) (**Riverine**)
___ Drift Deposits (B3) (**Riverine**)
___ Drainage Patterns (B10)
___ Dry-Season Water Table (C2)
___ Crayfish Burrows (C8)
___ Saturation Visible on Aerial Imagery (C9)
___ Shallow Aquitard (D3)
___ FAC-Neutral Test (D5)

**Field Observations:**

Surface Water Present? Yes ___ No X Depth (inches): ___

Water Table Present? Yes ___ No ✓ Depth (inches): ___

Saturation Present? (includes capillary fringe) Yes ___ No X Depth (inches): ___

**Wetland Hydrology Present?** Yes ___ No ✓

Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:

Remarks:

## **Appendix B:** Wetland Delineation Maps

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- Wetland Delineation Points
- Potential Coastal Wetland
- Potential Federal Wetland
- Potential Federal and Coastal Wetland
- Potential Other Waters of the U.S.
- Evaluation Area

N

0 25 50 100
Meters

0 100 200 400
Feet

Service Layer Credits: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

# GWR Wetland Delineation Maps

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Date: 4/8/2015
Scale: 1 in = 220 feet
Project: 2013-13


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Sheet
1



- Wetland Delineation Points
- Potential Coastal Wetland
- Potential Federal Wetland
- Potential Federal and Coastal Wetland
- Potential Other Waters of the U.S.
- Evaluation Area

N

0 25 50 100 Meters

0 100 200 400 Feet

Service Layer Credits: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
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2


- Wetland Delineation Points
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- Potential Federal and Coastal Wetland
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N

0 25 50 100
Meters

0 100 200 400
Feet

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- Wetland Delineation Points
- Potential Coastal Wetland
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- Potential Federal and Coastal Wetland
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- Evaluation Area

N

0 25 50 100
Meters

0 100 200 400
Feet




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- Wetland Delineation Points
- Potential Coastal Wetland
- Potential Federal Wetland
- Potential Federal and Coastal Wetland
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- Evaluation Area

N

0 25 50 100
Meters

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Feet

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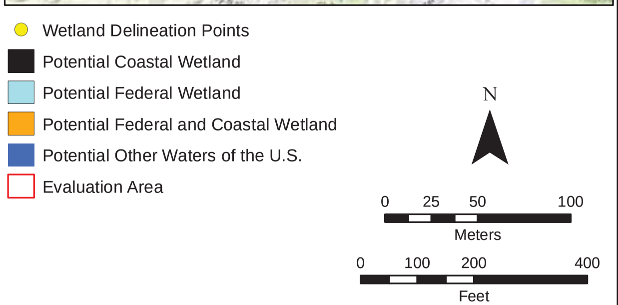




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- Wetland Delineation Points
- Potential Coastal Wetland
- Potential Federal Wetland
- Potential Federal and Coastal Wetland
- Potential Other Waters of the U.S.
- Evaluation Area

N

0 25 50 100
Meters

0 100 200 400
Feet

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- Wetland Delineation Points
- Potential Coastal Wetland
- Potential Federal Wetland
- Potential Federal and Coastal Wetland
- Potential Other Waters of the U.S.
- Evaluation Area

N

0 25 50 100
Meters

0 100 200 400
Feet

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- Wetland Delineation Points
- Potential Coastal Wetland
- Potential Federal Wetland
- Potential Federal and Coastal Wetland
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- Evaluation Area

N

0 25 50 100
Meters

0 100 200 400
Feet

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- Wetland Delineation Points
- Potential Coastal Wetland
- Potential Federal Wetland
- Potential Federal and Coastal Wetland
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- Evaluation Area

N

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Meters

0 100 200 400
Feet



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Wetland Delineation Points
Potential Coastal Wetland
Potential Federal Wetland
Potential Federal and Coastal Wetland
Potential Other Waters of the U.S.
Evaluation Area

N

0 25 50 100
Meters

0 100 200 400
Feet

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- Wetland Delineation Points
- Potential Coastal Wetland
- Potential Federal Wetland
- Potential Federal and Coastal Wetland
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- Evaluation Area

N

0 25 50 100
Meters

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Feet

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- Wetland Delineation Points
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N

0 25 50 100
Meters

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Feet

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- Wetland Delineation Points
- Potential Coastal Wetland
- Potential Federal Wetland
- Potential Federal and Coastal Wetland
- Potential Other Waters of the U.S.
- Evaluation Area

N

0 25 50 100
Meters

0 100 200 400
Feet

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- Wetland Delineation Points
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- Evaluation Area

N

0 25 50 100 Meters

0 100 200 400 Feet

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Wetland Delineation Points

Potential Coastal Wetland

Potential Federal Wetland

Potential Federal and Coastal Wetland

Potential Other Waters of the U.S.

Evaluation Area

N

0 25 50 100
Meters

0 100 200 400
Feet



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- Wetland Delineation Points
- Potential Coastal Wetland
- Potential Federal Wetland
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N

0 25 50 100
Meters

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Feet

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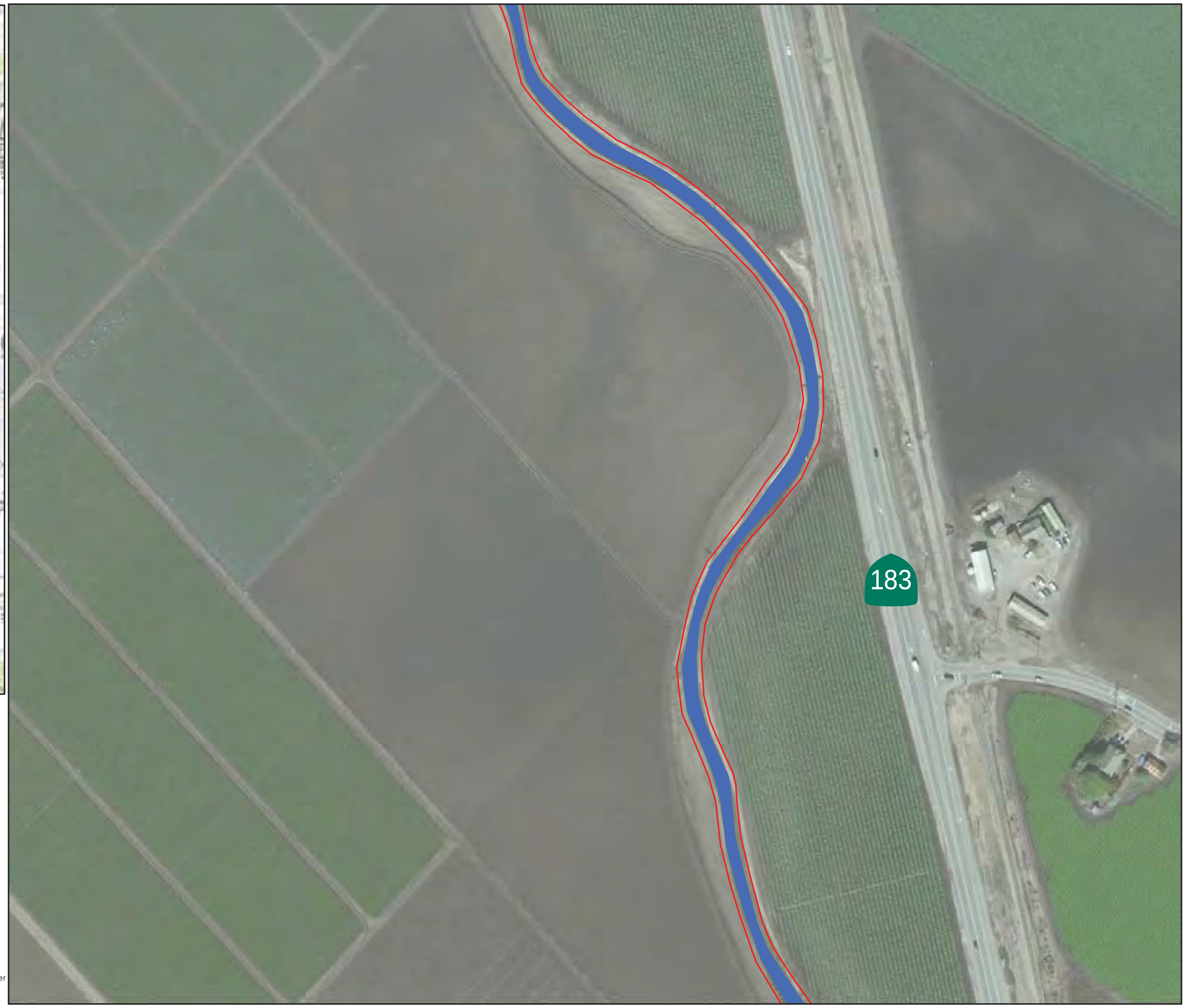


Wetland Delineation Points
Potential Coastal Wetland
Potential Federal Wetland
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Potential Other Waters of the U.S.
Evaluation Area

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Wetland Delineation Points
Potential Coastal Wetland
Potential Federal Wetland
Potential Federal and Coastal Wetland
Potential Other Waters of the U.S.
Evaluation Area

N

0 25 50 100
Meters

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0 25 50 100 Meters

0 100 200 400 Feet

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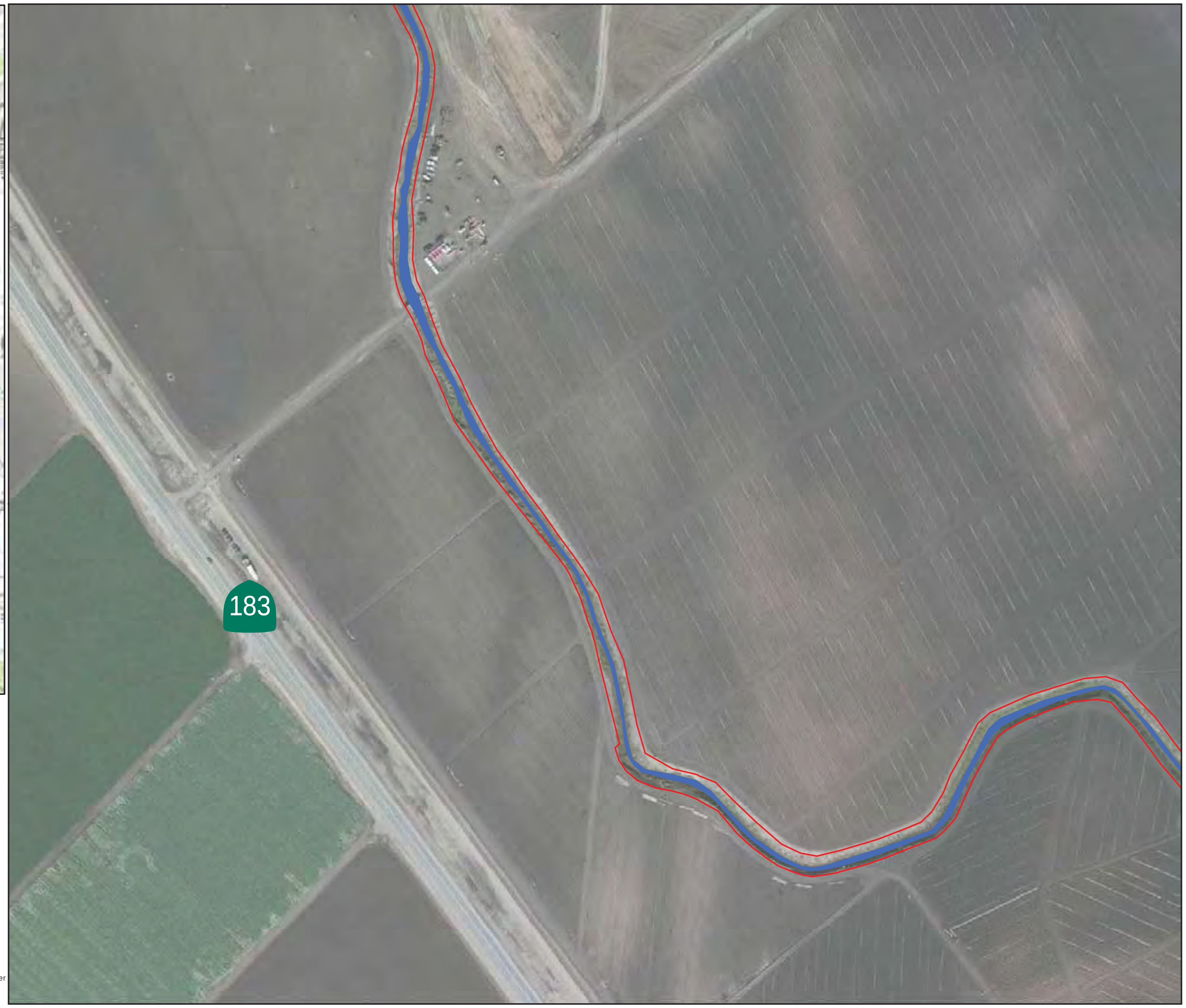


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Wetland Delineation Points

Potential Coastal Wetland

Potential Federal Wetland

Potential Federal and Coastal Wetland

Potential Other Waters of the U.S.

Evaluation Area

N

0 25 50 100

Meters

0 100 200 400

Feet

Service Layer Credits: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
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# GWR Wetland Delineation Maps

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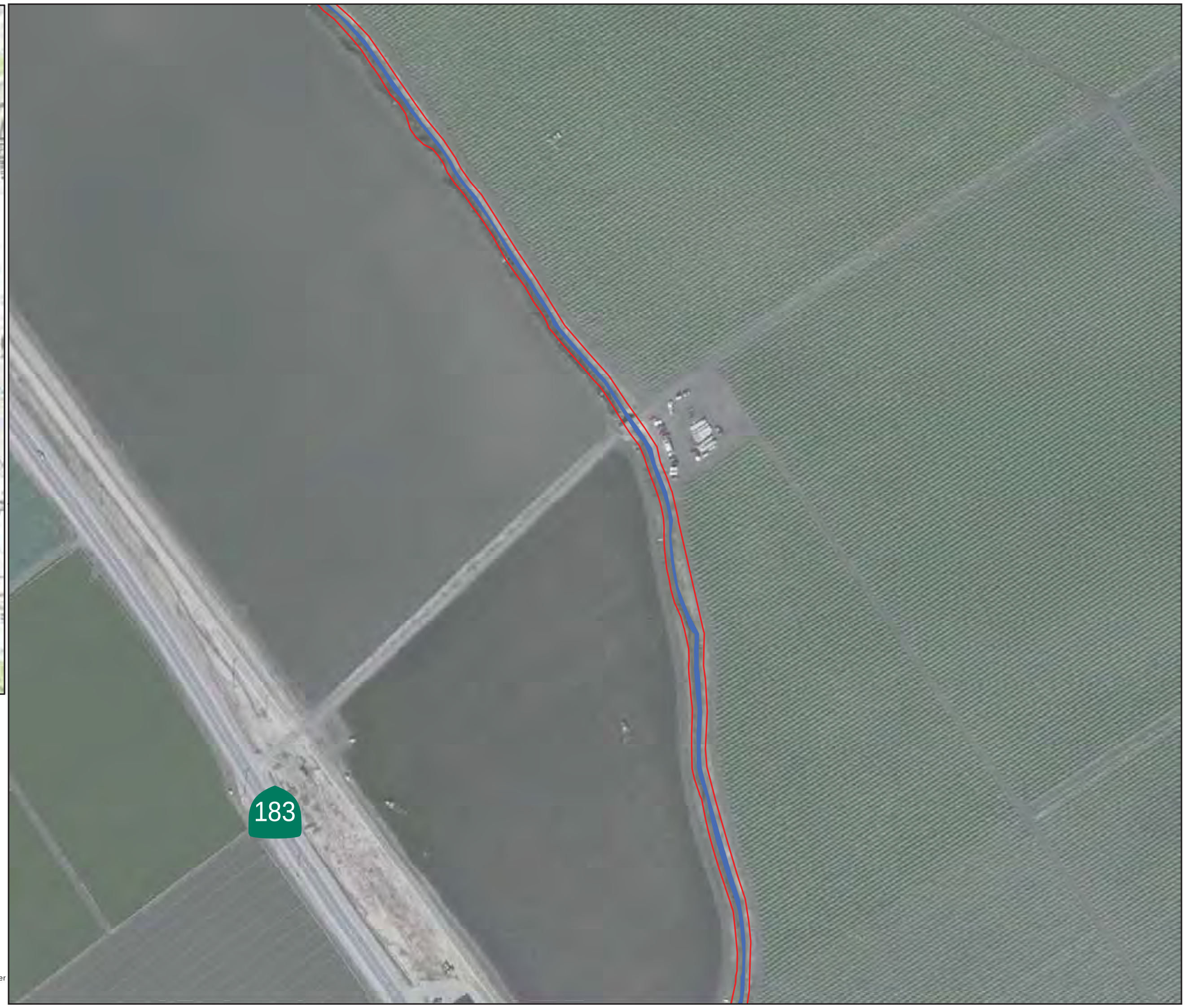


- Wetland Delineation Points
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- Wetland Delineation Points
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Meters

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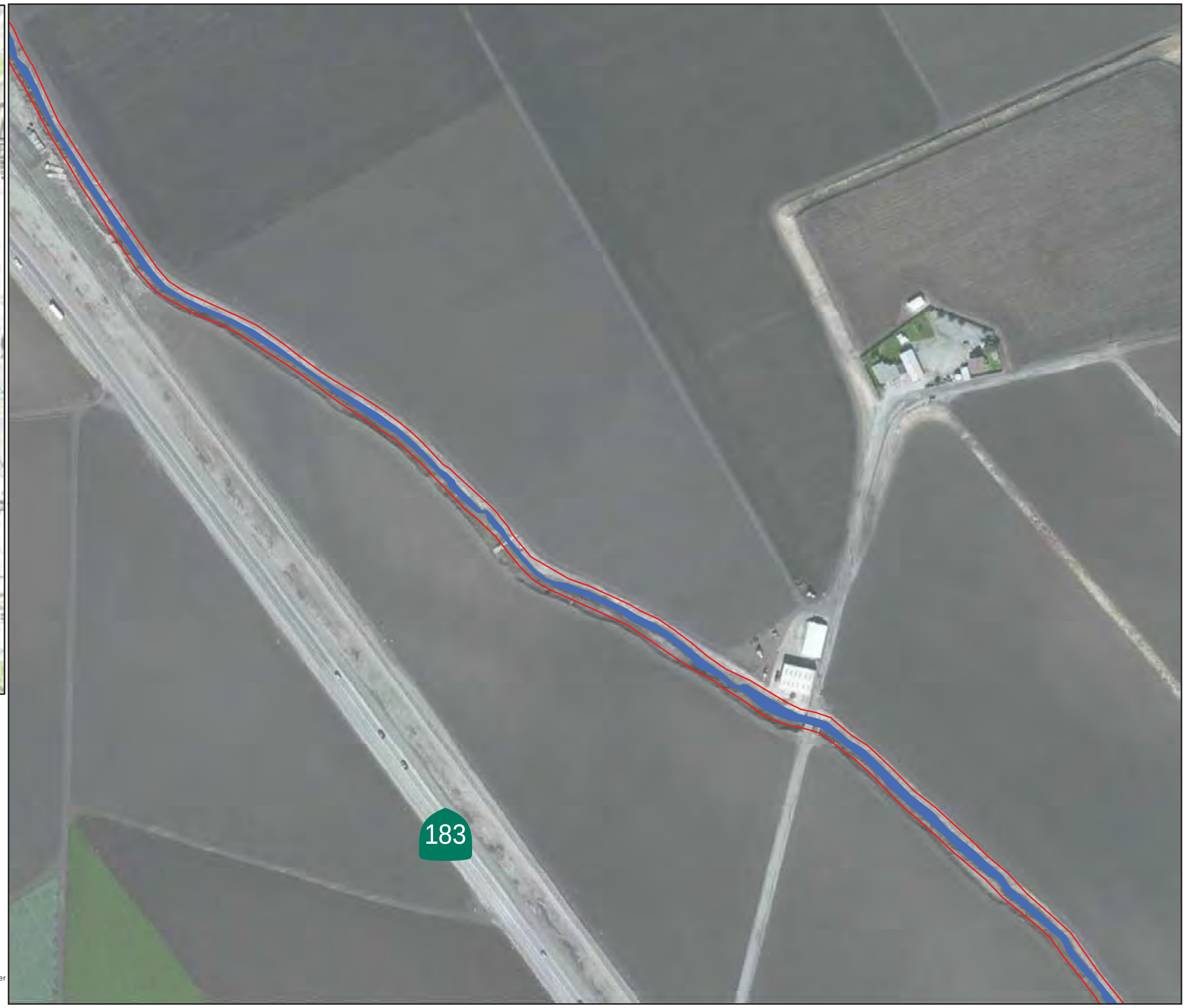


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- Wetland Delineation Points
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Meters

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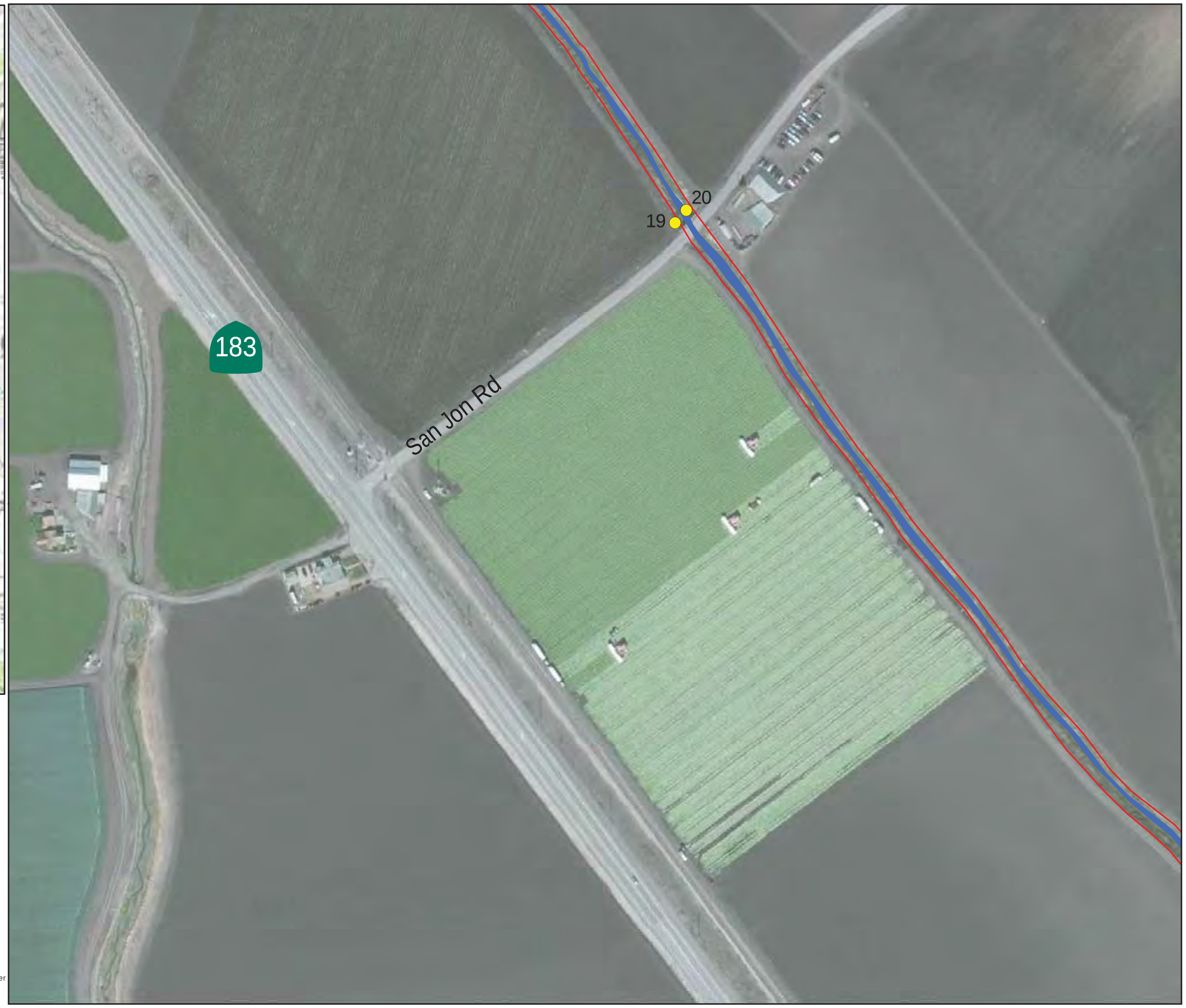


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Wetland Delineation Points
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N

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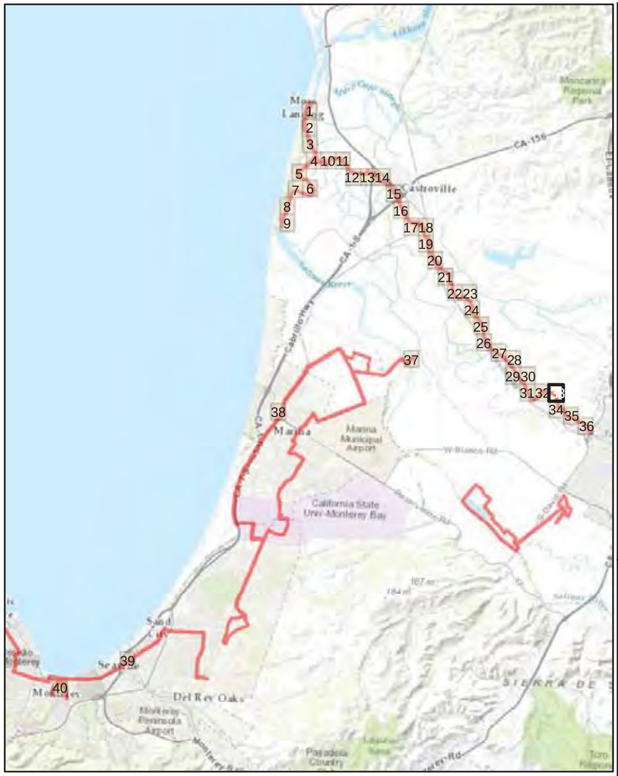


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Wetland Delineation Points

Potential Coastal Wetland

Potential Federal Wetland

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Evaluation Area

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- Wetland Delineation Points
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- Wetland Delineation Points
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- Wetland Delineation Points
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# Appendix J

# Cultural Resources Survey for the Proposed Pure Water Monterey Groundwater Replenishment Project, Northern Monterey County, California

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# ARCHAEOLOGICAL CONSULTING

**P.O. BOX 3377**
**SALINAS, CA 93912**
**(831) 422-4912**

**PHASE 1 ARCHAEOLOGICAL SURVEY FOR THE PROPOSED PURE MONTEREY GROUNDWATER REPLENISHMENT PROJECT, NORTHERN MONTEREY COUNTY, CALIFORNIA**

by

Mary Doane, B.A., and Gary S. Breschini, Ph.D., RPA

December 22, 2014
Rev. April 10, 2015

Prepared for
Denise Duffy & Associates

**SUMMARY**: PROJECT 4642B
**RESULTS**: SEE TEXT
**LINEAR**: <30 MILES
**SITES**: CA-MNT-494 AND CA-MNT-2281H NEAR 33" LINE TO SALINAS INDUSTRIAL WASTE WATER TREATMENT FACILITY; CA-MNT-494 WITHIN SALINAS INDUSTRIAL WASTE WATER TREATMENT FACILITY; CA-MNT-1382/H NEAR TEMBLADERO SOURCE ALTERNATE; P-27-2416 ADJACENT TO PRODUCT WATER CONVEYANCE LINES; P-27-2417 CROSSED BY COASTAL PRODUCT WATER CONVEYANCE LINE.
**UTMG**: SEE TEXT
**MAPS**: USGS 7.5 MINUTE SALINAS, MARINA, SEASIDE, MONTEREY AND MOSS LANDING QUADRANGLES

# INTRODUCTION

In November 2013 Archaeological Consulting was authorized by Denise Duffy of Denise Duffy & Associates to prepare a CEQA Plus Phase 1 Cultural Resources Survey report for the Monterey Peninsula Groundwater Replenishment Project in northern Monterey County, California.

As part of our methodology in the preparation of this report, we have conducted: 1) a background records search at the Northwest Information Center of the California Historical Resources Information System (CHRIS), located at Sonoma State University; 2) a Sacred Lands File Search through the Native American Heritage Commission (NAHC) and consultation with locally affiliated Native Americans; and 3) a field survey of portions of the project area not previously subject to Archaeological Survey. The following report contains the results of these investigations

# REGULATORY SETTING

This report is prepared to comply with the provisions of the California Environmental Quality Act (CEQA). Under CEQA, a determination must be made whether a project will produce a "potentially significant impact" to the environment. Cultural Resources is one of the environmental factors to be considered when the lead agency for project review makes an environmental impact determination.

## PROJECT DESCRIPTION

The Pure Water Monterey Groundwater Replenishment (GWR) Project is a water resources improvement project proposed by the Monterey Regional Water Pollution Control Agency (MRWPCA) in partnership with the Monterey Peninsula Water Management District (MPWMD). The proposed project would create a reliable source of water supply by injecting highly-treated water from a new advanced water treatment plant into the Seaside Groundwater Basin.

The proposed project consists of two components: 1) the GWR Project components that will develop high quality replacement water for existing urban supplies; and 2) an enhanced agricultural irrigation (Crop Irrigation) component that will increase the amount of recycled water available to the existing Castroville Seawater Intrusion Project (CSIP) in northern Monterey County. Water supplies proposed to be recycled and reused by the project include municipal wastewater, industrial wastewater, urban stormwater runoff and surface water diversions. The proposed project would create a reliable source of water supply by taking highly treated water from new and modified treatment facilities at the Regional Treatment Plant, including a new advanced water treatment (AWT) facility, and injecting it into the Seaside Groundwater Basin using a series of shallow and deep injection wells. Once injected into the Seaside Basin, the treated water would mix with the groundwater present in the aquifers and be stored for future use by CalAm.

## PROJECT LOCATION

The project Area of Potential Effects (APE) includes lands in Marina, Seaside Monterey and Pacific Grove, as well as unincorporated lands north of Marina, south and west of Salinas, and west of Castroville in northern Monterey County, California (see Attachment 1: Maps 1 through 9). The several components of the project include a) source water sites and pipelines, b) treatment facilities at the Regional Treatment Plant (RTP), c) product water conveyance means, d) injection well facilities (see Attachment 1: Figures M-1 through M-21 and M-26), and e) the complementary, but separate, CalAm Distribution System Improvements that consist of the Transfer Pipeline and the Monterey Pipeline (see Attachment 1: Figures M-22 through M-28). The CalAm Distribution System Improvements are being reviewed with regard to archaeological and cultural resources by ESA on behalf of the California Public Utilities Commission, and are not addressed in this report.

The Universal Transverse Mercator Grid (UTMG) coordinates for the approximate ends or centers of the components of the APE are provided below.

**Proposed Source Water Diversion and Storage sites:**

- Tembladero Slough Diversion 6.1022/40.6970 on the USGS 7.5 Minute Moss Landing Quadrangle (1954; photo-revised 1980) (see Figure M-1),
- Salinas Reclamation Ditch Diversion 6.1860/40.6060 on the USGS 7.5 minute Salinas Quadrangle (1947; photo-revised 1984) (see Figure M-2).
- Salinas Pump Station Diversion and Pipeline to the Salinas Industrial Wastewater Treatment Facility (NE 6.1786/40.5800 to SW 6.1606/40.5650 on the USGS 7.5 minute Salinas Quadrangle (1947; photo-revised 1984) (see Figures M-3 and M-4).
- Salinas Industrial Wastewater Treatment Facility. SE 6.1615/40.5636 to NW 6.1410/40.5800 on the USGS 7.5 minute Salinas Quadrangle (1947; photo-revised 1984) (see Figures M-4 and M-5).
- Blanco Drain Diversion Pump Station and Pipeline 6.1210/40.6310 on the USGS 7.5 Minute Salinas Quadrangle (1947; photo-revised 1984) to 6.0990/40.6286 on the Marina Quadrangle (1947; photo-revised 1983) (see Figures M-6 and M-7).

- Lake El Estero 5.9988/40.5075 on the USGS 7.5 Minute Monterey Quadrangle (1947; photo-revised 1983) (see Figure M-26).

**Regional Treatment Plant:** center of the facility 6.1020/40.6300 on the USGS 7.5 Minute Marina Quadrangle (1947; photo-revised 1983) (see Figure M-7).

**Product water conveyance pipeline alignment options:** from the Regional Treatment Plant NW (Coastal) 6.0970/40.6320 or NE (RUWAP) 6.1000/40.6260 on the USGS 7.5 Minute Marina Quadrangle (1947; photo-revised 1983) to 6.0616/40.5338 on the USGS 7.5 Minute Seaside Quadrangle, (1947; photo-revised 1983) (see Figures M-8 through M-21).

**Injection wells and backflush facilities:** from NE 6.0630/40.5350 to S 6.0585/40.5266 on the USGS 7.5 Minute Seaside Quadrangle, (1947; photo-revised 1983) (see Figure M-15).

**Area Of Potential Effects (APE)**

Depending upon the project components, the archaeological APE has been determined as the area of direct impact for the project including areas of ground disturbance, staging areas, access, and work areas. The APE is shown in detail on Figures M-1 through M-21 and M-26 (see Attachment 1). Excavation for pipelines will include an area of direct impact for installation of the pipeline (component footprint) as well as a work area (construction boundary). Because the exact location of some pipelines has not yet been determined, a maximum width (approximately 200 feet) has been delineated as the APE in undeveloped areas. For pipelines installed below existing roadways, the APE is the varying width of the road right-of-way. No excavation or grading will occur in the staging areas; therefore staging area APEs will include the horizontal extent and a minimal depth (less than 6 inches) from potential disturbance relating to the placement and movement of personnel and heavy equipment.

The architectural/structural APE for the project in developed areas includes the area of direct impact and varying width of the road right-of-way (typically 50–75 feet from curb to curb). In the case of project components located in undeveloped areas, the architectural/structural APE is 25 feet from the centerline of the pipeline or a 25-foot buffer from a project component or staging area.

## PROJECT METHODOLOGY

The methodology used in the preparation of this report included three primary steps, as follows:

### Background Research

The background research for this project included an examination of the archaeological site records, maps, and project files of the Northwest Information Center of the California Historical Resources Information System (CHRIS), located at Sonoma State University. In addition, our extensive files and maps were examined for supplemental information, such as unsubstantiated mention of historic or prehistoric resources in the general area. Background literature searches are undertaken to determine the locations of any archaeological resources recorded within or adjacent to the project APE and the scope, methodology and findings of previous archaeological research or reconnaissance studies in and near the APE.

Established by the California Office of Historic Preservation, the regional Information Centers are the local repository for all archaeological reports prepared under cultural resource management regulations. A background literature search at the appropriate Information Center is required by state guidelines and current professional standards. Following completion of a project, a copy of the report must be deposited with that organization.

## Native American Consultation

A Sacred Lands search was initiated with the Native American Heritage Commission (NAHC). Following their search, the commission recommended consultation with locally affiliated Native Americans and provided a list of individuals from several bands to contact for such consultation. Initial contact was initiated by mail or email, followed by telephone or additional email if a timely response was not received.

## Field Survey

Because portions of the APE have been subject to previous archaeological survey, only those areas not previously surveyed were included in the current field study.

On April 3, 2014, Patrick Cave and Gina Kay completed a field survey of the Blanco Drain Diversion pump station and pipeline and segments of the APE for the product water conveyance lines not previously subject to a cultural resources survey. The pedestrian survey consisted of a "general surface reconnaissance" of all parts of the APE that could reasonably be expected to contain visible cultural resources and that could be viewed without major vegetation removal. At the time of our field reconnaissance surface visibility in the undeveloped portions of the APE was generally good. In the developed segment of the Crescent Avenue APE in Marina, visibility adjacent to the roadway was fair. Overall, soil surface visibility was considered adequate for the purposes of this survey.

After receiving unexploded ordnance training Mary Doane and Patrick Cave surveyed the injection wells and backflush facilities portion of the APE located in the former Fort Ord on April 21, 2014. A small portion of that area was surveyed by Patrick Cave in 2012. Visibility in most of the project area was generally fair to poor, partially obscured by coastal scrub including dense patches of poison oak.

Visibility was very good along existing roads and in the southern part of the project area near General Jim Moore Boulevard.

Most of the project APE has been included in previous archaeological surveys and other studies as further described in the next section (see Attachment 2, CHRIS Documentation).

## RESULTS OF THE SURVEY

### Background Research

The project area lies within the currently recognized ethnographic territory of the Costanoan (often called Ohlone) linguistic group. Discussions of this group and their territorial boundaries can be found in Breschini, Haversat, and Hampson (1983), Kroeber (1925), Levy (1978), Margolin (1978), and other sources. In brief, the group followed a general hunting and gathering subsistence pattern with partial dependence on the natural acorn crop. Habitation is considered to have been semi-sedentary and occupation sites can be expected most often at the confluence of streams, other areas of similar topography along streams, or in the vicinity of springs. These original sources of water may no longer be present or adequate. Also, resource gathering and processing areas and associated temporary campsites are frequently found on the coast and in other locations containing resources utilized by the group. Factors that may influence the locations of these sites include the presence of suitable exposures of rock for bedrock mortars or other milling activities, ecotones, the presence of specific resources (oak groves, marshes, quarries, game trails, trade routes, etc.), proximity to water, and the availability of shelter. Temporary camps or other activity areas can also be found along ridges or other travel corridors.

The background search of the files at the Northwest Information Center found recorded cultural resources within or adjacent to several portions of the project APE (see Attachment 2, CHRIS documentation).

Prehistoric midden site CA-MNT-1382/H (P-27-1408) is located near the Tembladero Slough source water APE. Originally recorded south of the intersection of Highway 1 and Merritt Street, the site boundary was expanded to include the sewer pump station in 1989 (Snethcamp and York 1989). Subsequent archaeological testing resulted in remapping of the site boundary to nearly the size and location of the original site record (Jones and Thompson 1992). The current project is not expected to impact this site, based on the corrected site boundary.

Prehistoric site CA-MNT-494 (P-27-0580), recorded by Breschini in 1973 as a slight midden containing several burials, was located within the Salinas Industrial Wastewater Treatment facility. The site was greatly disturbed, if not destroyed by the 1972 grading of the aeration lagoon that unearthed the deposit.

An historic farm site, CA-MNT-2281H (P-27-3057), is recorded near the eastern end of the IWTF north and east of the APE. It will not be impacted by the proposed project.

Several archaeological sites are found around Lake El Estero, a source water location: prehistoric site CA-MNT-955H (P-27-1011) on the hill to the southeast, prehistoric sites CA-MNT-272/304 (P-27-0377), CA-MNT-372 and CA-MNT-373 at the southeast end of the lake, and the National Register listed Royal Presidio Chapel historic site CA-MNT-271 (P-27-0376) above the southwestern end of the lake. None of these recorded sites are within or close to the source water diversion APE on the northern end of Lake El Estero.

Sections of historical fence lines, CA-MNT-2079H (P-27-2416), are adjacent to the northern ends of the Coastal and RUWAP product water conveyance pipeline alignments.

An unremarkable segment of the Monterey and Salinas Valley Railroad Grade, CA-MNT-2080H (P-27-2417), is crossed by the northernmost alignment of the Coastal product water conveyance pipeline. The Monterey and Salinas Valley Railroad Grade has the potential to be a historical resource under CEQA. However, the railroad alignment within the APE exhibits no remaining characteristics of the railroad grade. None of the features or materials associated with the railroad are present in that section of the alignment which has been dramatically modified by activities associated with access roads, the adjacent landfill, fencelines, etc.

West of the Coastal product conveyance line are an historic site at Marina Beach (CA-MNT-1288H (P-27-1325) and several historic structures located in the former Fort Ord (P-27-2881, P-27-2882, P-27-2883, P-27-2884, P-27-2893, P-27-2894, P-27-2895, and P-27-2896). None of these resources will be physically or visually affected by the project.

Most of the project APE has been included in previous archaeological surveys (see Attachment 2, CHRIS Documentation).

Portions of the source water diversion and conveyance APE have been included in the following studies: Tembladero Slough (Peak and Associates 1976; Chavez 1978; Snethcamp 1991; York 1991), Salinas Pump Station Diversion (Weber and Peak 1976), Salinas Reclamation Ditch (Haversat and Breschini 1979), Salinas Industrial Wastewater Treatment facility (Doane and Breschini 2009a, 2009b, 2009c and 2013), Blanco Drain (Bouey 1989), Lake El Estero (Doane and Breschini 2007; Jones and Holson 2009).

The product water conveyance APE through the city of Marina and the Seaside portions of the former Fort Ord has been included in several previous studies (Weber and Peak 1976; Peak and Associates 1978; Runnings and Breschini 1992; Doane and Haversat 1999, 2006; Sawyer et al. 2000; Wilson 2000; Doane 2004; Kirk 2004; Jones and Holson 2009; Ruby 2010; Doane and Breschini 2008 and 2013).

The injection wells and backflush facilities APE have been included in two large studies of the former Fort Ord (Zahnizer and Roberts 1980; Swernoff 1982). The northern portion of the current project APE was field surveyed by Patrick Cave of Archaeological Consulting in 2012 (Doane and Breschini 2012).

**Native American Consultation**

The Native American Heritage Commission Sacred Lands file search found no recorded Sacred Sites in the project APE. Correspondence and consultation with several of the Native Americans recommended by the commission resulted in no additional information about specific resources or sacred sites within the project APE (see Attachment 3, Native American Consultation).

However, several of the consultants had concerns or other comments about the project and its potential impacts. Louise Miranda-Ramirez of the Ohlone/Costanoan-Esselen Nation provided a letter requesting no disturbance of cultural sites and specific follow-up regarding this project (see Attachment 3). Valentin Lopez of the Amah Mutsun Tribal Band declared that, although most of the project APE was out of their traditional territory, he thought any ground disturbance in the vicinity of Tembladero Slough, which is within traditional Mutsun territory, or the Salinas River should be monitored. Ann Marie Sayers of the Indian Canyon Mutsun Band also recommended monitoring of earthwork in the vicinity of Tembladero Slough or other watercourses. Michelle Zimmer and Irenne Zwierlein of Amah/Mutsun Tribal Band had no specific concerns about the project APE but wished to be informed of any new cultural discoveries. Tony Cerda of the Coastanoan Rumsen Carmel Tribe asked to be kept informed of any positive findings of cultural sensitivity in the Monterey area. Follow up messages were left with several others on the contacts list, but no other responses have been received.

**Field Research**

None of the materials frequently associated with prehistoric cultural resources in this area (dark midden soil, marine shell fragments, flaked or ground stone, weathered bone fragments, fire-affected rock, etc.) were observed in any part of the APE covered during the current field survey. The results of previous surveys will be discussed in the conclusions section of this report.

Although the northernmost segment of the Coastal product water conveyance line will pass around the western end of historic fence line CA-MNT-2079H (P-27-2416) and will cross the alignment of the Monterey and Salinas Valley Railroad Grade, CA-MNT-2080H (P-27-2417), no evidence of potentially significant historic resources was noted within the APE during the field survey. The northern segment of the RUWAP product water conveyance line will pass by the eastern section of historic fence line CA-MNT-2079H (P-27-2416). Again no evidence of potentially significant resources was noted during the field survey. No other evidence of potentially significant Historic Period resources, either archival or physical, was found within or adjacent to the project APE.

## CONCLUSIONS AND RECOMMENDATIONS

Based on the background research through the California Historic Resources Information System and the Native American Heritage Commission and based on the findings of our current field survey and previous surveys undertaken within the project APE, we have concluded that there is documentary evidence of cultural resources within or adjacent to portions of the project APE.

The boundary of site CA-MNT-1382/H (P-27-1408) previously included the proposed water source at Tembladero Slough. The archaeological boundary was subsequently redrawn to encompass a smaller area (Snethcamp and York 1991;

Jones et al. 1996). Based on the latest field findings, the project is expected to have no effect on potentially significant historic resources at this location.

The recorded location of prehistoric site CA-MNT-494 (P-27-0580) falls within the Salinas Industrial Wastewater Treatment facility. Based on the original field map location, this prehistoric site was likely damaged, destroyed or buried during development of the facility. No evidence of the archaeological resource has been seen during recent studies within the IWTF (Doane and Breschini 2009a, 2009b and 2009c). No impacts to nearby historic site CA-MNT-2281H (P-27-3057) are anticipated from the project because the recorded resource is north of the eastern end of the IWTF that will not be impacted by the proposed project.

The Coastal product water conveyance line from the RTP would cross the historic Monterey and Salinas Valley Railroad Grade, CA-MNT-2080H (P-27-2417), and skirt the end of historic fence line CA-MNT-2079H (P-27-2416). The RUWAP product water conveyance line would skirt the eastern part of historic fence line CA-MNT-2079H (P-27-2416). No impact to either section of fence line is anticipated with the alignments as proposed. The railroad grade at the point of crossing is visually unremarkable, and appears to have been previously altered by landfill and Regional Wastewater Treatment Plant construction. A segment further south is more apparent in a substantial grade cut through stabilized dunes. Excavation across the railroad alignment is not expected to cause significant impacts to the already substantially altered railroad alignment within the APE.

The remainder of the project, as currently designed, contains no archaeological or historic resources and is expected to have no effect on significant archaeological or historic resources. However, because of the possibility of unidentified (e.g., buried) resources being found during any project involving ground disturbance, we recommend that the following standard language, or the equivalent, be included in any permits issued for the project area:

- If archaeological resources or human remains are unexpectedly discovered during any construction, work shall be halted within 50 meters (±160 feet) of the find until it can be evaluated by a qualified professional archaeologist. If the find is determined to be significant, appropriate mitigation measures shall be formulated, with the concurrence of the Lead Agency, and implemented.

Because of their continuing interest in potential discoveries during construction, all listed Native American Contacts should be notified of any and all discoveries of archaeological resources in the project area.

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Doane and Breschini (cont)

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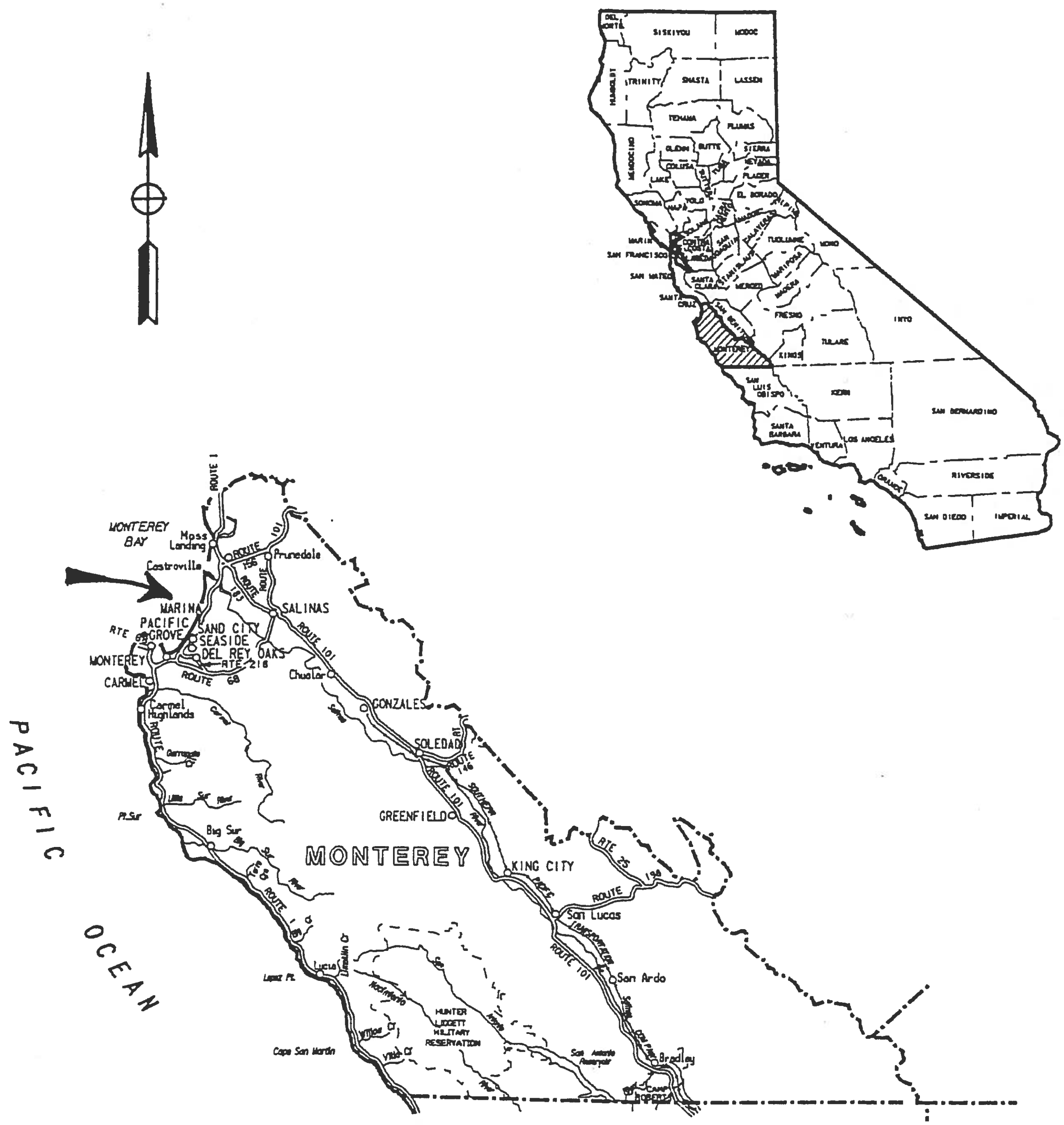
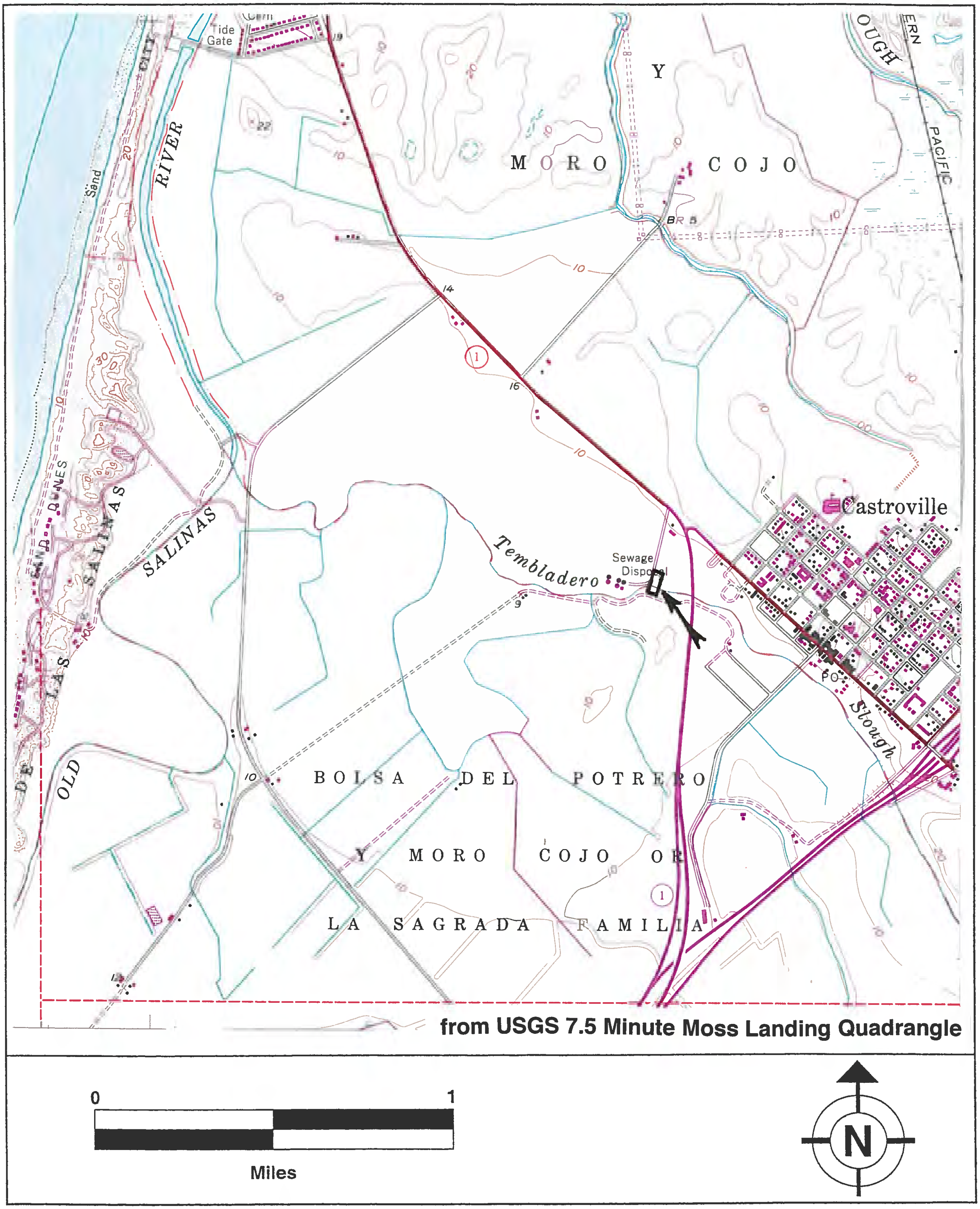
# ATTACHMENT 1

# MAPS AND FIGURES

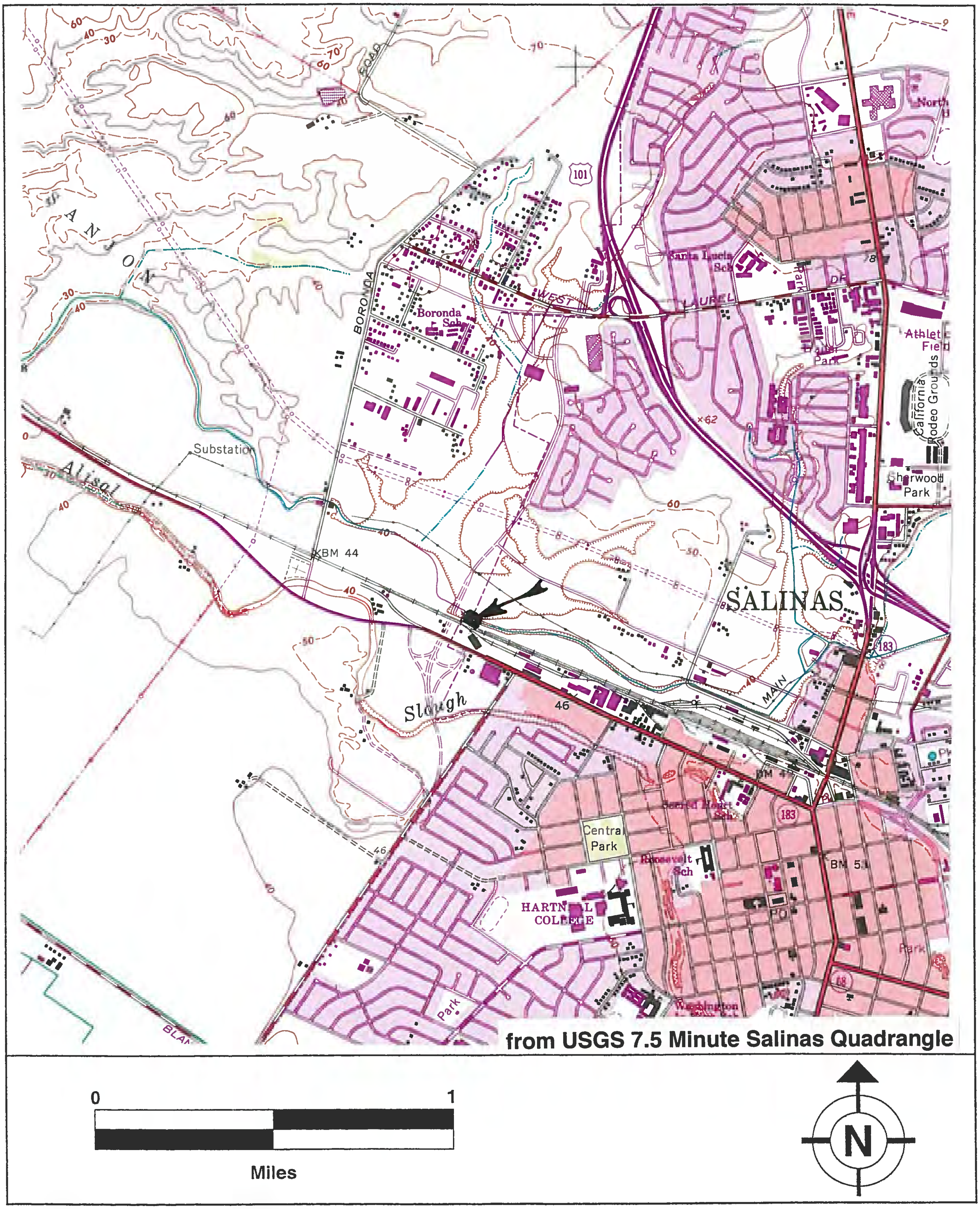



**Map 1. Project Vicinity**

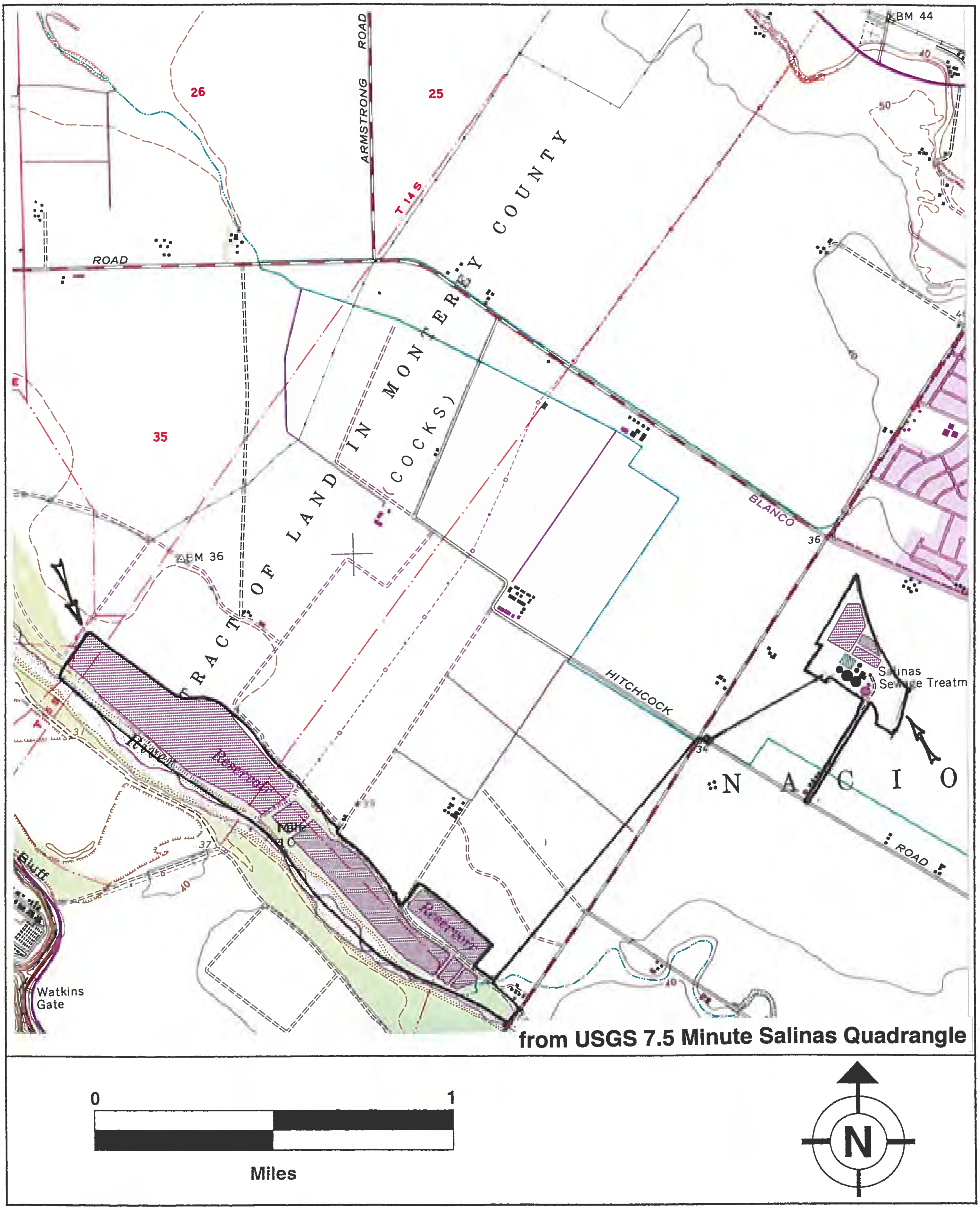



from USGS 7.5 Minute Moss Landing Quadrangle

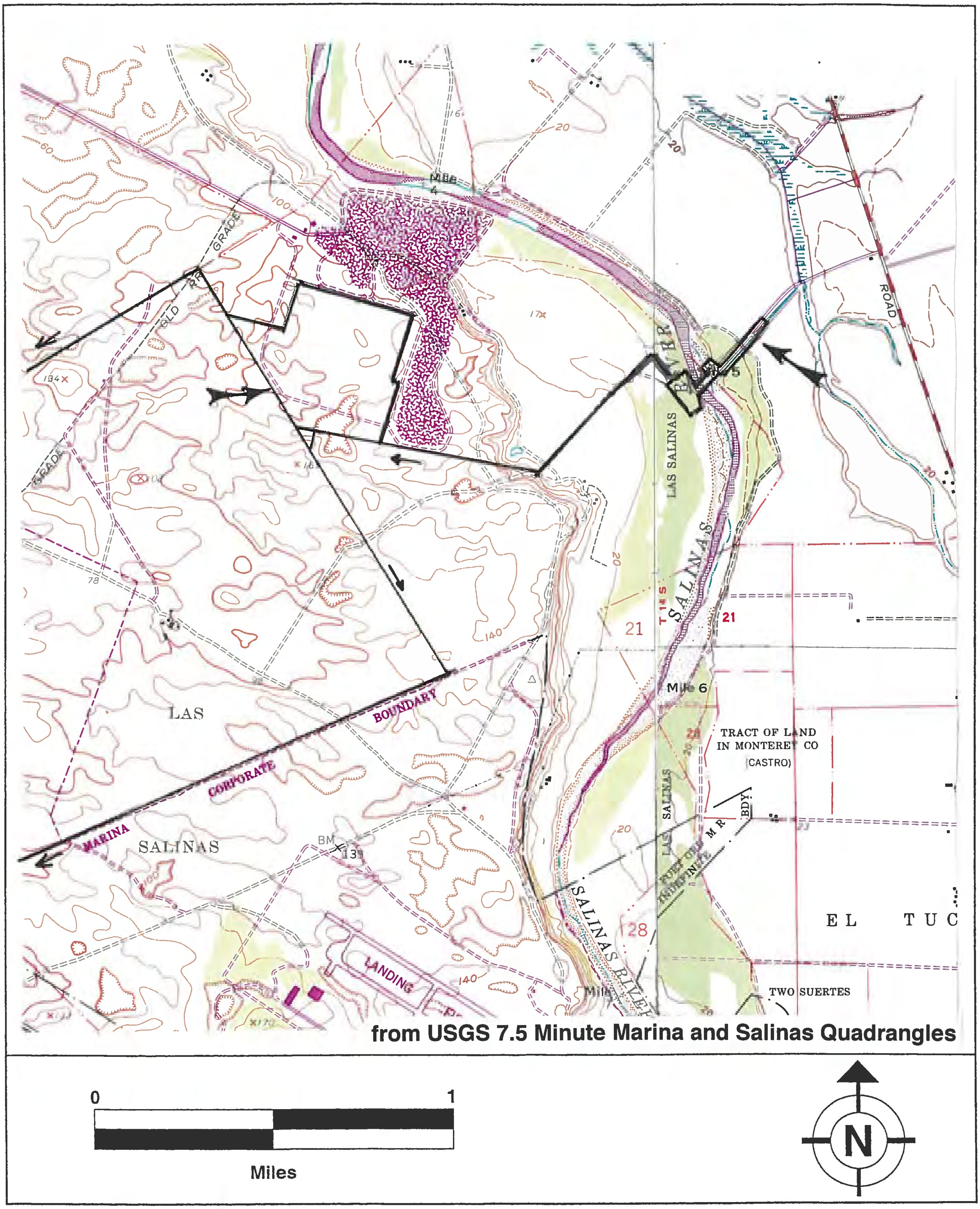
**Map 2. Project APE**



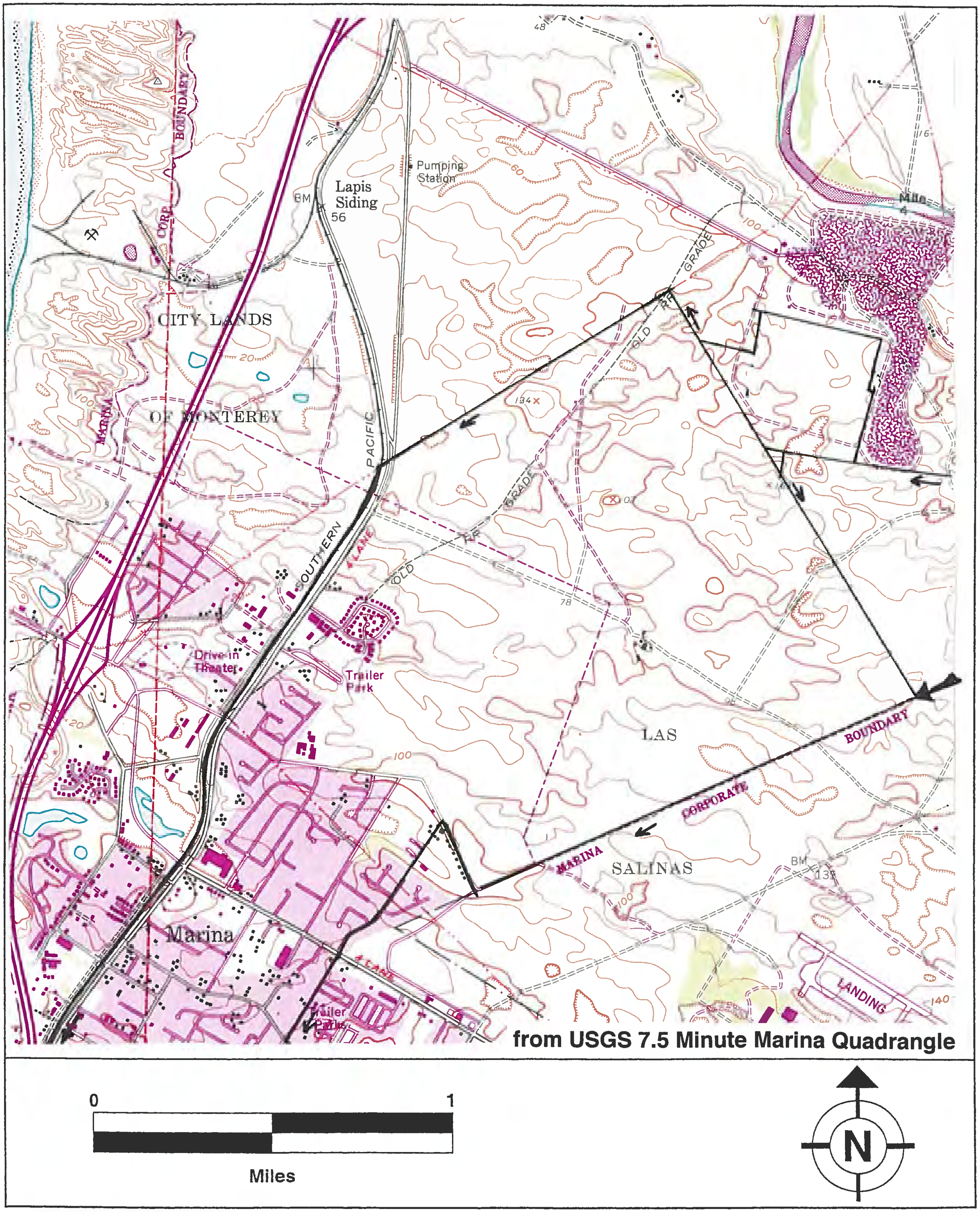

**Map 3. Project APE**



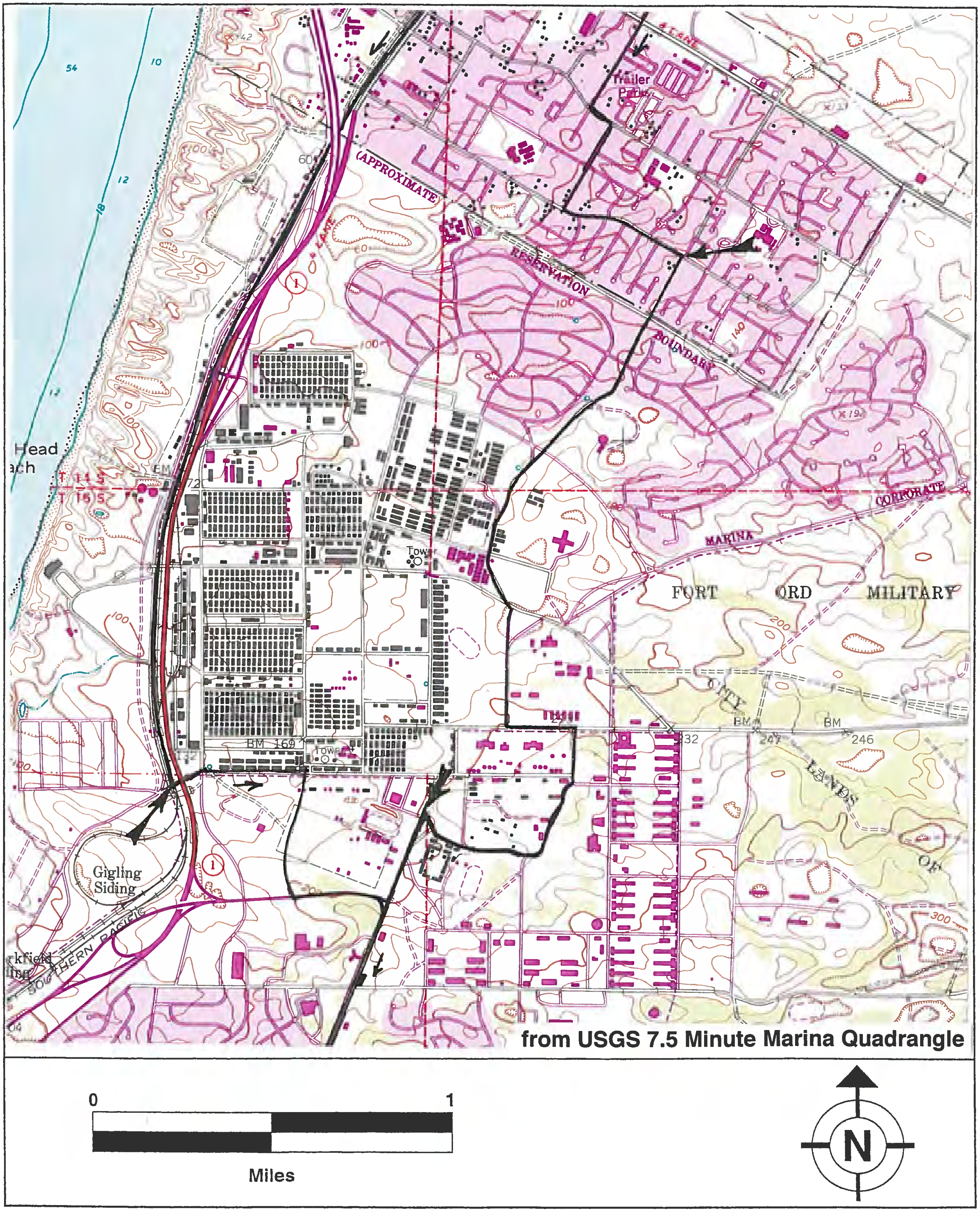

**Map 4. Project APE**



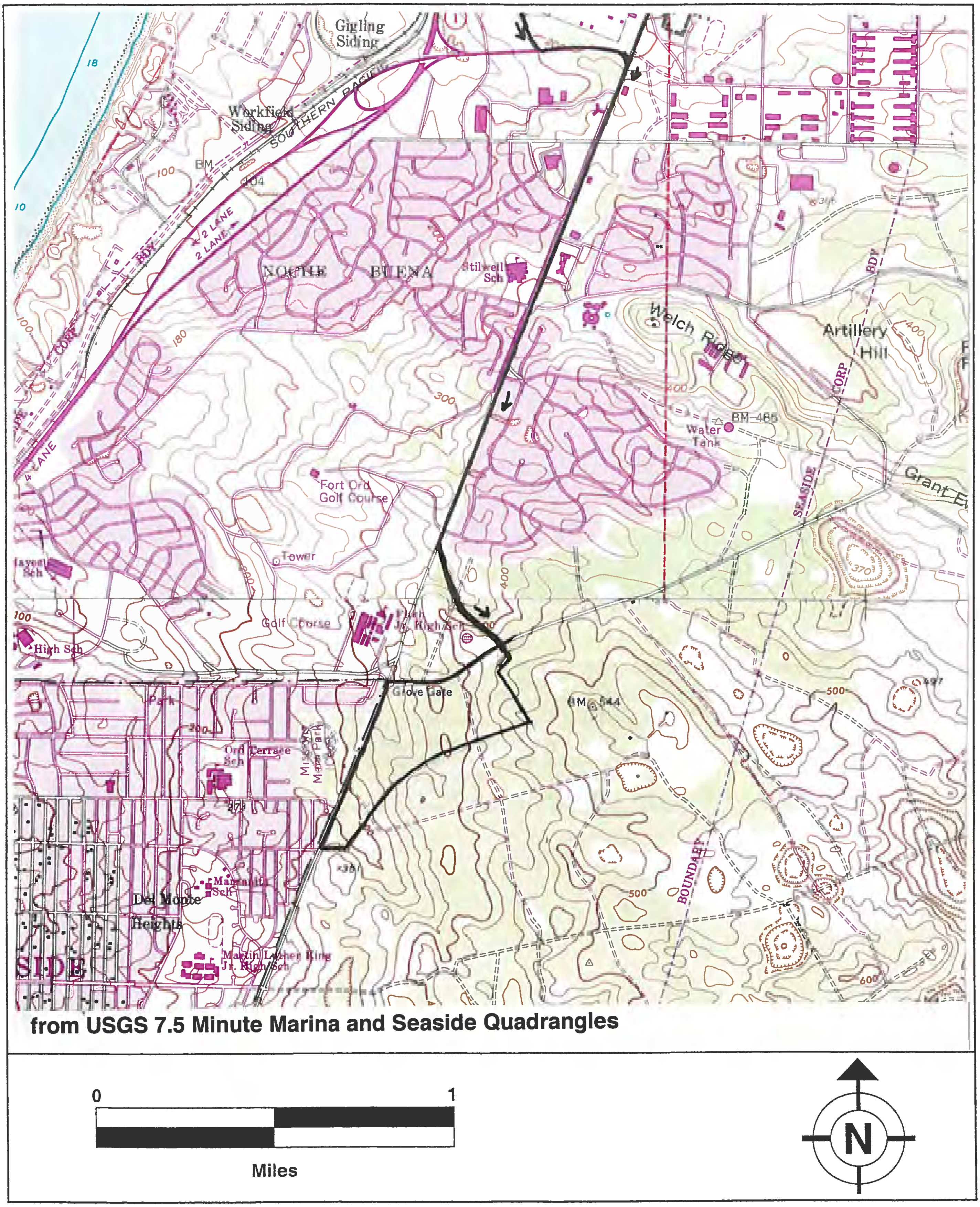

Map 5. Project APE




Map 6. Project APE

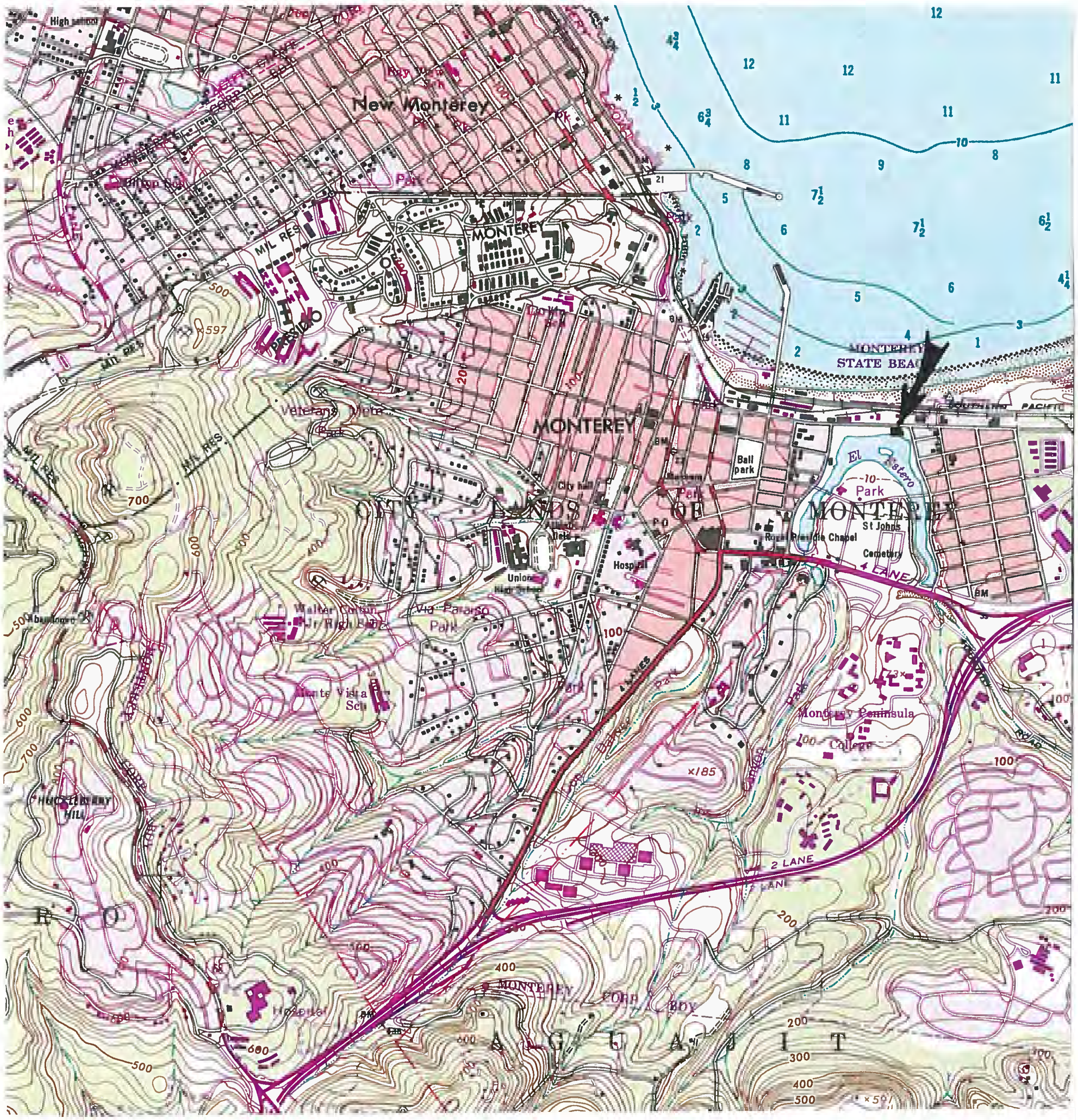



Map 7. Project APE

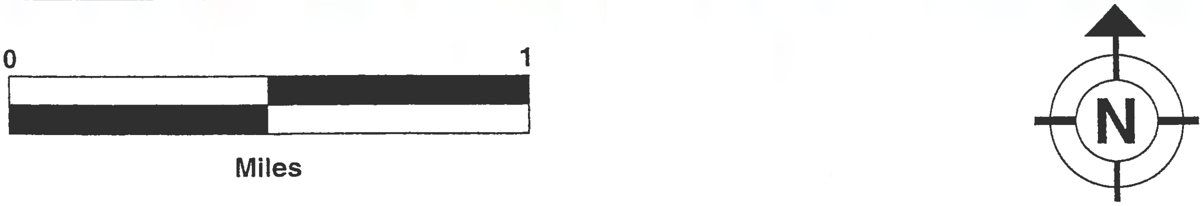



from USGS 7.5 Minute Marina and Seaside Quadrangles

**Map 8. Project APE**



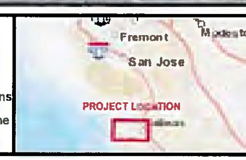

**from USGS 7.5 Minute Monterey Quadrangle**




**Map 9. Project APE**


| DRAFT AREA OF POTENTIAL EFFECT MAP BOOKLET |
|---|
| PURE WATER MONTEREY GROUNDWATER REPLENISHMENT PROJECT |
| VERSION DATE: NOVEMBER 7, 2014 |

- Existing Wastewater Pipeline
- Existing Ocean Outfall
- Proposed Source Water Pipeline
- Proposed Product Water Conveyance Options
- Proposed CalAm Distribution System Pipeline
- Proposed Project Facility Sites




0 1 2 mi

0 1.75 3.5 km

DD&A

Pure Water Monterey

Full large scale set of Area of Potential Effects maps are available for viewing at Denise Duffy & Associates, Inc. 947 Cass Street, Suite 5, Monterey, CA 93940 or contact Dbuhler@ddaplanning.com for a PDF version.

# ATTACHMENT 2

## CHRIS Documentation

CALIFORNIA HISTORICAL RESOURCES INFORMATION SYSTEM

ALAMEDA
COLUSA
CONTRA COSTA
DEL NORTE
HUMBOLDT
LAKE
MARIN
MENDOCINO
MONTEREY
NAPA
SAN BENITO
SAN FRANCISCO
SAN MATEO
SANTA CLATA
SANTA CRUZ
SOLANO
SONOMA
YOLO

**Northwest Information Center**
Sonoma State University
150 Professional Center Drive, Suite E
Rohnert Park, California 94928-3609
Tel: 707.588.8455
nwic@sonoma.edu
http://www.sonoma.edu/nwic

Date: 19 March 2014 NWIC File No.: 13-1234

To: Mary Doane, Archaeological Consulting, P.O. Box 3377, Salinas, CA 93912

From: Lisa Hagel

re: AC 4642B

**Moss Landing, Marina, Seaside, Salinas, & Monterey 7.5'**

| | |
|---|---|
| Resources In | CA-MNT-494; P-27-2940, 2882, 2416, 240, 242, 245, 246, 3010, 2989, 1752, 2923, 1011, & 2979. Enclosed is a database list of the sites and the mapped resource locations. |
| | |
| Resources within 0.5-mile radius (except for the project segments on the Monterey 7.5' quadrangle) | CA-MNT-699, 1288H, & 1817H; P-27-1408, 1564, 3099, 3100, 2946, 2947, 2948, 3097, 2881, 2893, 2894, 2895, 2896, 2884, 2883, 2415, 2417, 3088 – 3094, 2856, 3057, & 3058. Enclosed is a database list of the sites and the mapped resource locations. |
| | |
| Reports In | See enclosed database list and maps for information about reports within the project areas. |
| | |
| Reports within 0.5-mile radius (except for the project segments on the Monterey 7.5' quadrangle) | See enclosed database list and maps for information about reports within 0.5 mile. |
| | |
| Other Reports | Fourteen reports are classified as "Other Reports" (reports with little or no field work, missing maps, or inadequate locational information) that include your search areas: S-3400, 3457, 3671, 3677, 3739, 5458, 5536, 5537, 5550, 15654, 30789, 36237, 36699, & 38177. Enclosed is a database list of the reports. |
| | |
| OHP HPD | Copied the indices for Castroville, Marina, Monterey, Moss Landing, Pacific Grove, Salinas, & Seaside. |
| | |
| OHP ADOE | None of the above referenced recorded sites appear in the ADOE. |
| | |
| California Inventory | Copied the index pages for Monterey County. |

Cultural resource maps are left out because they are not suitable for public viewing for protection of the resources. Qualified individuals may request the full report at the Northwest Information Center of the California Historical Resources Information System at Sonoma State University, 150 Professional Center Drive, Suite E, Rohnert Park, California 94928-3609. nwic@sonoma.edu See also: www.sonoma.edu/nwic.

# Northwest Information Center Resource Listing

| Primary No. | HRI No. | Trinomial | Name | Other IDs | Reports (S-) |
|---|---|---|---|---|---|
| P-27-000240 | | CA-MNT-105 | Fisher #5 | | 03356, 03400, 03617, 04840, 05929, 07337, 21942, 23756, 30118, 30789, 31094, 39192 |
| P-27-000242 | | CA-MNT-107 | Fisher's Sites #7 Through #8 | | 03356, 03400, 03617, 04840, 05537, 05550, 05929, 21942, 22754, 24747, 29094, 30092, 30118, 30789, 31094, 31119, 38521 |
| P-27-000245 | | CA-MNT-110 | Fisher #10 | | 03356, 03400, 03617, 05452, 13306, 19635, 19967, 21942, 21990, 30118, 30789, 31094, 31344 |
| P-27-000246 | | CA-MNT-111 | Fisher #11 | Hill 8 | 03312, 03356, 03617, 04840, 05452, 21942, 30118, 30789, 31094, 33688, 35082, 35092, 37929 |
| P-27-000580 | | CA-MNT-494 | | | 36643 |
| P-27-000777 | | CA-MNT-699 | | | 03345, 03420, 03547, 03677 |
| P-27-001011 | | CA-MNT-955H | H-1003, H-1036 | | 06104, 36699, 37223, 38728 |
| P-27-001325 | | CA-MNT-1288H | Marina Beach #2 | | |
| P-27-001408 | | CA-MNT-1382/H | FW 1 | | 10561, 18813, 20201, 21239, 22657, 26949, 38177 |
| P-27-001564 | | CA-MNT-1570 | Tembladero Slough Site | | 21239, 38177 |
| P-27-001723 | | CA-MNT-1817H | Old Windmill Site | Farm Well, Windmill, Inventory #7, Farm well | 16225 |
| P-27-001752 | | CA-MNT-1849H | Presidio of Monterey | OHP HPD USA970908A, OHP HPD USA860830Z, OHP HPD DOE-27-96-0001-9999 | 17787, 17788, 18370 |
| P-27-002415 | | CA-MNT-2078H | AR-IH | | 34216 |
| P-27-002416 | | CA-MNT-2079H | AR-2 | | 34216, 36240 |
| P-27-002417 | | CA-MNT-2080H | AR-3 | "Old Railroad Grade" (USGS Marina quad., 1947, 1983) | 30832, 31328, 31346, 32920, 34216, 36240 |
| P-27-002856 | | CA-MNT-2246 | 4057-1 | | 34720 |
| P-27-002881 | | | Building TR9070, office, former Fort Ord | office | |
| P-27-002882 | | | Building 2066, warehouse, former Fort Ord | | |
| P-27-002883 | | | Building 2079, former Fort Ord | | |
| P-27-002884 | | | Building 914, Quonset, former Fort Ord | Quonset Storage | |
| P-27-002893 | | | Building 1A99, office, former Fort Ord | Balloon Spur Office | |
| P-27-002894 | | | Building 2026Z | storehouse, former Fort Ord, Fort Ord Dunes State Beach | |

## Northwest Information Center Resource Listing

| Primary No. | HRI No. | Trinomial | Name | Other IDs | Reports (S-) |
|---|---|---|---|---|---|
| P-27-002895 | | | Building TR9080 | Range Support Building, former Fort Ord, Fort Ord Dunes State Beach | |
| P-27-002896 | | | Building TR9081 | Range Support Building, former Fort Ord, Fort Ord Dunes State Beach | |
| P-27-002923 | | CA-MNT-2295H | Southern Pacific Railroad | 1999 Map Reference #1, Southern Pacific Coast Line, PL-2148-01 | 07606, 33258, 36237, 36240, 37725, 38728 |
| P-27-002940 | | | PL-2148-02 | Del Monte Depot | 36240 |
| P-27-002946 | | | Cottage 8 | | |
| P-27-002947 | | | Cottage 9 | OHP HPD DOE-27-90-0002-0002, (OHP Property # 115946) | 38160 |
| P-27-002948 | | | Cottage 1,6,7 | | |
| P-27-002979 | | | Building 208 | OHP HPD DOE-27-86-0001-001, Presidio of Monterey, WPA Project, OHP HPD USA860730Z, Other Building 132 | 17787, 17788, 18370 |
| P-27-002989 | | | Building 275 | Building 16, Presidio of Monterey, OHP HPD DOE-27-86-0001-0030, OHP HPD USA860730Z | 17787, 17788, 18370, 38930 |
| P-27-003010 | | | Building 276 | Building 18, Presidio of Monterey, OHP HPD DOE-27-86-0001-0031, OHP HPD USA860730Z | 17787, 17788, 18370 |
| P-27-003057 | | CA-MNT-2281H | DR-1 | | 40225 |
| P-27-003058 | | CA-MNT-2282H | DR-2 | | 40225 |
| P-27-003088 | | | 3100 Crescent Avenue | OHP HPD DOE-07-04-0049-0000, Map Reference No. 8 | 28253 |
| P-27-003089 | | | 3109 Crescent Avenue | OHP HPD DOE-27-04-0050-0000, Map Reference No.11 | 28253 |
| P-27-003090 | | | 3115 Crescent Avenue | OHP HPD DOE-27-04-0051-0000, Map Reference N0.12 | 28253 |
| P-27-003091 | | | 3117 Crescent Avenue | OHP HPD DOE-27-04-0052-0000, Map Reference No.13 | 28253 |
| P-27-003092 | | | 3128 Crescent Avenue | OHP HPD DOE-27-04-0048-0000, Map Reference No. 4 | 28253 |
| P-27-003094 | | | 3146 Crescent Avenue | OHP HPD DOE-27-04-0047-0000, Map Reference No.2 | 28253 |
| P-27-003097 | | | Del Rey Oaks PG&E Transmission Tower #022/147 | PG&E Transmission Tower, PG&E SAP Tower #40809174 | |
| P-27-003099 | | CA-MNT-2298H | ASM-NPS-2 | | |
| P-27-003100 | | CA-MNT-2299H | ASM-NPS-3 | | |

Reports within the project areas.

## Northwest Information Center Report Listing

| S-number | Year | Author(s) | Title | Affiliation |
|---|---|---|---|---|
| S-003345 | 1976 | Tony F. Weber and Ann S. Peak | Monterey Peninsula Regional Wastewater Treatment System Expansion Project | Ann S. Peak & Associates |
| S-003348 | 1974 | Toni Carrell | Archaeological Reconnaissance Report Prepared for Monterey City Planning Department, Jacks Park | |
| S-003356 | 1977 | Archaeological Consulting and Research Services, Inc. | Report of Archaeological Reconnaissance for the Proposed Stage 1 Pacific Grove-Monterey Consolidation Project of the Regional Sewerage System | Archaeological Consulting and Research Services, Inc. |
| S-003359 | 1977 | Margaret B. Adams | Outline History of the Presidio of Monterey (in the Fort Ord Military Complex) | U.S. Army Museum, Presidio of Monterey |
| S-003418 | 1978 | Ann S. Peak & Associates | Cultural Resource Assessment of the Proposed Effluent Disposal System, Fort Ord, Monterey County, California | Ann S. Peak & Associates |
| S-003440 | 1978 | David Chavez | Cultural Resources Evaluation of the Wastewater Collection System Projects, Castroville County Sanitation District, Monterey County, California | |
| S-003509 | 1979 | Trudy Haversat and Gary S. Breschini | Preliminary Archaeological Surface Reconnaissance of the Davis Road Grade Separation Project, West of Salinas, Monterey County, California | Archaeological Consulting |
| S-003542 | 1979 | William Roop | Preliminary Archaeological Investigations for the Monterey Bay Aquarium Foundation | Archaeological Resource Service |
| S-003617 | 1980 | Thomas L. Jackson and Stephen A. Dietz | Report of Archaeological Excavations at Nineteen Archaeological Sites for the Stage 1 Pacific Grove-Monterey Consolidation Project of the Regional Sewerage System | Archaeological Consulting and Research Services, Inc. |
| S-003633 | 1980 | Jack L. Zahniser, Lois J. Roberts, and Janice Findley Fisher | Intensive Cultural Resources Survey Report, Presidio of Monterey | Environmental Research Archaeologists |
| S-003651 | 1981 | Paul Hampson and Gary S. Breschini | Preliminary Archaeological Reconnaissance of a Parcel at Highway 1 and Tioga Avenue, Sand City, Monterey County, California | Archaeological Consulting |
| S-003671 | 1980 | Jack L. Zahniser and Lois J. Roberts | Cultural Resources Literature Search and Overview, Fort Ord, California | Environmental Research Archaeologists |
| S-003732 | 1981 | Gary S. Breschini and Paul Hampson | Preliminary Archaeological Reconnaissance for the Hotel San Carlos, Monterey, Monterey County, California | Archaeological Consulting |
| S-003739 | 1981 | David Chavez | Archaeological Resources Review for the Naval Postgraduate School, Monterey, California | |
| S-004840 | 1980 | G .S. Breschini and T. Haversat | Central California Obsidian Source Data and C-14 Dates | Archaeological Consulting |
| S-005210 | 1982 | Michael Swernoff | A Reconnaissance Cultural Resources Survey of Fort Ord, California. | Professional Analysts |
| S-005427 | 1978 | Ann S. Peak and Associates | Cultural Resource Assessment of the Golf Course Irrigation Project, Pacific Grove - Del Monte Forest, Monterey County, California. | Ann S. Peak & Associates |
| S-005439 | 1978 | Ann S. Peak and Associates | Cultural Resource Assessment of the Selected Alternative of the Monterey Regional Wastewater Treatment System, Monterey County, California. | Ann S. Peak and Associates |
| S-005491 | 1979 | Gary S. Breschini | Preliminary Archaeological Surface Reconnaissance of the Laguna Grande Regional Park, Adjacent to the Seaside City Hall, Seaside, Monterey County, California | Archaeological Consulting |
| S-005540 | 1979 | William Roop | A preliminary surface examination of a proposed aquarium site (letter report) | Archaeological Resource Service |
| S-005572 | 1979 | Dennis L. Wardell | Cultural Resource Impact Evaluation Report for the Laguna Grande Neighborhood Improvement Project, Project #79-140. | Parks Department, County of Monterey |

## Northwest Information Center Report Listing

| S-number | Year | Author(s) | Title | Affiliation |
|---|---|---|---|---|
| S-005589 | 1979 | Gary S. Breschini, Kent L. Seavey, and Trudy Haversat | Historical Research and Evaluation of the Kelleher Farmstead, West of Salinas, Monterey County, California | Archaeological Consulting |
| S-005929 | 1983 | Jan Whitlow and Gary S. Breschini | Preliminary Archaeological Reconnaissance of the Southern Pacific Right-of-Way, Monterey and Pacific Grove, Monterey County, California. | Archaeological Consulting |
| S-007337 | 1985 | Trudy Haversat and Gary S. Breschini | Preliminary Cultural Resources Reconnaissance of a Parcel on Ocean View Boulevard, Pacific Grove, Monterey County, California. | Archaeological Consulting |
| S-007606 | 1985 | R. Paul Hampson and Gary S. Breschini | Preliminary Cultural Resources Reconnaissance of a Portion of the Southern Pacific Right-of-Way, Monterey, Monterey County, California. | Archaeological Consulting |
| S-007738 | 1985 | Larry Bourdeau | Preliminary Report on Archaeological Reconnaissance and Evaluation with Recommendations for Cultural Resource Management, South Boronda Reorganization Area, Northwest of Salinas, Monterey County, California | Pacific Museum Consultants |
| S-009489 | 1987 | Archaeological Resource Management | Cultural Resource Evaluation of a Parcel on Beach Road in the City of Marina, County of Monterey | Archaeological Resource Management |
| S-010561 | 1989 | Paul D. Bouey | Archaeological Reconnaissance of the Salinas Valley Seawater Intrusion Project, Monterey County, California | Far Western Anthropological Research Group, Inc. |
| S-010764 | 1988 | Allen G. Pastron | Archaeological monitoring and evaluation in connection with the Laguna Grande/Roberts Lake Restoration project, City of Seaside, Monterey County, California (letter report) | Archeo-Tec |
| S-011151 | 1989 | Archaeological Resource Management | Cultural Resource Evaluation for 1711 Del Monte Boulevard in the City of Seaside, County of Monterey | Archaeological Resource Management |
| S-011462 | 1988 | Allen G. Pastron | An archaeological surface reconnaissance of the Roberts Lake area of the Laguna Grande/Roberts Lake Restoration project, City of Seaside, Monterey County, California (letter report) | Archeo-Tec |
| S-012618 | 1991 | Gary S. Breschini | Preliminary Cultural Resources Reconnaissance for the Del Monte Avenue Widening, Monterey, Monterey County, California | Archaeological Consulting |
| S-014001 | 1992 | Anna Runnings and Gary S. Breschini | Preliminary Cultural Resources Reconnaissance for the MPWMD Desalinization Pipeline, Monterey County, California | Archaeological Consulting |
| S-014013 | 1992 | Anna Runnings and Gary S. Breschini | Preliminary Cultural Resources Reconnaissance for the Monterey Visitor's Center, Monterey, Monterey County, California | Archaeological Consulting |
| S-015684 | 1993 | Anna Runnings and Trudy Haversat | Preliminary Prehistoric Cultural Resources Reconnaissance of Assessor's Parcel Number 001-382-04, Monterey, Monterey County, California | Archaeological Consulting |
| S-017787 | 1985 | Robert E. Mackensen | Preservation and Maintenance Manual for the Presidio of Monterey Historic District | Jackson Research Projects |
| S-017788 | 1985 | W. Turrentine Jackson, William Hildebrandt, Rand F. Herbert, Stephen Wee, Stephen D. Mikesell, Kelly R. McGuire, Judith Tordoff, and Mark Hylkema | Presidio of Monterey Cultural Resources Report: Historical Resources Overview, Presidio of Monterey, Monterey, California; Archaeological Investigations of Five Sites Located at the Presidio of Monterey, Monterey County, California | Jackson Research Projects, Far Western Anthropological Research Group |

# Northwest Information Center Report Listing

| S-number | Year | Author(s) | Title | Affiliation |
|---|---|---|---|---|
| S-018370 | 1985 | W. Turrentine Jackson, Rand F. Herbert, Stephen R. Wee, Stephen D. Mikesell, Elizabeth McKee, Sharon D. Schuler, Robert E. Mackensen, William R. Hildebrandt, Kelly R. McGuire, Judith Tordoff, and Mark Hylkema | Cultural Resources Overview, Presidio of Monterey, Monterey, California | Jackson Research Projects, Far Western Anthropological Research Group, Inc. |
| S-018372 | 1995 | Philip R. Waite | A Cultural Resources Survey of 783 Hectares, Fort Ord, Monterey County, California | Geo-Marine, Inc. |
| S-019963 | 1997 | Anna Runnings | Historic Property Clearance Report for Proposed Bicycle Path Along Sand Dunes Drive and Highway 1, Sand City, Monterey County, California | Archaeological Consulting |
| S-020201 | 1991 | Pandora E. Snethkamp | The Widening of Highway 1 from Castroville to the Santa Cruz County Line, 5-MON-1-T91.2/R101.5, Historic Property Survey Report | Dames & Moore |
| S-020585 | 1998 | Barry A. Price | Cultural Resources Assessment, Pacific Bell Mobile Services Facility SF-813-02, Monterey, Monterey County, California (letter report) | Applied EarthWorks |
| S-021942 | 1999 | Mary Doane and Gary S. Breschini | Preliminary Archaeological Reconnaissance for the Pacific Grove Shoreline Protection Project, Pacific Grove, Monterey County, California | Archaeological Consulting |
| S-021974 | 1999 | Mary Doane | Historic Property Clearance Report for Proposed Monterey Bay Coastal Trail Lighting & Del Monte Avenue Traffic Signal Modification Project Along Del Monte Avenue, Monterey, Monterey County, California | Archaeological Consulting |
| S-022329 | 1999 | Terry L. Joslin and Kelda Wilson | Archaeological Survey Report, 05-MON-01, PM R78.4-R81.2 CU 05-168 EA 05-0C4001, Fence Replacement | Caltrans |
| S-022405 | 2000 | Archaeological Consulting | Prehistoric Property Survey Report, 05-MNT-1, PM 78.48-79.00, Building of New Ocean Side Retaining Walls | Archaeological Consulting |
| S-022406 | 1999 | Mary Doane | Historic Property Clearance Report for the Proposed Monterey Bay Coastal Trail Improvements Project Including Lighting and Traffic Signal Modification Along Del Monte Avenue and Erosion Control Along Presidio Curve, Monterey, Monterey County, California | Archaeological Consulting |
| S-022432 | 1999 | Mary Doane and Trudy Haversat | Preliminary Archaeological Reconaissance of the Marina Coast Water District Recycled Water Pipeline Project, Monterey County, California | Archaeological Consulting |
| S-022537 | 2000 | Kelda Wilson | Archaeological Survey Report, 05-MON-1 PM R80.7-R85.3 CU 05-168 EA 05-0A3301, Proposal to Place an Asphalt Concrete Overlay on the Class 1 Bike Path on State Route 1 in Seaside and Marina, Monterey County | Caltrans |
| S-022657 | 2000 | Izaak Sawyer, Laurie Pfeiffer, Karen Rasmussen, and Judy Berryman | Archaeological Survey Along Onshore Portions of the Global West Fiber Optic Cable Project | Science Applications International Corporation |
| S-022740 | 2000 | Mary Doane and Trudy Haversat | Preliminary Archaeological Reconnaissance of the Del Monte Beach Tract #2 Resubdivision, Monterey, Monterey County, California | Archaeological Consulting |
| S-023023 | 2000 | Mary Doane and Trudy Haversat | Preliminary Archaeological Reconnaissance of the 2nd Avenue/12th Street Project, in the Former Fort Ord, Monterey County, California | Archaeological Consulting |
| S-023320 | 2000 | Mary Doane and Trudy Haversat | Cultural Resources Literature Search and Study for the MBEST Site and the Proposed Golf Course Project , Marina, Monterey County, California | Archaeological Consulting |

# Northwest Information Center Report Listing

| S-number | Year | Author(s) | Title | Affiliation |
|---|---|---|---|---|
| S-023331 | 2000 | Mary Doane and Trudy Haversat | Preliminary Archaeological Reconnaissance of the Seaside Resort Project on the Former Fort Ord Golf Courses, Seaside, Monterey County, California | Archaeological Consulting |
| S-024589 | 2002 | Cordelia Sutch and John Holson | Archaeological Literature Search and Survey for the Catellus Property Project, City of Monterey, Monterey County | Pacific Legacy, Inc. |
| S-024747 | 2001 | Archaeological Resource Management | Surface Collection Program for the 14th Street Project in Pacific Grove | Archaeological Resource Management |
| S-025075 | 2002 | Jonathan Goodrich, John Holson, and Thomas Jackson | Archaeological Survey and Record Search Results for the Window on the Bay Project, City of Monterey, Monterey County, California | Pacific Legacy, Inc. |
| S-025416 | 2002 | Mary Doane and Trudy Haversat | Preliminary Archaeological Reconnaissance for the First Tee Project and Two Separate Recreational Facility Sites in the Former Fort Ord, Monterey County, California | Archaeological Consulting |
| S-027043 | 2003 | Cordelia Sutch and John Holson | Archaeological Survey Report for the North Fremont Storm Drain Improvement Project, City of Monterey, Monterey County | Pacific Legacy, Inc. |
| S-027949 | 1981 | Michael Swernoff | A Reconnaissance Cultural Resources Survey of Fort Ord, California: Draft Report. | Professional Analysts |
| S-028253 | 2004 | Anthony Kirk | Crescent Avenue Widening Project, City of Marina, Monterey County, California | |
| S-028506 | 2004 | Mary Doane | Negative Archaeological Survey Report for the Crescent Avenue Widening Project Between Reservation Road and Carmel Avenue in Marina, Monterey County, California | Archaeological Consulting |
| S-028516 | 2004 | Mary Doane | Negative Archaeological Survey Report for the Crescent Avenue Widening Project Between Reservation Road and Carmel Avenue in Marina, Monterey County, California | Archaeological Consulting |
| S-029123 | 2004 | Mary Doane | APN 006-154-002 (letter report) | Archaeological Consulting |
| S-029875 | 1991 | Andrew York | Addendum Archaeological Survey Report for the Widening of Highway 1 from Castroville, California, to the Santa Cruz County Line, 5-MON-T91.2/R101.5, 05202 315900 | Dames & Moore |
| S-029932 | 2004 | Michael Darcangelo and Laura Leach-Palm | Archaeological Survey Report on the University Villages Specific Plan, 390 Acre Project Area, at Former Fort Ord, Monterey County, California. | Far Western Anthropological Research Group, Inc. |
| S-030118 | 2005 | Mary Doane and Gary S. Breschini | Preliminary Archaeological Reconnaissance for the Coastal Bluff Repair Project Along the Recreation Trail In Pacific Grove, Monterey County, California. | Archaeological Consulting |
| S-030134 | 2005 | Mary Doane | Archaeological Survey Report for the California Avenue Sidewalk and Bike Path Project Between Helena Way and Reindollar Avenue in Marina, Monterey County, California. | Archaeolgical Consulting |
| S-030373 | 2005 | Mary Doane | California Avenue Project (letter report) | Archaeological Consulting |
| S-031089 | 2005 | Mary Doane | Green Gables Inn Handicapped Access Walkway (letter report) | Archaeological Consulting |
| S-031094 | 2005 | Gary S. Breschini, Mary Doane, and Trudy Haversat | Monitoring and Mitigation Report for the Phase II Waste-Water Collection System Improvements Project and the Lovers Point Dry Weather Urban Runoff Diversion Project, Pacific Grove, Monterey County, California | Archaeological Consulting |
| S-032385 | 2006 | Mary Doane and Trudy Haversat | Phase I Archaeological Reconnaissance for the Marina Coast Water District Regional Urban Water Augmentation Project, Recycled Water Component, Northern Segment, in Marina and Seaside, Monterey County, California | Archaeological Consulting |
| S-032408 | 2006 | Mary Doane | Green Gables Inn Handicapped Access Walkway (letter report) | Archaeological Consulting |

# Northwest Information Center Report Listing

| S-number | Year | Author(s) | Title | Affiliation |
|---|---|---|---|---|
| S-032601 | 2006 | Elena Reese | Archaeological Monitoring of Sewer Rehabilitation Construction at the Presidio and Cannery Row Areas, Monterey, California (letter report) | Pacific Legacy, Inc. |
| S-033545 | 1994 | National Park Service | Draft Comprehensive Management and Use Plan and Environmental Impact Statement, Juan Bautista de Anza National Historic Trail, Arizona and California | National Park Service |
| S-033677 | 2007 | Mary Doane and Gary S. Breschini | Phase I Archaeological Reconnaissance for the Marina Coast Water District Regional Urban Water Augmentation Project, Recycled Water Component, in Marina, Ord Community, Seaside and Monterey, Monterey County, California | Archaeological Consulting |
| S-033688 | 2007 | Gary S. Breschini | Swan Boat Display Project (letter report) | Archaeological Consulting |
| S-034826 | 2008 | Andrew Pulcheon | A Cultural and Paleontological Resources Study for the Del Monte Boulevard Hotel Project | LSA Associates, Inc. |
| S-035060 | 2008 | Mary Doane and Gary Breschini | Preliminary Archaeological Reconnaissance for the Projects at Main Gate in the Former Fort Ord, Seaside, Monterey County, California | Archaeological Consulting |
| S-035082 | 2008 | Mary Doane and Gary S. Breschini | Preliminary Archaeological Reconnaissance for the Old Bath House Project at Lover's Point, Pacific Grove, Monterey County, California | Archaeological Consulting |
| S-035092 | 2008 | Gary S. Breschini | Swan Boat Display Project (letter report) | Archaeological Consulting |
| S-036089 | 2009 | Mary Doane and Gary Breschini | Preliminary Archaeological Reconnaissance for Assessor's Parcel 008-442-011, Pebble Beach, Monterey County, California | Archaeological Consulting |
| S-036240 | 2009 | Kari Jones and John Holson | Archaeological Survey for the Cal-Am Coastal Water Project, Monterey County, California | Pacific Legacy, Inc. |
| S-036643 | 2009 | Mary Doane and Gary S. Breschini | Phase 1 Archaeological Assessment for the Salinas Industrial Wastewater Treatment Facility Improvements Project, Salinas, Monterey County, California | Archaeological Consulting |
| S-037725 | 2010 | Allika Ruby | Archaeological Survey Report for the Monterey Light Rail Transit Project | Far Western Anthropological Research Services, Inc. |
| S-037929 | 2011 | Gary S. Breschini | Lovers Point Wastewater and Park Improvements project (letter report) | Archaeological Consulting |
| S-038728 | 2011 | Lisa Holm, Katherine Chao, and John Holson | Archaeological Assessment for the City of Monterey 2011 Sewer Rehabilitation Project, Monterey County, California, PL-2501-04 | Pacific Legacy, Inc. |
| S-038930 | 2010 | James M Willison | Report on the Interior Remodel of Building 275, Presidio of Monterey (letter report) | Director of Public Works, Presidio of Monterey |
| S-039192 | 2012 | Mary Doane and Gary S. Breschini | Preliminary Archaeological Reconnaissance for The Urban Runoff Diversion Project, Phase 3, Pacific Grove, Monterey County, California | Archaeological Consulting |
| S-039202 | 2012 | Mary Doane and Gary S. Breschini | Phase I Archaeological Survey for the Fort Ord Dunes State Park Project, Near Seaside, Monterey County, California | Archaeological Consulting |
| S-039287 | 2012 | Elena Reese | Archaeological Monitoring Report for the Replace Deteriorated Sewer Lateral, Buildings: 208, 209, 210, 211, 212, 213, 214, 215, 216, 218, 450, and 451 in the Lower Presidio of Monterey, California (letter report) | Pacific Legacy |
| S-040206 | 2013 | Mary Doane and Gary Breschini | Preliminary Archaeological Reconnaissance for the MRWPCA Salinas Pump Station Capacity Enhancement Project Between Salinas and Marina, Monterey County, California | Archaeological Consulting |
| S-040225 | 2013 | Mary Doane and Gary Breschini | Preliminary Archaeological Reconnaissance for the MRWPCA Salinas Pump Station Capacity Enhancement Project Between Salinas and Marina, Monterey County, California | Archaeological Consulting |

WRONG

## Northwest Information Center Report Listing

| S-number | Year | Author(s) | Title | Affiliation |
|---|---|---|---|---|
| S-040255 | 2013 | Jason A. Coleman | Cultural Resources Survey Report for the Alexandre Dairy WRP Project, Del Norte County, California | Solano Archaeological Services |
| S-040329 | 2012 | Hannah G. Haas, Kevin Hunt, and Robert Ramirez | Phase I Cultural Resources Survey for the Reservation Road Bikeways and Pathways Reconstruction Project Marina, Monterey County, California | Rincon Consultants |

wrong!!

# ATTACHMENT 3

## Native American Consultation

# ARCHAEOLOGICAL CONSULTING

**P.O. BOX 3377**
**SALINAS, CA 93912**
**(831) 422-4912**
**Fax (831) 422-4913**

April 8, 2014
AC 4642B

Alison Imamura
Denise Duffy and Associates
947 Cass, Suite 5
Monterey, CA 93940

Re: Monterey Peninsula Groundwater Replenishment Project

Dear Mrs. Imamura:

At your request we initiated a record search of the sacred lands file with the Native American Heritage Commission (NAHC) on March 3, 2014. Attached please find a copy of the response, dated March 6, 2014 from Katie Sanchez of the NAHC. As you will see there was no specific site information found in their files regarding the project area, which lies within traditional Ohlone territory. She recommended that we make additional contacts with other Native American sources of information regarding the potential for cultural resources in the project area. Because these Native American peoples are not a federally recognized tribe, there is no single person or group who represents all of them. A sample copy of the letters regarding your project that were sent on March 6 to the Native American contacts on the NAHC list is also attached.

I have received a letter response from Louise Miranda-Ramirez, Chairperson of the Ohlone/Costanoan-Esselen Nation, requesting information on the resources identified by the CHRIS search. She stresses that her group requests no disturbance of cultural resources. I discussed the project with Val Lopez of the Amah Mutsun Tribal Band, who requested monitoring of earth disturbance in the vicinity of Tembladero Slough and the Salinas River. Michelle Zimmer of Amah/Mutsun Tribal Band of Mission San Juan Bautista. She and her mother Irene Zwierlein recommend that work crews receive cultural sensitivity training when working in the vicinity of identified cultural resources and waterways. In addition, I talked with Anne Marie Sayers of the Indian Canyon Mutsun Band, who recommends archaeological and Native American monitoring of work in close proximity to recorded resources.

I called and left messages with the remainder of the listed Native Americans to call or email me with any information or concerns they might have about the project.

Although the Native Americans offered no additional information specific to sites in the project area, they all wished to know of any significant discoveries during any projects. Because of their concern for the preservation of the cultural resources which comprise their heritage, the listed Native Americans should be informed of the of the discovery of any previously unknown cultural resources which may occur during the course of this project. A continuing sensitivity to their concerns and the inclusion of interested Native Americans in this development will be greatly appreciated by them. I have attached an updated Native American Contacts list.

If I should receive further information or requests for consultation from other Native Americans, I will provide a supplement to this summary letter.

Please feel free to call if you have any further questions or need additional information in this matter.

Yours truly,

Mary Doane

Mary Doane

Cc. Native American Heritage Commission

Attachments

# ARCHAEOLOGICAL CONSULTING

**P.O. BOX 3377**
**SALINAS, CA 93912**
**(831) 422-4912**
**Fax (831) 422-4913**


March 3, 2014

AC 4642B

Debbie Pilas Treadway
State Of California
Native American Heritage Commission
Via email: nahc@pacbell.net

Re: Sacred Lands File search request

Dear Debbie:

We are preparing a Phase I Archaeological Survey for the proposed Monterey Peninsula Groundwater Replenishment Project in Monterey County. The pipelines will run through the cities of Marina, Seaside and Monterey, with some other facilities in parts of Salinas, Castroville and Pacific Grove. We do not yet have the results of the CHRIS search for recorded archaeological sites in the project APE but we are aware of several in the near vicinity of several parts of the proposed project.

We are contacting your office for information on possible Native American Sacred sites or concerns in the project area. Would you please search your Inventory of Sacred Lands to determine whether the project area contains any such resources in Township 13S-15S, Range 2E-1W (see attached maps from the USGS 7.5 Minute Moss Landing, Salinas, Marina, Seaside and Monterey Quads).

We are prepared to contact local Native Americans for their comments on the proposed project area if you will provide us with the names and addresses on your current list for this part of Monterey County.

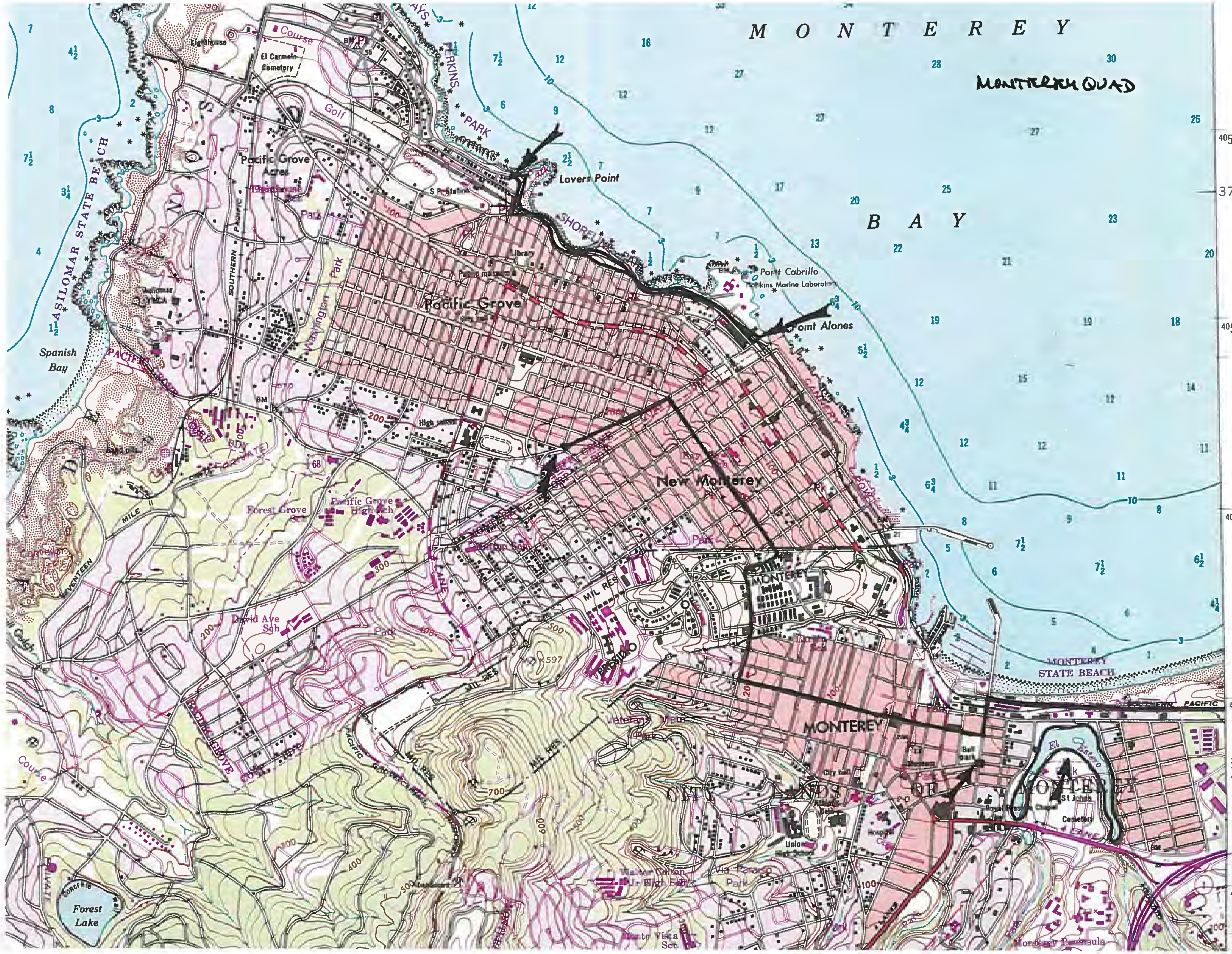
If you have any questions about this request, please do not hesitate to contact our office.

Yours truly,

Mary Doane

Mary Doane

Attachment

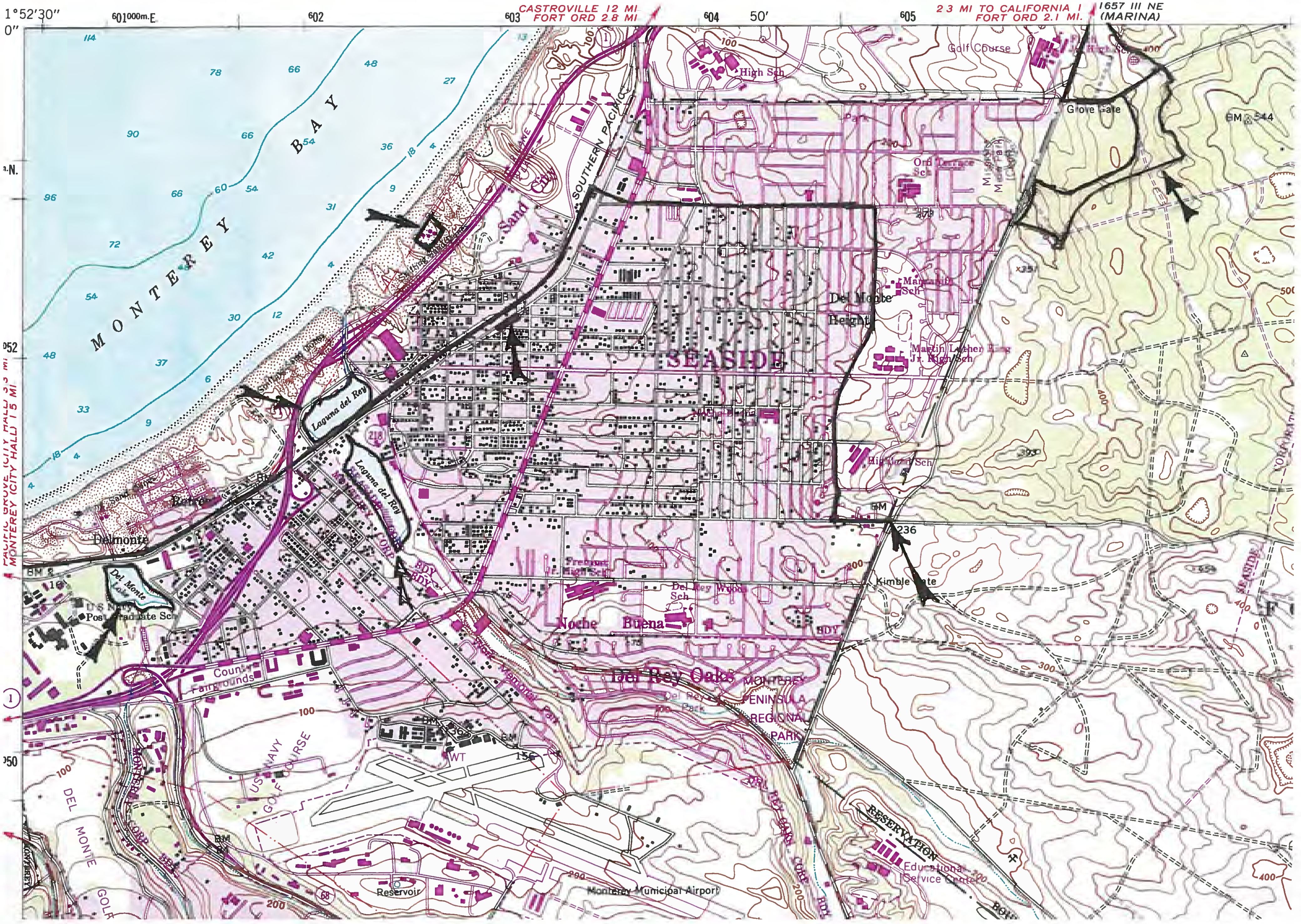


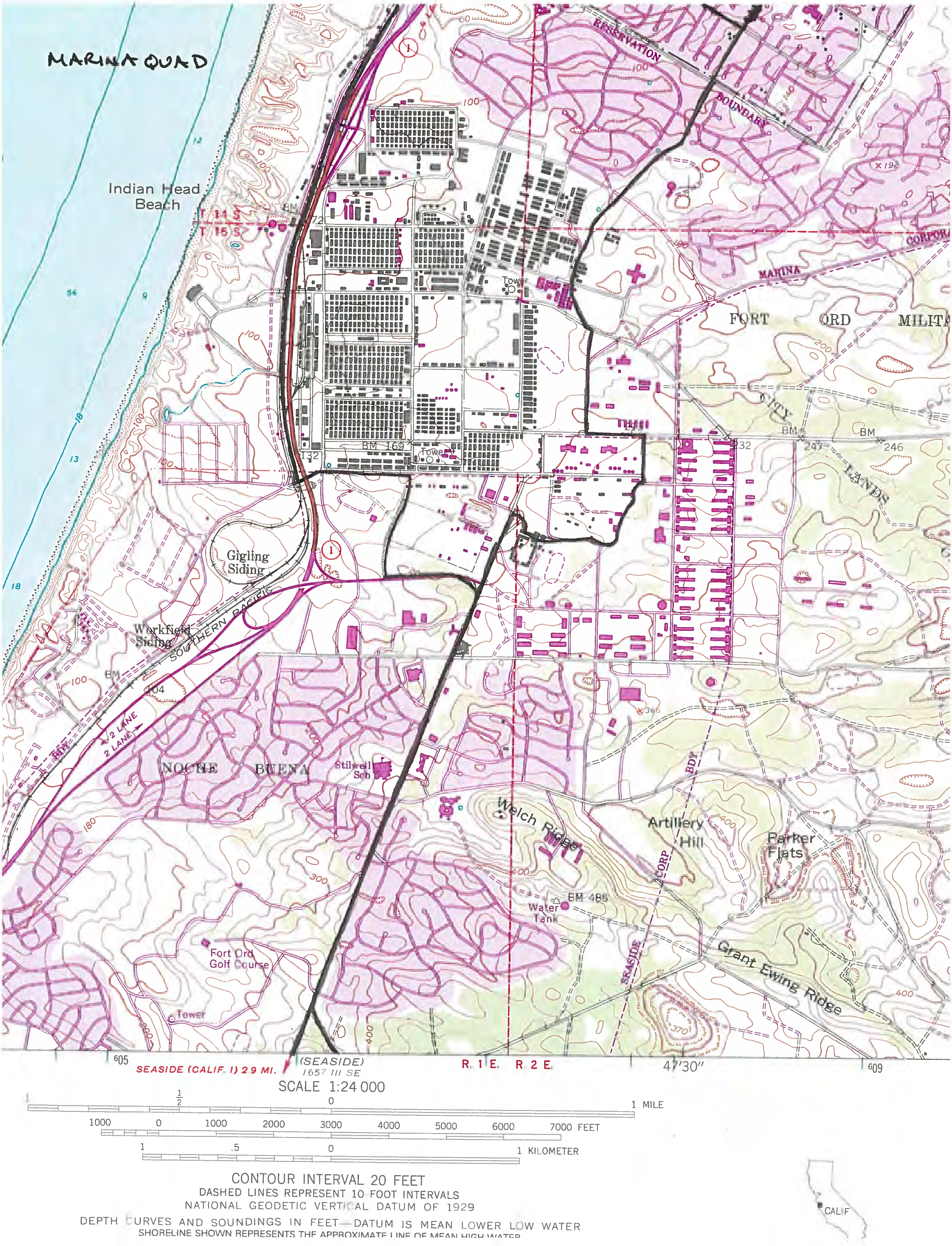
MONTEREY
BAY
MONTEREY QUAD
Lovers Point
Point Cabrillo
Hopkins Marine Laboratory
Point Alones
Pacific Grove
New Monterey
MONTEREY
Pacific Grove Acres
El Carmelo Cemetery
Lighthouse
Washington Park
Spanish Bay
ASILOMAR STATE BEACH
MONTEREY STATE BEACH
PERKINS PARK
SOUTHERN PACIFIC
Forest Grove Sch
Pacific Grove High Sch
David Ave Sch
MIL RES
PRESIDIO
Forest Lake
Cemetery
St Johns
SEASIDE 1.8 MI.
CASTROVILLE 15 MI.
37°37'30"

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SEASIDE QUAD

UNITED STATES
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS





MARINA QUAD
Indian Head Beach
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T 15 S
Gigling Siding
Workfield Siding
SOUTHERN PACIFIC
2 LANE
2 LANE
BDY
NOCHE BUENA
Stilwell Sch
Welch Ridge
Artillery Hill
Parker Flats
Water Tank
BM 485
Fort Ord Golf Course
Tower
Grant Ewing Ridge
SEASIDE
CORP
BDY
FORT ORD MILITA
CITY
LANDS
MARINA
CORPORA
RESERVATION
BOUNDARY
BM 169
BM 247
BM 246
605
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(SEASIDE)
1657 III SE
R 1 E. R 2 E.
47'30"
609
SCALE 1:24 000
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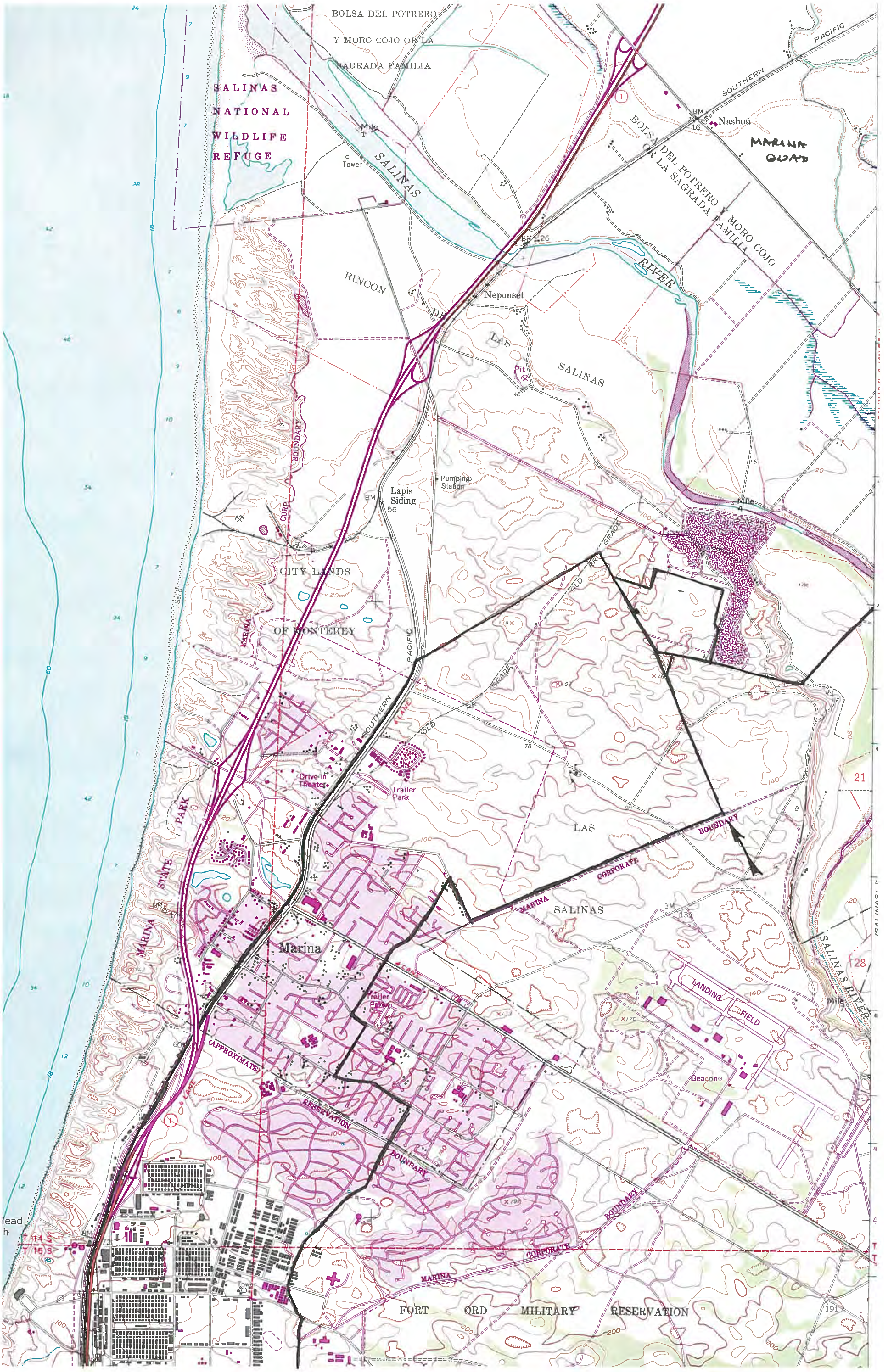
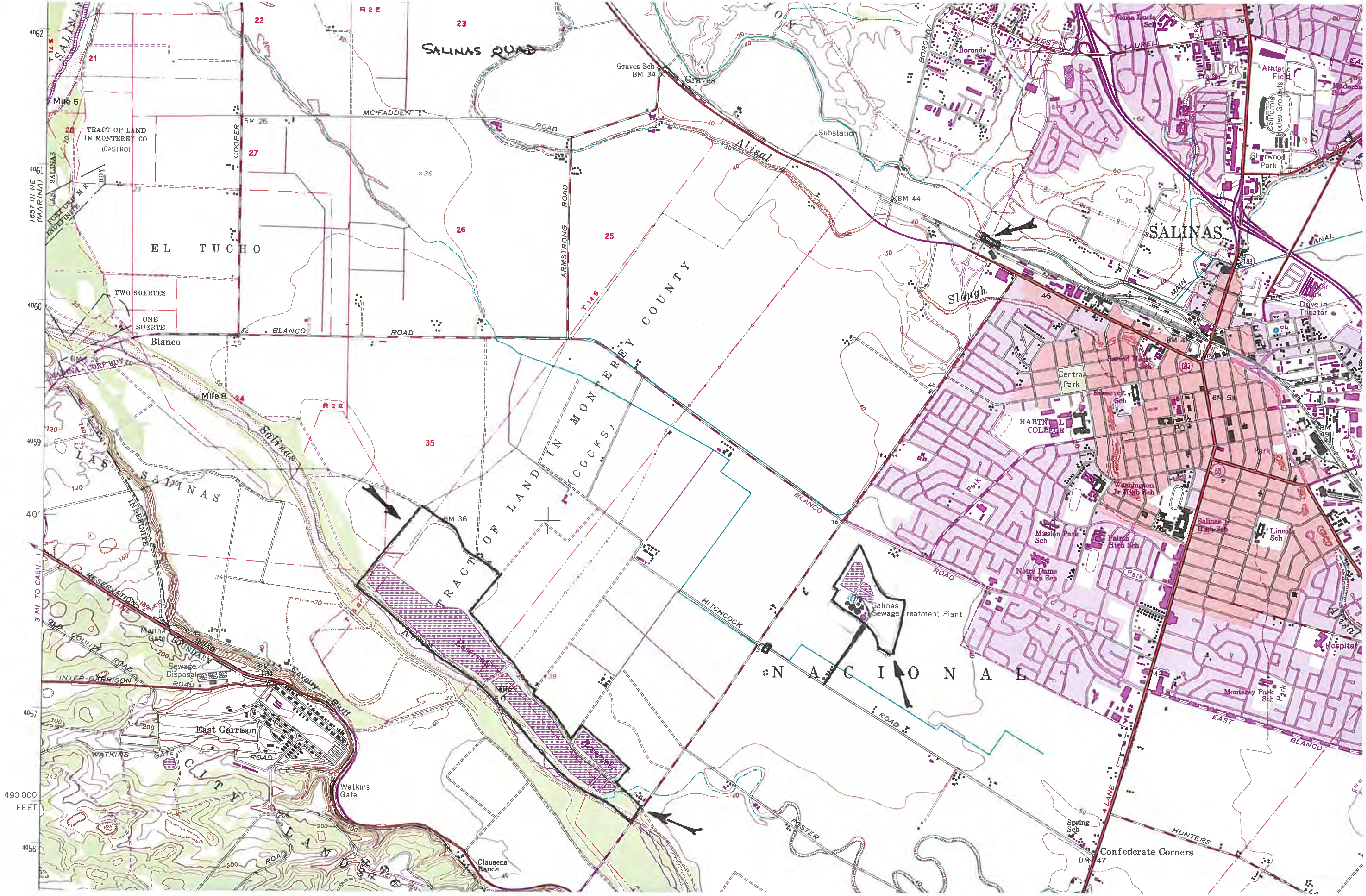
CONTOUR INTERVAL 20 FEET
DASHED LINES REPRESENT 10 FOOT INTERVALS
NATIONAL GEODETIC VERTICAL DATUM OF 1929
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOWER LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
CALIF

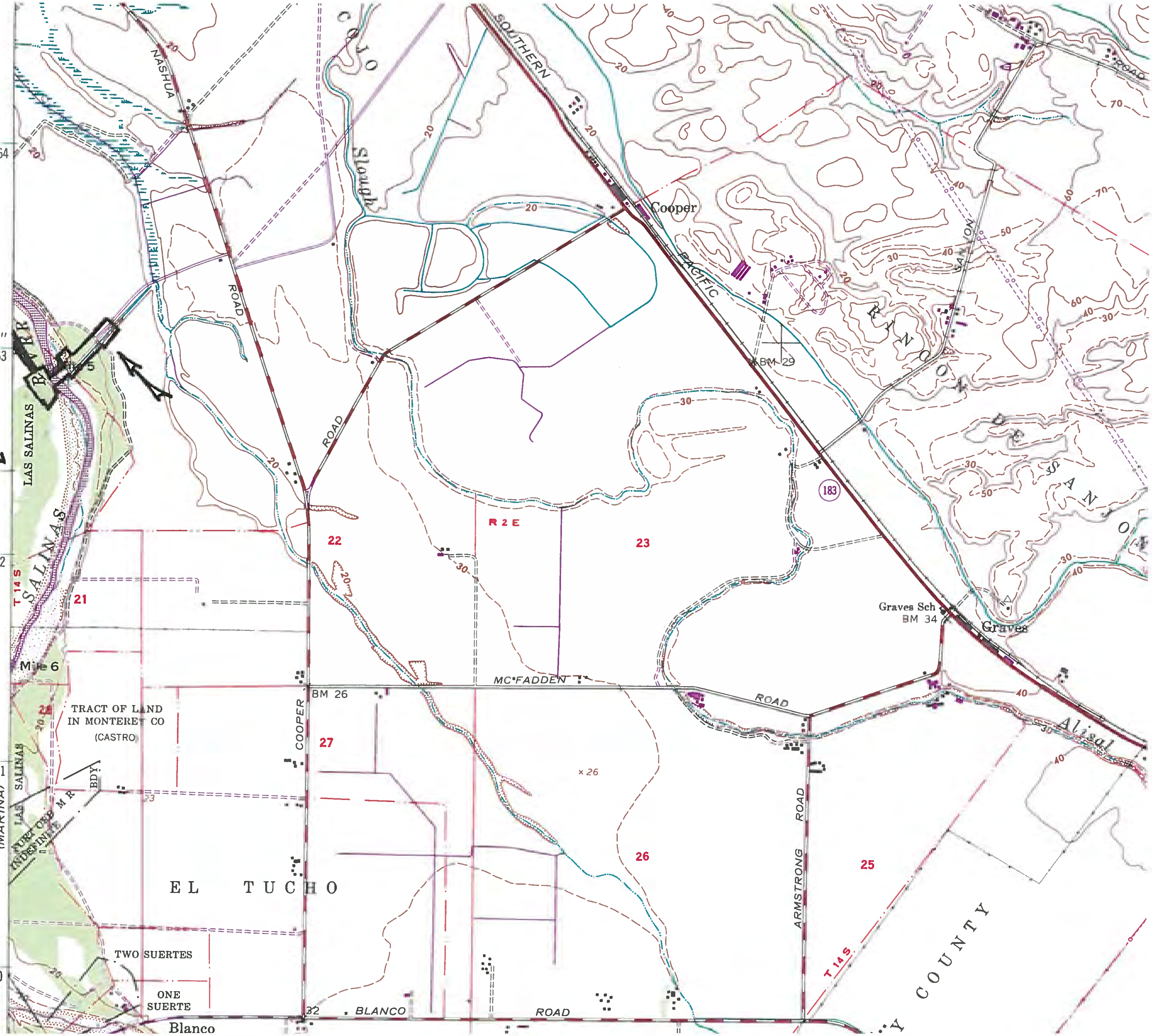

BOLSA DEL POTRERO
Y MORO COJO OR LA
SAGRADA FAMILIA
SALINAS
NATIONAL
WILDLIFE
REFUGE
SOUTHERN
PACIFIC
Nashua
MARINA
QUAD
BOLSA DEL POTRERO Y MORO COJO
OR LA SAGRADA FAMILIA
Tower
SALINAS
RIVER
RINCON
DE
LAS
SALINAS
Neponset
Pit
Pumping Station
Lapis Siding
CORP
BOUNDARY
CITY LANDS
OF MONTEREY
MARINA
SOUTHERN
PACIFIC
OLD
GRADE
Drive-in Theater
Trailer Park
LAS
SALINAS
BOUNDARY
CORPORATE
MARINA
MARINA
STATE
PARK
Marina
Trailer Park
(APPROXIMATE)
RESERVATION
BOUNDARY
LANDING
FIELD
Beacon
SALINAS RIVER
BOUNDARY
CORPORATE
MARINA
FORT
ORD
MILITARY
RESERVATION
T 14 S
T 15 S

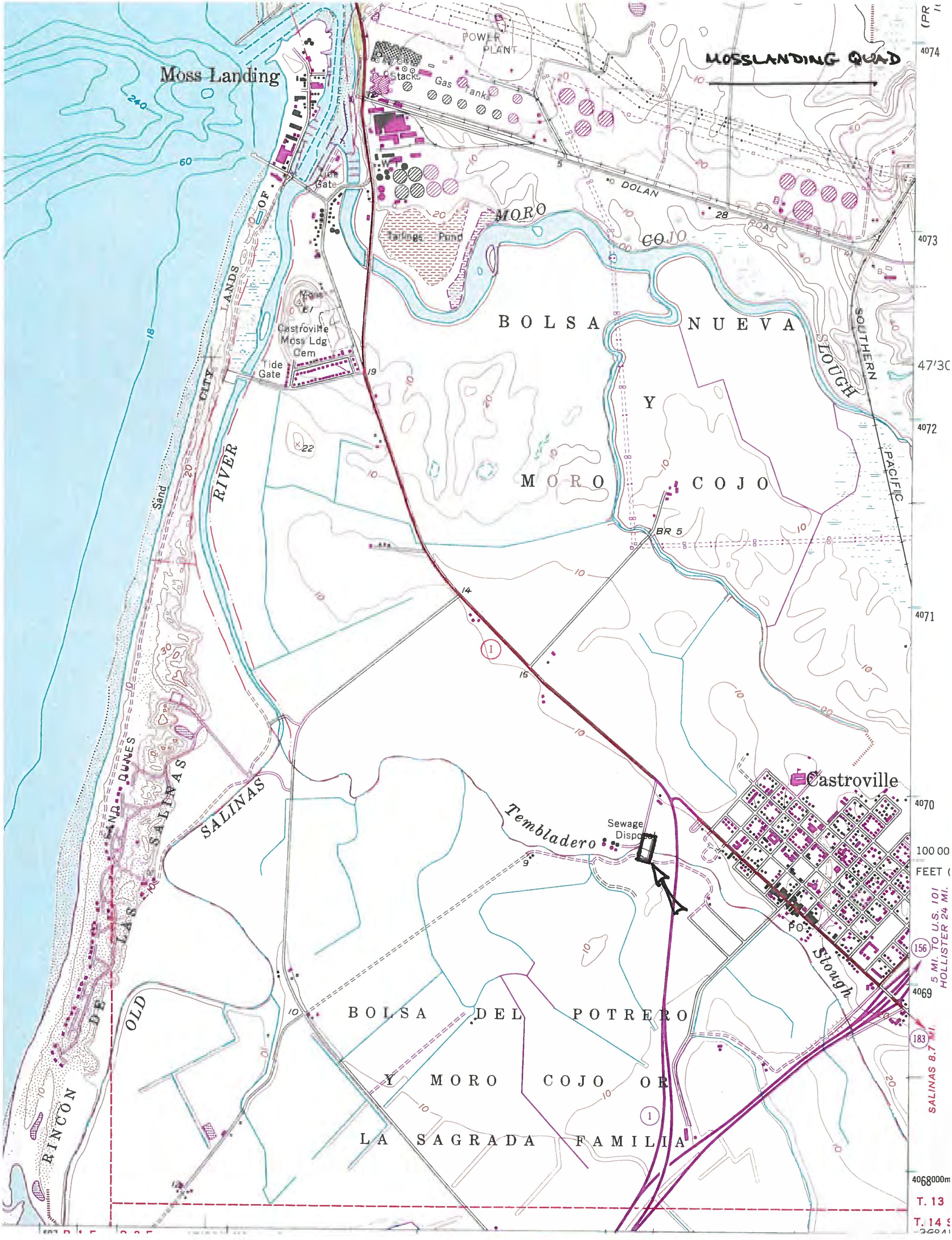


SALINAS QUAD
SALINAS
EL TUCHO
TRACT OF LAND IN MONTEREY COUNTY (COCKS)
TRACT OF LAND IN MONTEREY CO (CASTRO)
NACIONAL
TWO SUERTES
ONE SUERTE
Blanco
BLANCO ROAD
MC FADDEN ROAD
COOPER
ARMSTRONG ROAD
HITCHCOCK ROAD
FOSTER
HUNTERS
Graves Sch
Graves
Substation
Alisal
Slough
Salinas Sewage Treatment Plant
Reservoir
Salinas River
Mile 6
Mile 8
Mile 10
HARTNELL COLLEGE
Central Park
Boronda Sch
Washington Jr High Sch
Salinas High Sch
Lincoln Sch
Mission Park Sch
Palma High Sch
Notre Dame High Sch
Roosevelt Sch
Monterey Park Sch
Hospital
Drive-in Theater
Athletic Field
California Rodeo Grounds
Sherwood Park
Spring Sch
Confederate Corners
Clausens Ranch
Watkins Gate
East Garrison
Marina Gate
Sewage Disposal
Cavalry Bluff
LAS SALINAS
CITY LANDS
T 14 S
R 2 E
1657 III NE (MARINA)
3 MI. TO CALIF 1
490 000 FEET

SALINAS QUAD

SEE MARINA MAP FOR CONTINUATION





MOSSLANDING QUAD
Moss Landing
POWER PLANT
Stacks
Gas Tanks
Tide Gate
Tailings Pond
MORO COJO
DOLAN ROAD
BOLSA NUEVA Y MORO COJO
SLOUGH
SOUTHERN PACIFIC
Castroville Moss Ldg Cem
Tide Gate
CITY LANDS OF
RIVER
Sand
SALINAS
OLD SALINAS
SAND DUNES
RINCON DE LAS SALINAS
BR 5
Tembladero
Sewage Disposal
Castroville
Slough
BOLSA DEL POTRERO Y MORO COJO OR LA SAGRADA FAMILIA
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HOLLISTER 24 MI.
SALINAS 8.7 MI.
4074
4073
4072
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4070
4069
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47'30
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T. 13
T. 14

**NATIVE AMERICAN HERITAGE COMMISSION**
1550 Harbor Blvd., ROOM 100
West SACRAMENTO, CA 95691
(916) 373-3710
Fax (916) 373-5471

March 6, 2014

Mary Doane
Archaeological Consulting
P.O. Box 3377
Salinas, CA 93912

Sent by Fax: (831) 422-4913
Number of Pages: 3

RE: Monterey Peninsula Groundwater Replenishment Project, Monterey County.

Dear Ms. Doane,

A record search of the Native American Heritage Commission (NAHC) *Sacred Lands File* was completed for the area of potential project effect (APE) for the project referenced above. The search indicates the potential of Native American cultural resources in the project vicinity that may be impacted on the *Moss Landing* USGS quadrangle, (T 13S, R 2E, Sec. 18). The site is described as the *Elkhorn Slough*. For specific information regarding this site, please contact the *Ohlone Indians.* The contact information is on the attached *Native American Contacts List.*

The absence of specific site information in the *Sacred Lands File* does not indicate the absence of Native American cultural resources in any APE. Other sources of cultural resources information should be contacted regarding known and recorded sites. Please contact all of the people on the attached list. The list should provide a starting place to locate areas of potential adverse impact within the APE. I suggest you contact all of those listed, if they cannot supply information, they might recommend others with specific knowledge. By contacting all those on the list, your organization will be better able to respond to claims of failure to consult. If a response has not been received within two weeks of notification, the NAHC requests that you follow-up with a telephone call to ensure that the project information has been received

If you receive notification of change of addresses and phone numbers from any of these individuals or groups, please notify me. With your assistance we are able to assure that our lists contain current information. If you have any questions or need additional information, please contact me at my email address: Katy.Sanchez@nahc.ca.gov.

Sincerely,

Katy Sanchez

Katy Sanchez
Associate Government Program Analyst

# Native American Contacts
## Monterey County
## March 6, 2014

Jakki Kehl
720 North 2nd Street — Ohlone/Costanoan
Patterson, CA 95363
(209) 892-1060

Amah MutsunTribal Band of Mission San Juan Bautista
Irene Zwierlein, Chairperson
789 Canada Road — Ohlone/Costanoan
Woodside, CA 94062
amahmutsuntribal@gmail.com
650-400-4806 cell
650-332-1526 - Fax

Coastanoan Rumsen Carmel Tribe
Tony Cerda, Chairperson
240 E, 1st Street — Ohlone/Costanoan
Pomona, CA 91766
rumsen@aol.com
(909) 524-8041 Cell
909-629-6081

Ohlone/Coastanoan-Esselen Nation
Christianne Arias, Vice Chairperson
PO Box 552 — Esselen
Soledad, CA 93960 — Ohlone/Costanoan
831-235-4590

Ohlone/Coastanoan-Esselen Nation
Louise Miranda-Ramirez, Chairperson
PO Box 1301 — Esselen
Monterey, CA 93942 — Ohlone/Costanoan
ramirez.louise@yahoo.com
408-629-5189
408-205-7579 - cell

Amah MutsunTribal Band
Edward Ketchum
35867 Yosemite Ave — Ohlone/Costanoan
Davis, CA 95616 — Northern Valley Yokuts
aerieways@aol.com

Trina Marine Ruano Family
Ramona Garibay, Representative
30940 Watkins Street — Ohlone/Costanoan
Union City, CA 94587 — Bay Miwok
510-972-0645-home — Plains Miwok
Patwin
soaprootmo@comcast.net

Ohlone/Coastanoan-Esselen Nation
Pauline Martinez-Arias, Tribal Council woman
1116 Merlot Way — Esselen
Gonzales, CA 93926 — Ohlone/Costanoan
maklici0-us@gmail
831-596-9897

Amah MutsunTribal Band
Valentin Lopez, Chairperson
PO Box 5272 — Ohlone/Costanoan
Galt, CA 95632
vlopez@amahmutsun.org
916-743-5833

Indian Canyon Mutsun Band of Costanoan
Ann Marie Sayers, Chairperson
P.O. Box 28 — Ohlone/Costanoan
Hollister, CA 95024
ams@indiancanyon.org
831-637-4238

**This list is current only as of the date of this document.**

**Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code**

**This list is only applicable for contacting local Native Americans with regard to cultural resources for the proposed Monterey Peninsula Groundwater Replenishment Project, Monterey County.**

## Native American Contacts
## Monterey County
## March 6, 2014

Linda G. Yamane
1585 Mira Mar Ave — Ohlone/Costanaon
Seaside , CA 93955
rumsien123@yahoo.com
831-394-5915

Amah MutsunTribal Band of Mission San Juan Bautista
Michelle Zimmer
789 Canada Road — Ohlone/Costanoan
Woodside , CA 94062
amahmutsuntribal@gmail.com

(650) 851-7747 - Home

650-332-1526 - Fax

**This list is current only as of the date of this document.**

**Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code**

**This list is only applicable for contacting local Native Americans with regard to cultural resources for the proposed Monterey Peninsula Groundwater Replenishment Project, Monterey County.**

# ARCHAEOLOGICAL CONSULTING

**P.O. BOX 3377**
**SALINAS, CA 93912**
**(831) 422-4912**
**Fax (831) 422-4913**

March 6, 2014

AC 4642B

Linda Yamane
1585 Mira Mar Ave.
Seaside, CA 93955

Re: Monterey Peninsula Groundwater Replenishment Project

Dear Linda:

We are in the process of completing a Phase I Archaeological Survey for the proposed Monterey Peninsula Groundwater Replenishment Project in northern Monterey County, California (see Maps attached). The project involves pipelines between Salinas, Marina, Seaside and Monterey with other features for catchment of water in Salinas, Castroville and Pacific Grove, processing of water in Marina and injection wells in the former Fort Ord.

We have not yet received a result from the Northwest Information Center. We know that there is a site near the Castroville supply point and another near a possible Salinas facility. There are many sites along the shoreline in Pacific Grove and Monterey. Most of the areas on the Seaside and Marina Quads are not expected to be near recorded resources.

We are contacting you for additional information on Native American sites that may be in or near the project area and subject to project impacts.

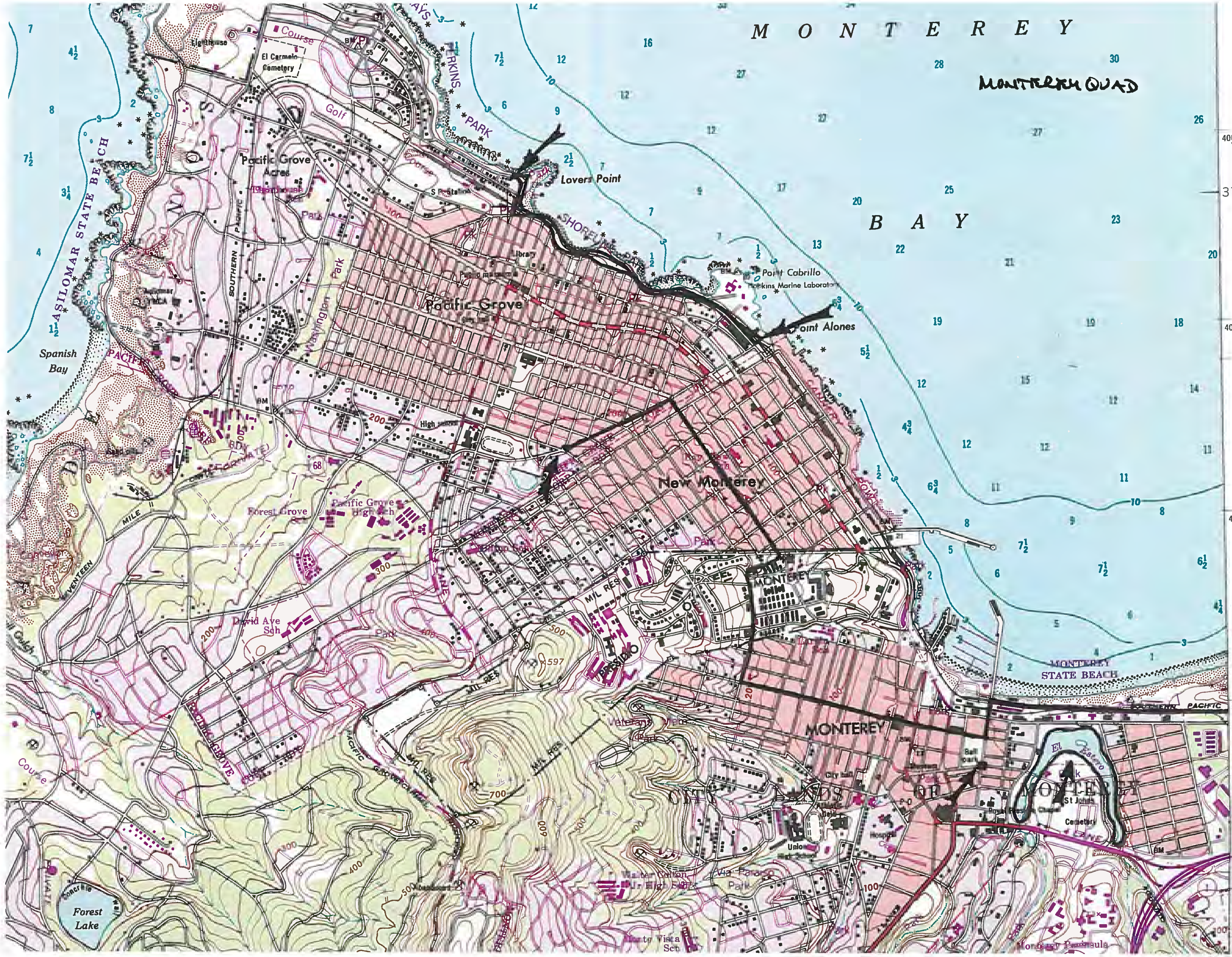
If you have any questions about this request, please do not hesitate to contact our office.

Yours truly,

Mary Doane

Mary Doane

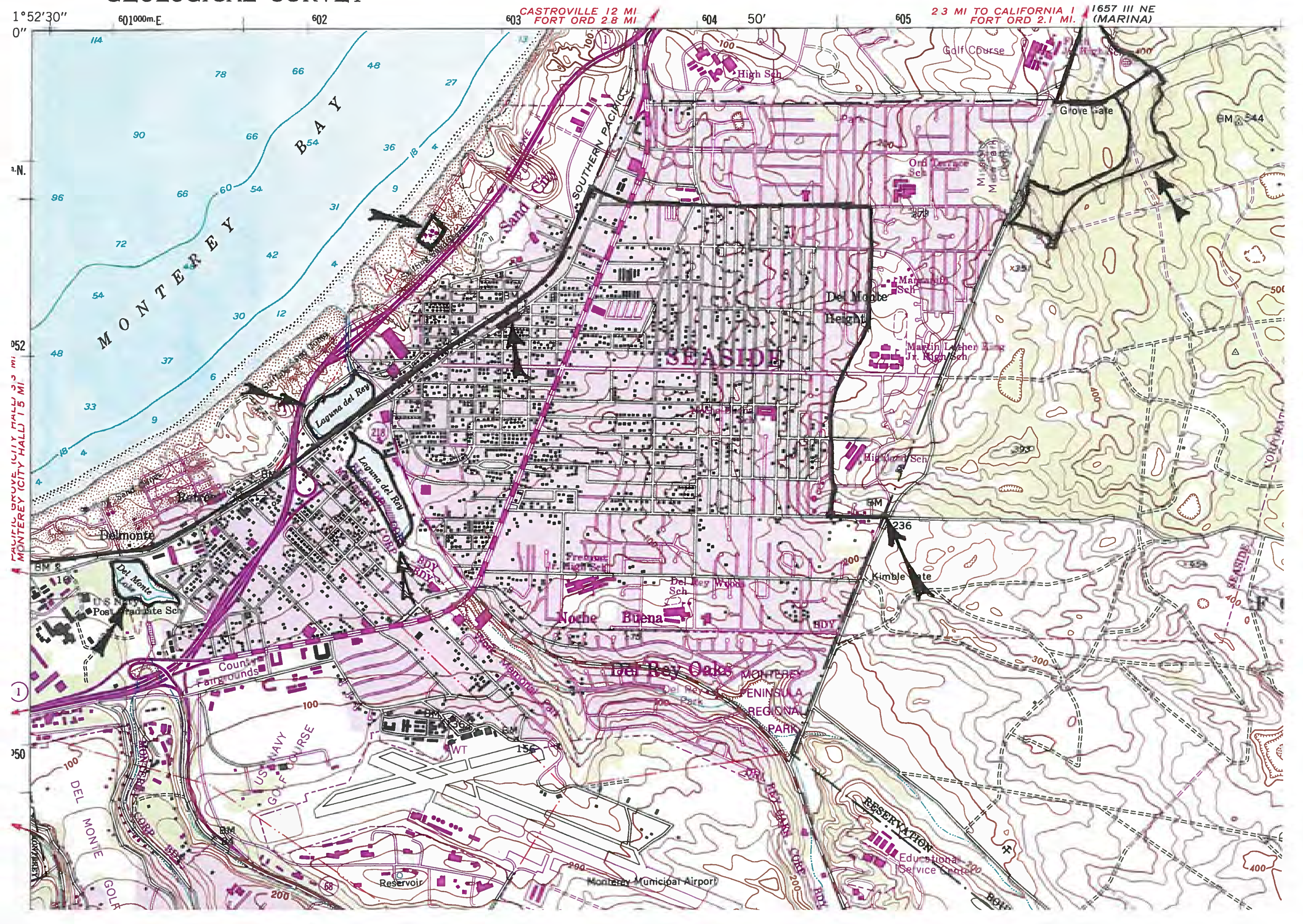
Attachments

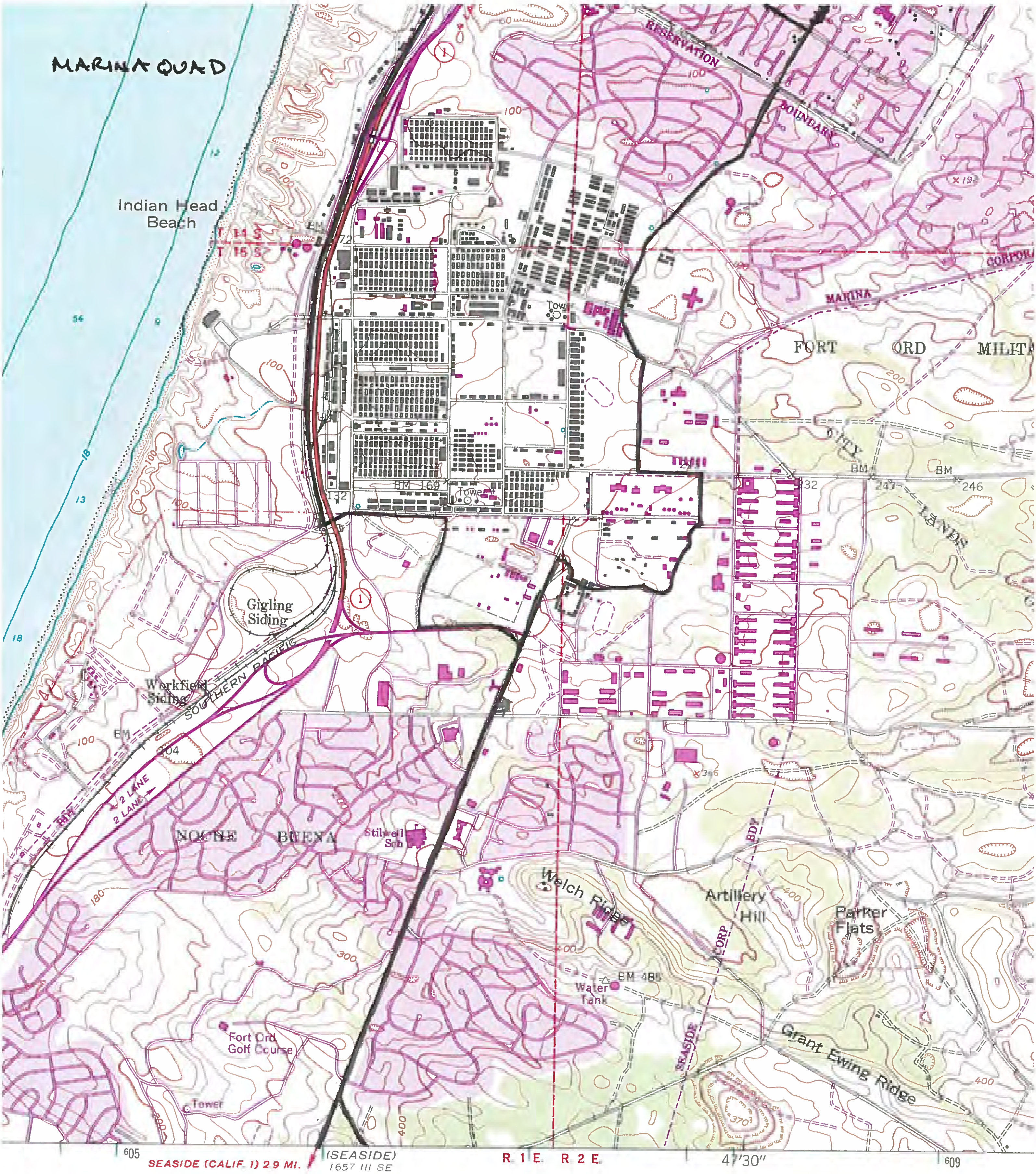

MONTEREY BAY
MONTEREY QUAD
Lovers Point
Point Cabrillo
Hopkins Marine Laboratory
Point Alones
Pacific Grove
New Monterey
MONTEREY
Pacific Grove Acres
El Carmelo Cemetery
Lighthouse
Golf Course
Washington Park
PERKINS PARK
SHORELINE PARK
ASILOMAR STATE BEACH
Spanish Bay
Forest Grove Sch
Pacific Grove High Sch
David Ave Sch
PRESIDIO
MIL RES
MONTEREY STATE BEACH
SOUTHERN PACIFIC
El Estero
St Johns
Cemetery
City Hall
CITY LANDS OF MONTEREY
Forest Lake
Via Paraiso Park
Monte Vista Sch
Monterey Peninsula
SEASIDE 1.8 MI.
CASTROVILLE 15 MI.
37°3'
4054
4053
4052
405

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

SEASIDE QUAD

UNITED STATES
DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS



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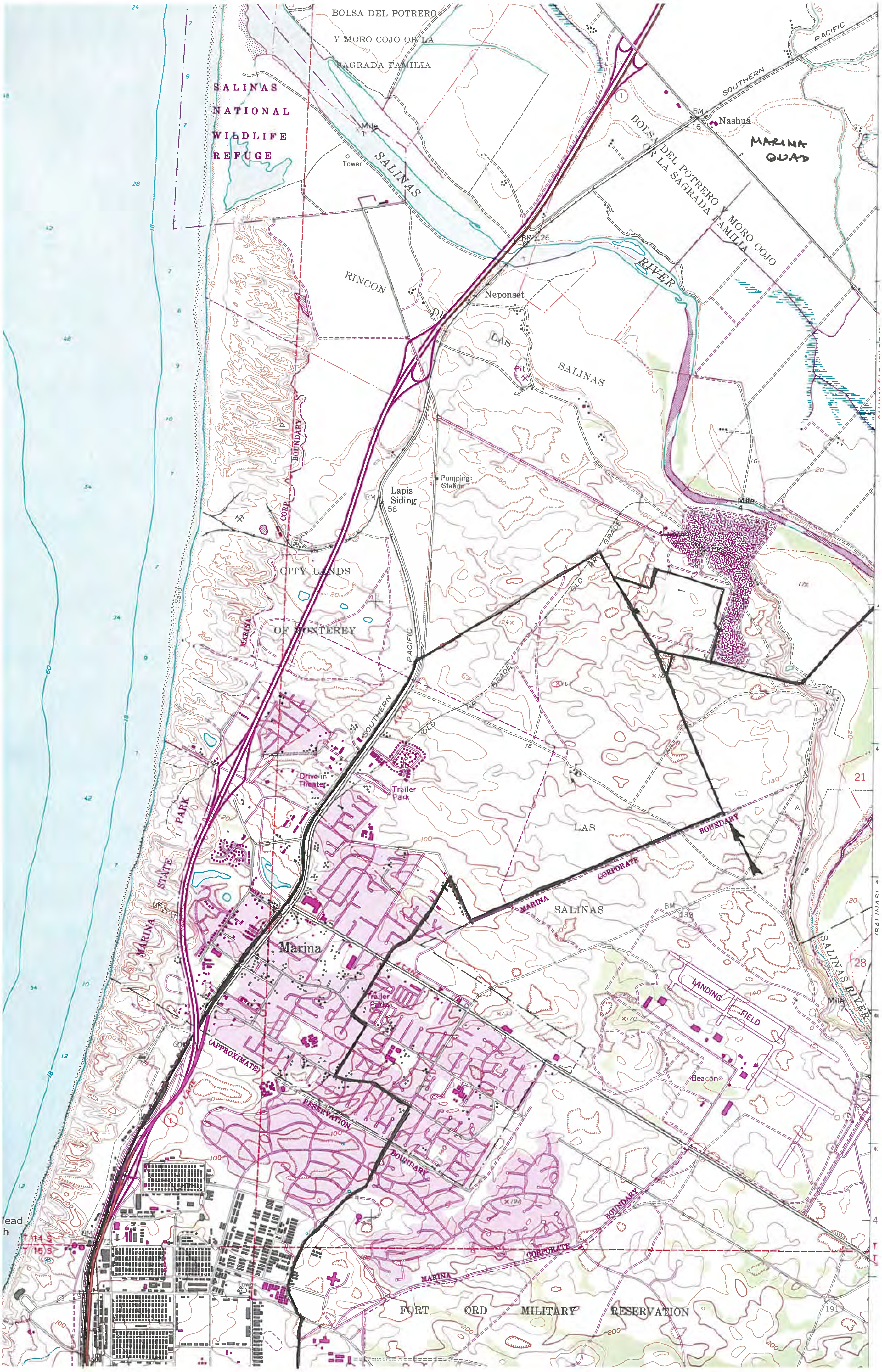
CONTOUR INTERVAL 20 FEET
DASHED LINES REPRESENT 10 FOOT INTERVALS
NATIONAL GEODETIC VERTICAL DATUM OF 1929

DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOWER LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER

CALIF


BOLSA DEL POTRERO
Y MORO COJO OR LA
SAGRADA FAMILIA
SALINAS
NATIONAL
WILDLIFE
REFUGE
Mile 1
Tower
SALINAS
RIVER
SOUTHERN
PACIFIC
BM 16
Nashua
MARINA QUAD
BOLSA DEL POTRERO Y MORO COJO
OR LA SAGRADA FAMILIA
BM 26
RINCON
DE
LAS
SALINAS
Neponset
Pit
Pumping Station
Lapis Siding
BM 56
Mile 4
MARINA CORP BOUNDARY
CITY LANDS
OF MONTEREY
OLD RR GRADE
SOUTHERN PACIFIC
Drive-in Theater
Trailer Park
LAS
SALINAS
MARINA CORPORATE BOUNDARY
MARINA STATE PARK
Marina
Trailer Park
LANDING
FIELD
Beacon
(APPROXIMATE)
RESERVATION
BOUNDARY
MARINA CORPORATE BOUNDARY
SALINAS RIVER
21
28
T 14 S
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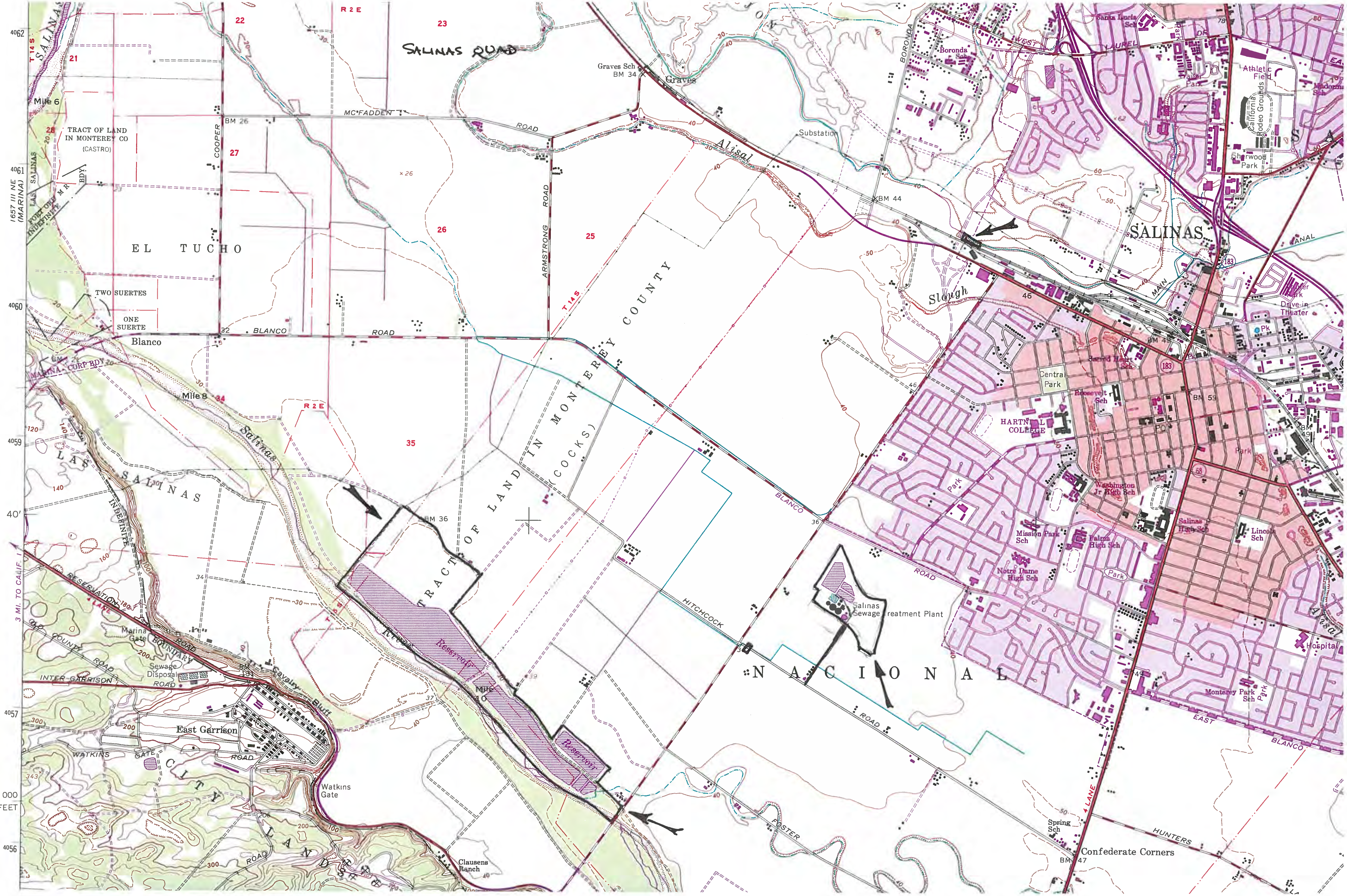
FORT ORD MILITARY RESERVATION


SALINAS QUAD
SALINAS
EL TUCHO
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NACIONAL
LAS SALINAS
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TRACT OF LAND IN MONTEREY CO (CASTRO)
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COOPER ROAD
ARMSTRONG ROAD
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HITCHCOCK ROAD
FOSTER ROAD
HUNTERS
EAST BLANCO
BORONDA
MAIN
WEST LAUREL DR
INTER-GARRISON ROAD
OLD COUNTY ROAD
RESERVATION
WATKINS GATE ROAD
Cavalry Bluff
Sewage Disposal
Salinas River
Mile 6
Mile 8
Mile 10
MARINA CORP BDY
FORT ORD M R BDY INDEFINITE
INDEFINITE
T 14 S
R 2 E
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BM 44
BM 47
BM 59
3 MI. TO CALIF. 1
1657 III NE (MARINA)
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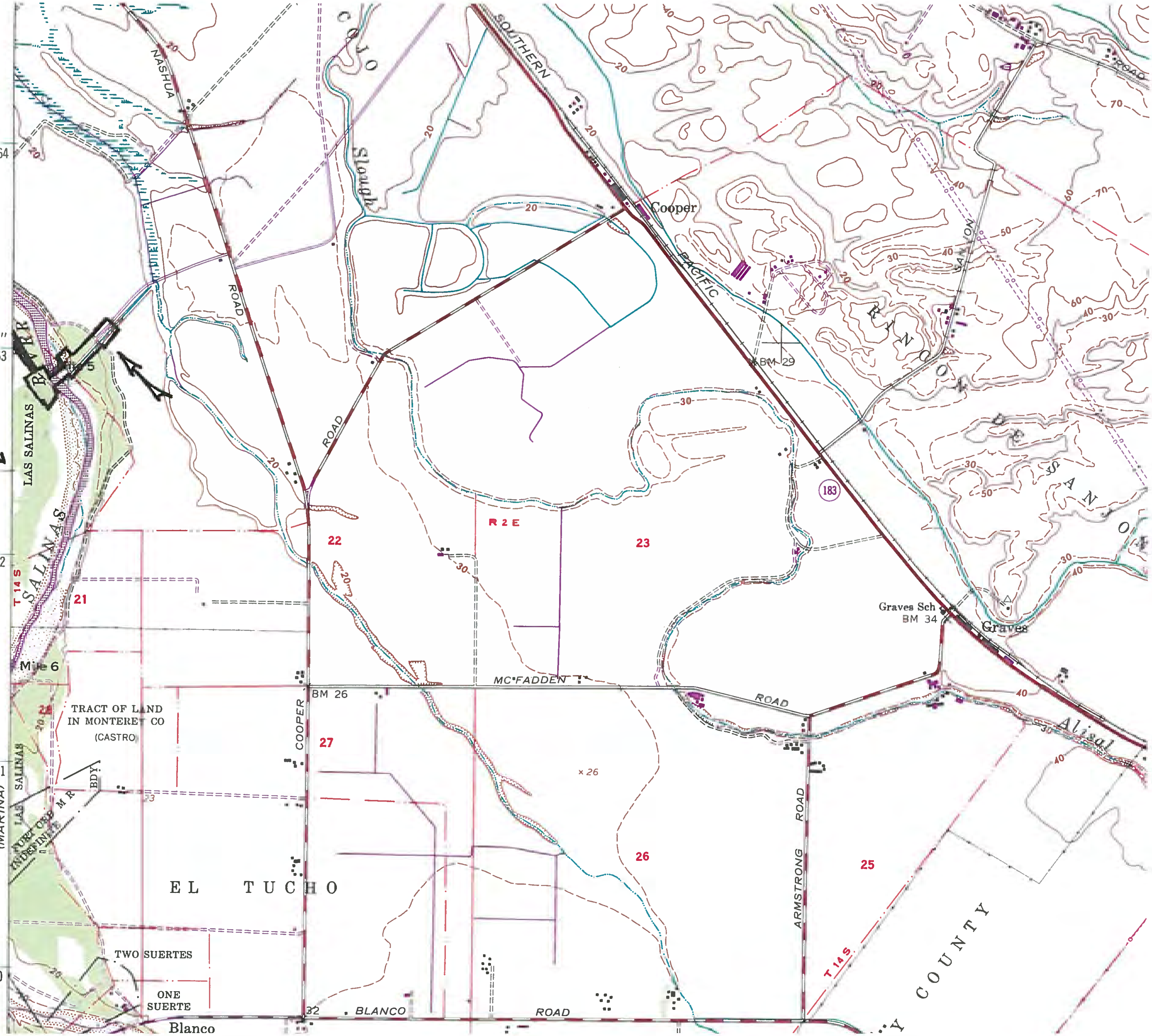
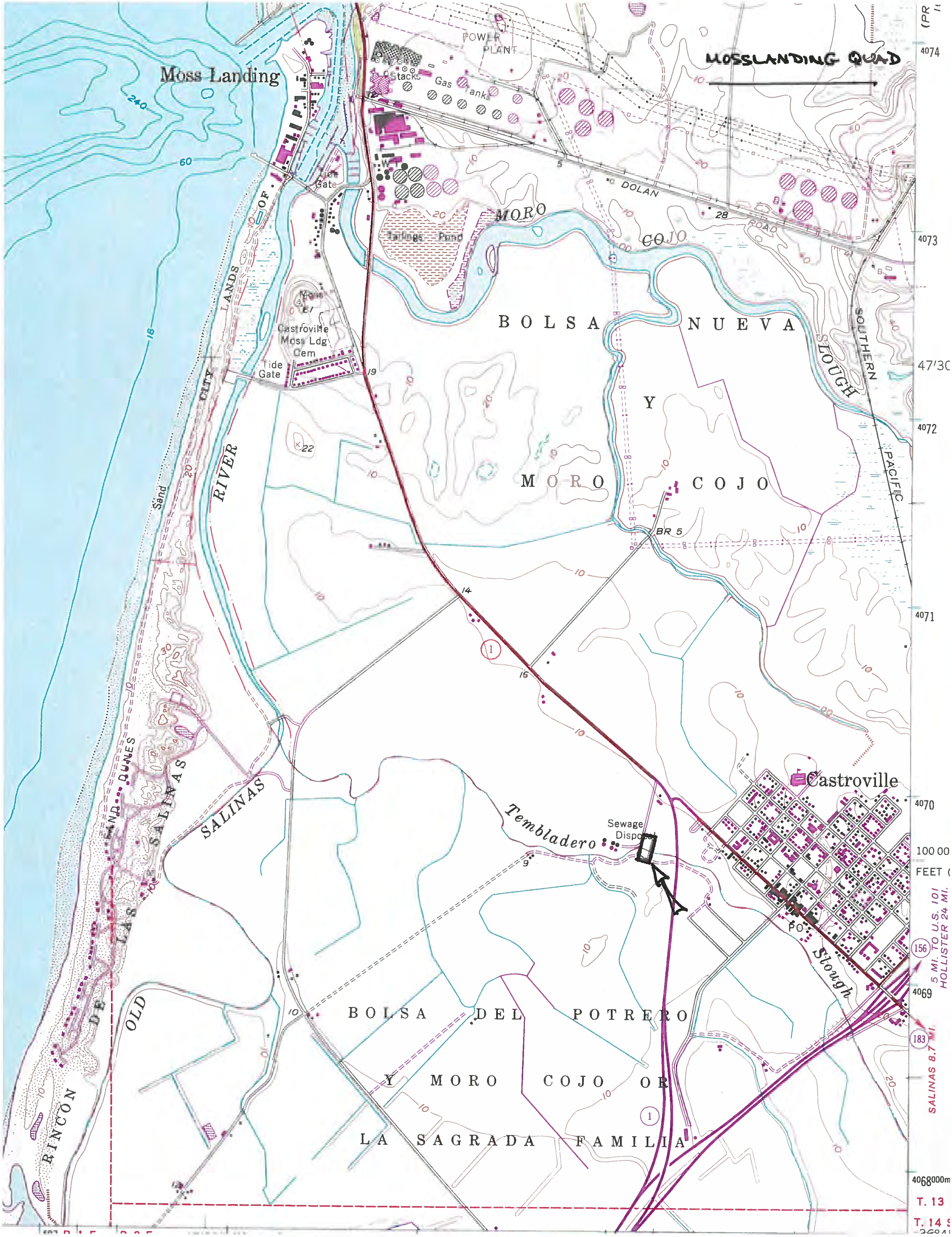
4060
4059
4057
4056
40'
490 000 FEET

SALINAS QUAD

SEE MARINA MAP FOR CONTINUATION




MOSSLANDING QUAD
Moss Landing
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Gas Tanks
Tide Gate
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BOLSA NUEVA Y MORO COJO
SLOUGH
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Castroville
Tembladero
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BOLSA DEL POTRERO Y MORO COJO OR LA SAGRADA FAMILIA
5 MI. TO U.S. 101
HOLLISTER 24 MI.
SALINAS 8.7 MI.
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4068000m
47'30
100 00
FEET

***Ohlone/Costanoan-Esselen Nation***

ESSELEN NATION

*Previously acknowledged as*
*The San Carlos Band of*
*Mission Indians*
*The Monterey Band*
*And also known as*
*O.C.E.N. or Esselen Nation*
*P.O. Box 1301*
*Monterey, CA 93942*

www.ohlonecostanoanesselennation.org.

March 21, 2014

Mary Doane
Archaeological Consulting
P.O. Box 3377
Salinas, CA 93912

Re: Castroville/Moss Landing Quad Map – Salinas Quad Map 1 - Salinas Quad Map 2
Marina Quad Map 1, Marina Quad, Seaside Quad, Monterey Quad – AC 4642B
CA-MNT- 102, 103, 104, 105,106,107 110, 111, 388, 389, 390, 392 and other sites

Saleki Atsa,

**Ohlone/Costanoan-Esselen Nation objects to all excavation in known cultural lands, even when they are described as previously disturbed, and/or are deemed to be of no significant archaeological value.**

**Please be aware that despite our objections, disturbance to our ancestral heritage sites continues, therefore we request that a Native American Monitor of Ohlone/Costanoan-Esselen Nation, approved by the OCEN Tribal Council be used within our aboriginal territory.** The OCEN Tribal leadership requests to be contacted with: 1) surveys, 2) subsurface testing, 3) presence/absence testing, 4) mitigation and recovery programs, 5) reburial of any of our ancestral remains, and 6) placement of all cultural items. Please be advised that it is our first priority that our ancestor's remains be protected and undisturbed. We desire that all cultural and sacred items be left with our ancestor on site or where they are discovered. We ask for the respect that is afforded all of our current day deceased, by no other word these burial sites are cemeteries, respect for our ancestors as you would expect respect for your deceased family members in today's cemeteries. **Our definition of respect is no disturbance.**

We are aware that Archaeological Consulting, though requesting our input chooses to work with individuals not representing Ohlone/Costanoan-Esselen Nation though we are the **legal, historical and previously federally recognized** tribal government representative for over BIA documented 600 enrolled members of Esselen, Carmeleno, Monterey Band, Rumsen, Chalon, San Carlos Mission and/or Costanoan Mission Indian descent.

Your statement "We know there is a site near Castroville supply point and another near a possible Salinas facility. There are many sites along the shoreline in Pacific Grove and Monterey. Most of the areas on the Seaside and Marina Quads are not expected to be near recorded resources." The acknowledgement that these ceremonial sites/burial cemeteries exist and are protected by CEQA, OCEN requests, upon response from the Northwest Information Center, that we are contacted with the updated information as to the location of these sites as well as other pertinent information. It is the responsibility of the archaeological firm to verify and acknowledge our sacred and ancestral heritage sites, with your employer so that any adverse impacts to OCEN's sacred sites are not destroyed by development. Please provide us with that information.

Thank you for your attention to this matter; I can be contacted at (408) 629-5189. Nimasianexelpasaleki

Sincerely and Respectfully Yours,

Louise J. Miranda Ramirez, Chairperson
Ohlone/Costanoan-Esselen Nation
(408) 629-5189

Cc: OCEN Tribal Council
Northwest Information Center

# Appendix K

# Preliminary Geotechnical Evaluation Groundwater Replenishment Project EIR Monterey County, California

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# PRELIMINARY GEOTECHNICAL EVALUATION
# GROUNDWATER REPLENISHMENT PROJECT EIR
# MONTEREY COUNTY, CALIFORNIA

**PREPARED FOR:**
Denise Duffy & Associates
947 Cass Street, Suite 5
Monterey, California 93940

**PREPARED BY:**
Ninyo & Moore
Geotechnical and Environmental Sciences Consultants
1956 Webster Street
Oakland, California 92123

December 2, 2014
Project No. 402251001

# Ninyo & Moore

December 2, 2014
Project No. 402251001

Ms. Diana Buhler
Denise Duffy & Associates
947 Cass Street, Suite 5
Monterey, California 93940

Subject: Preliminary Geotechnical Evaluation
Groundwater Replenishment Project EIR
Monterey County, California

Dear Ms. Buhler:

In accordance with your request, we have performed a preliminary geotechnical evaluation for the Environmental Impact Report on the Monterey Peninsula Groundwater Replenishment Project located in Monterey County, California. This report presents our preliminary findings, conclusions and recommendations regarding geotechnical aspects of the project for preliminary planning purposes.

We appreciate the opportunity to be of service on this project. If you have any questions or comments regarding our report, please contact the undersigned at your convenience.

Respectfully submitted,
**NINYO & MOORE**

Derek W. Magnuson
Senior Staff Geologist

Gregory T. Farrand, PG, CEG
Principal Geologist

REGISTERED GEOLOGIST GREGORY T. FARRAND No. 1037 CERTIFIED ENGINEERING GEOLOGIST STATE OF CALIFORNIA

REGISTERED PROFESSIONAL ENGINEER PETER C. CONNOLLY GE2707 GEO TECHNICAL STATE OF CALIFORNIA

Peter C. Connolly, PE, GE
Principal Engineer

DWM/PCC/GTF/vmp

Distribution: (1) Addressee (Electronic Copy)

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## 1. SUMMARY OF KEY FINDINGS

A brief summary of our key findings is presented below. More detailed information is presented in the following sections of this report.

- Variable geologic conditions are present within the project area. The project area may be divided into three general geologic regimes; northeastern, central, and southwestern. The northeastern area is comprised predominantly of the alluvial floodplain of the Salinas River. The central area is characterized by elevated rolling hills of wind blown eolian deposits. The geology of the southwestern area is variable and includes the flat coastline west of Canyon del Rey and elevated terrain of the Monterey Peninsula.

- Pipeline construction will vary along the alignments from north to south as the geologic conditions change. The northeastern low-lying areas are anticipated to encounter areas of shallow groundwater and soft soil conditions. The central areas are anticipated to encounter friable dune sands that may cave continuously in some areas. The southwestern areas will vary and may include soft wet soil conditions in canyon areas to difficult excavation in granodiorite.

- The project is located in an area of relatively high seismicity. Some active and potentially active faults do cross the project area. The preferred measure to minimize fault rupture hazards is to locate planned structures away from known fault traces. It may not be feasible or practical, however, to locate planned pipelines away from fault traces. Where pipelines cross known fault traces other measures may be considered depending on the potential risk and damage associated with fault rupture, the relative activity of faulting, and the soil conditions. Potential measures that may be considered include: 1) installation of isolation valves on either side of a pipeline fault crossing to reduce water loss in case of rupture, 2) oversize trench excavation and backfill with select compressible materials, or 3) open channel construction and/or flexible couplings. If damage were to occur to any of the pipelines due to fault rupture, it would amount to a pipe break. A broken pipeline could result in soil washout and sinkholes that could damage nearby non-project facilities or the environment. Locating and repairing damaged pipelines and pumps could require a temporary cessation of operations for a significant period of time.

- There is a strong potential for strong ground shaking, seismically induced soil liquefaction, and dynamic settlement at some locations within the project area. Soil liquefaction may impact some structure sites and pipeline alignments. Geotechnical evaluation of liquefaction potential and dynamic settlement, including subsurface exploration, should be performed during the design phase as required by the appropriate city, county, and state building codes and ordinances. Appropriate measures to protect structures and other improvements including foundation design, excavation, and compaction requirements may be developed based on the site specific geotechnical conditions.

- The project may be impacted by corrosion of ferrous metals or sulfate attack on concrete due to corrosive/deleterious soils. The corrosivity depends on the material type and the proximity to saltwater. In general, clay deposits in the alluvium of the Salinas River Valley, southwestern alluvial areas, or coastal marine areas may constitute a corrosive or deleterious environment. Geotechnical evaluation of corrosive soils, including subsurface exploration, should be performed during the design phase as required by the appropriate city, county, and state building codes and ordinances. Appropriate measures to protect structures and other improvements including selection of construction materials may be developed based on the site specific geotechnical conditions.

- The project may be impacted by expansive soils in locations containing clays including the Salinas River Valley, southwestern alluvial areas, and potential locations containing clayey fills. The expansion characteristics of clayey soils may vary locally and should thus be considered during detailed project design on a site-specific basis. Geotechnical evaluation of expansive soils, including subsurface exploration, should be performed during the design phase as required by the appropriate city, county, and state building codes and ordinances. Appropriate measures to protect structures and other improvements including common grading practices such as soil lime treatment, overexcavation, and compaction requirements may be developed based on the site specific geotechnical conditions.

- Some of the low-lying project components are mapped in a 100-year flood zone (See Section 4.7). Some of the project components in low-lying coastal areas are mapped in a tsunami inundation area (See Section 4.3.1.5). Design of such project components should take these hazards into consideration. Damage to, temporary inundation of, or temporary exposure of the proposed new water supply infrastructure due to flooding or tsunami is not expected to result in a significant risk of loss of life or property.

## 2. INTRODUCTION

In accordance with your request and authorization we have performed a preliminary geotechnical evaluation to be used in the preparation of an Environmental Impact Report (EIR) for the Monterey Peninsula Groundwater Replenishment Project (Proposed Project or GWR Project) located in Monterey County, California (Figure 1). The GWR Project is a water resources improvement project in advanced planning phases by the Monterey Peninsula Water Management District (MPWMD), and the Monterey Regional Water Pollution Control Agency (MRWPCA). The purpose of our services has been to make a preliminary evaluation of the soil and geologic conditions within the Proposed Project source water site areas and to develop preliminary data regarding potential geologic and seismic hazards that may impact the project, as well as geotechnical constraints associated with the design and construction of project improvements.

The Proposed Project consists of two components: the Pure Water Monterey Groundwater Replenishment improvements and operations (GWR Features) that will develop high quality replacement water for existing urban supplies; and an enhanced agricultural irrigation (Crop Irrigation) component that will increase the amount of recycled water available to the existing Castroville Seawater Intrusion Project (CSIP) in northern Monterey County. Water supplies proposed to be recycled and reused by the Proposed Project include municipal wastewater, industrial wastewater, urban stormwater runoff and surface water diversions. The Proposed Project would create a reliable source of water supply by taking highly treated water from new and modified treatment facilities at the Regional Treatment Plant, including a new advanced water treatment (AWT) facility, Brine Mixing Facility, Product Water Pump Station and SVRP Modifications, and injecting it into the Seaside Groundwater Basin using a series of shallow and deep injection wells. The GWR Project is being proposed by the MRWPCA in partnership with the MPWMD. Figure 1 shows the regional location of the study area for the Proposed Project. Once injected into the Seaside Basin, the treated water would mix with the groundwater present in the aquifers and be stored for future use.

The primary purpose of the Proposed Project is to provide 3,500 acre-feet per year (AFY) of high quality replacement water to the Seaside Basin to allow California American Water Company (or CalAm[1]) to extract the same amount for delivery to its customers in the Monterey District Service Area, thereby enabling CalAm to reduce its diversions from the Carmel River system by this same amount. Another purpose of the Proposed Project is to provide additional water to the Regional Treatment Plant that could be by recycled at the existing, tertiary treatment facility, the Salinas Valley Reclamation Plant, and used for crop irrigation using the Castroville Seawater Intrusion Project system.

The areas potentially affected by the GWR project source water sites for EIR purposes extend along the coastline of Monterey Bay from near Castroville approximately 16 miles southwest to Pacific Grove and up to approximately 3 miles inland. Additional areas potentially affected by

[1] CalAm is an investor-owned public utility with approximately 38,500 connections in the Monterey Peninsula area.

the GWR project occur between Salinas and the Salinas River (Figure 1). General study area features are described in Section 4.1.

### 2.1. Project Components

This section describes the physical components of the Proposed Project. The following project components are proposed:

- *Source water diversion and storage sites*– diversion of new source waters to the existing municipal wastewater collection system and conveyance of those waters as municipal wastewater to the Regional Treatment Plant (RTP) to increase availability of secondary-treated wastewater for the Proposed Project. See "GWR Source Water Diversion and Storage" in Figure 2A.

- *Treatment facilities at RTP* – use of existing primary and secondary treatment facilities at the RTP, as well as new pre-treatment, advanced water treatment (AWT), product water stabilization, product water pump station, and concentrate disposal facilities, as well as modifications to the Salinas Valley Reclamation tertiary treatment plant. See "GWR Treatment Facilities" in Figure 2A.

- *Product water conveyance* – new pipelines, booster pump station, appurtenant facilities along one of two optional pipeline alignments to move the product water from the RTP to the Seaside Groundwater Basin injection well facilities. See "GWR Product Water Conveyance" in Figure 2A.

- *Injection well facilities* - new deep injection and vadose zone wells to inject Proposed Project product water into the Seaside Groundwater Basin, backflush facilities, pipelines, electricity/ power distribution facilities, and an electrical/motor control building. See "GWR Injection Wells and Backflush Facility" in Figure 2A.

- *Distribution of groundwater from Seaside Groundwater Basin* – new CalAm distribution system improvements needed to convey extracted groundwater and deliver it to CalAm customers. See "California American Water Distribution System" in Figure 2A. These same CalAm distribution improvements also would be needed if CalAm were to implement the Monterey Peninsula Water Supply Project (CalAm Water Supply Project), which is undergoing separate CEQA review.

Many existing facilities will be utilized to convey new source water to the existing RTP including the Salinas sanitary sewer pump station, MRWPCA's 36-inch sanitary sewer force main, City of Salinas industrial wastewater conveyance and treatment facilities, City of Salinas stormwater conveyance facilities, City of Monterey Lake El Estero and nearby wastewater collection systems, and MRWPCA's Monterey Peninsula interceptor system including pump stations. These existing components are part of the Proposed Project; however the use of these components is not being evaluated for impacts because the usage is part of the existing setting. A schematic of the project components is presented in Figure 2A.

### 2.2. Project Alternatives

The Monterey Peninsula Groundwater Replenishment Project is currently considering alternatives for:

- Alternative source water diversion locations at:
  - Laguna Grande Lake
  - Roberts Lake
  - Navy Lake
  - Bay Avenue Outfall
  - Del Monte Dry Weather Diversion
  - Areas of Special Biological Significance (ASBS) compliance Wet Weather Diversion

Alternative project components are not currently part of the Proposed Project, but are being evaluated as part of this report. The locations of the alternative project components in relation to the proposed and existing project components are illustrated in Figure 2B.

## 3. METHODOLOGY

Our study consisted of a preliminary geotechnical evaluation of the various sites and alignments for preliminary planning purposes. Subsurface exploration has not been performed. Specifically, our evaluation included the following tasks:

- Project coordination, including review of preliminary conceptual plans and participation in conference calls.

- Research and review of readily available geologic and seismic literature pertinent to the study area including geologic maps, regional fault maps, seismic data, and geotechnical reports prepared by Ninyo & Moore or other consultants for the study area vicinity. The reports and documents reviewed for this study are listed in Section 9 of this report.
- Compilation and analysis of the data obtained during our literature review to evaluate potential geologic and seismic hazards that may impact the project and evaluate geotechnical aspects of the project for preliminary design and construction consideration.
- Preparation of this preliminary geotechnical evaluation report presenting our findings, conclusions, and recommendations regarding the geotechnical aspects of the project.

## 4. EXISTING CONDITIONS

The general features, geologic conditions, surface soil erosion characteristics, and faulting and seismic conditions as they currently exist over the project study area, are discussed in the following sections.

### 4.1. General Study Area Features

The study area extends from the Castroville area at the Tembladero Slough southwest to the Pacific Grove area in the Monterey Peninsula, and as far inland as Salinas (Figure 1). The project may be divided into three general areas that have relatively distinct geologic and topographic characteristics. These project areas include a northeastern area, a central area, and a southwestern area. The northeastern area of the project includes a large area of low-lying agricultural fields in the floodplain of the Salinas River. Castroville is located within this area approximately 2 miles from the coast, and Salinas is located within this area approximately 8 miles from the coast. The central portion of the project includes rolling hills extending inland from the coast comprised of wind blown eolian deposits. This area includes the urbanized developments of Seaside, and Marina, as well as the former Fort Ord military base. The southwestern portion of the project area includes rolling hills extending inland generally west of Canyon Del Rey into the Monterey Peninsula. The geologic characteristics and boundaries of the northeastern, central and southwestern areas are discussed further in Section 4.2.1.

### 4.2. Geologic Conditions

The regional geologic setting and the various geologic units encountered with the study area are discussed in the following sections.

#### 4.2.1. Geologic Setting

The project area is located within the Coast Ranges physiographic province which is characterized by a series of northwest-trending mountain ranges and valleys that are generally fault controlled. A regional fault map is presented on Figure 3. The Coast Ranges are chiefly composed of thick Mesozoic- and Cenozoic-age sedimentary strata. The northern and southern parts of the ranges are separated by a depression containing the San Francisco Bay. Faults juxtapose blocks of different origins. The majority of the Monterey area is underlain by the Salinian block, which is generally bounded by the San Andreas fault zone to the northeast and the San Gregorio fault zone to the southwest (Rosenberg, 2001h). The Salinian block is comprised of Mesozoic granitic rock and Paleozoic to Mesozoic meta-sedimentary rock (Norris & Webb, 1990). A series of thick Cretaceous- and Tertiary-age sedimentary strata overly much of the Salinian block, and were deposited during marine transgressions and regressions during this timeframe. Several episodes of volcanism, indicative of crustal extension and normal faulting, also occurred in the region during late Oligocene and Miocene time, and produced extrusive igneous rocks ranging in composition from basalt to rhyolite (Rosenberg, 2001h). During Quaternary time, the region has been uplifted to its current elevation and a combination of tectonic and geomorphic processes have shaped the present landscape, including the exposure of marine terraces, deposition of eolian sand, alluvial deposition, and landsliding.

The project may be divided into three general areas, northeastern, central, and southwestern, that have relatively distinct geologic and topographic characteristics. The northeastern portion extends north of the active Salinas River channel and generally consists of a relatively broad low-lying, alluvial floodplain. The central area of the project consists of eolian deposits that form a zone of moderately elevated, rolling hills extending several miles inland from the coastline and south from the Salinas River channel to Canyon del Rey. The southwestern portion of the project extends generally west along the coastline from the Canyon del Rey into elevated terrain of the Monterey Peninsula, which is the coastal expression of a northwesterly trending mountain range uplifted by faulting. The uplifted peninsula includes a variety of geologic units that includes a core of Cretaceous-age granitic rocks, Tertiary-age sedimentary rocks, Pleistocene-age terrace deposits, landslides and alluvial sediments.

### 4.2.2. Geologic Units

Based on our geologic literature review, the geologic units anticipated within the project study area include fill, alluvium, eolian deposits, terrace deposits, Tertiary-age Monterey Formation, and Cretaceous-age poryphyritic granodiorite of Monterey. The distribution of the various geologic units is shown on the regional geology map in Figure 4 along with the existing and proposed project components. The regional geology map symbols are described on Figure 5. A brief summary of these geologic units and their anticipated engineering characteristics are presented below.

#### *4.2.2.1. Fill*

Artificial fill materials are mapped along the proposed CalAm Monterey and Transfer pipelines in the southwest portion of the project study area. We also anticipate that fill materials will be encountered elsewhere throughout the study area where human alterations to the subsurface have occurred. The thickness of fill deposits varies. Based on our experience we anticipate that the fill materials are generally derived from local natural soils and will be similar to the natural soils as described in the following sections. Fill materials may also include imported materials, construction debris, or other waste products. Documentation of the compaction of the fill materials was not available for review.

#### *4.2.2.2. Alluvium*

Alluvial materials are generally mapped in the northeast and southwest portions of the project study area. Alluvium is generally comprised of unconsolidated sediments deposited in alluvial fans, along active stream and river channels, and in floodplains. Project components in the northeastern area of the project are mapped as being underlain by Holocene-age flood-plain deposits, Holocene basin deposits, Holocene alluvial deposits, and Holocene stream channel deposits (Rosenberg, 2001a). The alluvium in the northeastern area of the project is anticipated to generally consist of interbedded silts, clays, sands, and gravels. The northeastern area is largely agricultural and relatively flat, with relatively poor drainage features. Groundwater is anticipated to be within 10 feet of the ground surface (and shallower) in the low-lying areas. The alluvial materials in the northeastern floodplain area of the project are mapped as having moderate to high liquefaction susceptibility (Rosenberg, 2001d).

Portions of the project components in the southwestern area of the project are mapped as being underlain by Holocene basin deposits and Holocene alluvial deposits (Rosenberg, 2001a). Specifically, the proposed Lake El Estero, alternative Laguna Grande Lake[2], alternative Roberts Lake[2], and alternative Navy Lake[2] source water locations are mapped as being underlain by Holocene basin and alluvial deposits. Also, the proposed CalAm Monterey and Transfer pipelines and alternative ASBS Wet Weather Diversion area[2] are underlain by Holocene alluvial deposits where they intersect drainage courses. Alluvial materials in the southwestern project area are anticipated to be more variable due to the complex geologic conditions and terrain associated with the Monterey Peninsula and may include moist to wet, loose/soft clays, silts, and sands. The alluvial materials in the southwestern area of the project are mapped as having high liquefaction susceptibility (Rosenberg, 2001d).

#### 4.2.2.3. *Eolian Deposits*

The central portion of the project between the Salinas River and Canyon del Rey is mapped as being underlain by Pleistocene-age eolian deposits (Rosenberg, 2001a). Rosenberg (2001g) describes these deposits as being weakly to moderately consolidated, moderately to well-sorted silt and fine- to medium-grained sand deposited in an extensive coastal dune field. Shallow groundwater is not anticipated within the elevated eolian deposits, except for localized low-lying areas along the coastline. The eolian deposits are generally mapped as having low liquefaction susceptibility, except where shallow groundwater may be present in localized low-lying areas (Rosenberg, 2001d). The soil erosion hazard within the eolian deposits in the central portion of the project area is mapped as moderate, except along the coast where the soil erosion hazard is mapped as high (Rosenberg, 2001f). Eolian deposits may also be collapsible. Collapsible soil is broadly defined as loose and cemented soil with low moisture content that is susceptible to a large and sudden reduction in volume upon wetting, with no increase in vertical stress.

#### 4.2.2.4. *Terrace Deposits*

Pleistocene-age coastal terrace deposits are mapped within the southwestern portion of the project (Rosenberg 2001a). Rosenberg (2001g) describes these deposits as semiconsolidated, moderately well-sorted marine sand containing thin, discontinuous gravel-rich layers. These deposits can locally include some terrace surfaces and debris flow deposits resting on terrace surfaces. In general, the liquefaction hazard and landslide seismic hazard are mapped as low in areas underlain by coastal terrace deposits (Rosenberg 2001b & 2001d). The soil erosion hazard is mapped as moderate in areas underlain by coastal terraces (Rosenberg 2001f).

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[2] Alternative project elements are not currently part of the Proposed Project, but are being evaluated as part of this report.

#### *4.2.2.5. Monterey Formation*

The Tertiary-age Monterey Formation is mapped in the southwestern portion of the project along the southern margins of Lake El Estero (Rosenberg, 2001a). However, we understand that proposed physical facilities and disturbance associated with the Lake El Estero diversion will be limited to the northeastern side of the lake. Based on our review of available literature, we do not anticipate the Monterey Formation will be present within the footprint of the Lake El Estero diversion facilities.

Rosenberg (2001g) describes the Monterey Formation as light brown to white, hard, brittle, and platy siliceous mudstone. Clark (1997) describes this unit as thin-bedded and laminated, light brown to white porcelanite with thin clay partings between the porcelanite beds and with thin interbeds of waxy yellow chert. Bentonite beds are present within the Monterey Formation, which are prone to landsliding in sloped areas.

#### *4.2.2.6. Poryphyritic Granodiorite of Monterey*

The Poryphyritic Granodiorite of Monterey is mapped in the southwestern portion of the project along segments of the proposed CalAm Monterey and Transfer Pipeline and a portion of the alternative ASBS Wet Weather Diversion area[2]. This Cretaceous-age granitic rock is light gray to moderate pink, medium-grained, and contains orthoclase phenocrysts 3 to 10 centimeters long (Clark, 1997).

### 4.3. Faulting and Seismicity

The study site is located in the Coast Ranges geomorphic province of California, an area considered seismically active, as are most areas of California. The Coast Ranges are comprised of a series of parallel, northwest-trending mountain ranges and valleys generally controlled by faults. Faults juxtapose blocks of geologic units of different origins called belts. The Monterey area is located within the Salinian block which is a northwest-trending belt bounded to the east by the San Andreas fault, and to the west by the San Gregorio (Sur) fault (Harden, 1998).

Several active and potentially active faults have been mapped within or close to the study area. As defined by the California Geological Survey (CGS), an "active" fault is one that has exhibited seismic activity or has evidence of fault displacement within Holocene time (roughly during the last 11,000 years). "Potentially active" faults are those which show evidence of displacement during Quaternary time (roughly during the last 1.6 million years), but for which evidence of Holocene movement has not been established. The approximate locations of the major faults in the region and their geographic relationship to the project area are shown on Figure 3 and in greater detail on Figure 6.

The California Geological Survey has designated certain active fault traces as Earthquake Fault Zones under the Alquist-Priolo Special Studies Zone Act of 1972 (CGS, 2007). The study area does not include faults designated as Alquist-Priolo Earthquake Fault Zones. The closest such zoned fault is the San Andreas fault located to the northwest of the project.

Table 1 lists selected nearby principal active and potentially active faults that may impact the Proposed Project and the alternative project areas, the estimated maximum moment magnitude of each fault, and the estimated slip rate for each fault. For Proposed Project components, the maximum distances to each fault are based on estimated distances from the southwestern end of the proposed CalAm Distribution System, the Tembladero Slough diversion site, or the Reclamation Ditch diversion site. For alternative project areas, the distances to each fault are based on estimated distances from the Bay Avenue Outfall alternative source water area[2] or the alternative ASBS Wet Weather Diversion area[2].

**Table 1 – Principal Active and Potentially Active Faults**

| Fault | Fault to Proposed Project Area Distance (Range in Miles) | Fault to Alternative Project Areas Distance (Range in Miles) | Maximum Moment Magnitude (Mmax)[1] | Slip Rate (mm/yr)[2] |
|---|---|---|---|---|
| Monterey Bay – Tularcitos Fault Zone | 0-11 | 0-3 | 7.3 | 0.5 |
| Rinconada Fault Zone | 0-7.5 | 6-8 | 7.5 | 1.0 |
| San Andreas (Santa Cruz Mtn Section) | 12-26 | 23.5-25 | 7.0 | 17.0 |

1 Cao, 2003
2 Wills et. al, 2008

The Reliz fault zone is the northward extension of the Rinconada fault zone which trends to the northwest along the base of the mountains at the southwest side of the Salinas River valley. The northernmost known indication of Quaternary movement along this fault zone is the steeply dipping Paso Robles Formation beds near the Spreckels area (Rosenberg, 2001f). The Reliz fault has been projected northwest from Spreckels crossing through the central portion of the project area in the Marina vicinity (Jennings and Bryant, 2010; Rosenberg, 2001c). This portion of the fault passes beneath eolian deposits and the location is uncertain. This fault system has displaced materials of late Quaternary age (11,000 to 750,000 years old) and is considered potentially active (Rosenberg, 2001c).

The Monterey Bay-Tularcitos fault zone crosses through the Monterey-Seaside area and extends offshore (Clark et al., 1997). The onshore portion in the project vicinity includes the Ord Terrace, Seaside, Chupines, and Navy faults. These faults create an approximately 5 to 9 mile wide zone of short en echelon northwest-striking faults that are genetically related. The activity and locations of these faults are not well defined. Geologic data indicates Holocene displacement at some locations and these faults should be considered active for planning purposes.

The northernmost Ord Terrace fault is mapped beneath eolian deposits in the central portion of the project area through the proposed CalAm Monterey and Transfer Pipelines and near the proposed GWR Injection Well Facilities (Figure 6). The Ord Terrace fault is a steeply southwest-dipping reverse fault. There is evidence for Pleistocene activity in the northward extension of the fault into Monterey Bay, where it cuts Pleistocene strata and offsets the sea floor (Rosenberg, 2001h). Rosenberg (2001c) shows displacement on the Ord Terrace fault within Quaternary time but prior to the middle Pleistocene (Figure 6).

The Seaside fault is mapped beneath eolian deposits through the proposed CalAm Monterey and Transfer pipelines in the central portion of the project area. The Seaside fault is a steeply southwest-dipping reverse fault and well data suggests that its trace connects to a splinter of the Chupines fault near Highway 68. Well logs on either side of the fault show an approximate 275 foot vertical offset of Pleistocene continental deposits, but evidence for Holocene movement is lacking (Rosenberg, 2001h). Rosenberg (2001c) shows displacement along the Seaside fault within Quaternary time but prior to the middle Pleistocene (Figure 6).

The Chupines fault is mapped to the northeast of the Roberts Lake and Laguna Grande Lake through the proposed CalAm Monterey pipeline within the southwestern edge of the central portion of the project area. At locations where the fault orientation is measurable, its dip ranges from 50 degrees southwest to near-vertical. A probable offshore extension of the Chupines fault cuts Holocene deposits and seafloor deposits (Rosenberg, 2001h). Thus the portion of the fault within the project area is considered active.

The Navy fault is mapped to the southwest of Navy Lake through the proposed CalAm Monterey Pipeline within the southwestern portion of the project area. Its northwest-striking alignment is consistent with the Tularcitos fault zone and extends from Carmel Valley to Monterey Bay. The Navy fault dips steeply to the southwest and geomorphic features along its trace such as linear drainages and aligned benches indicate predominantly strike-slip movement. Clark (1997) reports Holocene activity on the Navy fault based on Holocene displacements of offshore strata and earthquake epicenter plots near the fault trace. Rosenberg (2001c) however shows displacement within Quaternary time but prior to the middle

Pleistocene. The Fault Activity Map of California (Jennings & Bryant, 2010) indicates that displacement along the onshore portion of the Navy fault within the study area dates to late Quaternary and pre-Holocene time.

### 4.3.1. Seismic Hazards

Seismic hazards that could potentially affect improvements within the study area include surface fault rupture, ground shaking, soil liquefaction and dynamic settlement, lateral spreading, tsunamis and landsliding. Seismic hazards associated with the Proposed Project and project alternatives are discussed in the following sections.

#### *4.3.1.1. Fault Rupture*

Evaluation of fault rupture hazard is based on the concepts of recency and recurrence of faulting along existing faults. Faults of known historic activity during the last 200 years, as a class, have a greater probability for future activity than faults classified as Holocene age (last 11,000 years), and a much greater probability of future activity than faults classified as Quaternary age (last 1.6 million years). However, it should be kept in mind that certain faults have recurrent activity measured in tens or hundreds of years whereas other faults may be inactive for thousands of years before being reactivated. The magnitude, sense, and nature of fault rupture also vary for different faults or along different strands of the same fault. Even so, future faulting generally is expected to recur along pre-existing faults (Bonilla, 1970). The development of a new fault or reactivation of a long-inactive fault is relatively uncommon.

Faults in the vicinity of the project have demonstrated Quaternary movement and can be considered at least potentially active (Figures 6A & 6B). The Chupines fault, the Navy fault, and the Seaside Fault have demonstrated Holocene movement and can be considered active. Based on our review of the project plans and geologic maps, these faults cross the proposed CalAm Monterey Pipeline. As such, there is potential for fault rupture within the project area.

The Reliz, Chupines, and Navy faults cross the proposed CalAm Monterey Pipeline. The Ord Terrace fault potentially crosses the CalAm Monterey Pipeline and traces very near the proposed GWR Injection Well Facilities. These faults have shown evidence of displacement within Quaternary time but have not shown displacement within Holocene time. The approximate location of these faults and their geographic relationship to the proposed improvements are shown on Figure 6.

#### *4.3.1.2. Ground Shaking*

Strong ground shaking may occur due to earthquake events along active faults nearby or distant to the study area. Disregarding local variations in ground conditions, the intensity of shaking at different locations within the area can generally be expected to decrease with distance away from an earthquake source. Measurements of peak ground acceleration, in units of g, may be used for quantification of shaking intensity. In general, peak ground accelerations of less than 0.10g are indicative of weak shaking, values between 0.10g and 0.20g are indicative of moderate shaking, and values over 0.20g are indicative of strong shaking. The shaking intensity due to an earthquake felt at any given site depends on the shear wave velocity properties of the soil or rock conditions at that site. The California Geologic Survey Ground Motion Interpolator (CGS, 2008) based on the 2008 Probalistic Seismic Hazard Assessment by the United States Geological Survey (Petersen et al, 2008), indicates that the peak ground acceleration with a 2 percent chance of being exceeded in 50 years ranges between 0.60g and 0.65g over the study area for an assumed shear wave velocity of 270 meters per second, which is representative of a site underlain by stiff soil.

#### *4.3.1.3. Soil Liquefaction and Dynamic Settlement*

Liquefaction is a phenomenon in which soil loses its shear strength for short periods of time during an earthquake. Ground shaking of sufficient duration results in the loss of grain-to-grain contact, due to a rapid increase in pore water pressure, causing the soil to behave as a fluid for short periods of time. The potential damaging effects of liquefaction include differential settlement, loss of ground support for foundations, ground cracking, heaving and cracking of structure slabs due to sand boiling, and buckling of deep foundations due to liquefaction-induced ground settlement. Dynamic settlement may also occur in loose, dry sands above the water table.

In general, a relatively high potential for liquefaction exists in loose, sandy soils that are within 50 feet of the ground surface and are saturated (below the groundwater table). Some locations within the project study area, including the floodplain of the Salinas River, low-lying coastal areas, and alluvial river-bottom areas such as Canyon del Rey (Highway 68) and other drainages within the southwestern portion of the project have a moderate to high liquefaction potential (Figure 7). Separate locations of historical liquefaction incidents have been documented within the project area, the majority of which were located within the northeastern project area (Figure 7). There may be a moderate potential for dynamic settlement of dry, loose sands within the elevated dune sand deposits.

#### *4.3.1.4. Lateral Spreading*

Lateral spreading is horizontal earth movement associated with soil liquefaction. Lateral spreading generally occurs in shallow ground water areas with unsupported embankments including natural creek banks, fill slopes, levees, etc. Areas that have a potential for lateral spreading within the study area are low-lying areas near river channels, sloughs, or other drainages.

#### *4.3.1.5. Tsunami*

Tsunamis are open sea tidal waves generated by earthquakes. Tsunami damage is typically confined to low-lying coastal areas. Project components along the low-lying coastal areas may be impacted by tsunamis. A majority of the coastline along

Monterey Bay is mapped within a tsunami inundation area (Figure 10), which includes some project components. Portions of the proposed CalAm Monterey Pipeline, the area within and around the proposed Lake El Estero, Tembladero Slough, and Blanco Drain source water locations are mapped within a tsunami inundation zone. The alternative source water locations[2] at Navy Lake, Roberts Lake, Laguna Grande Lake, and Bay Avenue are mapped within a tsunami inundation zone (CGS, 2009a,b,c).

##### *4.3.1.6. Earthquake-Induced Landslides*

Landslides initiated by earthquakes have historically been a major cause of earthquake damage. Landslides initiated by the 1971 San Fernando, 1989 Loma Prieta and 1994 Northridge earthquakes were responsible for destroying or damaging numerous homes and other structures, blocking major transportation corridors, and damaging various types of lifeline infrastructure. Seismically induced landsliding includes surficial sliding/rock falls and deep seated landsliding. Relatively shallow surficial sliding may occur throughout the project area where steep slope gradients are present and/or loose soil conditions exist (such as eolian sands, loose topsoil, and fill slopes). The relative potential for earthquake induced landslides within the project study area is presented in Figure 8. The project study area is generally considered to be in an area of low susceptibility to earthquake-induced landsliding (Rosenberg, 2001b).

### 4.4. Surface Soil Erosion

Surface soils tend to erode under the wearing action of flowing water, waves, wind, and gravity. Factors influencing erosion include topography, soil type, precipitation and other environmental conditions. In general, granular soils with relatively low cohesion and soils located on relatively steep topography have relatively high erosion potential. Within the project area, coastal areas north of Lake El Estero and the slopes on the southern side of the Salinas River have a high potential for erosion (Rosenberg, 2001f). The coastal terrace and eolian deposits inland from the coastline with less steep topography are considered to have a moderate potential for erosion. The relatively flat areas within the Salinas River valley have a low potential for erosion.

Coastal erosion in the Southern Monterey Bay is expected to increase with accelerating sea level rise. As the sea level rises over the next century and beyond, some of the project components may be affected during major storm events by wave run-up into dune areas and subsequent undercutting at the dune toe, causing increased erosion. A memorandum prepared by ESA PWA, 2014, shows selected coastal zones at risk of damage during a major storm event, considering sea level rise scenarios through 2060. The memorandum includes a longitudinal profile spanning between Lake El Estero and Monterey Bay, with the approximate location of the proposed CalAm Monterey Pipeline plotted within the envelope of erosion for a 100-year storm considering predicted sea levels in 2040 and 2060. Coastal areas significantly east and west of the above longitudinal profile location are not specifically analyzed in the memorandum, however it is possible that coastal erosion exacerbated by sea level rise may affect nearby project components.

The project may include earthwork for the construction of project improvements, including trenching for pipelines and miscellaneous excavations. Disturbed areas will have a relatively high potential for erosion. Standard construction practices to mitigate erosion include preparation of a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP includes construction best management practice measures such as desilting basins, silt fences, hydroseeding of slopes, and monitoring and clean-up requirements. Erosion control plans prepared and designed by the project civil engineer are recommended. Long term best management practice measures may include vegetating graded slopes, design of appropriate drainage control systems and suitable drainage outlets.

### 4.5. Expansive Soils

Some clay minerals undergo volume changes upon wetting or drying. Unsaturated soils containing those minerals will shrink/swell with the removal/addition of water. The heaving pressures associated with this expansion can damage structures, flatwork, and pipelines. Clayey soils may be encountered throughout the project area in fill, alluvial, and formational materials. The expansion characteristics of clayey soils may vary locally and should thus be evaluated on a site-specific basis. Such an evaluation may include laboratory testing.

### 4.6. Collapse Potential

Collapsible soil is broadly defined as loose and cemented soil with low moisture content that is susceptible to a large and sudden reduction in volume upon wetting, with no increase in vertical stress. The process of soil collapse upon wetting is referred to as hydrocollapse. Another type of collapse can occur in saturated soil bearing soluble minerals when subjected to continuous leaching. Some common soluble soil minerals include calcium chloride, magnesium chloride, sodium chloride, potassium chloride, gypsum, anhydrite, dolomite, and calcium carbonate (Mansour, 2008). The composition of minerals dissolved in leaching water will affect the soil mineral dissolution rate.

The most common types of collapsible soil include alluvial soils, eolian deposits, and residual soils formed by extensive weathering of parent materials such as granitic rock (Mansour, 2008). Within the project area alluvial materials, eolian deposits, and residual soil over granodiorite are present. Settlement may occur where these materials are loose, relatively dry, and subjected to a significant increase in moisture content. A site-specific evaluation of collapse potential and resulting settlement should be performed in these materials where saturation of the soil or a substantial rise in groundwater levels above the historic highs are anticipated.

### 4.7. Flooding

Our review of flood mapping by the Monterey County Resource Management Agency (2010) found that some of the project area is within a 100 year flood zone. A majority of the coastline along Monterey Bay is mapped within a 100 year flood zone (Figure 11), which includes some project components such as portions of the proposed CalAm, Monterey and Transfer pipelines and the Bay Avenue alternative source water location[2]. In the southwestern part of the project area, the areas within and around the proposed Lake El Estero source water location, and alternative source water locations[2] at Navy Lake, Roberts Lake, and Laguna Grande Lake are mapped within the 100 year flood zone. In the central part of the project area, there are sporadic zones within the vicinity of Marina and north of Seaside that are mapped within the 100 year flood zone. In the northeastern part of the project area, a majority of the Salinas River floodplain and Tembladero Slough vicinity is mapped within the 100 year flood zone.

## 5. PROJECT IMPACT ANALYSIS

The following sections discuss the impacts that the existing/anticipated geotechnical, geologic, and seismic conditions might have on the construction and performance of the proposed project. Each project element will be discussed in turn. Detailed design information regarding many of the project components is not yet available.

### 5.1. Proposed GWR Injection Wells and Backflush Facilitiy

It is our understanding that the proposed project includes the construction of an Injection Well Facility, which will include both deep injection wells into the confined Santa Margarita Aquifer and vadose zone wells to recharge the shallower Paso Robles Aquifer, as well as monitoring wells, a backflush basin, pipelines, and operations buildings. The location considered for this site is east of Seaside, along the eastern side of General Jim Moore Boulevard and south of Eucalyptus Road (Figure 2A). Elevations at this proposed site range from approximately 330 to 425 feet above mean sea level (MSL). This location is underlain by eolian deposits that are anticipated to consist of weakly to moderately consolidated, moderately to well-sorted silt and fine- to medium-grained sand. Groundwater is expected to be relatively deep; around 400 feet below the ground surface.

There are potential geologic hazards and considerations associated with the use of this site as an Injection Well Facility. The surface trace of the Ord Terrace Fault is mapped approximately ¼ mile southwest of this site; however the location of this fault within the

Pleistocene eolian deposits is not well-defined. The Ord Terrace fault is considered potentially active but dips steeply toward the southwest away from the site (Rosenberg 2001h),thus minimizing exposure of Injection Well Facilities to fault rupture.

The eolian deposits that underlie the proposed location for the Injection Well Facilities may be susceptible to hydro-collapse that would result in ground subsidence if large quantities of water are injected into the ground above historic high groundwater levels. However, we understand that the proposed vadose zone wells are designed to reach depths of 100 to 200 feet, so wetting of the eolian deposits would occur at 100 feet or deeper, and mounding beneath the vadose zone wells is not expected to be significant. Based on this scenario, we consider the potential for hydrocollapse due to the vadose zone injection wells to be negligible. We also understand that the proposed back-flush basin may cause wetting of the shallow eolian deposits. However, the back-flush basin is only expected to receive pumped water for a few hours per week so settlement due to hydrocollapse is anticipated to be relatively minor and limited to the footprint of the back-flush basin which can accommodate minor settlement. As such, we do not consider the impact of hydrocollapse resulting from use of the back-flush basin to be significant.

## 5.2. Water Collection, Conveyance, Distribution, and Storage Alignments

The existing and proposed project components are illustrated in Figure 2A. The alternative project components are illustrated in Figure 2B. As discussed in Section 4.2.1, the project study area may be divided into three general regions with relatively distinct geologic and topographic characteristics. In the following sections, we will address the potential impacts that the proposed project and alternative components experience in each of the three general areas: northeastern, central, and southwestern.

### 5.2.1. Northeastern Area

The northeastern area contains proposed project components including the Salinas Treatment Facility, the Salinas Pump Station, Tembladero Slough, Reclamation Ditch , and the eastern portion of the Blanco Drain source water diversion site. The Blanco

Drain source water site will require a new pipeline for connection to the RTP in the central project area.

The northeastern area includes low-lying, relatively flat, alluvial plains of the Salinas River valley and the relatively narrow flood plains of the Tembladero Slough. Ground surface elevations in the Salinas River valley area of the project generally range from approximately 10 to 45 feet above MSL. Ground surface elevations near the Tembladero Slough source water site[2] range from approximately 4 to 10 feet above MSL. The northeastern area is generally developed with agricultural fields, industrial facilities, and some mixed residential/commercial development in Salinas and Castroville.

The low-lying floodplain areas are underlain by Holocene alluvial deposits. These deposits include unconsolidated interbedded silts, clays, sands, and gravels. Groundwater is anticipated to be approximately 10 feet deep or less in low-lying areas. Drainage conditions are relatively poor and the subsurface is anticipated to consist of moist to saturated soils. Trench excavations may encounter groundwater, moist to wet soils, and soft ground conditions. Trench dewatering may be required. Moist to wet soil conditions along lower elevations may require drying/mixing prior to trench backfill compaction. Soft ground may require overexcavation and stabilization with crushed rock/filter fabric to provide suitable pipe bedding support. The liquefaction susceptibility in low-lying flood plain areas is moderate to high. Clayey soils are potentially corrosive and/or expansive.

#### 5.2.2. Central Area

The central portion of the study area includes the proposed GWR product water conveyance alignments, the eastern portion of the proposed CalAm Monterey and Transfer pipelines, the proposed GWR Injection Well Facility, and the western portion of the Blanco Drain source water diversion site. The Blanco Drain source water will require a new pipeline for connection to the RTP. The central area also contains several site locations considered as alternative project components[2] for supplemental source water.

including the Bay Avenue alternative outfall site and the Del Monte Boulevard Dry Weather Diversion site.

This central area includes gently to moderately rolling dunes with elevations ranging from approximately 10 feet above MSL near the Salinas River to approximately 350 feet above MSL along southernmost portion of the proposed GWR product water conveyance alignment. The project components in this area traverse agricultural fields, undeveloped areas, and residential, commercial, and military developments.

Trenching for pipelines in the central area will generally encounter eolian deposits and fill materials. The eolian deposits are anticipated to consist of weakly to moderately consolidated, moderately to well-sorted silt and fine- to medium-grained sand. Fill materials are generally anticipated to consist of compacted silts and sands generated locally from the natural eolian deposits. Fill materials may also include imported soils and miscellaneous debris (particularly in older developed areas and along the former Fort Ord military base). We generally anticipate well-drained conditions and relatively deep groundwater, although shallow groundwater may be present along low-lying coastal areas. Trenching conditions can vary depending on presence/absence of cementation and/or groundwater. Excavations in eolian deposits may encounter flowing sands and caving. Temporary construction slopes may range up to 1.5:1 or 3:1 (horizontal:vertical) inclinations. Continuous shoring may be appropriate to protect existing improvements, where temporary slopes are not feasible. Flowing sand conditions may warrant special excavation and shoring procedures to protect adjacent improvements and existing utilities, such as trench shields placed during excavation and limited open trench conditions. Sandy materials should be suitable for trench zone and trench backfill. The susceptibility to liquefaction is considered low, except in low-lying coastal areas. Dynamic settlement of loose dry sands may be a potential hazard to pipelines. Sands are anticipated to have low corrosivity potential and moderate to high potential for erosion. The Reliz fault has been projected across the proposed pipeline alignments near Marina. Similarly, the Chupines, Seaside and Ord Terrace faults have been traced across the proposed alignments near Seaside and Del Rey Oaks. As such there is potential that rupture along these faults may impact the pipelines at these locations.

### 5.2.3. Southwestern Area

The southwestern portion of the study area includes the western portion of the proposed CalAm Monterey and Transfer pipelines and the Lake El Estero source water site.

The southwestern area also contains several site locations considered as alternative project components[2] for supplemental source water, including the Laguna Grande Lake alternative source water diversion site, the Roberts Lake alternative source water diversion site, the Navy Lake alternative source water diversion site, and the ASBS Wet Weather Diversion area.

The topography in the southwestern area is variable and includes the relatively low-lying coastal area between Canyon del Rey and Lake El Estero, gently sloping terraces beginning several blocks west of Lake El Estero and inland, and undulating coastal bluffs on portions of the coastline. Elevations range from approximately 10 feet above MSL between Canyon Del Rey and Lake El Estero to approximately 220 feet above MSL at the western terminus of the proposed CalAm Monterey Pipeline. The project components span park areas, commercial developments, and residential developments.

Variable geologic conditions are present within the southwestern area, including fill materials, Holocene-age alluvial materials, Pleistocene-age coastal terraces, Tertiary-age Monterey Formation, and Cretaceous-age Porphyritic granodiorite of Monterey. It is anticipated that the fill materials are generally derived from local natural soils and will be similar to the natural soils. Fill materials may also include imported materials, construction debris, or other waste products. Alluvium along canyon bottoms and drainages is anticipated to include moist to wet, loose/soft clays, silts, and sands. Shallow groundwater may be encountered along lower canyon and drainage areas. Flat and sloped areas throughout the southwestern portion of the study area contain coastal terrace deposits anticipated to be comprised of semi-consolidated, moderately well-sorted marine sand containing thin, discontinuous gravel-rich layers. The southwestern edge of Lake El Estero is mapped as being underlain by the Monterey Formation. The western portion of the proposed CalAm Monterey Pipeline is anticipated to encounter granodiorite in several locations.

Trench excavations in the low-lying alluvial areas may encounter some soft, wet, alluvium with a potential for caving and unstable trench bottoms. Dewatering may be required. Moist to wet soil conditions along lower elevations may require drying/mixing prior to trench backfill compaction. Soft ground may require overexcavation and stabilization with crushed rock/filter fabric to provide suitable pipe bedding support. Low-lying alluvial areas may be considered to have a relatively high susceptibility to liquefaction and dynamic settlement. Trenches excavated in coastal terrace deposits may experience variable stability due to potential zones where debris flow deposits locally overlie the terrace deposits. Monterey Formation and granodiorite materials are anticipated to be relatively stable in trench excavations. Difficult excavating may be encountered in granodiorite and strongly cemented layers of the Monterey Formation. Specialized excavation equipment, such as ripper teeth or chipper attachments may be appropriate for trenching in these deposits. The materials generated from trench excavations in the southern area will vary and are not anticipated to be suitable for use as pipe zone material. Imported sand should be used for backfill around pipes. The majority of excavated material should be suitable for trench backfill, but oversize rock fragments from hard rock areas may be unsuitable.

The proposed CalAm Monterey Pipeline in the City of Monterey crosses a mapped trace of the Navy fault. Additionally, project components underlain by fill or alluvium may have high liquefaction susceptibility. Soil erosion hazards within this area range from low to high. Subsequent geotechnical evaluations within these areas of the project should further evaluate potential liquefaction and fault rupture hazards.

## 6. PRELIMINARY CONCLUSIONS AND RECOMMENDATIONS

The purpose of our preliminary geotechnical services has been to evaluate the soil and geologic conditions within the project area and to develop preliminary data regarding geologic and seismic hazards and geotechnical constraints that may impact the project. To accomplish this we have reviewed geologic and seismic background data of the current Proposed Project and alternative project components. Detailed design information regarding most of the project components is not available yet. Based on the results of our preliminary evaluation, it is our opinion that the project is feasible from a geotechnical perspective, provided appropriate design, engineering and construction considerations are incorporated into the project. This report has been prepared for use in the preliminary planning of the project. Prior to design of facilities geotechnical evaluations should be performed to prepare appropriate geotechnical design criteria for pipeline alignments and sites, as required by the appropriate city, county, and state building codes and ordinances. A summary of our preliminary findings and recommendations is presented below.

- Variable geologic conditions are present within the project area. The project area may be divided into three general geologic regimes; northeastern, central, and southwestern. The northeastern area is comprised predominantly of the alluvial floodplain of the Salinas River. The central area is characterized by elevated rolling hills of wind blown eolian deposits. The geology of the southwestern area is variable and includes the flat coastline west of Canyon del Rey and elevated terrain of the Monterey Peninsula.

- Pipeline construction will vary along the alignments from north to south as the geologic conditions change. The northeastern low-lying areas are anticipated to encounter areas of shallow groundwater and soft soil conditions. The central areas are anticipated to encounter friable dune sands that may cave continuously in some areas. The southwestern areas will vary and may include soft wet soil conditions in canyon areas to difficult excavation in granodiorite.

- The project is located in an area of relatively high seismicity. Some active and potentially active faults do cross the project area. The preferred measure to minimize fault rupture hazards is to locate planned structures away from known fault traces. It may not be feasible or practical, however, to locate planned pipelines away from fault traces. Where pipelines cross known fault traces other measures may be considered depending on the potential risk and damage associated with fault rupture, the relative activity of faulting, and the soil conditions. Potential measures that may be considered include: 1) installation of isolation valves on either side of a pipeline fault crossing to reduce water loss in case of rupture, 2) oversize trench excavation and backfill with select compressible materials, or 3) open channel construction and/or flexible couplings. If damage were to occur to any of the pipelines due to fault rupture, it would amount to a pipe break. A broken pipeline could result in soil washout and sinkholes that could damage nearby non-project facilities or the environment. Locating and repairing damaged pipelines and pumps could require a temporary cessation of operations for a significant period of time.

- There is a strong potential for strong ground shaking, seismically induced soil liquefaction, and dynamic settlement at some locations within the project area. Soil liquefaction may impact some structure sites and pipeline alignments. Geotechnical evaluation of liquefaction potential and dynamic settlement, including subsurface exploration, should be performed during the design phase as required by the appropriate city, county, and state building codes and ordinances. Appropriate measures to protect structures and other improvements including foundation design, excavation, and compaction requirements may be developed based on the site specific geotechnical conditions.

- The project may be impacted by corrosion of ferrous metals or sulfate attack on concrete due to corrosive/deleterious soils. The corrosivity depends on the material type and the proximity to saltwater. In general, clay deposits in the alluvium of the Salinas River Valley, southwestern alluvial areas, or coastal marine areas may constitute a corrosive or deleterious environment. Geotechnical evaluation of corrosive soils, including subsurface exploration, should be performed during the design phase as required by the appropriate city, county, and state building codes and ordinances. Appropriate measures to protect structures and other improvements including selection of construction materials may be developed based on the site specific geotechnical conditions.

- The project may be impacted by expansive soils in locations containing clays including the Salinas River Valley, southwestern alluvial areas, and potential locations containing clayey fills. The expansion characteristics of clayey soils may vary locally and should thus be considered during detailed project design on a site-specific basis. Geotechnical evaluation of expansive soils, including subsurface exploration, should be performed during the design phase as required by the appropriate city, county, and state building codes and ordinances. Appropriate measures to protect structures and other improvements including common grading practices such as soil lime treatment, overexcavation, and compaction requirements may be developed based on the site specific geotechnical conditions.

- Some of the low-lying project components are mapped in a 100-year flood zone (See Section 4.7). Some of the project components in low-lying coastal areas are mapped in a tsunami inundation area (See Section 4.3.1.5). Design of such project components should take these hazards into consideration. Damage to, temporary inundation of, or temporary exposure of the proposed new water supply infrastructure due to flooding or tsunami is not expected to result in a significant risk of loss of life or property.

## 7. FUTURE WORK

Detailed site-specific geotechnical engineering studies including subsurface exploration and laboratory testing should be performed during future design phases of the project, as required by the appropriate city, county, and state building codes and ordinances to identify engineering and geotechnical design criteria related to liquefaction potential, fault surface rupture, or other geotechnical constraints at the specific sites so that appropriate geotechnical design and construction recommendations can be prepared. Subsurface exploration may also be considered to provide additional data for selection of alternative sites. The recommendations developed as part of the final geotechnical study would provide the engineering and construction design details related to seismic design considerations, foundation design, excavation characteristics, and backfill requirements. Design measures may include foundation parameters, removal of problematic soils, compaction requirements, pipe bedding requirements, and special trench backfill requirements that represent standard engineering practices typically utilized for infrastructure and pipeline projects.

## 8. LIMITATIONS

The desktop evaluation and geotechnical analyses presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. Conditions not described in this report may be encountered during subsurface exploration and construction. Uncertainties relative to subsurface conditions can be reduced through subsurface exploration. Please also note that our evaluation was limited to assessment of the geotechnical aspects of the project, and did not include evaluation of structural issues, environmental concerns, or the presence of hazardous materials.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

This report is intended for preliminary planning purposes only. A detailed geotechnical evaluation, including subsurface exploration should be performed prior to detailed design and construction.

Our conclusions, recommendations, and opinions are based on a review of preliminary conceptual plans and geologic and seismic literature. If geotechnical conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if warranted, will be provided upon request. It should be understood that the conditions of a site could change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

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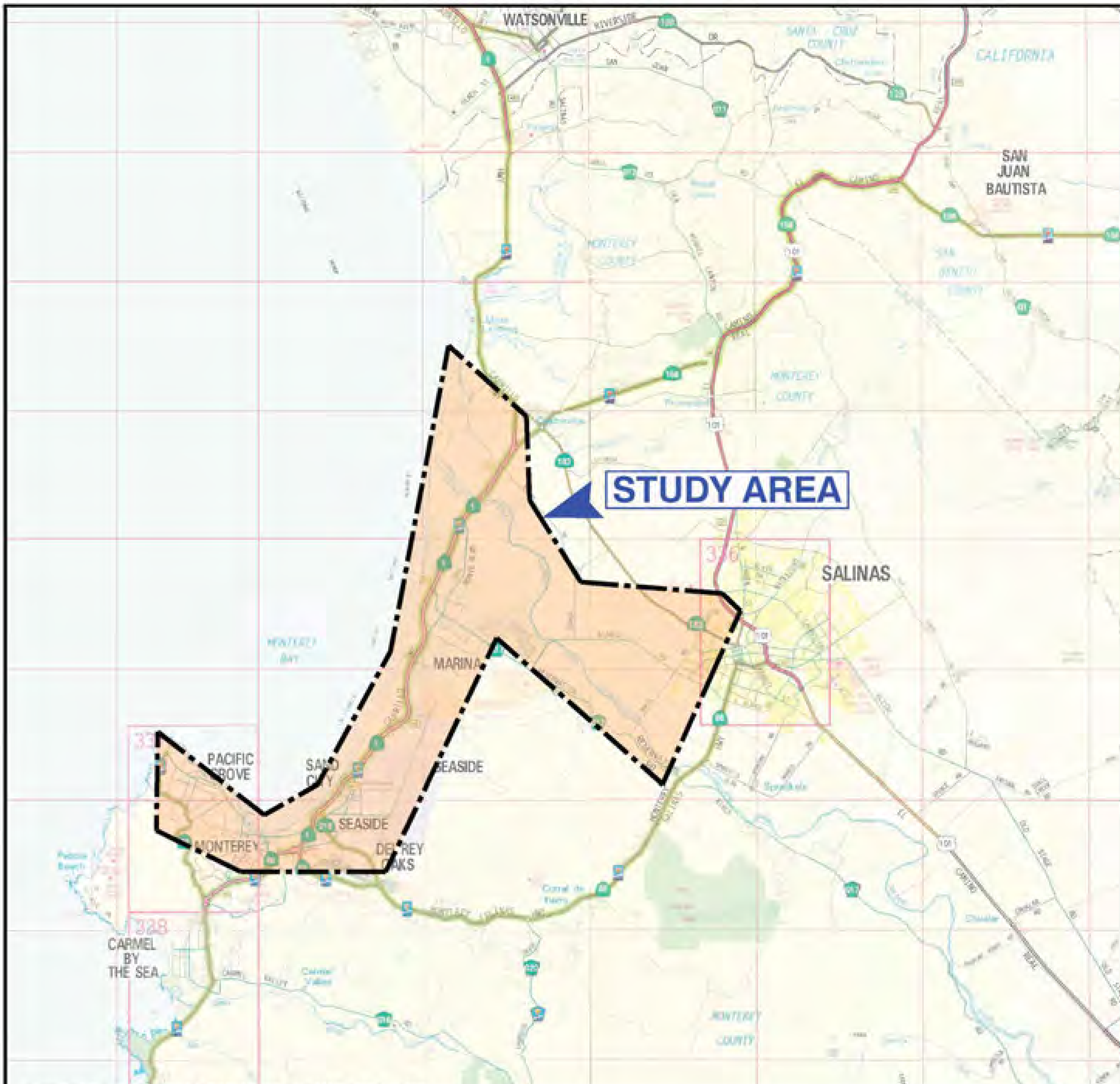


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SCALE IN MILES

0 4 8

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

| Ninyo & Moore | | STUDY AREA LOCATION | FIGURE |
|---|---|---|---|
| PROJECT NO. | DATE | GROUNDWATER REPLENISHMENT PROJECT EIR<br>MONTEREY COUNTY, CALIFORNIA | 1 |
| 402251001 | 3/15 | | |

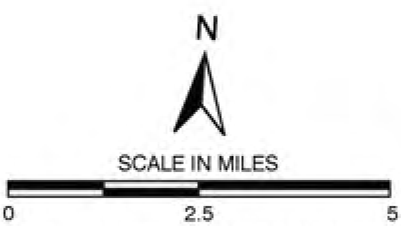

REFERENCE: GOOGLE EARTH IMAGERY, 2013.


NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

**LEGEND**
- EXISTING WASTEWATER PIPELINE
- EXISTING OCEAN OUTFALL
- GWR PRODUCT WATER CONVEYANCE
- CALIFORNIA AMERICAN WATER DISTRIBUTION SYSTEM
- GWR INJECTION WELLS AND BACKFLUSH FACILITY
- GWR TREATMENT FACILITIES
- GWR SOURCE WATER DIVERSION AND STORAGE SITES

| Ninyo & Moore | | PROJECT COMPONENTS | FIGURE |
|---|---|---|---|
| PROJECT NO. | DATE | GROUNDWATER REPLENISHMENT PROJECT EIR<br>MONTEREY COUNTY, CALIFORNIA | 2A |
| 402251001 | 3/15 | | |


REFERENCE: GOOGLE EARTH IMAGERY, 2013.




NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

**LEGEND**

- EXISTING WASTEWATER PIPELINE
- EXISTING OCEAN OUTFALL
- GWR PRODUCT WATER CONVEYANCE
- CALIFORNIA AMERICAN WATER DISTRIBUTION SYSTEM
- GWR INJECTION WELLS AND BACKFLUSH FACILITY
- GWR TREATMENT FACILITIES
- GWR SOURCE WATER DIVERSION AND STORAGE SITES
- ALTERNATIVE PROJECT COMPONENT LOCATION

| Ninyo & Moore | | PROJECT COMPONENTS | FIGURE |
|---|---|---|---|
| PROJECT NO. | DATE | GROUNDWATER REPLENISHMENT PROJECT EIR<br>MONTEREY COUNTY, CALIFORNIA | 2B |
| 402251001 | 3/15 | | |


SOURCE: Fault Activity Map of California, 2010, Jennings, C.W., and Bryant, W.A., California Geological Survey

APPROXIMATE SCALE

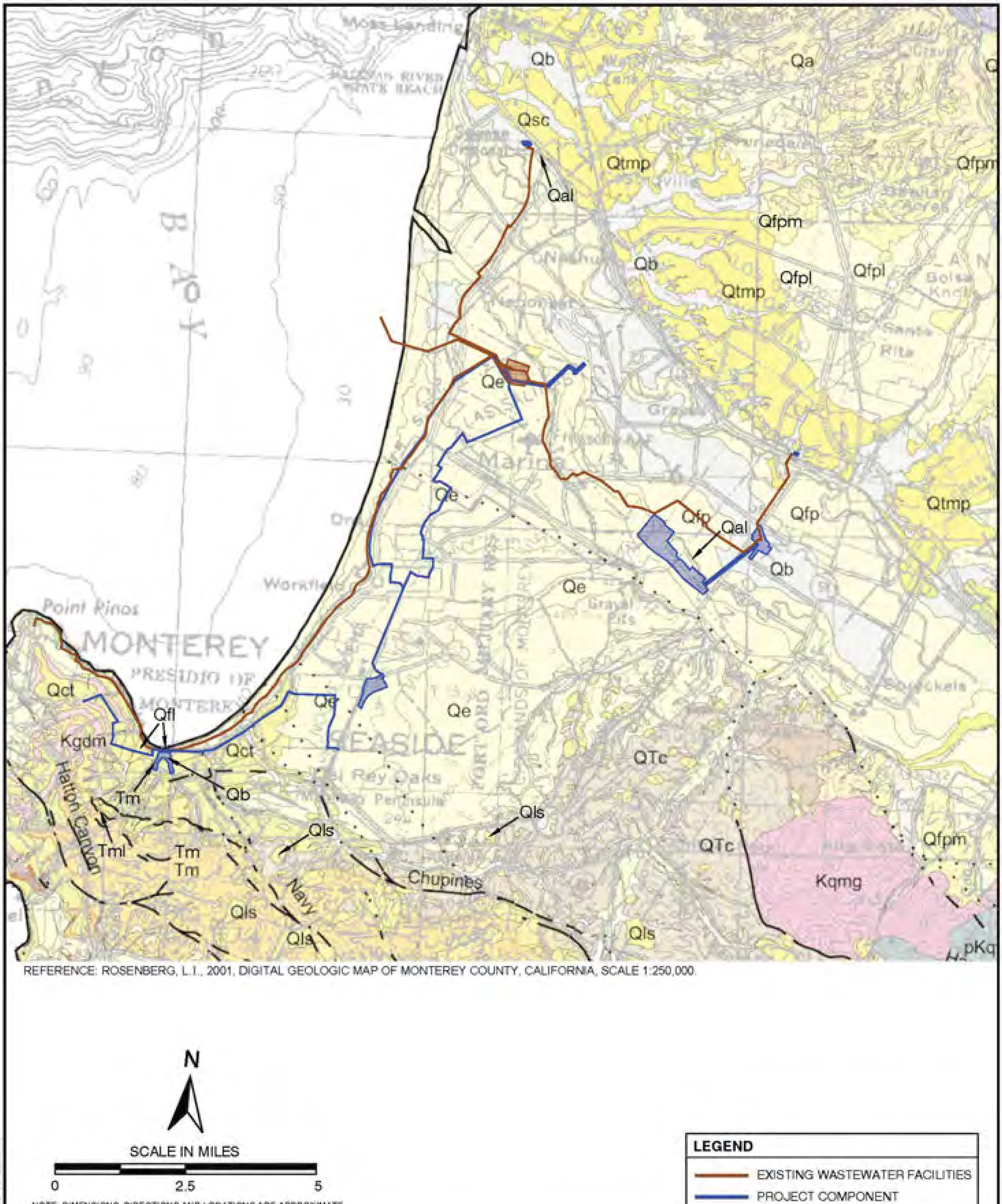
0 20 40 MILES

**LEGEND**

CALIFORNIA FAULT ACTIVITY
- HISTORICALLY ACTIVE
- HOLOCENE ACTIVE
- STATE/COUNTY BOUNDARY
- QUATERNARY (POTENTIALLY ACTIVE)
- LATE QUATERNARY (POTENTIALLY ACTIVE)

NOTES: ALL DIRECTIONS, DIMENSIONS AND LOCATIONS ARE APPROXIMATE

| Ninyo & Moore | | REGIONAL FAULT LOCATIONS | FIGURE |
|---|---|---|---|
| PROJECT NO. | DATE | GROUNDWATER REPLENISHMENT PROJECT EIR<br>MONTEREY COUNTY, CALIFORNIA | 3 |
| 402251001 | 3/15 | | |




REFERENCE: ROSENBERG, L.I., 2001, DIGITAL GEOLOGIC MAP OF MONTEREY COUNTY, CALIFORNIA, SCALE 1:250,000.

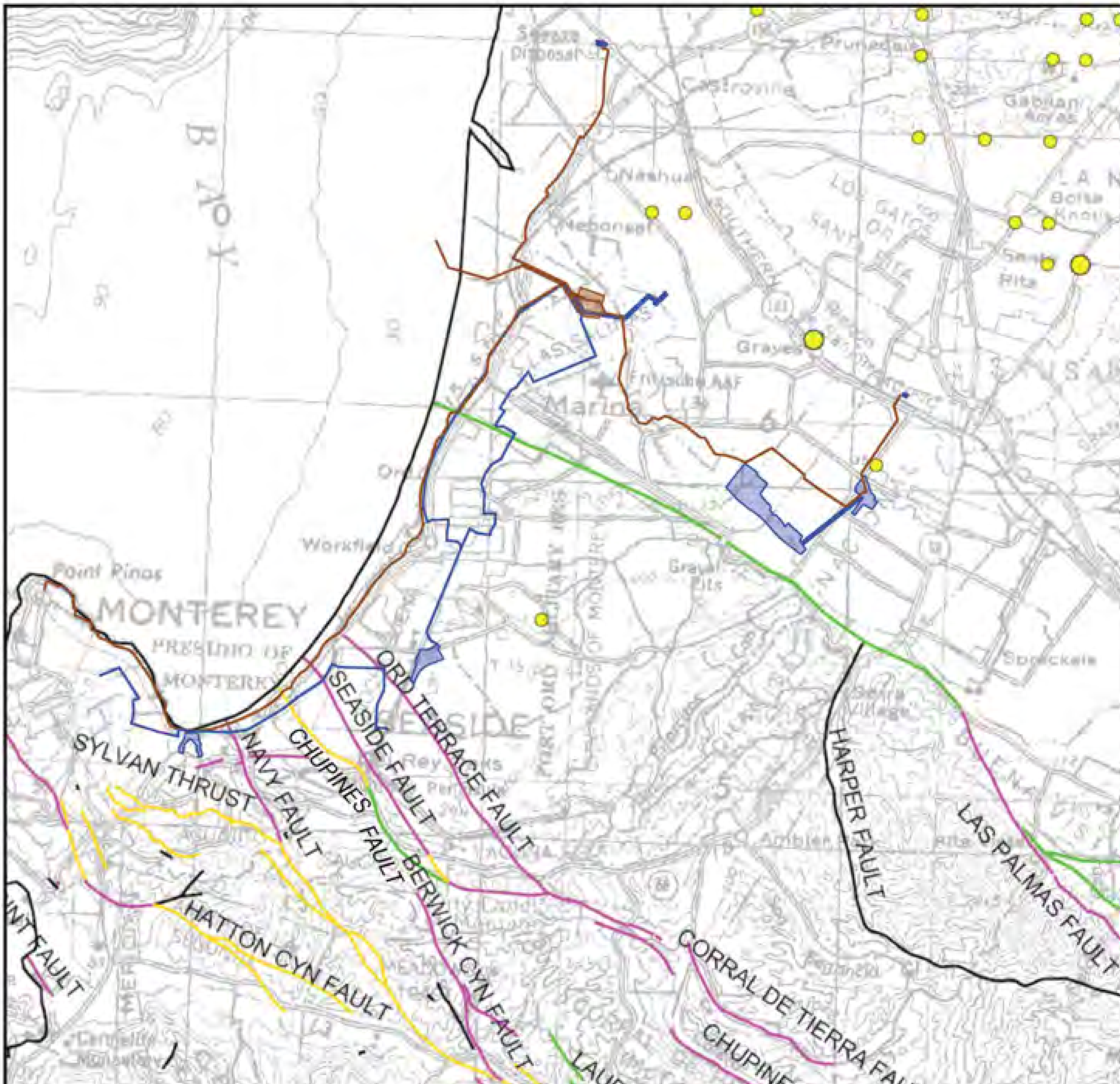
NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

| Ninyo & Moore | | REGIONAL GEOLOGY | FIGURE |
|---|---|---|---|
| PROJECT NO. | DATE | GROUNDWATER REPLENISHMENT PROJECT EIR<br>MONTEREY COUNTY, CALIFORNIA | 4 |
| 402251001 | 3/15 | | |

| | |
|---|---|
| Qaf | **Artificial fill (Historic)**—Deposits of fill resulting from human construction or mining activities ranging from well-compacted sand and silt to poorly compacted sediment high in organic content, only locally delineated |
| Qbs | **Beach sand (Holocene)**—Unconsolidated, well-sorted, medium- to coarse-grained sand; local layers of pebbles and cobbles |
| Qb | **Basin deposits (Holocene)**—Unconsolidated, plastic clay and silty clay containing much organic material; locally contains interbedded thin layers of silt and silty sand |
| Qal | **Alluvial deposits, undifferentiated (Holocene)**—Unconsolidated, heterogeneous, moderately sorted silt and sand with discontinuous lenses of clay and silty clay |
| Qhf | **Alluvial fan deposits, undifferentiated (Holocene)**—Unconsolidated, moderately to poorly sorted sand, silt, and gravel, with layers of silty clay |
| Qfp | **Flood-plain deposits, undifferentiated (Holocene)**—Unconsolidated, relatively fine-grained, heterogeneous deposits of sand and silt; commonly includes relatively thin, discontinuous layers of clay |
| Qsc | **Stream channel deposits, undifferentiated (Holocene)**—Modern stream channels and channel deposits of the Salinas River and principal tributaries. Loose, moderately- to well-sorted gravel, coarse- to fine-grained sand and silt |
| Qls | **Landslide deposits (Quaternary)**—Heterogeneous mixture of deposits ranging from large block slides of indurated bedrock to debris flows in semiconsolidated sand and clay |
| Qe | **Eolian deposits, undifferentiated (Pleistocene)**—Weakly to moderately consolidated, moderately to well-sorted silt and fine-to medium-grained sand deposited in extensive coastal dune field |
| Qfpl | **Alluvial fans (late Pleistocene)**—Weakly consolidated, moderately to poorly sorted sand, silt, and gravel |
| Qfpm | **Alluvial fans (middle Pleistocene)**—Moderately consolidated, deeply weathered, moderately to poorly sorted sand, silt, and gravel, capped with moderately well drained, maximally developed soils |
| Qtlp | **Fluvial terrace deposits (late Pleistocene)**—Semi-consolidated, moderately to poorly sorted silt, sand, silty clay, and gravel |
| Qtmp | **Fluvial terrace deposits (middle Pleistocene)**—Semi-consolidated, moderately well to poorly sorted sand, silt, and clay with interbedded gravel |
| Qct | **Coastal terraces, undifferentiated (Pleistocene)**—Semiconsolidated, moderately well-sorted marine sand containing thin, discontinuous gravel-rich layers. Locally includes some terrace surfaces and debris flow deposits resting on terrace surfaces |
| QTc | **Continental deposits, undifferentiated (Pleistocene-Pliocene?)**—Semiconsolidated, relatively fine-grained, oxidized sand and silt. Probably equivalent to Paso Robles Formation |
| Tm | **Monterey Formation, siliceous mudstone (Miocene)**—Light brown to white, hard, brittle, platy; Mohnian Stage. Mapped as McLure Shale Member northeast of San Andreas fault |
| Tml | **Monterey Formation, semi-siliceous mudstone (middle Miocene)**—Semi-siliceous mudstone and siltstone (Sandholdt Shale Member of Durham, 1968, 1974) |
| Kgdm | **Porphyritic granodiorite of Monterey (Ross, 1976) (Cretaceous)** |
| ———— | **Contact**—Accuracy ranges from well-located to approximately located. Most sedimentary units are well-located and most igneous and metamorphic units are approximately located at main mapping scale of 1:62,500 |
| ——— — —?—·····?·· | **Fault**—Solid where accurately located; dashed where approximately located; dotted where concealed; queried where location or existence uncertain. Includes strike-slip, normal and reverse dip-slip, oblique-slip, and thrust faults |

REFERENCE: ROSENBERG, L.I., 2001, EXPLANATION FOR DIGITAL GEOLOGIC MAP OF MONTEREY COUNTY.

| Ninyo & Moore | | EXPLANATION OF REGIONAL GEOLOGY | FIGURE |
|---|---|---|---|
| PROJECT NO. | DATE | GROUNDWATER REPLENISHMENT PROJECT EIR<br>MONTEREY COUNTY, CALIFORNIA | 5 |
| 402251001 | 3/15 | | |




REFERENCE: ROSENBERG, L.I., 2001, DIGITAL MAP SHOWING RELATIVE FAULT HAZARDS OF MONTEREY COUNTY, CALIFORNIA, SCALE 1:250,000.

N

SCALE IN MILES

0 2.5 5

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

**LEGEND**

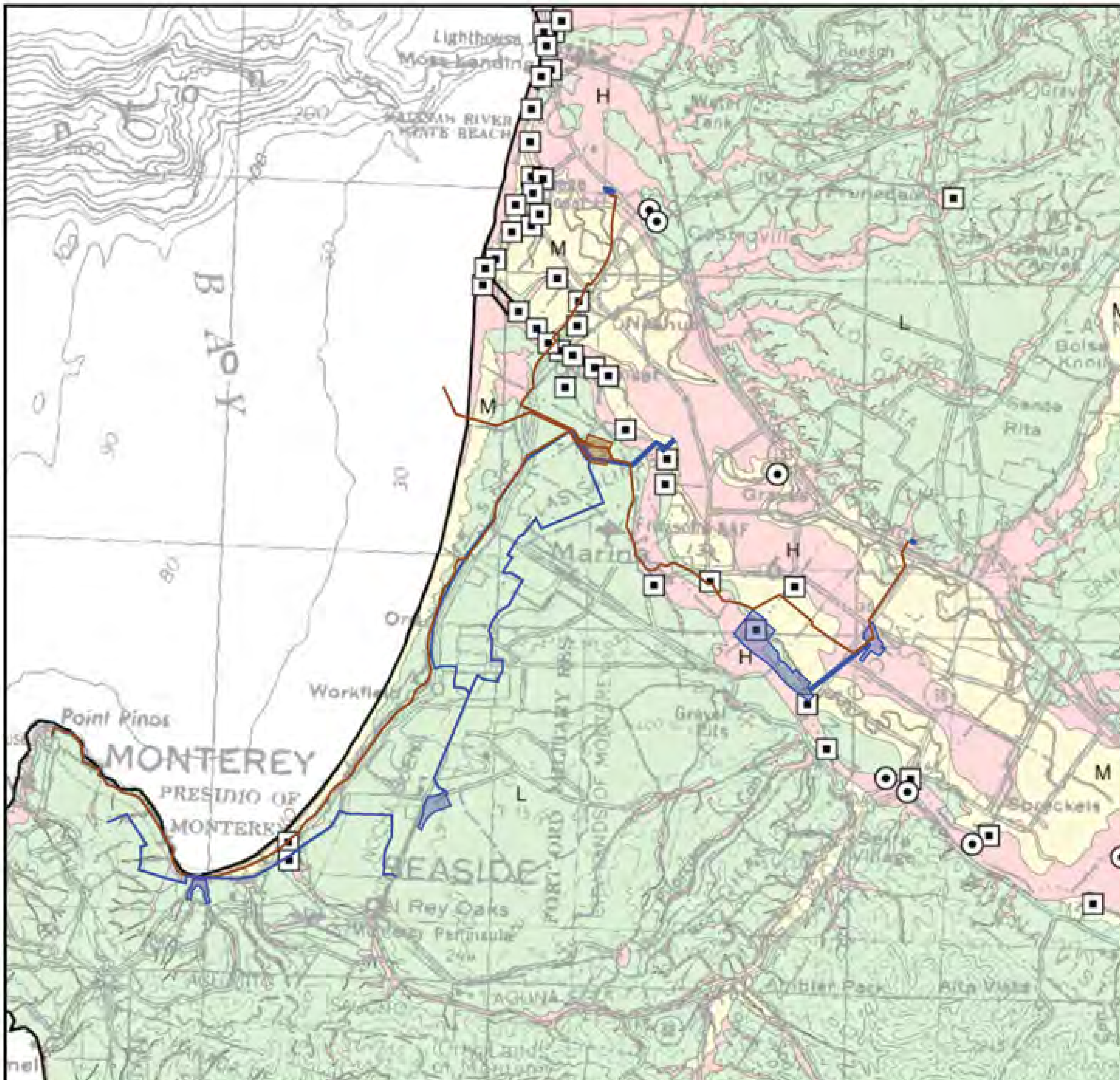
- EXISTING WASTEWATER FACILITIES
- PROJECT COMPONENT
- **Historic (younger than 200 years before present)**—Displacement during historic time (1906 San Andreas fault earthquake).
- **Holocene (younger than 11,000 years before present)**—Fault offsets Holocene deposits as dated by radiocarbon methods; delineated by well-developed geomorphic features such as deflected stream channels, linear drainages, saddles, notches, and troughs; aligned with historic seismicity recorded by the UCB/USGS Northern California Earthquake Data Center.
- **Late Quaternary (750,000 to 11,000 years before present)**—Fault cuts middle Pleistocene or younger deposits. Marine terrace age estimates based on correlations by McKittrick (1988) and Dupré (1990). Alluvial fan age estimates based on correlations by Tinsley (1975), Dupré and Tinsley (1980), and Klaus (1999).
- **Undivided Quaternary (younger than 1,600,000 years before present)**—Offset of Quaternary deposits not otherwise determined to be younger than middle Pleistocene.
- **Pre-Quaternary (older than 1,600,000 years before present)**—Faults without recognized Quaternary displacement or showing evidence of no displacement during Quaternary time. Not necessarily inactive.
- Earthquake epicenter (magnitude 3.0-3.9)
- Earthquake epicenter (magnitude 4.0-4.9)
- Earthquake epicenter (magnitude 5.0-5.9)
- Earthquake epicenter (magnitude 6.0-6.9)

Ninyo & Moore

# PROJECT FAULT LOCATIONS

GROUNDWATER REPLENISHMENT PROJECT EIR
MONTEREY COUNTY, CALIFORNIA

| PROJECT NO. | DATE | FIGURE |
| --- | --- | --- |
| 402251001 | 3/15 | 6 |




REFERENCE: ROSENBERG, L.I., 2001, DIGITAL MAP SHOWING RELATIVE LIQUEFACTION SUSCEPTIBILITY OF MONTEREY COUNTY, CALIFORNIA, SCALE 1:250,000.

N

SCALE IN MILES

0 2.5 5

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

**LEGEND**

EXISTING WASTEWATER FACILITIES — PROJECT COMPONENT

H — **High liquefaction susceptibility**— Engineering tests and shallow ground water, the local presence of free faces, or historical evidence of liquefaction-induced ground failure in the 1906 San Francisco or 1989 Loma Prieta earthquakes. Mainly latest Holocene (0-500 years before present) younger flood-plain deposits and most Holocene basin deposits, undivided alluvial deposits, and abandoned channel-fill deposits. Sediments are likely to liquefy in a nearby major earthquake

M — **Moderate liquefaction susceptibility**—Historical evidence of liquefaction-induced ground failure absent, although high susceptibilities calculated in engineering tests. Includes late Holocene (500-5,000 years before present) older flood-plain deposits, colluvium, and some late Pleistocene-Holocene eolian deposits. May liquefy in a nearby major earthquake

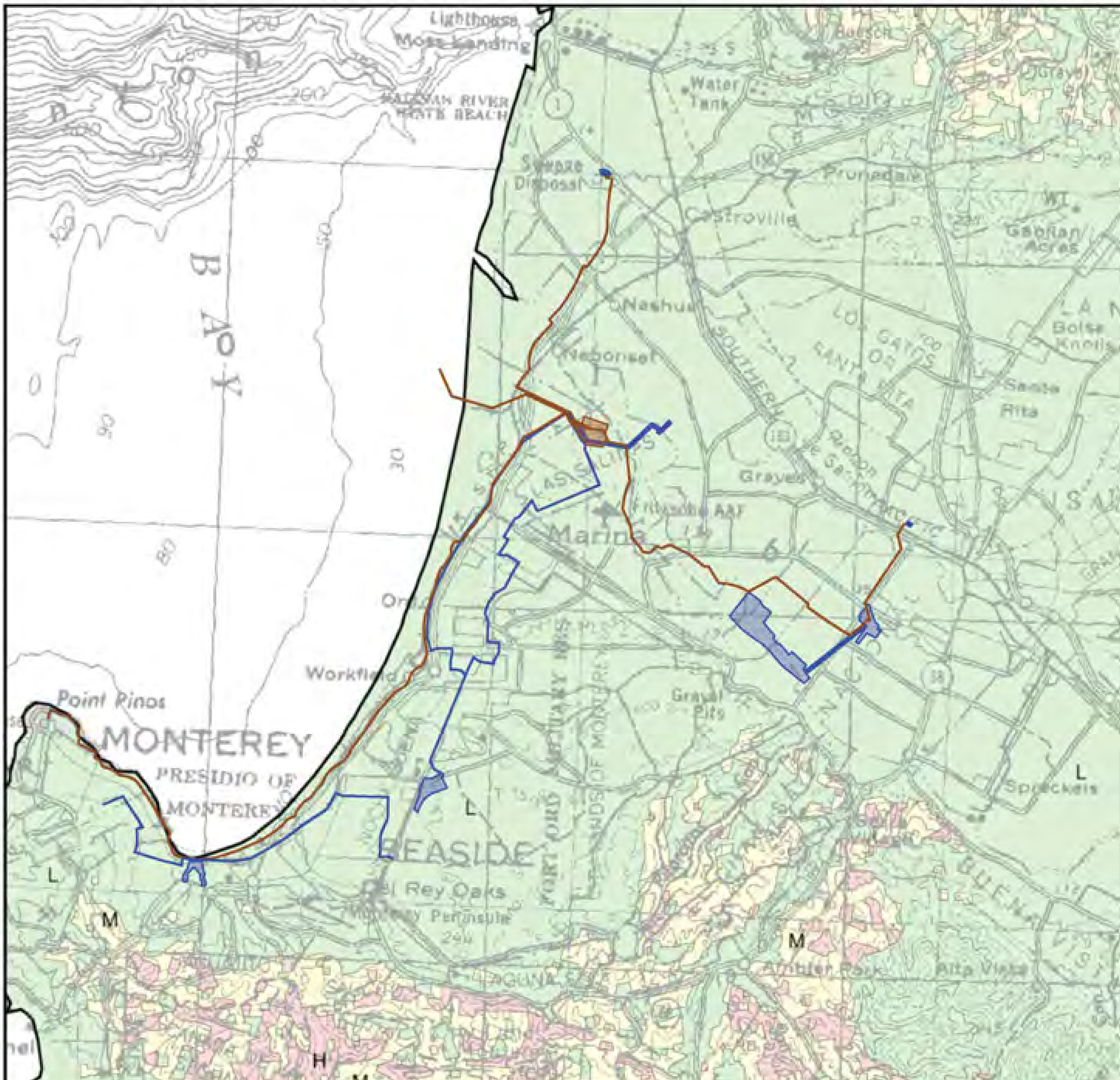
L — **Low liquefaction susceptibility**—Includes almost all Pleistocene deposits and pre-Quaternary deposits, and Holocene deposits where the historical high ground water table is at least 30 feet below the ground surface (e.g., most alluvial fan deposits). Unlike to liquefy, even in a nearby major earthquake

V — **Variable liquefaction susceptibility**—Areas of mapped artificial fill. Depending on the type of material and method of placement, the susceptibility may range from high to low

**Historical liquefaction present in 1906 San Francisco or 1989 Loma Prieta earthquakes**

**Historical liquefaction absent in 1906 San Francisco or 1989 Loma Prieta earthquakes**

| Ninyo & Moore | | LIQUEFACTION HAZARDS | FIGURE |
|---|---|---|---|
| PROJECT NO. | DATE | GROUNDWATER REPLENISHMENT PROJECT EIR<br>MONTEREY COUNTY, CALIFORNIA | 7 |
| 402251001 | 3/15 | | |




REFERENCE: ROSENBERG, L.I., 2001, DIGITAL MAP SHOWING RELATIVE EARTHQUAKE-INDUCED LANDSLIDE SUSCEPTIBILITY OF MONTEREY COUNTY, CALIFORNIA, SCALE 1:250,000.

N

SCALE IN MILES

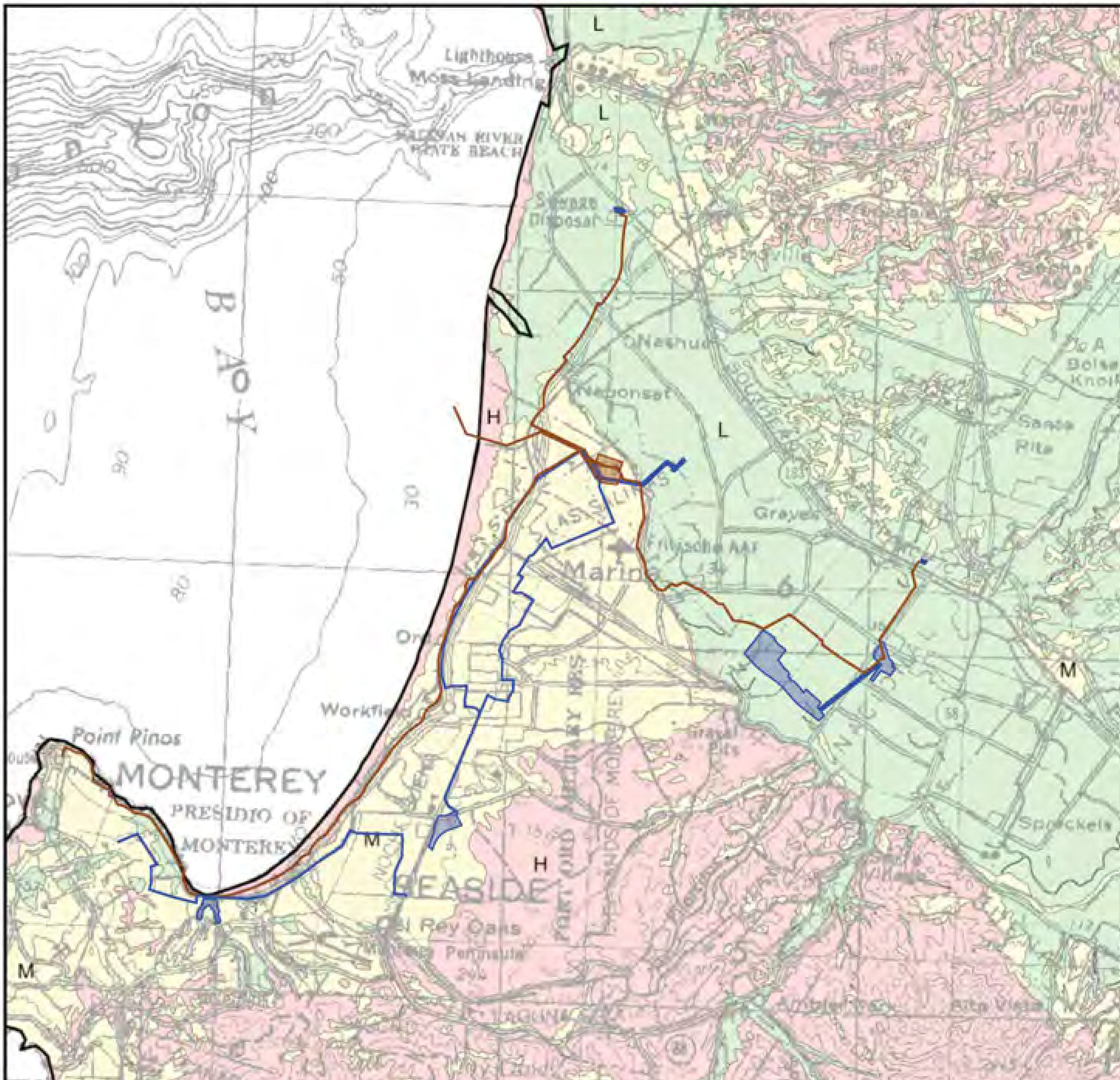
0 2.5 5

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

**LEGEND**

- EXISTING WASTEWATER FACILITIES
- PROJECT COMPONENT
- H Area of high susceptibility to earthquake-induced landsliding
- M Area of moderate susceptibility to earthquake-induced landsliding
- L Area of low susceptibility to earthquake-induced landsliding

| Ninyo & Moore | | LANDSLIDE SEISMIC HAZARDS | FIGURE |
|---|---|---|---|
| PROJECT NO. | DATE | GROUNDWATER REPLENISHMENT PROJECT EIR<br>MONTEREY COUNTY, CALIFORNIA | 8 |
| 402251001 | 3/15 | | |



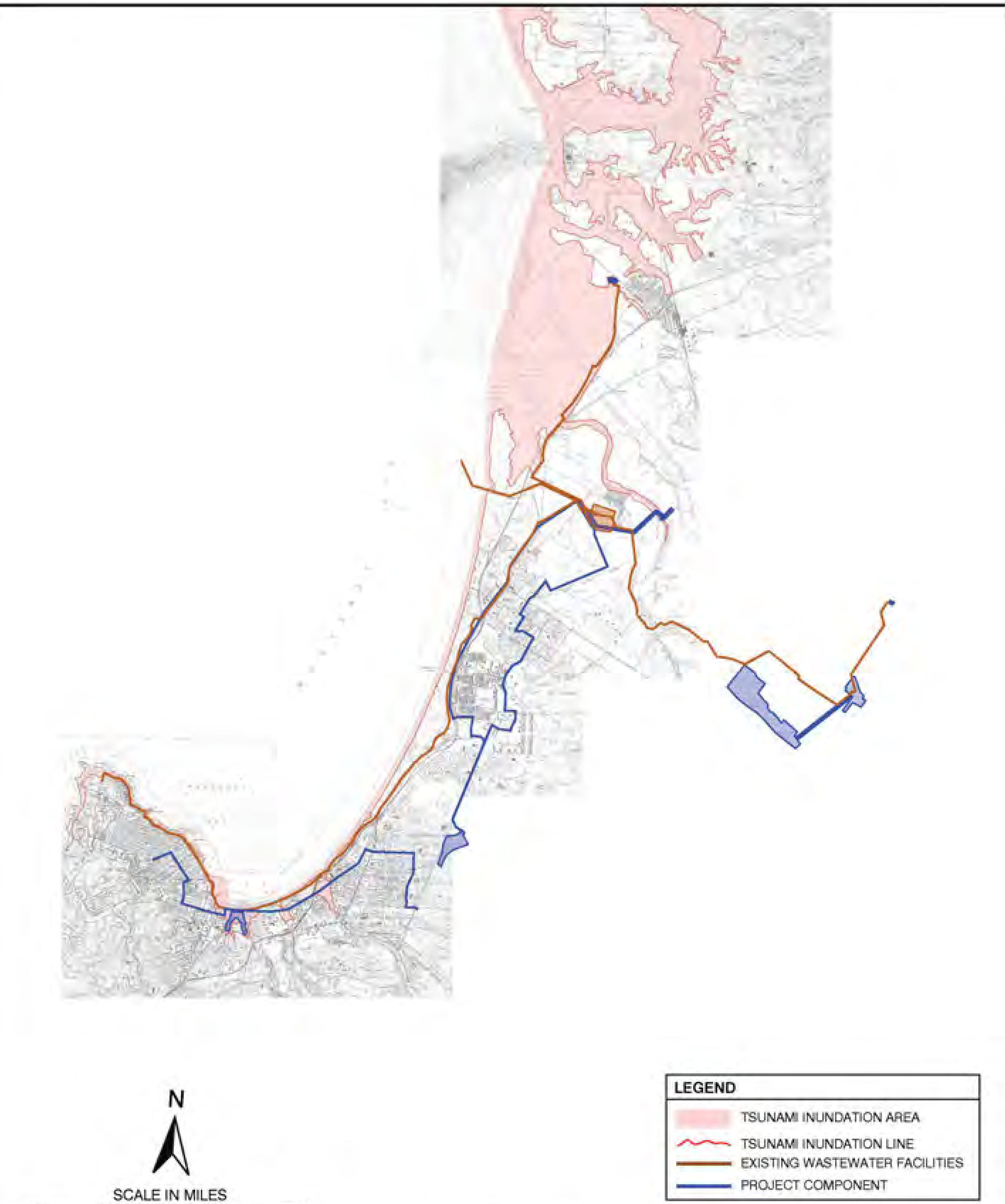

REFERENCE: ROSENBERG, L.I., 2001, DIGITAL MAP SHOWING RELATIVE SOIL EROSION HAZARDS OF MONTEREY COUNTY, CALIFORNIA, SCALE 1:250,000.


NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

**LEGEND**

- EXISTING WASTEWATER FACILITIES
- PROJECT COMPONENT
- H — **Area of high erosion hazard**—Includes areas classified by Cook (1978) as high and very high, high or very high, high to very high, moderate to high, slight to high, very high, and high
- M — **Area of moderate erosion hazard**—Includes areas classified by Cook (1978) as moderate, and slight to moderate
- L — **Area of low erosion hazard**—Includes areas classified by Cook (1978) as minimal, minimal to slight, none, and slight
- V — **Area of variable erosion hazard**—Includes areas classified by Cook (1978) as variable

| Ninyo & Moore | | SOIL EROSION HAZARDS | FIGURE |
|---|---|---|---|
| PROJECT NO. | DATE | GROUNDWATER REPLENISHMENT PROJECT EIR<br>MONTEREY COUNTY, CALIFORNIA | 9 |
| 402251001 | 3/15 | | |




NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

REFERENCE: CALIFORNIA EMERGENCY MANAGEMENT AGENCY, CALIFORNIA GEOLOGICAL SURVEY, UNIVERSITY OF SOUTHERN CALIFORNIA, 2009, TSUNAMI INUNDATION MAP, MOSS LANDING, PRUNEDALE, MARINA, AND SEASIDE QUADRANGLES, SCALE: 1:24000, DATED JULY 1.

| Ninyo & Moore | | TSUNAMI INUNDATION AREAS | FIGURE |
|---|---|---|---|
| PROJECT NO. | DATE | GROUNDWATER REPLENISHMENT PROJECT EIR<br>MONTEREY COUNTY, CALIFORNIA | 10 |
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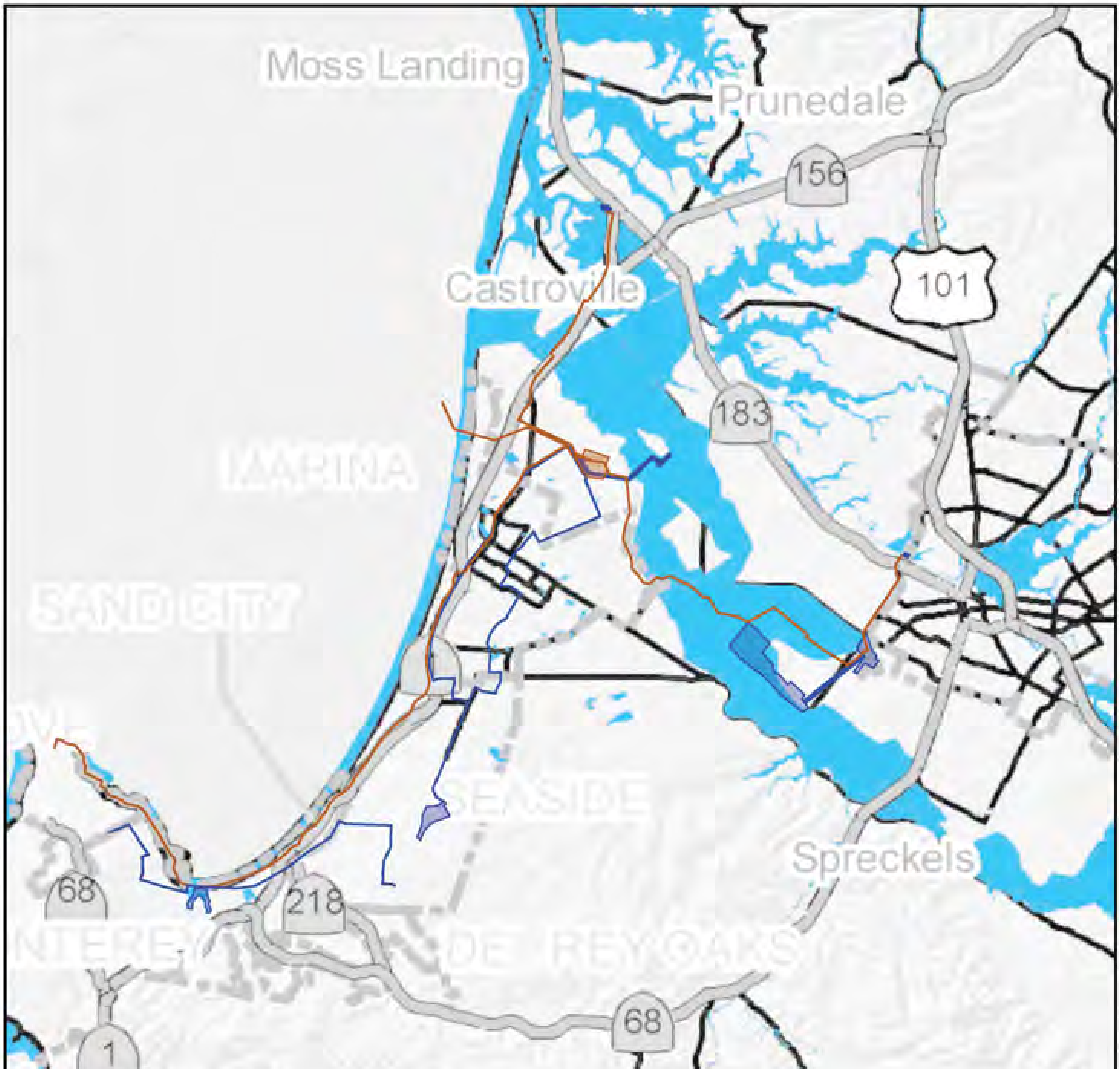
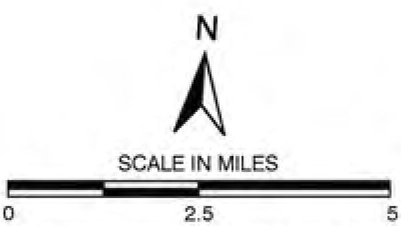



REFERENCE: MCRMA, 2010, MONTEREY COUNTY, FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA)
100 YEAR FLOOD MAP: DATED JANUARY 22.




NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE.

| LEGEND |
| --- |
| 100 YEAR FLOOD ZONE |
| EXISTING WASTEWATER FACILITIES |
| PROJECT COMPONENT |

| Ninyo & Moore | | 100-YEAR FLOOD ZONES | FIGURE |
| --- | --- | --- | --- |
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# Appendix L

# Recharge Impacts Assessment Report for the Pure Water Monterey Groundwater Replenishment Project

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# Recharge Impacts Assessment Report

March 2015

Pure Water Monterey

Groundwater Replenishment Project

# RECHARGE IMPACTS ASSESSMENT REPORT

## PURE WATER MONTEREY GROUNDWATER REPLENISHMENT (GWR) PROJECT

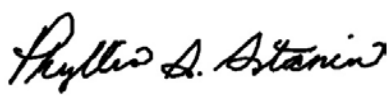
March 2015

TODD GROUNDWATER

2490 Mariner Square Loop, Suite 215
Alameda, CA 94501
510.747.6920
www.toddgroundwater.com

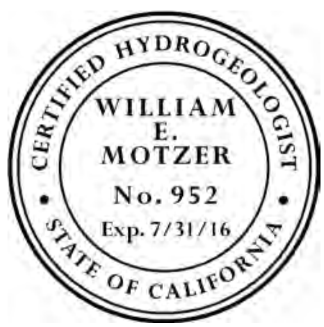
# SIGNATURE PAGE

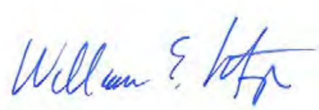




Phyllis S. Stanin, PG, CH, CEG

Vice President/Principal Geologist



William Motzer, Ph.D., PG, CH

Senior Geochemist

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APPENDIX B: HydroMetrics Water Resources Inc. (HydroMetrics), Memorandum to Mr. Bob Holden, Subject: Groundwater Replenishment Project Development Modeling, October 2, 2013

APPENDIX C: HydroMetrics WRI (HydroMetrics), Technical Memorandum, To: Bob Holden/MRWPCA, From: Stephen Hundt and Derrik Williams, GWR Project EIR: Project Modeling Results, January 12, 2015.

APPENDIX D: Groundwater Quality Analytical Program, Groundwater Analytical Results, MRWPCA Field Program, Tables D-1 and D-1A through D-1P.

# 1. INTRODUCTION

Monterey Regional Water Pollution Control Agency (MRWPCA), in partnership with Monterey Peninsula Water Management District (MPWMD), is developing the Proposed Pure Water Monterey Groundwater Replenishment (GWR) Project (Proposed Project) to provide a high-quality recycled water supply for the northern Monterey County area. The Proposed Project consists of two components: advanced treated water for injection in the Seaside Groundwater Basin to replace urban supplies (the GWR Facilities) and additional recycled water for irrigation supplies to be provided through the existing Castroville Seawater Intrusion Project (CSIP). Specifically, MRWPCA plans to construct and operate an advanced water treatment facility (AWTF) to produce up to 3,700 acre feet per year (AFY) of highly-purified recycled water for conveyance to and recharge in the Seaside Groundwater Basin. In addition, MRWPCA would deliver approximately 4,750 to 5,290 AFY of supplemental water to the CSIP area.

In accordance with the California Environmental Quality Act (CEQA), MRWPCA as the lead agency is preparing an Environmental Impact Report (EIR) for the Proposed Project. This report is being prepared to assess potential impacts of the Proposed Project on groundwater resources. Although the Seaside Basin recharge and CSIP delivery components of the Proposed Project are closely related, this impacts assessment report focuses on groundwater impacts from injection and recovery of the Proposed Project water (product water) in the Seaside Basin. Potential impacts from the irrigation water component are addressed separately in the EIR.

This recharge impacts assessment report provides details on proposed recharge facilities including injection wells (Injection Well Facilities) and general information on how the Proposed Project would be constructed and operated. In addition, an analysis of potential impacts from the Proposed Project on groundwater resources (including water levels and quality) is presented to support the EIR.

## 1.1. GWR FACILITIES

The Proposed Project would provide up to 3,700 AFY of product water for recharge in the Seaside Groundwater Basin (or Seaside Basin). The feed water for treatment at the new AWTF would be secondary-treated municipal wastewater from MRWPCA's Regional Treatment Plant (RTP). Prior to treatment at the RTP, the raw municipal wastewater would be augmented by urban stormwater/runoff, agricultural wash water, and runoff collected in local drainage ditches including the Reclamation Ditch, the Blanco Drain, and Tembladero Slough. The AWTF would include pre-treatment (using pre-screening, ozone, and potentially biologically activated filtration); membrane filtration; reverse osmosis (RO); advanced oxidation (AOP) using ultraviolet light (UV) and hydrogen peroxide; and product water stabilization with calcium and alkalinity.

The AWTF recycled water would be conveyed by pipeline from the AWTF to newly-constructed shallow and deep recharge (injection) wells in the north-central portion of the

Seaside Basin (Figure 1). Recharged water would be stored in the groundwater basin for subsequent extraction by California American Water Company (CalAm) using existing production wells. The Proposed Project would increase the basin yield and allow CalAm to reduce Carmel River diversions in compliance with a state order to secure replacement water supplies (MRWPCA, May 2013).

Recycled water would be recharged into the Seaside Basin's two primary aquifers used for water supply - the Paso Robles Aquifer and the underlying Santa Margarita Aquifer. Recharge would be accomplished through relatively shallow vadose zone wells (Paso Robles Aquifer) and deep injection wells (Santa Margarita Aquifer). Locations of the Proposed Project Injection Well Facilities site and proposed vadose zone and deep injection wells are shown on Figure 2.

This report focuses on the Proposed Project recharge, storage, and recovery operations and analyzes potential impacts from the Proposed Project on groundwater resources. The groundwater impacts assessment will provide technical support for the EIR.

## 1.2. Report Goal and Objectives

The goal of this report is to assist with development and implementation of the Proposed Project by developing and analyzing the recharge components of the project. Specifically, the recharge components include recharge wells (also referred to as injection wells), operational facilities, and the fate and transport of the recycled water in the groundwater basin. To achieve this goal, the following objectives have been identified for this report:

- provide the technical basis for Proposed Project recharge components including wells and operational facilities
- support the EIR with a groundwater impacts analysis
- outline potential steps for construction and operation of the recharge components of the Proposed Project
- provide a preliminary schedule for construction of recharge components
- incorporate existing studies for project development and implementation.

## 1.3. Incorporation of Recent Studies

Numerous studies have been conducted involving various aspects of the Proposed Project. Collectively, these studies provide the technical basis for project development and operations and support ongoing analyses including preparation of an EIR. Studies summarized below are the most relevant for the groundwater and recharge components of the Proposed Project and do not represent a comprehensive list. The following descriptions of the studies provide an understanding of how the work done by others is incorporated into this report.

### 1.3.1. MRWPCA Field Program

In December 2013 and January 2014, Todd Groundwater developed and implemented a field program (referred to herein as the MRWPCA field program or field program) in the vicinity of the Proposed Project Injection Well Facilities site. The field program involved data collection and testing through the 400 feet of vadose zone and installation and sampling of a new monitoring well drilled to a depth of 535 feet. The entire borehole was continuously cored and selected core samples were analyzed for hydraulic properties, mineralogy, and leaching potential. The new well, MRWPCA MW-1, is screened in the upper Paso Robles Aquifer and is capable of monitoring the water table beneath the site. MRWPCA MW-1 and five existing nearby production and monitoring wells were sampled to supplement existing groundwater quality data in the area. MRWPCA MW-1 and the five additional wells (FO-7 Shallow, FO-7 Deep, PRTIW, ASR MW-1, and Seaside 4) are shown on Figure 2.

The field program also included an analysis of potential geochemical changes in groundwater as a result of the Proposed Project. In conformance with the State Recycled Water Policy (California SWRCB, 2013), a Regional Water Quality Control Board may impose restrictions on a proposed groundwater replenishment project if the project changes the geochemistry of an aquifer thereby causing the dissolution of constituents from the geologic formation into groundwater. To assess if the Proposed Project has the potential to cause dissolution, laboratory leaching analyses were conducted on core samples to ensure the protection of groundwater beneath the Proposed Project's vadose zone wells. Results of the leaching analyses were further analyzed using geochemical modeling.

Results of the program have been documented and analyzed in a separate report prepared by Todd Groundwater (Todd Groundwater, 2015). The groundwater quality data collected during the MRWPCA field program, along with the results of the core leaching analyses and associated geochemical modeling, are incorporated herein (see sections 7.3 and 7.4) to assist with the assessment of potential impacts from the Proposed Project on groundwater quality.

### 1.3.2. Proposed Project Product Water Quality

MRWPCA constructed a GWR pilot treatment plant on the RTP site to evaluate treatment options for the AWTF and collected data to characterize the water quality of the product water and reverse osmosis concentrate by-product. The GWR pilot plant product water was analyzed for various constituents as the treatment process was adjusted and optimized. Analyses demonstrated that the product water would meet drinking water standards. However, the GWR pilot plant did not include a process to provide chemical stabilization, which would be included in the proposed AWTF to protect against corrosion in conveyance pipelines and recharge wells. The planned stabilization would also limit the potential for product water injected into the Proposed Project vadose zone wells to leach constituents from the geologic formation and impact groundwater quality as mentioned above. Bench scale chemical stabilization was conducted on the GWR pilot plant product water to simulate final water quality and to allow for evaluation of the leaching potential of the recycled water as part of the laboratory leaching analyses. Additional details and water quality data of the bench scale water sample are provided in Section 7.3.4. Results of the leaching analyses and geochemical modeling are summarized in Section 7.3.5 of this report. Details of the analysis and an expanded discussion of the results are presented in the draft report on the field program (Todd Groundwater, 2015).

### 1.3.3. Groundwater Modeling with the Seaside Basin Watermaster Model

To provide a quantitative assessment of the Proposed Project impacts on water levels and other production wells, and to assess changing conditions relating to the potential for seawater intrusion, a basin-wide numerical model has been used. Specifically, the Seaside Basin Watermaster has constructed and calibrated a multi-layer transient groundwater flow model using MODFLOW 2005. HydroMetrics WRI (HydroMetrics), consultant to the Seaside Basin Watermaster, has been retained by MRWPCA to apply the Watermaster model to simulate potential impacts of the Proposed Project on groundwater resources. Results of the modeling are presented in a technical memorandum (TM), included as Appendix C of this report and summarized herein.

## 2. RECYCLED WATER DELIVERY FOR RECHARGE

MRWPCA has evaluated the amounts and availability of the Proposed Project source waters and has developed estimates of monthly deliveries of recycled water to the Seasisde Basin. On average, about 3,500 AFY would be delivered to the Seaside Basin, but monthly amounts would vary based on hydrologic conditions.

Specifically, the Proposed Project would incorporate the concept of a drought reserve account. During wet and normal years, the Project would convey an extra 200 acre feet (AF) of advanced treated water to the Seaside Basin for recharge and storage, up to a cumulative total of 1,000 acre feet. During dry conditions, the Project could reduce its deliveries to the Seaside Basin by as much water as had accumulated in the drought reserve. The Project water that is not delivered to the Seaside Basin would instead be used to augment irrigation supplies delivered through the CSIP. CalAm would continue to extract 3,500 AFY for municipal supplies by using the water stored in the drought reserve. These operational guidelines have been translated into potential monthly delivery amounts to the Seaside Basin as discussed in more detail below.

### 2.1. DELIVERY SCHEDULES AND OPERATION OF THE DROUGHT RESERVE ACCOUNT

MRWPCA has evaluated the availability and amounts of source waters, capacity of the AWTF, minimum delivery targets, and operational guidelines discussed above in order to develop potential delivery schedules for recharge to the Seaside Basin. Based on this analysis, there are eight potential delivery schedules that could occur, based on two water management decision points made in each year of GWR operation. These eight delivery schedules are presented in Table 1. The two management decisions that determine appropriate deliveries to the Seaside Basin are described below.

The first management decision would be made by October 1, the beginning of the water year,[1] and would dictate which of two delivery schedules is followed during October through March of that water year. The decision would be based on whether or not the drought reserve account is full (1,000 AF). If the account is full, the project would deliver monthly amounts from October through March based on average annual deliveries (highlighted in purple on Table 1; for example, see October through March deliveries for Schedule 2 and Schedule 8). If the account balance is less than 1,000 AF on October 1, then an additional 200 AF would be delivered from October through March (highlighted on Table 1 in blue; for example, see October through March delivery schedules 1, and 3 through 7). For wet or normal years, these two recharge schedules would produce a total of 3,700 AFY (Schedule 1) or a total of 3,500 AFY (Schedule 2) (Table 1).

[1] A Water Year is defined as October 1 through September 30, and is based on the annual precipitation pattern in California. The Water Year is designated by the calendar year in which it ends.

## Table 1. Product Water Available for Injection

| | Product Water Delivery Schedules for Seaside Basin Injection | | Acre-Feet per Month (AF/month) | | | | | | | | | | | | Total | Add to | Available |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | AFY | Reserve | in Reserve |
| 1 | Drought Reserve <1,000 AF | Wet/Normal Year | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 | 200 | - |
| 2 | Drought Reserve 1,000 AF | Wet/Normal Year | 297 | 288 | 297 | 297 | 268 | 297 | 288 | 297 | 288 | 297 | 297 | 288 | 3,500 | - | - |
| 3 | Drought Reserve <1,000 AF | Drought Year | 331 | 321 | 331 | 331 | 299 | 331 | 255 | 263 | 255 | 263 | 263 | 255 | 3,500 | 200 | 200 |
| 4 | Drought Reserve <1,000 AF | Drought Year | 331 | 321 | 331 | 331 | 299 | 331 | 222 | 229 | 222 | 229 | 229 | 222 | 3,300 | 200 | 400 |
| 5 | Drought Reserve <1,000 AF | Drought Year | 331 | 321 | 331 | 331 | 299 | 331 | 189 | 196 | 189 | 196 | 196 | 189 | 3,100 | 200 | 600 |
| 6 | Drought Reserve <1,000 AF | Drought Year | 331 | 321 | 331 | 331 | 299 | 331 | 156 | 162 | 156 | 162 | 162 | 156 | 2,900 | 200 | 800 |
| 7 | Drought Reserve <1,000 AF | Drought Year | 331 | 321 | 331 | 331 | 299 | 331 | 124 | 128 | 124 | 128 | 128 | 124 | 2,700 | 200 | 1,000 |
| 8 | Drought Reserve 1,000 AF | Drought Year | 297 | 288 | 297 | 297 | 268 | 297 | 124 | 128 | 124 | 128 | 128 | 124 | 2,500 | - | 1,000 |

| Maximum Monthly Injection Rates | Injection Rates in Gallons per Minute (gpm) | | | | | | | | | | | | Maximum |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | (gpm) |
| Santa Margarita Aquifer (90%) | 2,175 | 2,179 | 2,175 | 2,175 | 2,175 | 2,175 | 1,955 | 1,951 | 1,955 | 1,951 | 1,951 | 1,955 | 2,179 |
| Paso Robles Aquifer (10%) | 242 | 242 | 242 | 242 | 242 | 242 | 217 | 217 | 217 | 217 | 217 | 217 | 242 |
| Total | 2,417 | 2,422 | 2,417 | 2,417 | 2,417 | 2,417 | 2,173 | 2,168 | 2,173 | 2,168 | 2,168 | 2,173 | 2,422 |

The second management decision would be made in early Spring as to which schedule will be followed for deliveries in April through September. This decision would be based on whether or not the previous 6 months of precipitation has indicated a drought year and whether supplemental irrigation water is needed and available from the drought reserve account. This decision would be made by the Monterey County Water Resources Agency (MCWRA). If it is a wet/normal year, the delivery would follow the April through September delivery schedule shown for both Schedule 1 and Schedule 2. However, if MCWRA requests water from the drought reserve account during a drought year, the delivery schedule for April through September would follow one of the drought delivery schedules shown in green on Table 1. The selection of the drought schedule would be based on the then-current balance in the drought reserve account (as of April 1 – see last column on Table 1).

## 2.2. MAXIMUM DELIVERY FOR RECHARGE

The maximum monthly amount of advanced-treated recycled water available from any of the eight potential delivery schedules on Table 1 has been converted to a maximum monthly injection rate in gallons per minute (gpm) for each aquifer. These rates are summarized in the lower portion of Table 1. The maximum injection rates are estimated for planning purposes to design recharge facilities that will accommodate peak flows and to inform the number and spacing of injection wells. As shown in Table 1, the total maximum injection rate for any of the schedules is 2,422 gpm (lower right on Table 1). Assuming 90 percent of the water is injected into the deeper Santa Margarita Aquifer, deep injection wells need to accommodate an estimated peak flow of about 2,179 gpm (see Section 3.3.5.1 for an explanation on allocating recharge between the two aquifers). Assuming 10 percent of the water is injected into the Paso Robles Aquifer, shallow injection (or vadose zone) wells would need to be capable of injection rates up to about 242 gpm.

For the purposes of project planning and EIR analysis, recharge facilities are sized for these maximum rates incorporating conservative injection rates and allowing for down-time associated with well operation and maintenance. As actual operation is refined, monthly injection amounts can be balanced with operation at the AWTF, as needed. However, this approach provides future project flexibility and allows for evaluation of reasonable "worst-case" potential environmental impacts on groundwater resources associated with the recharge component of the Proposed Project.

# 3. PROJECT LOCATION AND HYDROGEOLOGIC SETTING

## 3.1. GROUNDWATER BASIN AND STUDY AREA

The Proposed Project Injection Well Facilities site is located within a portion of the Seaside Subbasin of the Salinas Valley Groundwater Basin as defined by the California Department of Water Resources (CDWR) in the Bulletin 118 description of California's groundwater basins (CDWR, 2004). The boundaries of the Seaside Subbasin and delineation of four subareas within the subbasin have been redefined by Yates et al. (2005) based on a reinterpretation of geologic faulting and groundwater flow divides. The northern basin boundary is based on a groundwater divide that is subject to movement with changing conditions in groundwater levels (Yates, et al., 2005; HydroMetrics, 2010).

The redefined subbasin covers about 20 square miles and is referred to as the Seaside Groundwater Basin, or simply Seaside Basin, in this report. The boundaries of the Seaside Groundwater Basin and four subareas are shown on Figure 1. Basin wells (including production and monitoring wells) are also shown on the figure to highlight areas of groundwater development. Figure 2 includes production and monitoring wells in the vicinity of the Proposed Project Injection Well Facilities.

The Proposed Project Injection Well Facilities would be located within the northeastern-most subarea of the Seaside Groundwater Basin, referred to as the Northern Inland Subarea (Figure 1). The site is close to the Northern Coastal Subarea where most of the basin's groundwater pumping occurs (as indicated by the relatively large number of wells on Figure 1). Groundwater production also occurs in the Southern Coastal Subarea and the Laguna Seca Subarea.

Historically, only minimal pumping has occurred within the Northern Inland Subarea. Of the three wells in the subarea shown on Figure 1, only one well - the City of Seaside Reservoir Well (identified on Figure 2) - has provided water supply. The other two wells in the Northern Inland Subarea are monitoring wells. The subarea has remained largely undeveloped as a result of its long-term use as a large firing range by the U.S. Army on the former Fort Ord military base, which closed in 1994.

The southern subareas are considered less hydraulically connected to the Proposed Project Injection Well Facilities area and are not included in the Study Area for the impact analysis. Accordingly, for the purposes of the impact analysis, the Study Area is defined as the Northern Inland and Northern Coastal subareas of the Seaside Groundwater Basin.

### 3.1.1. Seaside Basin Adjudication

The Seaside Basin was adjudicated by the California Superior Court on March 27, 2006, establishing groundwater extraction rights in the basin. A court-appointed Watermaster has been formed to execute the requirements of the adjudication. The court decision requires a decrease in pumping after three years from the effective date of the adjudication (and additional pumping reductions over time) unless the Watermaster has secured additional sources of water from outside the basin for injection into the basin or for replacing pumping (i.e., in lieu replenishment). Further, the Watermaster has responsibilities with respect to securing replenishment water from outside the basin to offset the over-production in the basin.

### 3.1.2. Groundwater Use

Groundwater pumping in the Seaside Groundwater Basin provides water supply for municipal, irrigation (primarily golf courses), and industrial uses. Historically, about 70 to 80 percent of the pumping has occurred in the Northern Coastal Subarea, with additional pumping occurring in the Laguna Seca Subarea supplemented by small amounts in the Southern Coastal Subarea. CalAm is the largest pumper in the basin accounting for about 79 percent of the groundwater pumped in water year (WY) 2013[2] (Watermaster, 2013).

Available annual pumping in the Coastal subareas and total basin production over the last 20 years are shown on Figure 3. Over this time period, production in the Coastal subareas has averaged about 4,000 AFY and total basin production has averaged about 5,000 AFY.

Prior to basin adjudication in 2006, pumping exceeded sustainable yield and contributed to significant basin-wide water level declines. Over-pumping in the coastal subareas resulted in water levels declining below sea level at the coast, placing aquifers at risk of seawater intrusion. In particular, basin pumping increased after a 1995 order by the State Water Resources Control Board (SWRCB) placed constraints on out-of-basin supplies (Figure 3).

Since 2008, groundwater pumping has declined. Pumping in coastal subareas averaged about 4,505 AFY from 1996 through 2008, but has decreased to about 3,288 AFY from 2009 through 2013 (Watermaster production records). For comparison purposes, the court established a natural safe yield for the coastal subareas of between 1,973 AFY to 2,305 AFY during the Seaside Basin adjudication (California Superior Court, 2006).

The production data in Figure 3 do not include injection and recovery from the nearby Monterey Peninsula Aquifer Storage and Recovery Project (ASR Project) where about 1,100 AFY has been injected and/or recovered from 2010 through 2012. Details of that project are summarized in the following subsection.

### 3.1.3. ASR Project

The ASR Project is operating in the Seaside Basin downgradient and within about 1,000 feet from the Proposed Project Injection Well Facilities site. CalAm and MPWMD are in partnership in implementing the ASR Project, which involves the injection of treated Carmel River Basin groundwater into a series of ASR wells for seasonal storage in the basin and subsequent recovery for drinking water supply.

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[2] Water Year (WY) 2013 begins October 1, 2012 and ends September 30, 2013.

Currently, Carmel River Basin water (extracted from riverbank wells) is treated to drinking water standards and conveyed to the ASR wells for recharge when excess water is available (e.g., periods when flows in the Carmel River exceed fisheries bypass flow requirements). The ASR wells are also planned for injection of product water from a proposed ocean desalination plant to be developed by CalAm.

As of 2014, four ASR wells have been installed along General Jim Moore Boulevard in the City of Seaside, California (Figure 2). ASR-1 and ASR-2 are located about 1,000 feet northwest of the Proposed Project Injection Well Facilities site. ASR-3 and ASR-4 are located about 1,600 feet to the northwest of the Proposed Project wells (Figure 2).

The amount of Carmel River water injected varies from year to year depending on availability; specifically, diversions from the Carmel River for ASR injection are limited to certain times of the year and are allowed only when minimum flows are present at certain gages on the Carmel River (i.e., to provide adequate fish passage). Table 2 summarizes river water that has been injected and recovered as part of the ASR Project for the last five complete water years.

**Table 2. Injection and Recovery Volumes, ASR Project**

| Water Year | ASR Injection (AFY) | ASR Recovery (AFY) |
|---|---|---|
| 2010 | 1,110 | 0 |
| 2011 | 1,117 | 1,110 |
| 2012 | 131 | 1,117 |
| 2013 | 294 | 644 |
| 2014 | 0 | 0 |
| Total | 2,652 | 2,871 |

Although data in Table 2 indicate that the ASR Project has recovered more water than injected over the last four years, the table does not include the full historical record of all of the injected water as the first ASR test well was drilled in 1998. A regulatory order requires that the injected Carmel River water be extracted to meet demands, and the project is not operated for the long-term replenishment of basin aquifers (i.e., recharge that is kept in the basin without extraction) (Watermaster, 2012).

### 3.1.4. Watermaster Numerical Model

In 2009, the Seaside Basin Watermaster completed construction of a numerical groundwater flow computer model for the basin using the model code MODFLOW 2005 (HydroMetrics, 2009). The model provides a basin-wide tool for evaluating protective water levels and various groundwater management strategies.

The Watermaster model covers approximately 76 square miles of the Salinas Valley Groundwater Basin including the Seaside Groundwater Basin. In order to represent the hydrostratigraphy and simulate three-dimensional flow in the basin, the model was constructed with five layers. Model layers generally correspond to observed hydrostratigraphic units[3] as follows:

- Layer 1 - Older Dune deposits and Aromas Red Sand
- Layers 2 and 3 - Upper and Middle Paso Robles Aquifer
- Layer 4 - Basal clay layers (approximately 80 feet thick) typically observed in the Lower Paso Robles Formation, where present
- Layer 5 - Santa Margarita Aquifer (including the Purisima Formation where present).

Additional details on the basin hydrostratigraphy and aquifers are discussed in Section 4 of this report.

The Watermaster model is a transient model that has been calibrated over a 22-year period from January 1987 through December 2008 and is capable of simulating groundwater levels over a wide variety of hydrologic conditions. The model includes conditions that occur during the drought period of the early 1990s and relatively wet periods such as 1998 and 2005. Boundary conditions and additional details on the Watermaster model are documented in a report on model construction and calibration (HydroMetrics, 2009).

The model provides a valuable quantitative tool for the evaluation of the Proposed Project and potential impacts to basin water levels and wells. HydroMetrics has been contracted by MRWPCA to apply the model to simulate aquifer response to various conditions including No-Project conditions and conditions associated with the Proposed Project. Modeling results are provided in the appendices and summarized in the impacts section of this report (Section 7).

## 3.2. PROPOSED PROJECT INJECTION WELL FACILITIES SITE

The Proposed Project Injection Well Facilities would be located along a strip of land on the eastern boundary of the City of Seaside, California and about 1.5 miles inland from Monterey Bay (Figure 1). Facilities would be constructed within an approximate 150-feet wide corridor of land about 3,000 feet long (Figure 2). The corridor would begin approximately 1,200 feet south of Eucalyptus Road, and would extend south-southwest for approximately 3,000 feet toward General Jim Moore Boulevard. The southwestern end of the Injection Well Facilities site would be approximately 200 feet east of General Jim Moore Boulevard.

The Proposed Project Injection Well Facilities would be situated along existing unimproved roads of former Fort Ord lands and along the edge of two parcels that are proposed for

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[3] A hydrostratigraphic unit can be defined as a formation, part of a formation, or groups of formations in which there are similar hydraulic characteristics allowing for grouping into aquifers or confining layers (aquitards).

conveyance from the Fort Ord Reuse Authority to the City of Seaside. This property boundary has been identified by the City of Seaside as functioning as a utility right-of-way corridor where the Proposed Project wells could be located for minimum interference with future land use plans. The site was selected using the following criteria:

- upgradient of existing CalAm production wells for efficient recovery of recharged project water that has comingled with native groundwater and ASR-injected Carmel River water
- within areas of favorable aquifer properties for replenishment and groundwater production, such as relatively high transmissivity and sufficient aquifer thickness
- sufficiently deep water table to provide a large local storage volume
- close to pumping depressions[4] to provide replenishment water to areas of declining water levels.

Over the last few years, several alternate proposed project Injection Well Facilities locations within the Seaside Basin were considered for project development. Two locations, previously referred to as the Coastal location and the Inland location, were considered favorable and were evaluated in 2009 during early project development. Since that time, further analyses have been conducted and the Coastal location has been eliminated from consideration due to hydrogeologic conditions, engineering factors, and costs. A discussion of the selection of the current Proposed Project Injection Well Facilities location as the preferred location over the Coastal location is documented in a TM provided in Appendix A (Todd Groundwater, May 2014). The current Proposed Project site Injection Well Facilities has been modified slightly from the previously considered inland location to optimize project performance.

### 3.2.1. Physical Setting

The Proposed Project Injection Well Facilities are located on an upper coastal plain of low hills and mature dunes that slopes northward toward the Salinas Valley and westward toward Monterey Bay (approximately 1.5 miles to the west) (Figure 1). The Proposed Project Injection Well Facilities area is characterized by rolling hills and closed depressions. The area is currently undeveloped and surrounded by natural vegetation that is cross-cut by unimproved roads and trails associated with former military activities (Figure 2). An access road to a small water reservoir is across Eucalyptus Road from the northern-portion of the Proposed Project Injection Well Facilities area. This reservoir and adjacent groundwater well have been used historically for irrigation at a golf course west of General Jim Moore Boulevard (Figure 2).

### 3.2.2. Topography

The ground surface elevation rises across the groundwater basin from sea level at the coast to more than 800 feet above mean sea level (msl) in the southeastern portions of the basin.

[4] As groundwater is pumped, water levels are lowered in the aquifer creating a zone of water levels lower than ambient levels, and referred to as a cone of depression around the pumping well(s).

For the area shown on Figure 2, ground surface elevations rise to about 550 feet msl in the east central portion of the map. Along Eucalyptus Road, ground surface elevations vary from about 470 feet msl at the monitoring well identified as FO-7 to about 430 feet msl at the recently drilled monitoring well identified as MRWPCA MW-1, down to about 340 feet msl at General Jim Moore Boulevard and at ASR-1 (Figure 2). Ground surface elevations along the Proposed Project area vary from about 455 feet msl at proposed DIW-1, 396 feet msl at DIW-2, sloping downward to about 300 feet msl at DIW-4.

### 3.2.3. Climate and Hydrology

The Proposed Project Injection Well Facilities area receives about 14.5 inches of annual rainfall (Yates, et al., 2005). Runoff on the rolling hills collects in low areas and provides recharge to the Seaside Groundwater Basin. Recharge from deep percolation of rainfall (and minor amounts of irrigation) in the Northern Inland Subarea has averaged about 1,080 AFY from 2003 through 2007 (HydroMetrics, 2009). This amount represents 99 percent of the total recharge estimated for this undeveloped subarea (HydroMetrics, 2009). (Additional sources of recharge allow for the natural safe yield from adjacent coastal subareas to be higher as noted in Section 3.1.2).

### 3.2.4. Land Use

The Proposed Project Injection Well Facilities would be located on a portion of the former Fort Ord military base, which provided training and staging for U.S. troops from 1917 to 1994. The proposed site is on the northwestern edge of a large upland area referred to as the Inland Ranges (HLA, 1994). The Inland Ranges consist of about 8,000 acres bounded by Eucalyptus Road to the north, Barloy Canyon Road to the east, South Boundary Road to the south, and General Jim Moore Boulevard to the west. For environmental investigation and remediation purposes on former Fort Ord lands, a portion of the area is also referred to as Site 39. The general area of the Inland Ranges and the area of the Proposed Project wells are shown on Figure 4.

Site 39 contained at least 28 firing ranges that were used for small arms and high explosive ordnance training using rockets, artillery, mortars and grenades. Range 18 (HA-18) and Range 19 (HA-19) are the closest ranges to the Proposed Project Injection Well Facilities location (approximately 200 feet south and east), with Range 48 (HA-48) farther east (Figure 4).

Considerable expended and unexploded ordnance (UXO) have been documented in various areas of Site 39. The specific ordnance types include rounds from shotguns, mortars, M74 rockets, recoilless rifles, aircraft, grenades, artillery, howitzers, mines, anti-tank weapons (bazookas), bombs, naval ordnance, Bangalore torpedoes, C-4, TNT, military dynamite, and shaped charges. Functions for these items included high explosives, heat generating, armor piercing, white phosphorous, smoke tracer, illumination, incendiary, and photo flash devices. As a result of the spontaneous ignition of a white phosphorous grenade in August 2009, a Munitions and Explosives of Concern (MEC) sweep was conducted at Range 48. This surface sweep removed MEC or MEC-like items using physical and demolition methods.

Beginning in 1984, numerous environmental investigation and remediation activities have occurred on Site 39. During these investigations, metals and various compounds associated with explosives have been detected in soil. Remediation has been more extensive in areas targeted for redevelopment, an area that includes the Proposed Project Injection Well Facilities site.

Most of these lands are now controlled by the Fort Ord Reuse Authority (FORA), the organization responsible for the planning, financing, and implementing the conversion of former Fort Ord military lands to civilian activities. FORA has signed an Environmental Services Cooperative Agreement (ESCA) with the U. S. Army to allow transfer of approximately nine parcels (3,340 acres) that were associated with military munitions (e.g., unexploded ordnance (UXO) or munitions and explosives of concern (MEC)). Under ESCA, FORA is responsible for addressing munitions response actions. FORA and their contractors are working with regulatory agencies including the California Department of Toxic Substances Control (DTSC) and the U.S. Environmental Protection Agency (USEPA) to conduct munitions remediation activities, scheduled for completion by 2015.

Most of the ESCA parcels, including the area of the Proposed Project wells, will ultimately be transferred to the City of Seaside. The ESCA parcels that contain the Proposed Project Injection Well Facilities were less impacted by former Fort Ord activities than other parcels associated with Site 39 and have already been cleared of MEC and approved for future development. The Proposed Project wells are purposefully located along the southern-southeastern edge of the parcels and are not expected to interfere with future re-development by the City of Seaside (Figure 4). By spacing the wells along the parcel boundary, it is anticipated that any visual or noise concerns would also be minimized in comparison to a configuration where multiple deep injection wells were operating closer together.

## 3.3. Hydrostratigraphy and Target Aquifers

The Seaside Groundwater Basin consists of semi-consolidated to consolidated sedimentary units overlying relatively low permeability rocks of the Miocene Monterey Formation and older crystalline rocks. The sedimentary units consist of deep marine sandstones of Tertiary age overlain by a complex Quaternary-age sequence of continental deposits and shallow Quaternary-age dune deposits. In general, the sedimentary units dip northward and thicken into the Salinas Valley.

The basin has been structurally deformed by geologic folding and faulting. In particular, sedimentary units in the southern portion of the basin have been uplifted and displaced along the Ord Terrace and Seaside faults, which create some hydraulic separation, referred to as compartmentalization, within the basin. Both faults are generally south of the Proposed Project Injection Well Facilities. However, one interpretation of the Ord Terrace fault trace (Yates, et al., 2005) indicates that the fault trends relatively close (within 1,000 feet) to the southern Proposed Project wells (DIW-4 and VZW-4) and could potentially result in some hydraulic separation between the project wells and the closest municipal well to the southwest, Seaside No. 4 (Figure 2). This uncertainty would not affect the Proposed Project operations. As a conservative assumption, the hydrogeologic investigation assumes that the wells are hydraulically connected.

Two main sedimentary units provide the source of groundwater supply for existing pumping operations in the Seaside Basin: the continental Quaternary-age (Pleistocene) Paso Robles Formation and the Tertiary-age (Miocene) Santa Margarita Sandstone. Permeable units in these two geologic formations are referred to herein as the Paso Robles and the Santa Margarita aquifers. Although the Santa Margarita Aquifer is more homogeneous than the Paso Robles Aquifer, both are defined by a series of stratified layers rather than a single continuous sand unit.

The two aquifers are overlain by Quaternary-age units including undifferentiated sediments, eolian sand deposits, and the consolidated Aromas Formation (CDWR, February 2004; Yates et al., 2005). Although these shallow units are highly permeable in most areas, the deposits occur generally above the water table and are only saturated in coastal areas. As such, these shallow units do not contribute substantially to the basin's water supply.

Aquifer parameters and groundwater conditions associated with each of the two target aquifers in the Proposed Project Injection Well Facilities area are discussed in more detail below. Also included is a discussion of vadose zone properties of the older dune sands and Aromas Sand beneath the proposed site to assist in design of recharge wells (vadose zone wells) for the Proposed Project. A geologic cross section, shown on Figure 5, illustrates the subsurface conditions beneath the area. The location of the cross section and corresponding wells are shown on Figure 2. Subsurface conditions and aquifer parameters in the Proposed Project Injection Well Facilities area are also summarized on Table 3 and discussed in the following sections.

## Table 3. Estimated Subsurface Conditions in Proposed Project Area

| | Aromas Sand / Older Dune Deposits | Paso Robles Aquifer | Santa Margarita Aquifer | Data Sources |
|---|---|---|---|---|
| **Lithology** | Fine brown sand, silty sand, some medium to coarse sand, minor silt and clay. | Heterogeneous package of interbeds of sand, silt, and clay mixtures. Average bed thickness of | Fine- to medium-grained well sorted sand to silty sand; sandy silt in lower portions of formation; minor | 1, 2, 3 |
| **Interval Thickness** | 400 feet | 250 feet | 280 feet | 1, 2 |
| **Percent Sand** | 92% | 52% | 74% | 2 |
| **Depth** | Surface sediments | 356 feet | 609 feet | Figure 5; Ground surface elev. |
| **Groundwater Conditions** | unsaturated | unconfined | semi-confined | 4, 5 |
| **Aquifer Parameters** | | | | |
| ***Transmissivity (T)*** | Not applicable; unsaturated locally | 659 feet$^2$/day to 1,524 feet$^2$/day | 11,377 to 13,947 feet$^2$/day<br>24,003 feet$^2$/day | 1, 5, 6, 7, 8, 9 |
| ***Horiz. Hydraulic Conductivity ($K_h$)*** | 350 feet/day | 20 feet/day | 63 feet/day | 2, 6 |
| ***Vertical Hydraulic Conductivity ($K_v$)*** | 70 feet/day | 0.66 feet/day to 16 feet/day | 0.63 feet/day | 1, 3, 7 |
| ***Storativity (S)*** | 0.24 to 0.40 (sand);<br>0.04 to 0.09 (silt; silty sand) | 0.12 | 0.0018<br>0.00258 | 1, 4, 5 |
| **Average Coastal Subarea Production** | Not applicable; unsaturated locally | Est. 500 AFY<br>(15% of total coastal production) | Est. 2,500 AFY<br>(85% of total coastal production) | 9, 10 |
| **Area Water Levels Below Sea Level** | Not applicable; unsaturated locally | 900 acres | >2,000 acres | 9 |

*Data Sources: 1.Todd Groundwater, 2014; 2.Padre, 2002; 3. HydroMetrics, 2006; 4. ASR Systems, 2005; 5. MPWMD, 2002; 6. Yates et al., 2005;7. Fugro, 1998. 8. HydroMetrics, 2009; 9. Hydrometrics, 2013; 10. MPWMD, 2014.*

### 3.3.1. Older Dune Sands/Aromas Sand

The shallowest geologic deposits at the Proposed Project Injection Well Facilities site are composed of recent and older eolian sands and older continental deposits of Pleistocene age referred to herein as the Older Dune Sands/ Aromas Sand or Aromas Sand. The unit has been described as also including fluvial and coastal terrace deposits, as well as flood-plain and other basin deposits (Yates, et al., 2005; HydroMetrics, 2009).

The entire sequence was recently cored in a boring for a recently-installed monitoring well by Todd Groundwater in the Proposed Project Injection Well Facilities area (see MRWPCA MW-1 on Figure 2). The unit was described on a geologic log and selected core samples were analyzed at various laboratories to evaluate lithology and mineralogy, porosity and permeability, infiltration rates, leaching potential, and other factors to support the Proposed Project development. Complete laboratory results are documented and analyzed in a separate report (Todd Groundwater, February 2015).

Geologic core descriptions from MRWPCA MW-1 indicate that the Aromas Sand is approximately 400 feet thick in the Proposed Project Injection Well Facilities area and is composed primarily of fine-grain sand (about 92 percent sand) with minor amounts of silt and clay. The upper 300 feet is the most homogeneous with generally higher permeability values. As previously shown on Table 3, the unit is associated with high horizontal hydraulic conductivity (350 feet per day) and vertical hydraulic conductivity (70 feet per day) as estimated from laboratory core data.

The geologic unit is illustrated on the cross section on Figure 5 and ranges from about 225 feet at ASR-1 up to about 400 feet thick at MRWPCA MW-1 and monitoring well FO-7. Also shown on the cross section are geophysical logs for the three existing wells that provide readings of electrical (resistivity) measurements throughout the borehole. Although the logs are provided for illustrative purposes only (without ohm-meter or other electrical scales), log curves show relatively high readings in the Aromas Sand (shaded in orange) [5], generally indicative of higher permeability sediments. The Aromas Sand is unsaturated in the Proposed Project Injection Well Facilities area as indicated by the deeper water levels shown on the cross section (water table and potentiometric surface, Figure 5).

Also projected onto the cross section are schematic diagrams of Proposed Project wells (Figure 5). In particular, vadose zone wells (labeled VZW-1 and shown on Figure 2) would be used for recharge into the shallow aquifer. The advanced treated water recharged through vadose zone wells would be released into the Aromas Sand for percolation to the water table. Selection of vadose zone wells as a recharge method is discussed in subsequent sections of this report. Details of the Proposed Project wells, including preliminary designs, are provided in Section 4.

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[5] Logs were unavailable in the upper portions of ASR-1 and FO-7 due to shallow surface casings. Log in MRWPCA MW-1 is a cased-hole induction log.

### 3.3.2. Paso Robles Aquifer

Beneath the Aromas Sand is the Paso Robles Formation (Figure 5). The formation is heterogeneous and contains interbeds of sand, silt, and clay mixtures (Yates et al., 2005). Silt and clay layers are described by a variety of colors including yellow-brown, reddish brown, whitish gray, and dark bluish gray, indicating a variety of depositional and geochemical environments. These continentally-derived deposits are discontinuous and difficult to correlate from well to well in the basin.

The formation is saturated in the Proposed Project Injection Well Facilities area (and coastal areas) and forms the shallow aquifer in the basin (referred to as the Paso Robles Aquifer herein). Permeable units in the Paso Robles aquifer are screened in several production wells downgradient of the Proposed Project Injection Well Facilities area.

The heterogeneous nature of the aquifer can be seen on the electric logs from FO-7, ASR-1, and MRWPCA MW-1 in the Proposed Project Injection Well Facilities area (Figure 5). As shown from the logs, resistivity readings (right of the depth columns) are highly variable throughout the Paso Robles Aquifer, indicating interbeds of varying thicknesses. The upper 50 to 100 feet of the aquifer appear to contain a higher percentage of sand, indicating relatively higher permeability. These sands are screened in MRWPCA MW-1. Below the upper sand unit, the formation becomes more heterogeneous and generally more fine-grained. A lower, more permeable layer in the Paso Robles aquifer is screened in FO-7 at about 600 feet deep (about -125 feet msl). Using an approximate sand indicator of 25 ohm-meters on the electric log of a nearby Paso Robles test well, the overall Paso Robles aquifer is estimated to contain about 52 percent sand (Table 3).

#### 3.3.2.1. Paso Robles Aquifer Parameters

The ability of an aquifer to transmit, store, and yield reasonable quantities of water is reflected in aquifer parameters including transmissivity (T), horizontal hydraulic conductivity (K or $K_h$), and storativity (S). These parameters for the Paso Robles Aquifer have been compiled and reviewed by previous investigators in the basin (Fugro, 1997; Yates et al., 2005; HydroMetrics, 2009). In the Proposed Project Injection Well Facilities area, representative aquifer parameters include a T value of about 659 square feet per day ($ft^2$/day) to 1,524 $ft^2$/day, a K value of 20 ft/day and an S value of 0.12 (dimensionless), reflecting an effective porosity of 12 percent. These parameters for the Paso Robles Aquifer are listed in Table 3.

#### 3.3.2.2. Groundwater Recharge in the Paso Robles Aquifer

The Paso Robles aquifer is recharged mainly from surface infiltration of precipitation (HydroMetrics, 2009). The formation crops out in the eastern portion of the basin where rainfall infiltrates directly into the aquifer units (Yates, et al., 2005). In the Proposed Project Injection Well Facilities area, recharge occurs by percolation through the surficial deposits of the Aromas Sand.

#### 3.3.2.3. Groundwater Production in the Paso Robles Aquifer

The Paso Robles Aquifer is less productive than the deeper Santa Margarita Aquifer, but is screened in several production and monitoring wells near the Proposed Project Injection Well Facilities area. In particular, the Paso Robles is screened in production wells Paralta, Ord Grove, PRTIW, MMP, and Seaside 4, all located within about 1,000 feet west of General Jim Moore Boulevard. In addition, the Reservoir well, located east of General Jim Moore Boulevard and north of Eucalyptus Road, is also screened in the Paso Robles Aquifer. The Paralta and Ord Grove wells are also screened in the deeper aquifer.

Because many wells are screened in both the Paso Robles Aquifer and the Santa Margarita Aquifer, the contribution of the Paso Robles Aquifer to basin production is not known with certainty. Estimates by previous investigators (Yates et al., 2005) indicate that an average of about 40 percent of the coastal area production was from the Paso Robles Aquifer in 2000 through 2003. However, with additional wells in the Santa Margarita Aquifer and changes in production over time, the current contribution from the Paso Robles Aquifer is estimated to be less. Recent analysis indicated that only about 20 percent of the basin pumping was from the Paso Robles Aquifer (HydroMetrics, October 2013 – see Appendix B).

It is expected that this declining trend in Paso Robles Aquifer production will continue into the future as the main producer in the Coastal Subareas, CalAm, transitions from their older wells that were primarily Paso Robles Aquifer wells, to the newer (and higher capacity) wells (i.e., Ord Grove, Paralta, ASR wells), which are primarily Santa Margarita Aquifer wells. Accordingly, the planned 10% allocation of GWR recharge to the Paso Robles Aquifer is reasonable as a future approximation, as further described in subsequent sections of this report (i.e., Section 3.3.5).

### 3.3.3. Santa Margarita Aquifer

The Santa Margarita Sandstone of Pliocene/Miocene age underlies the Paso Robles Aquifer throughout most of the Seaside Basin. The aquifer consists of a poorly-consolidated marine sandstone approximately 250 feet thick in the Northern Coastal subarea of the basin. The unit has apparently been eroded near the southern basin boundary due to uplift from folding and faulting along the Seaside and Chupines faults (Yates et al., 2005).

The Miocene/Pliocene Purisima Formation overlies the Santa Margarita Sandstone in some areas. This unit has been described in more detail along the coast and has been grouped with the Santa Margarita Aquifer in Layer 5 of the basin groundwater model (HydroMetrics, 2009). The Purisima Formation is difficult to delineate using subsurface data and is either thin or not present beneath the Proposed Project Injection Well Facilities area.

The Santa Margarita Aquifer is shown on the cross section on Figure 5. The more homogeneous nature of the Santa Margarita aquifer is illustrated on the geophysical logs for ASR-1 and FO-7. The aquifer is approximately 280 feet thick in the Proposed Project Injection Well Facilities area and contains about 74 percent sand (with the remainder containing sandy silt and minor clay). The aquifer is about 600 feet deep in the Proposed Project Injection Well Facilities area as indicated on Figure 5.

#### 3.3.3.1. Santa Margarita Aquifer Parameters

A review of Santa Margarita Aquifer parameters in the Proposed Project Injection Well Facilities and coastal areas indicated an average T value of 11,377 $ft^2$/day (Fugro, 1997; Padre, 2002). More recent aquifer tests in ASR-1 indicated a similar, but slightly higher, T value of 13,947 $ft^2$/day (Padre, 2002). The Watermaster model has a T value of about 24,000 $ft^2$/day in the Proposed Project Injection Well Facilities area.

Storativity (S) values have been estimated at 0.0018 and 0.00258 (dimensionless) for the Santa Margarita aquifer, indicating semi-confined to confined conditions. The confined nature of the aquifer suggests that groundwater replenishment can raise water levels more quickly and to higher levels than an equivalent amount of recharge in an unconfined aquifer. Parameters for the Santa Margarita Aquifer are summarized in Table 3.

#### 3.3.3.2. Santa Margarita Aquifer Recharge

Most of the recharge to the Santa Margarita Aquifer is assumed to occur by leakage from the overlying Paso Robles Formation, especially in areas where the lower Paso Robles is relatively permeable (Yates, et al., 2005; HydroMetrics, 2009). Recharge also enters the Santa Margarita Aquifer from subsurface inflow from other subareas and north of the basin boundary. Although the Santa Margarita crops out east of the Seaside Groundwater Basin, recharge occurring in the outcrop area has been interpreted to flow with groundwater toward the Salinas Valley away from the Seaside Groundwater Basin.

#### 3.3.3.3. Santa Margarita Aquifer Production

Coastal pumping in the Santa Margarita Aquifer was estimated to average about 2,500 AFY from 1999-2003, or about 60 percent of the coastal subarea production. Recent changes in wells and production intervals indicate that this percentage has increased. Basin-wide, the total production from the Santa Margarita is estimated to be about 80 percent (HydroMetrics, 2013, see Appendix B).

### 3.3.4. Groundwater Occurrence and Flow

As discussed above, groundwater occurs under unconfined and confined conditions in the Seaside Basin. Prior to groundwater development, groundwater flow patterns were generally from inland areas toward the coast. Currently, groundwater flow patterns are controlled by local groundwater pumping and subarea pumping depressions. In addition, groundwater flow patterns are altered near certain subarea boundaries where geologic faulting and other discontinuities have compartmentalized groundwater. In particular, the boundary between northern and southern subareas appears to impede groundwater flow. As pumping has lowered water levels in the northern subareas, changes in water levels and flow patterns across the boundary to the south have become more pronounced, with water levels in the southern subarea remaining higher and less influenced by pumping gradients.

In the Proposed Project Injection Well Facilities area, the unconfined water table occurs in the Paso Robles Aquifer leaving the overlying Aromas Sand unsaturated (Figure 5). To be specific, the water table occurs at a depth of about 400 feet below ground surface (bgs). Groundwater within the Santa Margarita Aquifer is semi-confined by low permeability units in the basal sediments of the Paso Robles Aquifer. Although some leakage occurs, water levels are different in the two aquifers. Differences are less near wells that are pumping from both aquifers. Beneath the Proposed Project Injection Well Facilities area, the potentiometric surface[6] in the Santa Margarita Aquifer is generally about 5 to 10 feet lower than the water table (Figure 5).

Water levels have been monitored in the Seaside Basin for at least 25 years. These data document the decline of water levels in the mid-1990s and a recent partial recovery of water levels in some areas. In general, changes in water levels have occurred in response to changes in groundwater production and ASR operation.

Figure 6 shows a long-term hydrograph of a well in the Northern Coastal Subarea, the PCA East well, to illustrate water level trends and fluctuations since 1989 in coastal areas of the basin. The curve highlighted in orange on Figure 6 represents water levels in the Paso Robles Aquifer and the lower curve represents water levels in the Santa Margarita Aquifer. Figure 7 shows hydrographs in two monitoring wells close to the Proposed Project Injection Well Facilities area, FO-7 and Paralta Test Well (located adjacent to the Paralta production well). Note that data for these wells are displayed from 1994 to 2013, a shorter time interval than shown for the PCA East Well on Figure 6. Similar to the PCA East well, FO-7 also consists of two monitoring points: a shallow well screened in the Paso Robles Aquifer, and a deep well screened in the Santa Margarita Aquifer. The Paralta Test well is screened in both aquifers and represents average water levels, although most of the water appears to be coming from the Santa Margarita Aquifer. Locations of the wells with hydrographs on Figures 6 and 7 are shown on Figure 8.

Hydrographs and water level contour maps are discussed in the following sections.

#### 3.3.4.1. Water Levels in the Paso Robles Aquifer

As shown on Figure 6, water levels in the Paso Robles Aquifer (PCA East – Shallow) have fluctuated between about minus 1 foot below msl to about 7 feet above msl over the last 24 years. Water levels declined below sea level in the mid-1990s in response to increases in groundwater production. Most of the subsequent groundwater production occurred in the deeper Santa Margarita Aquifer and water levels in the Paso Robles Aquifer rose near the coast. Since that time, water levels in the PCA well have stabilized at about two to seven feet above msl. However, water levels remain below msl farther inland where a pumping depression persists (Figure 8).

An additional hydrograph for the Paso Robles Aquifer is shown on the top graph on Figure 7. Water levels in FO-7 (shallow curve shown in orange) illustrate water table conditions about 3,000 feet north of the Proposed Project Injection Well Facilities. Since 1994, the water table in FO-7 has declined from elevations above 20 feet msl in the mid-1990s to about 15 feet msl and have averaged 14.5 feet since 2006 (Figure 7). This decline is consistent with

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[6] The level to which water rises in a well.

downgradient pumping in both aquifers that has created a localized pumping depression in the Northern Coastal Subarea.

Figure 8 shows the pumping depression by the closed contour of 0 feet msl (sea level) on the water level contour map (contours from HydroMetrics, 2013). This map, representing water levels measured in July and August 2013, shows water levels below msl covering an area of almost 1,000 acres (also covering about one-half of the Northern Coastal Subarea). Groundwater flow in both the Northern Coastal and Northern Inland subareas is controlled by the depression. Shallow groundwater beneath the Proposed Project Injection Well Facilities area flows west toward the center of the depression where water levels are lower than - 40 feet below msl.

The map also shows that the water levels in the adjacent Southern Coastal Subarea are not significantly influenced by the pumping depression. Contours in that subarea indicate westerly groundwater flow toward the coast and provide some evidence of compartmentalization of the groundwater system across the subarea boundary.

#### 3.3.4.2. Water Levels in the Santa Margarita Aquifer

Water levels have declined in the Santa Margarita Aquifer at a much faster rate than in the Paso Robles Aquifer. As shown on Figure 6, the potentiometric surface of the semi-confined Santa Margarita Aquifer indicates a long-term decline in the PCA East (Deep) well since the mid-1990s with only seasonal recovery. The high rate of decline is likely related to both the increase in Santa Margarita Aquifer pumping as well as the lower S value of the semi-confined aquifer. In general, the rate of decline has been less since about 2006 as a result of the adjudication of the groundwater basin and subsequent changes in pumping rates. Nonetheless, water levels have been below sea level in the coastal PCA East (Deep) well since 1995, increasing the risk of seawater intrusion.

Figure 7 shows similar trends and fluctuations on two hydrographs from Santa Margarita wells closer to the Proposed Project Injection Well Facilities area (FO-7 is about 3,000 feet north and Paralta Test Well is about 1,300 feet to the northwest, see Figure 8 for well locations). Water levels in the Paralta Test Well are generally higher than in FO-7 (Deep), likely due to the well screens installed in both the Paso Robles and the Santa Margarita Aquifers. Although the trends and fluctuations are more similar to the Santa Margarita water levels, the contribution from the Paso Robles Aquifer would raise overall water levels in the well. Water levels in the Paralta Test Well show greater seasonal fluctuations than observed in FO-7 due to its proximity to large pumping wells (Figure 7).

Figure 9 shows the widespread area of water level declines on a recent water level contour map for the Santa Margarita Aquifer (contours from HydroMetrics, 2013). The map shows that water levels are below msl over almost all of the Northern Coastal Subarea and a large portion of the Northern Inland Subarea. The lowest water levels are below -40 feet msl, similar to the low levels in the Paso Robles Aquifer (Figures 6 and 7). Water levels beneath the Proposed Project Injection Well Facilities area range from about -10 feet msl to about -30 feet msl.

The water level contour map also indicates that the pumping depression extends beyond the northern basin boundary but does not extend into the Southern Coastal subbasin. Similar to conditions in the Paso Robles Aquifer, groundwater in the Santa Margarita Aquifer in the Southern Coastal Subarea appears to be compartmentalized by geologic faulting and relatively unaffected by pumping to the north.

#### 3.3.5. Proposed Project Target Aquifers

Hydrogeologic and groundwater data indicate that both aquifers in the Seaside Basin could be recharged to increase basin yield. As shown by the water level contour maps in Figures 8 and 9, water levels in both aquifers have fallen below sea level, placing them both at risk for seawater intrusion.

To increase the basin yield and well production as envisioned in the Proposed Project, replenishment would occur to prevent adverse impacts on basin water levels. If an aquifer is pumped but not directly recharged, water levels may exhibit a short-term decline in one aquifer and a rise in the other. Although most of the groundwater production (and corresponding water level declines) has occurred within the Santa Margarita Aquifer, numerous production wells are also screened in the Paso Robles Aquifer.

These and other considerations for incorporating each aquifer into the Proposed Project are summarized in Table 4. Relative benefits and limitations are listed for comparison between the two aquifers. Issues are focused on the ability to recharge the Proposed Project's recycled water in a cost effective manner in order to allow basin yield to be increased. Based on the information discussed above and summarized in Table 4, the Proposed Project would include recharge into both of the basin aquifers.

**Table 4. Aquifer Considerations for the Proposed Project Injection Well Facilities Site**

| Issue | Paso Robles Aquifer | | Santa Margarita Aquifer | |
|---|---|---|---|---|
| | Relative Benefit | Relative Limitation | Relative Benefit | Relative Limitation |
| **Aquifer Characteristics** | Relatively shallow and thick aquifer. | More heterogeneous, interebedded with low permeability units, lower sand content, and lower hydraulic conductivity (K) values. | More permeable and homogeneous with a larger percentage of sand and higher K values. | Deep aquifer, occurring at depths greater than 600 feet locally. |
| **Groundwater Occurrence and Recharge Methods** | Unconfined groundwater allows for surface recharge. Deep water table creates large storage volume. Some downward leakage recharges underlying Santa Margarita Aquifer. | Interbeds limit downward migration of recharge in some areas. Lower K values limit injection capacity. Local test wells only capable of injecting about 350 gpm. | Semi-confined groundwater will respond more quickly to the same amount of recharge than in the shallower unconfined aquifer. High K values allow for high injection capacity. Local ASR wells inject >1,000 gpm. | Semi-confined groundwater has less storage. Direct recharge will require relatively expensive deep injection wells. |
| **Water Levels and Recovery of Product Water** | Water levels below sea level over large area. Several downgradient production wells screened in both aquifers. | Water level declines occur over a smaller area than Santa Margarita declines. Fewer wells are screened in the Paso Robles Aquifer. | Water levels declines are more severe, cover a larger area, and are below sea level throughout the Northern Coastal Subarea. | May require more coordination with nearby ASR operations. |

#### 3.3.5.1. Groundwater Modeling for Aquifer Allocation

The amount of recycled water from the Proposed Project allocated to the Paso Robles Aquifer and the Santa Margarita Aquifer can be varied to meet a variety of Proposed Project objectives including increasing basin yield, raising water levels, and providing adequate underground retention time of recycled water to meet regulatory requirements (see Section 4.1.4). The primary objective of the Proposed Project is to replenish the groundwater basin in a manner that allows for increased production in existing basin wells.

To support project planning, HydroMetrics applied the Watermaster groundwater model to determine the optimal allocation of recycled water injection between the two aquifers. Criteria for determining the optimal allocation included the following:

- capability of existing drinking water wells to capture the recharged recycled water
- minimizing loss of injected recycled water to ocean outflow
- balancing inflows and outflows with no groundwater storage changes.

A TM prepared by HydroMetrics documents the modeling assumptions and results. That TM is provided in Appendix B of this report (HydroMetrics, October 2013). Three scenarios were simulated as summarized in Table 5 below.

**Table 5. Aquifer Allocation of Recharge Water in Model Scenarios**

| Model Scenario | Paso Robles Recharge | Santa Margarita Recharge |
|---|---|---|
| 1 | 100% | 0% |
| 2 | 0% | 100% |
| 3 | 20% | 80% |

Based on the results of the modeling and application of evaluation criteria, an aquifer allocation between 80 percent and 100 percent of recharge to the Santa Margarita Aquifer (accompanied by 20 percent to 0 percent of recharge to the Paso Robles Aquifer) was judged optimal to allow increased production with minimal impacts to basin storage. Based on these results, the following recycled water injection allocations were proposed: 90 percent for the Santa Margarita Aquifer and 10 percent for the Paso Robles Aquifer. This allocation also approximates the production allocation from each aquifer screened in existing production wells.

### 3.3.6. Methods Considered for Groundwater Recharge

In order to select the most cost effective groundwater recharge method for the Proposed Project, Todd Groundwater examined various recharge methods for both aquifers. A summary of this examination is provided in the subsequent sections.

#### 3.3.6.1. Paso Robles Aquifer Recharge Method

Several recharge methods were considered for recharge into the Paso Robles Aquifer: surface recharge basins, vadose zone wells, and deep injection wells.

##### *3.3.6.1.1. Surface Recharge Methods*

Surface recharge basins were considered for the Proposed Project, given their long performance record in California and relative ease of construction and maintenance. However, surface recharge basins capable of recharging the total amount of water for the Proposed Project would require a large surface area of relatively flat land (estimated at about 10 acres) in a hydrogeologically-favorable location. MRWPCA determined that purchase of such a large parcel in the project area would be very expensive, even if land could be located. Even though recharge into the Paso Robles Aquifer was eventually allocated to be only a small percentage of project water, a surface basin would have a larger visual impact than using subsurface methods such as injection wells. In addition, subsurface methods can be spaced for minimal overall land disturbance. Also, the travel time for recharge water to reach the aquifer would be maximized in surface basins. For these and other reasons, surface recharge methods were eliminated from further consideration.

##### *3.3.6.1.2. Deep Injection Wells*

Deep injection wells for the Paso Robles Aquifer recharge were considered but eliminated after a hydrogeologic review of a test injection well that had been installed near the Proposed Project Injection Well Facilities. Specifically, MPWMD drilled a Paso Robles test injection well, PRTIW, for potential storage and recovery of surface water in the Paso Robles Aquifer. PRTIW is located west of General Jim Moore Boulevard across from the ASR-1 wellfield (Figure 2).

Injection testing in PRTIW indicated relatively low injection rates of approximately 350 gpm (compared to the nearby ASR Project and Proposed Project wells in the Santa Margarita Aquifer, which are expected  inject approximately 1,000 gpm), due to the lower hydraulic conductivity of the aquifer. The rate was deemed inadequate for an economical injection well by MPWMD, and the well is now being used for monitoring and for extracting water for irrigation supplies. Even though injection of 350 gpm might be considered an acceptable rate for the Proposed Project, it is unlikely that such a rate could be sustained on a long-term basis. Because of the heterogeneity and overall lower permeability in the Paso Robles Aquifer, injection capacity is likely to decrease more rapidly than in the more permeable Santa Margarita Aquifer. Lower permeability aquifers can be more susceptible to physical and biological processes that clog pores and restrict groundwater flow.

##### *3.3.6.1.3. Vadose Zone Wells*

A vadose zone well is an injection well installed in the unsaturated zone above the water table. These wells typically consist of a large-diameter borehole with a casing/screen assembly installed with a filter pack. The well is used as a conduit for transmitting water into the subsurface, allowing infiltration into the vadose zone through the well screen and percolation to the underlying water table. Creating this pathway is advantageous for replenishment projects where surficial soils or the shallow subsurface contain clay layers or other low permeability impediments to deep percolation. Vadose zone wells allow replenishment water to bypass shallow layers, reaching the water table faster and along more direct pathways. In addition, replenishment water quality can potentially benefit from soil-aquifer treatment (SAT) in the lower vadose zone prior to arrival at the water table.

Historically, vadose zone wells have been used in the U.S. with varying success, primarily functioning as disposal wells, or “dry wells” and often used for lower quality wastewater or stormwater. The primary disadvantage to using vadose zone wells is the difficulty of repairing wellbore/aquifer damage from physical or biological clogging once it occurs in the well. Typical well development and rehabilitation techniques cannot be conducted on wells screened in the vadose zone. However, the high quality recycled water anticipated for injection for the Proposed Project would be less likely to create potential clogging. Further, design specifications can be incorporated to mitigate clogging and other factors that decrease well performance such as air entrainment.

Over the last 15 years, vadose zone wells have been used successfully in similar areas for recharging recycled water. In particular, the City of Scottsdale, Arizona operates approximately 35 active vadose zone wells (with 27 additional backup wells) for groundwater recharge of recycled water at their Water Campus. Recharge capacity on a per well basis averages about 200 gpm to 400 gpm with some wells capable of injection rates higher than 1,000 gpm. Wells are spaced about 100 feet apart. MRWPCA visited the City to review details of the project. City technical staff provided information and data from these wells in support of the Proposed Project (City of Scottsdale, personal communication, July 16, 2007; July 27, 2007).

Some of the advantages and disadvantages of using vadose zone wells are listed below. Advantages of incorporating vadose zone wells into the Proposed Project include:

- greater certainty of migration pathways into the subsurface compared to surface basins
- ability to by-pass shallow low permeability layers, if any
- less land requirement than surface recharge basins
- no evaporation losses
- less expensive to construct compared to injection wells.

Some disadvantages of using vadose zone wells include:

- limited methods to develop or rehabilitate wells to address lost capacity due to clogging
- limited recharge rates
- air entrainment can reduce recharge capacity if wells are not operated properly.

Because of prior data gaps associated with the physical characteristics and recharge capability of the deep vadose zone at the Proposed Project Injection Well Facilities site, the MRWPCA field program focused on core samples and laboratory analyses throughout the vadose zone to about 130 feet below the water table. Results of the field program and laboratory analyses were used to confirm design features of the vadose zone wells for the Proposed Project (Section 4.2). Complete results of the vadose zone characterization are documented in a separate report on the field program (Todd Groundwater, February 2015).

#### 3.3.6.2. Santa Margarita Aquifer Recharge Method

Due to the semi-confined groundwater conditions in the Santa Margarita Aquifer, deep injection wells are the only viable method for groundwater replenishment. Although some vertical natural recharge occurs from the Paso Robles Aquifer into the Santa Margarita Aquifer, the amount and timing are uncertain. As noted above (Section 3.3.3.3), most of the extraction in the Northern Coastal Subarea is from the Santa Margarita Aquifer. Direct injection into the aquifer would allow for immediate benefits to water levels in that aquifer and allow downgradient wells to recover the recycled water in a more direct manner.

Successful use of deep injection wells in the Santa Margarita Aquifer has already been demonstrated at the nearby MPWMD ASR Project. Located only about 1,000 feet to 1,600 feet from the Proposed Project Injection Well Facilities site, these wells provide site-specific information on aquifer properties, injection capacity, well design, and costs. According to MPWMD, ASR wells are capable of sustaining injection rates of 1,000 gpm to 1,500 gpm. Testing data in ASR-1 indicated a T value of 104,325 gallons per day per foot (gpd/ft) and a specific capacity of 55 gallons per minute per foot of drawdown (gpm/ft) dd (Padre, 2002). Collectively these data, along with ongoing operational data, indicate that only three to four deep injection wells (allowing for down time associated with well maintenance) would be needed for the Proposed Project to recharge recycled water, a number that is feasible for the Proposed Project.

In addition to these site-specific data, there are four operating groundwater replenishment injection projects in California that have demonstrated the viability of long-term deep injection of recycled water. One example is the project implemented by the Orange County Water District (OCWD). For more than 36 years, OCWD has injected recycled water (and diluent water until 2008) into the Talbert Barrier, a line of more than 40 injection wells creating a hydraulic barrier to seawater along the Orange County coast. A second example is the West Coast Basin Barrier Project in nearby Los Angeles County, where recycled water (and potable water) has been injected into aquifers associated with the West Coast Basin Barrier Project since 1995. The barrier consists of an 8-mile line of about 150 injection wells from the Los Angeles airport to the Palos Verdes peninsula. Both projects have replenished various aquifers, increased the sustainable yield of the basins, and impeded the further intrusion of seawater.

## 4. PROPOSED PROJECT WELLS

The conceptual layout and preliminary design for the Proposed Project wells are based on the amount of recycled water available for replenishment (see Section 2) and the local hydrogeology (see Section 3). General specifications suggested for the two types of injection wells (vadose zone well and deep injection well) are summarized in Table 6.

### Table 6. Proposed Project Well Specifications

| Potential Project Specification[1] | Paso Robles Aquifer | Santa Margarita Aquifer |
|---|---|---|
| **Depth to Aquifer Top** | 371 feet | 623 feet |
| **Depth to Aquifer Bottom** | 623 feet | 903 feet |
| **Depth to Water** | 382 feet | 404 feet |
| **Recharge Method** | Vadose Zone Well | Deep Injection Well |
| **Groundwater Occurrence** | Unconfined | Semi-Confined to Confined |
| **Transmissivity** | 659 to 1,524 $ft^2$/day | 11,377 to 13,947 $ft^2$/day |
| **Hydraulic Conductivity** | 20 ft/day | 63 ft/day |
| **Number of Wells** | 4 | 4 |
| **Injection Capacity per well** | 500 gpm | 1,000 gpm |
| **Total Injection Capacity** | 2,000 gpm | 4,000 gpm |
| **Extraction Capacity per well (for well maintenance)** | NA | 2,000 gpm |

[1] Assumes project well configuration as shown on Figure 2 with an average ground surface elevation of 379 feet, mean sea level (msl). Depths are average depths for all wells.
$ft^2$/day – square foot per day; gpm = gallons per minute; NA – not applicable

The injection wells would be constructed on a parcel of land (APN-031-211-001-000) that is currently owned by FORA and scheduled for re-conveyance to the City of Seaside (City). This conceptual project configuration has been presented to the City in informational meetings but has not yet been formally approved by FORA or the City. The City, through its Municipal Code Ordinance, has placed prohibitions and restrictions on construction of wells on certain FORA parcels. However, the Proposed Project Injection Well Facilities would be located on a parcel that is not on the City's prohibited/restricted construction list. The only Municipal Code restriction for this parcel involves soils management during construction activities, which would be readily incorporated into the Proposed Project well Technical Specifications and drilling program requirements.

The Proposed Project injection well locations are shown on Figure 10 along with other project components including back-flush basins and monitoring wells. Estimated ground surface elevation, depth to water and the aquifers encountered in each proposed well are presented in Table 7.

## Table 7. Proposed Project Wells

| GWR PROJECT WELLS | GSE[1] | Groundwater Elevation[2] | Depth to Water | Paso Robles[3] | | Santa Margarita | | Well Depth |
|---|---|---|---|---|---|---|---|---|
| | | | | Depth to Top | Depth to Base | Depth to Top | Depth to Base | |
| | ft, msl | ft, msl | ft, bgs | ft, bgs | ft, bgs | ft, bgs | ft, bgs | ft, bgs |
| **Santa Margarita Deep Injection Wells (DIW)** | | | | | | | | |
| GWR-DIW-1 | 455 | -22 | 477 | 425 | 645 | 700 | 1000 | 1020 |
| GWR-DIW-2 | 395 | -30 | 425 | 395 | 647 | 647 | 947 | 967 |
| GWR-DIW-3 | 365 | -30 | 395 | 365 | 605 | 605 | 865 | 885 |
| GWR-DIW-4 | 299 | -18 | 317 | 299 | 539 | 539 | 799 | 819 |
| Average | 378.5 | -25 | 404 | 371 | 609 | 622.75 | 902.75 | 922.75 |
| **Paso Robles Vadose Zone Wells (VZW)** | | | | | | | | |
| GWR-VZW-1 | 455 | -5 | 460 | | | | | 200 |
| GWR-VZW-2 | 395 | -20 | 415 | | | | | 200 |
| GWR-VZW-3 | 365 | -30 | 395 | | | | | 200 |
| GWR-VZW-4 | 299 | -15 | 314 | | | | | 150 |
| Average | 379 | -18 | 396 | | | | | 187.5 |

[1]Ground Surface Elevation (GSE) based on Ord_Topo_Polyline shapefile from Marina Coast Water District, 2013.
[2]Water levels from July/August 2013 estimated from HydroMetrics WY 2013 SW Intrusion Analysis Report, December 2013, Figures 28 and 29.
[2]Groundwater elevation and depth to water represents the water table for the VZWs and the Santa Margarita potentiometric surface for DIWs.
[3]Aquifer geometry estimated from cross section analysis.
bgs = below ground surface
msl = mean sea level (negative indicates below sea level)

## 4.1. DEEP INJECTION WELLS

Key considerations for the design of Proposed Project deep injection wells include:

- sufficient capacity to accommodate delivered recycled water from the AWTF
- sufficient number of wells to plan for well maintenance and repairs offline
- adequate well spacing to minimize hydraulic mounding interference with other project wells or nearby ASR Project wells
- location sufficiently close to existing production wells to allow the efficient recovery of recycled water
- location with sufficient distance from downgradient production wells to comply with regulatory requirements regarding response and retention times (see Section 4.1.4).

These proposed design considerations are summarized in the following sections.

### 4.1.1. Deep Injection Well Capacity

Although MPWMD has installed four successful deep injection (and recovery) wells at the nearby ASR Project, the manner in which the Proposed Project deep injection wells would be operated may result in a slightly different well capacity than the ASR wells. Compared to the ASR Project wells, the Proposed Project wells would receive recycled water on a more continuous basis, would inject water at a more consistent rate over time, and would not be used for recovery of injected water (which would be accomplished through existing downgradient production wells). Injection wells would only be pumped (backwashed) periodically for well maintenance.

In consideration of these factors, a design injection rate slightly lower than the ASR Project wells has been selected for the Proposed Project. Injection capacity at the nearby ASR wellfield is estimated at approximately 1,500 gpm/well. Therefore, a slightly more conservative injection rate of 1,000 gpm/well is estimated for the Proposed Project. This rate would minimize local mounding and long-term stress on the wells.

#### 4.1.2. Number of Deep Injection Wells

Table 1 (in Section 2) presents potential recycled water delivery schedules to provide an average of 3,500 AFY and a maximum of 3,700 AFY of recycled water for Seaside Basin recharge. A key criterion is that the deep injection wells must be capable of accepting the maximum daily injection rate for recycled water from the AWTF for the Santa Margarita Aquifer. As shown in Table 1, the maximum rate for Santa Margarita injection is estimated at 2,179 gpm. With an injection capacity of 1,000 gpm/well, a minimum of three deep injection wells with total design capacity of 3,000 gpm would be required.

Although three wells appear to have sufficient capacity to handle the proposed recycled delivery schedules, extra injection capacity would be desirable to account for well maintenance/down time and potential decreases in well capacity over time. For planning purposes, an injection well is assumed to be operational about 80 percent of the time. Although decreasing injection capacity with time would be managed through well maintenance (back-flushing), the exact maintenance schedule is difficult to predict. Because a well might be down for maintenance (or other reasons) at a time when the maximum injection rate would be required, it is reasonable to incorporate a fourth deep injection well into the Proposed Project.

Accordingly, a total of four deep injection wells are proposed for the project, designated as DIW-1 through DIW-4 on Figure 10. The four proposed wells would provide a total operational capacity of 4,000 gpm, allowing capacity to be reduced to 3,000 gpm when any one well goes offline.

#### 4.1.3. Location and Spacing of Deep Injection Wells

As shown on Figure 10, the deep injection wells have been sited with approximately 1,000 feet between Proposed Project wells. A minimum 1,000-foot spacing is also maintained between each Proposed Project well and the closest downgradient well. There are technical and regulatory considerations for the location and spacing of these wells. Because the injection wells would be operated continuously (except during routine maintenance), water levels are expected to rise or “mound” around the injection wells and expand over time until steady state conditions are reached. As these groundwater mounds overlap in the subsurface, groundwater gradients increase and injection rates may decrease as the well becomes less efficient. Increased spacing between wells (based on the aquifer’s hydraulic properties) can minimize the impacts of this hydraulic interference. In addition, spacing between the injection wells and downgradient production wells is considered to balance the timely recovery of recharged water with longer retention times required by state regulations (see section 4.1.3.2). These considerations are discussed in more detail below.

#### 4.1.3.1. Hydraulic Interference

For the four deep injection wells that target the same confined aquifer, the proposed well spacing considers the potential for hydraulic interference due to groundwater mounding. Preliminary modeling conducted in 2005 for the CalAm ASR Project indicated that well spacing of about 1,000 feet between wells screened in the Santa Margarita Aquifer would result in only minor interference (ASR Systems, April 2005). Because the hydraulic properties assumed for that modeling are similar to those anticipated beneath the project Injection Well Facilities site, the 1,000-foot spacing is incorporated for the Proposed Project. By moving wells back to the edge of the parcel, the Proposed Project wells would also retain 1,000 feet spacing from the ASR wellfields to minimize interference with ASR operation.

#### 4.1.3.2. Response Retention Time

The SWRCB Division of Drinking Water (formerly the California Department of Public Health) has adopted Groundwater Replenishment Regulations (SWRCB Regulations) for the recharge of recycled water (SWRCB, June 2014). The SWRCB Regulations contain requirements for underground retention time of recycled water that could also potentially affect well spacing. For example, recycled water must be retained underground for a sufficient period of time (as proposed by a project sponsor as part of the California Water Code project permitting[7]) to identify and respond to any treatment failure so that inadequately treated recycled water does not enter a potable water system (referred to as the response retention time). The response retention time has to be at least two months. The 1,000-feet distance between Proposed Project wells and the closest downgradient production wells is expected to result in a travel time of approximately one year. Therefore, the proposed configuration of the Proposed Project wells would readily meet the minimum required response retention time.

#### 4.1.3.1. Underground Retention Time

Additional requirements in the SWRCB Regulations were also considered for well locations and spacing. According to the SWRCB Regulations, a groundwater replenishment project must achieve a 12-log enteric virus reduction using at least three treatment barriers, one of which can be underground retention time with a 1-log reduction per month up to 6 months (6-logs). Notwithstanding the effectiveness of the RTP and AWTF in controlling pathogens, the Proposed Project includes a conservative goal of achieving up to a 6-log virus reduction credit by keeping the recycled water underground for six months prior to arrival at the closest downgradient production wells (ASR-1, ASR-2, and City of Seaside 4 – see Figure 10).

This underground retention time will be demonstrated through a field tracer test after project implementation in compliance with the SWRCB Regulations. For planning purposes, the Watermaster groundwater model has been used to predict or estimate underground retention times for Proposed Project wells. When a model is used to demonstrate the travel

[7] This process includes submittal of an Engineering Report for approval by the SWRCB Division of Drinking Water and review by the CRWQCB.

time, the required retention time is doubled to account for uncertainty in the method of analysis as required by the SWRCB Regulations. Therefore, the model needs to demonstrate a travel time of one year to allow for a six-month credit. Preliminary modeling indicates that seven of the eight Proposed Project wells would meet the one year requirement needed to assume a 6-log virus reduction credit prior to a tracer test. However, modeling indicates that recycled water injected into one injection well, DIW-3, could reach ASR-1 in less than one year (shortest time of 327 days) under certain pumping conditions during five years of the 25-year simulation period. The fastest travel time of 327 days is 38 days short of the model-based one-year travel time project planning goal.

While the necessary underground retention time of six months remains applicable to the Proposed Project, a tracer test, rather than modeling alone, will be needed to demonstrate the project can meet the underground retention time to claim a 6-log reduction credit. Until that test can occur, it is assumed for planning purposes that the estimated minimum 10.5 to 11 months travel time from DIW-3 to the nearest extraction well will limit the reduction credit to a 5-log credit for the Proposed Project. For the conservative purposes of the EIR analysis, it is anticipated that a 5-log reduction credit can be achieved based on modeling results and future revisions would be based on an actual tracer test that is initiated after project startup. Model results are discussed in detail in Section 7. Documentation of the particle tracking associated with the modeling of the Proposed Project is provided in the TM by HydroMetrics (January 2015), included in this report as Appendix C.

#### 4.1.4. Preliminary Deep Injection Well Design

Incorporating some of the successful design features already tested in MPWMD ASR wells, a preliminary well design for a Proposed Project deep injection well has been developed. The exact well depth and screen placement may be determined based on field results during project construction. Current design criteria are summarized in Table 8. A preliminary deep injection well construction diagram is shown on Figure 11.

### Table 8. Summary of Design Criteria For Proposed Project Injection Wells

| Component/Parameter | Criteria |
|---|---|
| Number of Santa Margarita injection wells | 4 |
| Average depth to water | 400 feet |
| Injection rate per well | 1,000 gpm |
| Discharge rate per well | 2,000 gpm |
| Average well depth | 909 feet |
| Casing size and materials | 18-inch outer diameter (OD) stainless steel |
| Screen assembly | 230 feet stainless steel wirewrap |
| Pump for back-flush | 400 horse power (Hp) |

## 4.2. VADOSE ZONE WELLS

Similar to deep injection wells, well capacity and well spacing are also key considerations for vadose zone wellfield design. However, pathways and transport of the product water from the AWTF are also important considerations. Recent data from the MRWPCA field program was used to analyze a preliminary vadose zone well design and operational parameters for the Proposed Project. Complete results of the field program are presented in a separate report (Todd Groundwater, February 2015). For planning purposes, the vadose zone well layout is shown on Figure 10 and discussed in more detail below.

### 4.2.1. Well Capacity

MRWPCA collected site-specific data during the 2013-2014 field program to better assess potential injection capacity and optimize well design for recharging the Paso Robles Aquifer. Based on core samples and geologic logging in MRWPCA MW-1, the vadose zone appears more homogeneous and permeable than the saturated zone of the Paso Robles Aquifer. Hydraulic conductivity data from core samples indicate the potential for high injection rates. An analysis of vadose zone well capacity presented in the field program report (Todd Groundwater, February 2015) indicated that one vadose zone well could likely recharge the entire allocation of 242 gpm. The analysis suggests that with about 100 feet of screen, an injection rate of approximately 500 gpm could be achieved. This analysis is supported by the large storage capacity in the vadose zone beneath the Proposed Project Injection Well Facilities site.

Thin, low-permeability silt and clay zones were more prevalent in the lower portions of the vadose zone that could potentially decrease injection rates or result in long travel times to the water table. A comparison of these zones with geologic descriptions in the closest production wells (Reservoir Well and PRTIW) indicate that these layers are not likely continuous over the Proposed Project Injection Well Facilities area.

### 4.2.2. Number of Wells

With an estimated injection capacity of 500 gpm, only one vadose zone well would be needed to accommodate the anticipated delivery of product water. As shown in Table 1 (Section 2), the maximum injection rate estimated for the Paso Robles Aquifer is 242 gpm.

However, more than one well is recommended for several reasons. First, the long-term injection capacity of vadose zone wells is uncertain and may also represent very long travel times. Vadose zone wells are subject to clogging and cannot be redeveloped using conventional techniques. Vadose zone wells are much less expensive than deep injection wells and can be incorporated into the Proposed Project at a much lower cost. In addition, the extra capacity would provide the Proposed Project with operational flexibility. If unanticipated well problems arise, additional vadose zone capacity would allow injection to continue while wells are being repaired or replaced. If monitoring indicates that certain target recharge areas are being under-supplied to the Paso Robles Aquifer, additional vadose zone wells would allow recharge to be targeted in specific areas. Accordingly, four vadose zone wells are being incorporated into the Proposed Project design.

#### 4.2.3. Spacing and Location of Wells

The locations of the vadose zone wells along the 3,000 feet corridor are less sensitive to the criteria for placing the deep injection wells with respect to the distance to the nearest downgradient production well. In particular, vadose zone wells are less sensitive to the requirement for underground retention time described previously (Section 4.1.3.1). Average linear groundwater velocities are lower in the Paso Robles Aquifer due to lower permeability, which adds to the travel time to production wells. In addition, travel time is lengthened by the additional time needed for water to percolate from vadose zone well screens to the water table.

In addition, the spacing between wells is considered less critical for hydraulic interference than deep injection well spacing, given the large storage volume in the vadose zone and the relatively small amounts of injection planned for the vadose zone wells. Well spacing at the Scottsdale Water Campus was only a few hundred feet for wells of similar depth and injection rates as the Proposed Project. Further, there is no spacing requirement between deep injection wells and vadose zone wells because they are recharging separate aquifers.

For planning purposes, it is proposed that one vadose zone well would be placed next to each of the four deep injection wells, resulting in a well spacing of 1,000 feet between vadose zone wells (Figure 10). This configuration provides some construction and operational conveniences in that deep and shallow wells are in close proximity for monitoring and maintenance.

#### 4.2.4. Preliminary Well Design

Based on the above analysis of the Proposed Project, a preliminary vadose zone well design has been developed. The preliminary well design incorporates some of the appropriate design features from the City of Scottsdale's successful vadose zone wells including well and casing diameter and materials. Most of the City of Scottsdale's recent wells consist of a 30-inch to 48-inch diameter borehole containing a 12-inch to 18-inch PVC casing/screen assembly with approximately 100 feet of slotted screen. Wells were typically drilled to a depth of 150 to 180 feet and installed with a filter pack from the bottom of the well up to a surface seal. The vadose zone beneath Scottsdale consists of permeable alluvial sediments with the water table at a depth of approximately 400 feet, conditions similar to the Proposed Project Injection Well Facilities site (City of Scottsdale, personal communication, July 27, 2007).

One of the early operational problems experienced by the City of Scottsdale was lost capacity due to air entrainment, a situation remedied by maintaining a full water column in the recharge pipe and preventing cascading water in the well (Marsh, et al., 1997). Casing failures also have occurred in some wells and appear to correlate to the placement and operational pressure of the injection line at the well screen (City of Scottsdale, personal communication, July 16, 2007).

Over time, the City of Scottsdale has modified their well design to install one or more small-diameter recharge lines to the bottom of the well (e.g., a 4-inch PVC casing referred to as an eductor line). The well design also incorporates transducer tubes, ventilation lines, and lines to access the gravel pack (City of Scottsdale, personal communication, July 27, 2007). These three additional components allow for more accurate monitoring, less chance of air entrainment, and ability to add to the gravel pack, respectively.

Based on the information reviewed from the Scottsdale vadose zone wells and site-specific conditions investigated during the recent MRWPCA field program, design criteria have been developed for the Proposed Project wells as summarized in Table 9. A preliminary vadose zone well construction diagram is provided on Figure 12.

**Table 9. Summary of Design Criteria for Proposed Vadose Zone Wells**

| Component/Parameter | Criteria |
|---|---|
| Number of wells | 4 |
| Depth to water table | 380 feet |
| Borehole diameter | 48 inches to 150 feet; 30 inches to 200 feet |
| Casing/Screen diameter | 18-inch OD PVC with 100 feet slotted casing (100 slot) |
| Injection | 4-inch OD PVC eductor line |
| Injection capacity | 500 gpm |
| Annular material | Artificial filter pack or gravel |
| Monitoring equipment | Transducer |

## 4.3. Well Maintenance and Back-flushing Operations

Deep injection wells would need to be pumped periodically to maintain injection capacity, a process known as back-flushing. Injection rates typically decrease with time as a result of numerous conditions that can clog the well such as air entrainment, filtration of suspended or organic material, bacterial growth, precipitates due to geochemical reactions, swelling of clay colloids, dispersal of clay particles due to ion exchange, and/or mechanical compaction of aquifer materials (Fetter, 1988). Clogging rates are often directly related to the presence of solids in the recharge water and indirectly related to the permeability of the aquifer (i.e., higher clogging rates are typically correlated to lower permeability aquifers). Pumping reverses the flow in the well, alters the geochemical environment, and dislodges some of the clogging particles.

### 4.3.1. Back-flushing Rates and Schedule

Back-flushing is typically conducted at pumping rates higher than injection rates. In a plugging survey published by Pyne (2005), injection rates averaged about 75 percent of extraction rates, but that percent varied widely from project to project. At the nearby ASR Project, MPWMD back-flushes the wells at about twice the injection rate. For planning purposes, it is assumed that the Proposed Project would also back-flush the deep injection wells at twice the injection rate. Accordingly, the deep injection wells would be designed for an injection rate of 1,000 gpm, and back-flushing would be conducted at 2,000 gpm.

The optimal back-flushing schedule and required pumping volumes would be determined once the injection wells are operational. At one Arizona project, injection well operators found that frequent pumping for short periods on a daily basis was the most effective schedule for re-establishing declining capacity (Bouwer, 2002). Other operators have found monthly pumping to be adequate.

The nearby MPWMD ASR wellfield site contains a small back-flush basin that holds approximately 240,000 gallons of water to accommodate several hours of weekly pumping. Because the Proposed Project recycled water will contain relatively low suspended or total dissolved solids (TDS), clogging rates of the deep injection wells may be lower than observed at nearby ASR wells. However, because the Proposed Project wells are being completed in the same aquifer as the ASR wells, and because the injectate for the ASR Project is also relatively low in solids content, weekly pumping is being assumed for planning purposes. Regardless of the pumping frequency, a facility for retention and recharge of the discharged water would be constructed.

For planning purposes, a back-flush schedule similar to the one established at the nearby ASR wellfields would be incorporated into the Proposed Project. The ASR operations suggest that the proposed deep injection wells would be pumped for approximately four hours each on a weekly basis at a pumping rate of 2,000 gpm (twice the estimated injection rate). The actual amount of backflushing would be based on operational needs established in the field, but this schedule represents a reasonable maximum for evaluation of potential impacts. This schedule would produce approximately 480,000 gallons per well per week for discharge into a back-flush basin.

### 4.3.2. Back-flush Basin Location

In order to facilitate the back-flushing operation, a small surface basin would be constructed near the Proposed Project wells. Water would be piped to the basin, allowed to infiltrate the permeable sediments on the open basin bottom, and percolate down to the water table. By allowing the water to recharge, pumped water would be conserved. This approach for infiltration of back-flushed water was conceptually approved by the SWRCB Division of Drinking Water (Division of Drinking Water, 2014). A preliminary design of the basin and other back-flushing appurtenances has been conducted for MRWPCA by E2 Consulting Engineers.

Several sites have been considered for the proposed back-flush basin location. Although only one site would be needed to support the Proposed Project, three potential sites are shown on Figure 10. The northeastern-most site is the preferred location for the Proposed Project due to its proximity to DIW-1 and DIW-2, the two wells likely to be installed first during the construction phase of the project. The northeastern basin location is also situated on a relatively flat area along the comparatively steep grade of the Proposed Project area.

Two alternate basin sites have been conceptualized at the southern portion of the Proposed Project Injection Well Facilities site near General Jim Moore Boulevard. One site is of similar design to the northeastern basin alternative and is situated at the lowest ground surface elevation of the Proposed Project Injection Well Facilities area (refer to the southern area of blue shading on Figure 10). That basin would be capable of receiving and recharging back-flush water from the Proposed Project wells via a gravity-flow pipeline.

A third location for a back-flush basin is identified northwest of the second location and within 100 feet of General Jim Moore Boulevard. This larger, and potentially deeper basin, was originally identified by MPWMD as an alternative site for back-flush water from the ASR Project wells. The basin is located within a natural depression, referred to as the San Pablo depression due to its proximity to San Pablo Avenue (see Figure 10). Discussions between MPWMD and MRWPCA indicated that there may be some efficiency for sharing a back-flush basin. However, basin construction has not yet been approved and MPWMD has been considering other discharge options in addition to the San Pablo depression.

#### 4.3.3. Back-flush Basin Design

The basin would be constructed on the Aromas Sand, which comprises the upper 300- to 400-feet of vadose zone beneath the Proposed Project Injection Well Facilities area. This geologic unit was recently evaluated in a nearby monitoring well MRWPCA MW-1 (Figure 10). Core samples throughout the vadose zone were collected and analyzed for vertical permeability values to assist with the design. Laboratory permeability values vary widely from more than 100 feet per day in the most permeable sand zones to less than 0.01 feet per day in silty clay intervals. However, samples above about 277 feet contain very little fine-grained sediment (silt or clay). The lowest permeability value above that depth is about 14 inches per hour (or 28 feet per day). MPWMD corroborated this laboratory infiltration rate with observed infiltration rates of about one foot/hour during the first hour of discharge at the existing ASR back-flush basin (located between ASR-1 and ASR-2 and about 1,000 feet from the preferred Proposed Project back-flush basin location, see Figure 10).

Although the vertical permeability value of 28 feet per day may not translate into a long-term infiltration rate, the laboratory data and geologic core samples from MRWPCA MW-1 indicate that the upper 277 feet of the vadose zone is capable of rapid infiltration and storage of water discharged into a back-flush basin. Further, these rates suggest that the basins would be empty on a regular basis for drying and periodic tilling to break up any surficial clogging. For planning purposes, a conservative design infiltration rate of six feet per day is assumed. That rate is judged reasonable, given that it is only about 20 percent of the lowest permeability value recorded in the upper 277 feet of the vadose zone.

Based on these data, E2 Consulting Engineers has developed a preliminary design for the back-flush basin at the Proposed Project Injection Well Facilities site. The preliminary design covers a footprint of approximately 180 feet by 50 feet and would be located between DIW-2 and DIW-3 in the general vicinity of the northeastern-most location shown on Figure 10.

#### 4.3.4. Vadose Zone Wells and Back-flushing

Although vadose zone wells are also subject to clogging, they are constructed above the water table and cannot be readily back-flushed. The injection rate decline in those wells will not be known until the Proposed Project injection begins. However, there are many factors associated with the Proposed Project that would compensate for this potential issue. First, injection design rates are much smaller than indicated by recent permeability data for the Aromas Sand (Todd Groundwater, February 2015). Second, only about 10 percent of the total recycled water produced by the AWTF is currently planned for injection into vadose zone wells. With the assumed conservative injection rate and the smaller amounts of water available for injection, wells would not be needed full time and can dry between injection cycles. This would encourage die-off of any bacterial growth in the well. In addition, the Proposed Project recycled water would be highly treated with very low suspended or dissolved solids that could clog wells. Finally, more vadose zone wells are being incorporated into the Proposed Project than the anticipated volumes suggest are needed. If vadose zone wells are capable of 500 gpm as planned, four wells would provide a capacity of 2,000 gpm. However, a total capacity of only about 242 gpm is needed to handle the maximum amount of water allocated for the Paso Robles Aquifer (see Table 1). Collectively, these factors indicate that vadose zone wells can be incorporated successfully into the Proposed Project without back-flushing.

Even if all of the factors above are not sufficient to maintain injection capacity, there is the potential to install temporary equipment into the vadose zone wells to flush the annular space and pump out water that subsequently flows into the well. This method may be considered if injection rates in vadose zone wells cannot be sustained or managed with the number of wells proposed. The current design of the back-flushing detention basin would be capable of handling this small amount of extra water on a temporary basis if needed.

### 4.4. MONITORING WELLS

New monitoring wells and a monitoring well program are incorporated into the Proposed Project to demonstrate ongoing project performance and to comply with existing regulations. Objectives of the monitoring well program would be to comply with SWRCB and Central Coast Regional Water Quality Control Board (CRWQCB) regulatory requirements by:

- collecting baseline water quality samples prior to startup of the Proposed Project
- monitoring groundwater levels and water quality; the well design would allow for sample collection from each aquifer receiving recycled water
- siting one downgradient well with groundwater travel times (underground retention time) no less than two weeks and no more than six months from the Proposed

Project injection wells (well also has to be greater than 30 days travel time from the nearest drinking water source)

- siting an additional downgradient well between the Proposed Project Injection Well Facilities and the nearest downgradient potable water supply (in addition to the downgradient monitoring well used to demonstrate retention time).

The monitoring wells would also be used to collect data as part of the tracer study (or studies) to demonstrate an underground recycled water retention time of at least six months for a 6-log virus reduction credit and the response retention time that would be developed as part of the California Water Code project permitting process for the Proposed Project.

#### 4.4.1. Monitoring Well Locations

The number and location of appropriate monitoring wells will be negotiated with the SWRCB Division of Drinking Water and CRWQCB for the Proposed Project. Proposed monitoring wells would satisfy the regulations described above and allow for proper monitoring of project performance. After the completion of one field tracer test, results may eliminate the need for one or more monitoring wells located close to remaining injection wells. Further, it appears from preliminary particle tracking results that several injection wells could be monitored by one set of downgradient monitoring points. Nonetheless, the locations of the monitoring wells have not yet been optimized and approved by the SWRCB Division of Drinking Water or CRWQCB. Accordingly, two monitoring well locations for each of three injection well clusters are assumed for the purposes of the impacts analysis.

Following this conservative assumption, the Proposed Project could incorporate up to six downgradient monitoring wells in each aquifer (12 monitoring points) on the north, central, and south portions of the project area, resulting in monitoring wells at six locations (GWR MW-1 through GWR MW-6 on Figure 10). At each of the six monitoring well locations, two adjacent, but separate boreholes would be drilled in close proximity (within about 20 feet) of each other at the same location – one for the Paso Robles Aquifer and one for the Santa Margarita Aquifer (referred to as a well cluster). These six well clusters would result in 12 monitoring points at six locations. For simplicity, each well cluster is referred to as one monitoring well in the text and on the figures.

This monitoring well distribution would allow two downgradient well clusters between each of three injection wells (DIW-2, DIW-3, and DIW-4) and the closest production wells (ASR-1 and ASR-2 for DIW-2 and DIW-3 and Seaside No. 4 for DIW-4). Due to the location and distance of DIW-1 from the nearest downgradient well, GWR MW-2 would also provide monitoring of DIW-1 and no additional wells in the eastern project area are envisioned (Figure 10).

Three of the downgradient monitoring well clusters (GWR MW-1, GWR MW-3, and GWR MW-5) would be located within about 100 feet of three Proposed Project injection wells (DIW-2, DIW-3, and DIW-4) to allow near-injection monitoring and to accommodate tracer testing in compliance with the SWRCB Regulations (SWRCB, 2014). According to the regulations, the near-injection monitoring well would monitor subsurface transport times between two weeks and six months (SWRCB, 2014). This well can also serve as the monitoring well for an injectate tracer test. Three additional downgradient monitoring well clusters, GWR MW-2, GWR MW-4, and GWR MW-6, would be located about halfway between the Proposed Project and the nearest drinking water well in order to monitor groundwater conditions with more than 30 days of transport time away from the drinking water well (SWRCB, 2014).

MRWPCA MW-1 and FO-7 (shallow and deep) would provide upgradient data to support the monitoring program by serving as control wells (Figure 10). Sampling of these wells in January 2014 included an expanded analyte list to provide background water quality data.

## 5. WELL CONSTRUCTION ACTIVITIES

The field construction program involves construction and testing of the Proposed Project wells as described in this section. The actual timing of construction, equipping, and hook-up of the proposed wells would be coordinated with construction of the Proposed Project facilities being developed by others.

### 5.1. FIELD PLANNING

Prior to the initiation of the proposed well construction field program (referred to simply as field construction program in this section), numerous planning activities would be required including:

- identification of specific field activities
- sequencing and scheduling of events
- development of Technical Specifications for wells and the drilling and testing program
- selection of qualified contractors
- assistance to MRWPCA for permit applications, as needed
- confirmation of sampling protocols
- coordination with analytical laboratories
- preparation of field documents that may be required by FORA or the City such as Health and Safety Plans, Traffic Control Plans, Hazardous Materials Plan, and/or Noise Control Plans.

Logistics for the proposed field construction program would include any mitigation measures that may be required by the EIR.

#### 5.1.1. Permits

The numerous permits required for the Proposed Project are documented in the EIR. The primary permits related to well drilling and construction are listed below.

##### 5.1.1.1. Fort Ord Reuse Authority (FORA) Right-of-Entry

Until the ESCA parcels have been cleared by FORA (scheduled for 2015), a Right-of-Entry (ROE) permit will be required for any field work conducted in the Proposed Project Injection Well Facilities area. MRWPCA would be required to submit a workplan for proposed field activities and an ROE application with a reimbursement agreement for application review. For the recently-completed MRWPCA field program, this ROE permit process was initiated in March 2013, but not completed until September 2014 (18 months later). Although there are some efficiencies that have been learned during this initial application phase, long lead times would still be required for FORA ROEs for the proposed field construction program.

#### 5.1.1.2. City of Seaside Conditional Use Permit and Encroachment Permit

The City of Seaside has established operating procedures for any projects involving soil disturbance or groundwater wells within the former Fort Ord lands (Chapter 15.34, Seaside Municipal Code, also referred to as the Ordnance Ordinance). Permit conditions are applicable to projects that disturb greater than 10 cubic yards ($yds^3$) of soil on certain parcels identified as having munitions or explosives of concern or a project involving a well installation or groundwater replenishment (limited to parcels having a groundwater covenant as defined by the ordinance that restricts groundwater use).

The Proposed Project Injection Well Facilities would be located on portions of two parcels (APN 031-151-048-000 and APN 031-211-001-000) that are not associated with a groundwater covenant in the Ordnance Ordinance but are associated with some construction restrictions. These include no soil disturbance without a soils management plan, notification of possible MEC, and access requirements.

The City will also require a Conditional Use Permit (CUP) to be approved by the Planning Commission. Currently, the City views the wells associated with the Proposed Project as a utility that requires a CUP application and fee.

#### 5.1.1.3. Monterey County

Monterey County Drinking Water Protection Services, Environmental Health Bureau requires a permit for all water supply and monitoring wells. Application forms can be downloaded from the Environmental Health Bureau website for the monitoring wells. For the proposed injection wells, the Drinking Water Protection Services should be contacted directly. The applications must be signed by the property owner; for this project, an encroachment permit from a municipality (e.g., City of Seaside) can be submitted in lieu of a property owner signature. For the recent monitoring well, a signature from FORA was also required because they were the land owner at that time. Application fees are required for each well.

#### 5.1.1.4. California Department of Water Resources (CDWR) and Monterey County Water Resources Agency (MCWRA)

All wells drilled in California, including monitoring and injection wells, require a permit from the CDWR. Such permits, including required completion of a Driller's Log, would be secured by the drilling contractors used for Proposed Project. In Monterey County, MCWRA has a cooperative agreement with the CDWR to manage the Driller's Log permits. Also, DEH provides paperwork from the Monterey County DEH well construction permit process (described above) to MCWRA.

#### 5.1.1.5. CRWQCB and SWRCB Division of Drinking Water

Currently, groundwater replenishment projects must obtain a permit from the CRWQCB (Waste Discharge Requirements and/or Waste Discharge and Water Reclamation Requirements) in accordance with California Water Code Sections 13523 and 13523.1. This process entails submittal of a Report of Waste Discharge to the CRWQCB and an Engineering Report for review by the CRWQCB and approval by the SWRCB Division of Drinking Water. The Division of Drinking Water issues a conditional approval letter, which contains provisions for the CRWQCB to include in the permit. Effective July 1, 2014, California Water Code Section 13528.5 provides the SWRCB (and hence the Division of Drinking Water) with the authority to issue groundwater replenishment permits. At this time is it is not known if or when the Division of Drinking Water might take over the permitting responsibility from the CRWQCB.

An additional permit for well construction may also be required by the CRWQCB. If drilling methods result in application to land of cuttings or drilling fluids/development water, a Notice of Intent may be required to comply with a state-wide General Order (No. 2003-0003-DWQ). This General Order allows the CRWQCB to grant a permit through an administrative approval process for *General Waste Discharge Requirements for Discharges to Land with a Low Threat to Water Quality*. General Order No. 203-0003-DWQ applies to well development discharge, monitoring well purge water discharge, and boring waste discharge.

#### 5.1.1.6. U. S. Environmental Protection Agency (USEPA) Injection Well Registration

The USEPA administers the Underground Injection Control (UIC) Program, which contains requirements for various classes of injection wells in the state. Injection wells associated with the Proposed Project are designated as Class V wells under the UIC program. Any injection project planned in California must meet the State Sources of Drinking Water Policy, which ensures protection of groundwater quality for drinking water supplies, and therefore a USEPA permit would not be necessary. However, the wells must be registered on the UIC injection well database maintained by USEPA.

### 5.1.2. Well Technical Specifications

Technical Specifications would be developed for each of the Proposed Project injection wells and monitoring wells. These detailed documents would provide a preliminary well design and describe methods and standards for each well. The specifications would also identify requirements for drilling cuttings and fluid disposal, and use of local utilities, if allowed. In addition, specifications would provide constraints associated with the ROE or other permits not obtained by the drilling contractor. The documents would require preparation and implementation of a site-specific health and safety program.

## 5.2. INSTALLATION AND TESTING OF DEEP INJECTION WELLS

The drilling of a deep injection well would require sufficient space for drilling rig access and for storage of temporary wastes such as drilling fluid and cuttings from the borehole. In general, a relatively small site (smaller than about 100 feet by 100 feet) can be accommodated, but may result in increased well costs if staging and equipment storage is limited or if onsite equipment cannot be located for optimal construction operations. However, such a site may not be sufficient to support additional project components such as pits or holding tanks for well discharge. Technical specifications would be based on the drilling site available.

### 5.2.1. Drilling

The proposed deep injection wells would be drilled with rotary drilling methods similar to those employed for the ASR wellfield. Those wells were drilled using reverse rotary drilling methods and polymer-based drilling fluids to minimize deep invasion of fluids into the formation. Similar methods would be used for the Proposed Project wells to minimize borehole impacts from drilling fluids. Cuttings from the borehole would be logged by a California Certified Hydrogeologist. Open-hole geophysical logging would also be conducted.

It is anticipated that at least one of the Proposed Project monitoring wells would be installed prior to the installation of the proposed deep injection well. This would provide site-specific information and inform details of injection well design. The well would also provide a monitoring point during injection well testing.

### 5.2.2. Design, Installation, and Development

The proposed deep injection well design would incorporate 18-inch to 24-inch diameter production casing and a wire-wrap stainless steel screen. Screen selection and filter pack design would be developed using both cuttings from the adjacent proposed monitoring well in addition to data collected from nearby ASR wells. Mechanical and pumping techniques would be used to develop the well after installation. Video logs would be conducted in the final wellbore to document well construction and ensure appropriate down-hole conditions for equipping.

### 5.2.3. Testing and Equipping

Both variable (step) and constant discharge pumping test and constant injection tests would be completed in the proposed injection wells. An 8- to 24-hour test length would be sufficient for the variable and constant rate tests. Flowmeter surveys would be conducted following pumping and injection testing to identify water movement within the wellbore. For planning purposes, it is assumed that both static and dynamic flow testing will be conducted.

The variable and constant rate discharge tests would be conducted immediately following installation and well development and would provide aquifer parameters to support final well design. Injection testing could be conducted after the constant rate discharge tests, but would require product water that may not be available at the time of well construction. As such, injection testing may be delayed unless an adequate alternative water source is available for testing purposes.

At the end of the constant rate discharge test, a water quality sample would be collected to confirm local groundwater quality. Constituents targeted for analysis would be based on compliance with the SWRCB and CRWQCB requirements. The well would be disinfected with chlorine to control any bacterial growth introduced during installation.

A 400 horsepower, variable speed pump for the proposed injection wells is assumed for planning purposes and costs. Additional requirements for wellhead equipment and surface connections are being developed with others on the Proposed Project team.

To maintain injection capacity, the wells would need to be taken offline for periodic pumping to back-flush the well screens and repair or prevent physical clogging. Details for the back-flush basin were discussed previously in this report (Section 4.3). This water would not be lost from the project, but would be allowed to percolate back into the groundwater basin.

## 5.3. INSTALLATION AND TESTING OF VADOSE ZONE WELLS

The drilling, installation, and testing of the proposed vadose zone wells would likely require less surface area than the proposed deep injection wells. Currently, the proposed vadose zone wells are planned to be on the same well sites as the proposed deep injection wells to minimize construction and ground disturbance to a smaller area than would otherwise be needed.

### 5.3.1. Drilling

The proposed vadose zone wells would be drilled using the bucket auger drilling method. The field data and results from the drilling, logging, and installation of GWR MW-1 and DIW-1 would be used to confirm the depth and placement of well screens. Grab samples in the vadose zone well boreholes would be logged by a certified California Hydrogeologist during drilling to assist in final vadose zone well design. Open-hole geophysical logging (including induction logging and other logs suitable for the unsaturated zone) would be conducted to assist in stratigraphic characterization. The final logging program would depend on the quality of the data collected in DIW-1. The usefulness of additional logging, such as a video log, would be evaluated based on results of the initial field investigation and pilot testing.

### 5.3.2. Design and Installation

The preliminary vadose zone well design is discussed in Section 4.2.4 and shown on Figure 12. An 18-inch diameter casing would be set in a borehole drilled to below 200 feet. The annular space would be filled with a high quality gravel pack appropriately sized to avoid plugging the formation with filter-pack fines during long-term injection. Dry chlorine would be mixed with the gravel pack during installation to control bacterial growth that may have been introduced during well installation. Air vents and a transducer tube would also be installed in the annular space of the well.

The casing would be perforated over an approximate 100-foot interval to optimize the open area for recycled water recharge. An eductor tube (typical 4-inch diameter) would be installed in the casing and used to introduce water into the wellbore in a manner that avoids turbulent flow in the open casing and potential air entrainment. The eductor tube would be installed with an orifice plate on the bottom or a variable orifice valve to introduce specified sustained or variable flows. An air vent would also be installed in the casing to allow air to escape while being displaced by the water.

### 5.3.3. Pilot Testing and Monitoring

Injection testing would be conducted to establish a wetting front and estimate long-term injection rates. A one-month test is assumed to be sufficient to inform any well design modifications for the remaining wells. In general, the subsequent three vadose zone wells would be installed in the same manner as the first vadose zone well, which is considered a pilot well.

To allow for monitoring during pilot testing, a small-diameter boring would be drilled adjacent to the pilot vadose zone well to install temperature probes or other monitoring devices to track the wetting front of the project water as it percolates through the vadose zone. This monitoring would provide valuable information for the demonstration of underground retention time associated with the SWRCB Regulations (SWRCB, 2014).

Hook-up to the conveyance system may incorporate a butterfly valve that allows automatic recharge operation at each well. All wells would be equipped with a high water level alarm. Well hook-ups and onsite water supply lines would be coordinated with pipeline and surface equipment designs by others. Once installed, the vadose zone wells would require a relatively small surficial footprint and can be incorporated into the Proposed Project close to deep injection wells.

## 5.4. Drilling, Installation and Development of Monitoring Wells

The Proposed Project monitoring wells would be drilled with the direct or reverse rotary method. Wells would either be installed as well clusters (separate casings in two smaller boreholes) or nested wells (two casings in one larger borehole) in order to monitor both the Paso Robles and Santa Margarita Aquifers at each monitoring well location. For planning purposes, well clusters are assumed.

Geologic samples from all boreholes would be logged by a California Certified Hydrogeologist. Geophysical logging would be conducted to supplement geologic data from the well cuttings.

Casing diameter would need to be sized to accommodate a sampling pump sufficiently large to lift a groundwater sample from depths greater than 400 feet (minimum 3-inch outer diameter). Wells would be drilled to similar depths as the closest proposed deep injection well and screened similar to injection wells for the Santa Margarita Aquifer. For the Paso Robles Aquifer monitoring, well casings would be screened across the upper-most permeable zones and close to the water table in order to track shallow recharge from the proposed vadose zone wells.

## 5.5. GROUNDWATER MONITORING PROGRAM

Following installation, all of the Proposed Project monitoring wells and deep injection wells would be sampled and analyzed to collect baseline water quality data in conformance with SWRCB Division of Drinking Water and CRWQCB requirements.

# 6. PROPOSED PROJECT INJECTION WELL FACILITIES: SEQUENCING AND SCHEDULE

Field planning for the Proposed Project Injection Well Facilities would begin soon after certification of the Final EIR. One of the initial steps in field planning would involve the preparation of Technical Specifications for the wells and applications for drilling permits. The FORA right-of-entry permit for the recently installed monitoring well took approximately 14 months to secure.

The field activity sequencing could consider some alternate scheduling to minimize construction time while providing some flexibility for unanticipated subsurface conditions that would impact well drilling.  A list of steps describing the potential sequencing of the Proposed Project well program is provided below. Well locations are shown on Figure 10. The field program generally begins in the north (DIW-1) and ends in the south (DIW-4).

1. Mobilize a bucket auger rig to the field to install surface conductor casing at the two northern monitoring well sites (GWR MW-1 and GWR MW-2). Then move the auger rig to each of the four deep injection well sites (DIW-1, DIW-2, DIW-3, and DIW-4 for conductor casing installation. Surface casings may also be installed for GWR MW-3 and MW-4 before the bucket auger rig is released. Each surface casing is assumed to be installed in one day including rig mobilization.

2. As soon as the bucket auger rig completes the casing at GWR MW-1, mobilize a reverse rotary drilling rig to the field to drill, log, install, and develop two well clusters (Shallow and Deep) at the first monitoring well location. Data from GWR MW-1 would be used to finalize the pre-drilling design of DIW-1. The reverse rig can then be moved to GWR MW-2 to complete the monitoring wells on the north end of the site. Monitoring wells would need to be the first wells installed to allow for collection of baseline groundwater data prior to project startup. A small pump rig can be moved onto GWR MW-2 to complete the monitoring wells while the reverse rotary rig is moved to DIW-1.

3. The reverse rotary rig would drill and install DIW-1. The pump rig would be brought onto DIW-1 for well development and pumping/injection testing, allowing the reverse rig to move to DIW-2. Pumping test would be conducted initially with the pump rig. The injection testing may be delayed, depending on the availability of source water; product water would not be available initially after well completion. The remaining DIW wells would be drilled in a similar manner with the pump rig following the reverse rig.

4. Monitoring well clusters at GWR MW-3 and MW-4 can be completed with the reverse rotary rig after completion of the deep injection wells. Alternatively, an additional reverse rotary rig could be brought in to complete the monitoring well program prior to drilling DIW-4. In that way, hydrogeologic data in the southern

Proposed Project area could be obtained that might inform well design modifications for DIW-4. In addition, baseline sampling events would need to be conducted prior to injection into DIW-4.

5. Mobilize a bucket auger rig to the field to drill a pilot vadose zone well, VZW-1. The vadose zone program could begin after the installation of DIW-1 or after all deep injection wells and monitoring wells are installed. It is recommended that at least the two northern monitoring wells and DIW-1 be completed prior to construction of vadose zone wells. This would allow analysis of the site-specific hydrogeologic data collected during the drilling of the three wells to ensure an optimal pre-drilling design of the vadose zone wells. The first vadose zone well should be viewed as a pilot well or test well to allow testing of the injection capacity prior to installation of the remaining wells. The injection capacity of 500 gpm/well used in project planning is highly conservative, given the thick and permeable sands in the vadose zone. In addition, the maximum amount of injection into the Paso Robles Aquifer is small (277 gpm) and may be accommodated with fewer wells. However, this testing and sequencing of wells would allow optimization and modification of vadose zone well design, as necessary.

6. An additional, small-diameter boring would be installed adjacent to the pilot vadose zone well and equipped with temperature probes or other vadose zone monitoring devices to allow tracking of the wetting front with the initial pilot well testing. The boring could be installed in close proximity to the vadose zone well and would not require additional construction space than has already been allocated for the EIR evaluation. A 30-day (approximate) pilot test would be conducted in VZW-1 to quantify the injection capacity of the vadose zone at that location and to inform future well design.

7. Construction and installation of the back-flush basin could be conducted during the initial drilling of DIW-1 to provide a temporary location for well testing water. Alternatively, other arrangements could be made for testing water, allowing the back-flush basin construction to be completed during conveyance piping and wellhead equipping. It is assumed that pipeline installation would be best conducted soon after the drilling program has been completed to allow for injection testing.

Depending on the timing of other activities, the field program could also be completed in phases. For example, GWR MW-1, MW-2, DIW-1 and DIW-2 could be completed in an initial phase to allow for tracer testing and groundwater modeling prior to installation of the remaining program wells. Phasing would be controlled by the amount and timing of product water available for injection.

# 7. GROUNDWATER IMPACTS ASSESSMENT

The Seaside Groundwater Basin is an important resource for a reliable water supply for the Monterey Bay area. Increased replenishment of basin aquifers has many benefits including locally higher groundwater levels and increased basin yield, while mitigating the effects of over-pumping during the dry season. Potential impacts from the Proposed Project on water levels, quantity, and quality are described in this section.

## 7.1. GROUNDWATER LEVELS AND QUANTITY

In order to predict the transport of recycled water in the groundwater system and to evaluate potential impacts of the Proposed Project on groundwater levels and quantity, HydroMetrics has conducted groundwater modeling using the Seaside Basin groundwater flow model. The modeling of the Proposed Project builds on previous modeling runs that were used during project development to allocate project water between the two basin aquifers (HydroMetrics, October 2013). The initial project development modeling was described previously in this report (Section 3.3.5.1); the TM documenting the project development modeling results is included in this report as Appendix B. The Proposed Project modeling is included in this report as Appendix C.

The Proposed Project modeling incorporated the proposed delivery schedule and drought reserve account as described in Section 2. The appropriate delivery schedule of the eight schedules shown on Table 1 was assigned to each year of project operation in the modeling based on hydrology and the balance of the drought reserve account. The amounts used for injection for each year of the 25-year simulation are documented in an attachment at the end of the HydroMetrics TM (Appendix C).

A brief summary of the Proposed Project modeling in Appendix C and implications for project impacts on groundwater resources are discussed in the following sections.

### 7.1.1. Modeling Approach

The Proposed Project modeling was conducted using the predictive model setup that the Watermaster has developed previously for analyzing future conditions in the basin. The predictive model covers a 33-year period from 2009 through 2041. The Proposed Project well operations are currently anticipated to begin in 2017. For purposes of the modeling analysis, the injection was simulated as beginning in October 2016 to cover the entire Water Year (WY) 2017 and allow for a 25-year analysis of the project.

The Proposed Project modeling was also conducted using reasonable assumptions of future operation of production wells in the basin. Production wells were assumed to be pumping in the model based on court-allocated pumping and agreements associated with the Seaside Basin adjudication. CalAm production wells (and the ASR wells) were assumed to be the recovery (extraction) wells for the Proposed Project product water based on existing well capacity and water demand (see Appendix C).

The Proposed Project modeling also incorporated a quantitative assessment of future operations of the ASR Project. This assessment was developed by MPWMD, which coordinates the ASR injection and extraction operations under cooperative agreements with CalAm. The assessment was based on historical hydrologic conditions on the Carmel River between 1987 and 2008 and approved rules of ASR operation. This allowed MPWMD to predict both injection and recovery schedules at each ASR well over time. By incorporating this assessment into the model setup, the Proposed Project was evaluated during a full range of ASR injection and recovery (pumping) conditions (see Appendix C).

#### 7.1.2. Modeling Results

The Proposed Project modeling simulated the travel time between injection wells and the closest production wells under the varying hydrologic and pumping conditions throughout the 33-year simulation, incorporating all of the associated delivery schedules in Table 1. The Proposed Project modeling also evaluated changes in water levels at eight production wells over time and assessed the potential for the Proposed Project to potentially affect the risk for seawater intrusion. Full modeling results are presented in Appendix C and summarized below.

##### 7.1.2.1. Flow Paths and Travel Time to Production Wells

The travel time analysis, a modeling process referred to as particle tracking, evaluated the transport of recycled water from injection well to production (extraction) wells. The analysis allows the visualization of groundwater flow paths and provides details for demonstrating compliance with the underground retention time requirements in the SWRCB Regulations.

For the particle tracking analysis, “particles” (acting as a simulated tracer of the recharged water) were released at each of the eight proposed injection well sites (four deep injection wells and four vadose zone wells) in every month of the 25-year simulation when the Proposed Project was in operation. This ensured that the fastest travel time under numerous combinations of pumping and ASR operations could be identified. Particles were simulated as being released around the edges of each model cell containing an injection well and tracked as the water flows downgradient in the groundwater system. Particles were tracked until they reached a cell containing a production well. Tracking from the edges of cells (rather than at the well within the cell) allows for a thorough examination of particle transport, but is also conservative in that it eliminates the additional distance a particle would travel between the actual well and the edge of a cell.

The fastest flow paths as indicated by the model particle tracking simulations are shown on Figure 13. The upper map on Figure 13 shows simulated flow paths from the deep injection wells and the lower map shows the paths from the vadose zone wells. Simulated flow paths from the deep injection wells are being influenced by the dynamic system created by changes in pumping and injection in both production and ASR wells. As shown, the shortest simulated flow paths are from DIW-3 to the nearby ASR wells (shown in red on the top of Figure 13). Simulated vadose zone flow paths are not impacted by the ASR wells, which are screened in the deeper Santa Margarita Aquifer. Recycled water injected in the vadose zone wells flows downgradient unimpeded until arrival at wells that are at least partially screened in the Paso Robles Aquifer (e.g., Paralta, Luzern). Injection at VZW-1 does not arrive at any production well during the travel time simulation shown in Figure 13, but provides replenishment to the local Paso Robles Aquifer as water flows downgradient.

The fastest travel times for each of the injection wells are tabulated by HydroMetrics (Appendix C) and reproduced in Table 10. The shading for each injection well in Table 10 generally corresponds to the colors of the respective well flow paths on Figure 13.

**Table 10. Simulated Fastest Travel Times between Injection and Extraction Wells, in days**

| Extraction Well | Well of Origin of Particles with Fastest Travel Time (Days) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | DIW-1 | DIW-2 | DIW-3 | DIW-4 | VZW-1 | VZW-2 | VZW-3 | VZW-4 |
| ASR 1&2 | - | 371 | 327 | 1,780 | - | - | - | - |
| ASR 3&4 | 724 | - | - | 3,074 | - | - | - | - |
| Luzern | - | - | - | - | - | - | 3,140 | - |
| Ord Grove | 3,718 | 1,952 | 1,052 | 1,497 | - | - | - | 4,250 |
| Paralta | 506 | 521 | 852 | 2,076 | - | 5,114 | - | - |

Note: - = no particle traveling between wells

As shown in Table 10, simulated travel times vary considerably from each injection point to a production well. The deep injection wells provide water to six different wells (including four ASR wells, Paralta, and Ord Grove), varying from 327 days (about 11 months) to more than 3,000 days (more than eight years). Simulated travel times are longer for the injection into the vadose zone wells, but water is still being added to basin storage, which increases hydraulic gradients and groundwater flow toward downgradient wells.

Regarding the underground retention time in the SWRCB Regulations, it appears that project water would remain in the groundwater system for at least six months, which would provide the Proposed Project with the maximum allowed 6-log virus removal credit. However, the demonstration of retention time with groundwater modeling requires a one-year travel time for approval of the six-month credit; DIW-3 does not meet the one-year requirement for all conditions (including the fastest simulated travel time for DIW-3 shown in Table 10). Although the simulated travel times from all injection wells meet the one-year requirement during 20 of the 25-year GWR simulation period, simulated travel times for injection in DIW-3 during five years of the simulation are between 327 days and 365 days. The shortest simulated travel time from DIW-3 to ASR-1/ASR-2 is 327 days, 38 days short of the 365-day simulated travel time needed for the maximum 6-log removal credit. The modeling does, however, support at least a 5-log removal credit. The six-month credit would be re-evaluated as part of the tracer testing to be conducted after the Proposed Project begins operation.

#### 7.1.2.2. Groundwater Levels

Because the Proposed Project would provide additional water for downgradient extraction, the project would result in both higher and lower water levels in existing basin wells over time depending on the timing of extraction and the buildup of storage in the basin. An examination of eight key production wells was completed by HydroMetrics and presented for the entire 33-year simulation period (including 25 years of GWR project operation) (HydroMetrics, January 2015, in Appendix C). These hydrographs illustrate simulated changes in water levels over time at various locations within the basin with and without the Proposed Project. Hydrographs for all eight wells (with one hydrograph representing both ASR-1 and ASR-2) are presented and discussed in the HydroMetrics TM (see Appendix C). Four example hydrographs comparing the *Proposed Project* with a *No Project* scenario are presented on Figures 14 and 15, representing deep and shallow water levels, respectively.

##### *7.1.2.2.1. Deep Water Levels*

Figure 14 presents water levels representing two ASR wells closest to the Proposed Project Injection Well Facilities (ASR-1 and ASR-2) and a downgradient production well, Ord Grove 2. Well locations are shown on Figure 10 (Ord Grove 2 is labeled Ord Grove on the figure). On both Figures 14 and 15, the *No Project* scenario is represented by the blue line and the GWR *Project* scenario is represented by the green line. The Proposed Project is simulated to begin in late 2016 (WY 2017); prior to that time period, the water levels for the *No Project* and *Project* scenarios are the same (Figures 14 and 15).

In general, simulated deep water levels (Figure 14) rise in the ASR and Ord Grove wells soon after the Proposed Project is implemented in late 2016. Although simulated water levels continue to rise and fall due to seasonal fluctuation associated with water demand and pumping, water levels do not fall to the lower levels observed in 2011 – 2016. The general rise in water levels occurs under both *Project* and *No Project* conditions. This change is primarily due to the decrease in overall basin pumping as required under the adjudication. For the ASR wells, simulated water levels under the *Proposed Project* scenario are similar to or slightly higher than the *No Project* water levels.

An exception to this occurs during a drought cycle, generally represented by the time period 2031 – 2035, when simulated water levels associated with the Proposed Project are one to nine feet lower than under *No Project* conditions. During that time, the ASR wells are pumping to recover GWR Project water under *Project* conditions, but the ASR wells are not operating under *No Project* conditions. ASR wells are idle during *No Project* conditions because, during drought conditions, no water is available to be extracted from the Carmel River Alluvial Aquifer for ASR injection and no stored water is available for ASR recovery. Because the simulated pumping for the *Project* conditions causes water levels in the wells to fluctuate more than for the *No Project* conditions, simulated water levels are lower on a seasonal basis under the *Project* conditions during a simulated drought cycle. This impact is seen as beneficial overall in that simulated water levels are not lowered significantly and only for a short duration, while simulated groundwater pumping and water supply has been increased during a drought. Under both scenarios, overall simulated water levels remain higher than current levels.

For the Ord Grove well (Figure 14), simulated water levels are relatively similar for the *Project* and *No Project* scenarios from project implementation to about 2029. At that time, *Proposed Project* simulated water levels are generally lower (up to about 10 feet lower), but typically less than about five feet lower during the bottom of each pumping cycle. Again, this is due to the increased pumping allowed by the increased recharge of the Proposed Project. Also, the simulated lower water levels during the drought cycle are higher than the low levels reached prior to the initiation of the Proposed Project. Because simulated water levels are higher than current levels while production is being increased in the basin, the Proposed Project is considered to have a beneficial impact on water supply without a significant adverse impact to groundwater levels and wells.

##### *7.1.2.2.2. Shallow Water Levels*

Figure 15 documents changes in simulated water levels under both *Project* and *No Project* scenarios, as illustrated by the Luzern and PCA-W Shallow wells (both screened in the Paso Robles Aquifer). Similar to the deeper hydrographs, simulated water levels generally rise under both *Project* and *No Project* conditions due to an overall decrease in basin pumping. After the Proposed Project is initiated, the Luzern well is pumped to recover the recharged water, although the water has not yet arrived in the vicinity of the well. This creates slightly lower simulated water levels (up to about seven feet) in early stages of the Proposed Project. This also occurs in the PCA-W Shallow well, but the difference is only a few feet because this well is not being pumped to recover Project water. With time, simulated water levels in the Luzern and PCA-W wells rise under the *Project* scenario as Project recharge water moves downgradient toward these wells. The benefit of additional recharge is demonstrated by higher simulated water levels associated with the Proposed Project during drought conditions for both of these wells (beginning in about 2030).

Importantly, simulated water levels do not fall below pre-project levels and do not fall below the Protective Elevation for seawater intrusion (see the Protective Elevation line on PCA-W Shallow well on Figure 15). These Protective Elevations have been determined by the Seaside Basin Watermaster to provide target water levels that are considered to protect the basin from the adverse consequences of seawater intrusion (HydroMetrics, 2009). Although other coastal wells remain below Protective Elevations with and without the Proposed Project, the changes predicted to be associated with the Proposed Project are demonstrated by the hydrograph of PCA-W Shallow, the closest coastal well. These data indicate that the Proposed Project will not exacerbate the risk for seawater intrusion compared to the *No Project* conditions.

#### 7.1.2.3. Groundwater Quantity

The modeling simulations of the Proposed Project recover only the water recharged to the aquifers. As such, the Proposed Project would not result in a significant change in groundwater storage in the basin because the water being injected would eventually be extracted for municipal use. Further, the Proposed Project would increase basin yield and groundwater supply.

## 7.2. IMPACTS ASSESSMENT ON GROUNDWATER LEVELS AND QUANTITY

Based on the results of the modeling and groundwater analyses, potential impacts of the Proposed Project on groundwater levels and quantity are compared to thresholds of significance as developed from CEQA guidance.

### 7.2.1. Thresholds of Significance

Appendix G of the 2013 CEQA Guidelines provides the following question to be addressed as part of the Proposed Project EIR regarding groundwater resources:

> *Would the Proposed Project substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted)?*

The criterion above was applied to the results of the groundwater modeling as summarized in the following section. Additional CEQA questions and significance criteria have been developed for addressing water quality. The analysis of groundwater quality is provided in Section 7.3 with the impacts analysis and the significance criteria provided in Section 7.4.

### 7.2.2. Analysis of Potential Impacts

As discussed above, simulated water levels are sometimes lower under the *Project* scenario because of increased pumping at existing extraction wells. However, simulated water levels are lowered only about 10 feet or less and would be lowered for a relatively short duration, typically for a few months. In addition, simulated water levels are generally higher than pre-project levels. As such, none of the municipal or private production wells would experience a reduction in well yield or physical damage. All existing wells would be capable of pumping the current level of production or up to the permitted production rights.

In addition, analysis of the closest shallow coastal well (PCA-West Shallow) indicates that increased pumping of project water would not result in water levels falling below elevations protective of seawater intrusion. Although it would take time for the beneficial impacts of recharge to reach coastal pumping wells, the increased pumping of nearby Paso Robles production wells would only reduce water levels about two feet near the coast. The closest coastal well, PCA-W shallow remains above Protective Elevations for the duration of the model simulation period.

In addition, there would be no adverse impacts to the quantity of groundwater resources. Because the Proposed Project would only recover the amount of water injected, there would be no long-term change in groundwater storage associated with the Proposed Project.

## 7.3. EXISTING GROUNDWATER QUALITY AND PROPOSED PROJECT RECYCLED WATER QUALITY

In order to evaluate potential impacts on water quality from the Proposed Project, both ambient groundwater quality and quality of the Proposed Project recycled water are characterized. The characterization of ambient groundwater quality establishes a baseline for a water quality impacts assessment in support of the EIR. The characterization incorporates available data and previous investigations, and also summarizes the results of new geochemical evaluations regarding the interaction of the existing geologic sediments in the Proposed Project area with product water generated from the GWR pilot/demonstration treatment facility[8]. Those geochemical analyses are presented more fully in a separate report on the MRWPCA field program (Todd Groundwater, February 2015).

The Proposed Project Injection Well Facilities study area shown on Figure 2 was used as the focus of the groundwater quality characterization. In order to incorporate additional available water quality data, the study area was expanded about 2,000 feet to the west to include five additional production wells. Water quality data were also evaluated for: 1) the Carmel River water, which is injected into nearby ASR wells; and 2) predicted recycled water quality to be produced at the AWTF and to be injected into the Seaside Basin. The geochemical evaluation utilized data from the advanced treatment pilot testing and bench scale chemical stabilization, which did not include all of the new source waters to be treated at the RTP and subsequently treated at the proposed AWTF. However, the data are a reasonable representation for purposes of the EIR. Types of data and analyses are described in the subsequent sections of this report.

### 7.3.1. Data Sources

Previous investigations on groundwater quality in the Seaside Groundwater Basin were reviewed including Fugro (1998), Yates et al. (2005), and HydroMetrics (2009). Recent annual reports developed by the Watermaster contain evaluations of potential seawater intrusion (HydroMetrics, 2013). Information was also reviewed in the Final Salt and Nutrient Management Plan (SNMP), which includes summaries of ambient groundwater quality including concentrations of TDS, nitrate, and other constituents (HydroMetrics, 2014).

Recent and historical groundwater quality data for the Proposed Project Injection Well Facilities study area were provided by MPWMD and CalAm. These data were supplemented with recent data collected by Todd Groundwater in association with the MRWPCA field program. Data provided from these sources are summarized in Table 11 and described in the following sections.

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[8] A description of the water quality of the Proposed Project product water is provided in Section 7.3.4. based on a bench-scale stabilized sample from the pilot treatment facility.

**Table 11. Source of Groundwater Quality Data**

| Water Quality Database | Data Source | | |
|---|---|---|---|
| | MPWMD | Cal-Am | MRWPCA |
| *# Wells* | 14 | 8 | 6 |
| *Time Period* | 1990-2012 | 2010 - 2013 | 2014 |
| Anions | x | x | x |
| Metals (including major cations) | x | x | x |
| Conventional Chemistry Parameters | x | x | x |
| Chlorinated Pesticides and PCBs | x | x | x |
| Nitrogen and Phosphorus Pesticides | x | x | x |
| Organic Analytes | x | x | x |
| Chlorinated Acids | x | x | x |
| Carbamates | | x | x |
| Volatile Organic Compounds (VOCs) | x | x | x |
| Semivolatile Organic Compounds | | x | x |
| Haloacetic Acids | | x | x |
| Herbicides | | x | x |
| Nitroaromatics and Nitramines (Explosives) | | | x |
| Other (e.g., isotopes) | | | x |

*PCBs – Polychlorinated Biphenyls*
*Organic Analytes – including 1,2-Dibromo-3-chloropropane, 1,2-Dibromoethane (EDB), diquat, endothall, glyphosate*
*Carbamates – organic compounds derived from carbamic acids*

#### 7.3.1.1. MPWMD Groundwater Quality Monitoring Program

MPWMD conducts a basin-wide groundwater monitoring program with support from the Seaside Basin Watermaster. Components of the program also serve as the monitoring program for the ASR Project. An electronic database in Access© format was provided by MPWMD for this analysis. The database included the Watermaster monitoring program data along with historical groundwater quality data dating back to 1990. Data from 14 wells were used in the water quality characterization.

#### 7.3.1.2. CalAm Production Well Monitoring

CalAm monitors the water quality from their production wells in the basin in compliance with drinking water requirements per California Water Code, Title 22. These data were provided to Todd Groundwater in Excel© format for eight production wells in the water quality study area and included samples from 2010 through 2013.

#### 7.3.1.3. Water Quality Analyses from MRWPCA Field Program

From December 2013 through February 2014, Todd Groundwater conducted a field program for MRWPCA in support of the Proposed Project. The program included a detailed vadose zone analysis, installation and sampling of a new monitoring well (MRWPCA MW-1), and groundwater sampling from five additional wells in the Proposed Project Injection Well Facilities area including two upgradient monitoring wells (FO-7 Shallow and FO-7 Deep) that had not previously been sampled for groundwater quality. The field program, including all testing and analyses, is documented in a separate report (Todd Groundwater, February 2015). Groundwater sampling results were incorporated into this report to support the water quality impacts assessment. Wells sampled during the field program are summarized in Table 12.

**Table 12. Wells Sampled in 2013-2014 Proposed Project Field Program**

| Well | Well Type | Screened Aquifer | Well Depth (feet, bgs) | Screen Interval (feet, bgs) |
|---|---|---|---|---|
| **MRWPCA MW-1** | Monitoring | Paso Robles | 521 | 421 - 446; 466 - 516 |
| **FO-7 Shallow** | Monitoring | Paso Robles | 650 | 600 - 640 |
| **FO-7 Deep** | Monitoring | Santa Margarita | 850 | 800 - 840 |
| **PRTIW** | Irrigation | Paso Robles | 460 | 345 - 445 |
| **ASR MW-1** | Monitoring | Santa Margarita | 740 | 480 - 590; 610 - 700 |
| **Seaside Muni 4** | Production | Santa Margarita | 560 | 330 - 350; 380 - 420; 430 - 470; 490 - 550 |

*Notes: All wells sampled January/February 2014. bgs = below ground surface.*

An expanded list of constituents was analyzed in these samples (compared to the list of constituents available from monitoring at other basin wells) including:

- chemicals including explosives associated with former Fort Ord activities
- constituents in the SWRCB Regulations
- constituents of emerging concern (CECs) as included in the SWRCB Recycled Water Policy
- isotopic data to support hydrogeologic analysis
- data to support geochemical modeling in order to analyze the compatibility of the Proposed Project recycled water with ambient groundwater.

Laboratory analyses of groundwater samples collected at these six wells are presented in Appendix D (as Tables D-1A through D-1P).

#### 7.3.1.4. Water Quality Database

Data sets from the sources described above were compiled into an Access© database. This database was used to characterize groundwater quality and identify potential constituents of concern for the Proposed Project water quality impacts assessment.

### 7.3.2. Groundwater Quality Characterization

The available data representing general groundwater chemistry were checked for accuracy and then evaluated using various geochemical techniques, as summarized in this section.

#### *7.3.2.1.* Geochemical Analysis and Methodology

Major cation (calcium, magnesium, sodium, potassium) and anion (chloride, sulfate, bicarbonate and carbonate) analyses were plotted on standard Stiff, Trilinear (Piper), Schoeller diagrams (see Hem, 1989), and Brine Differentiation (BDP) plots. Analyses reported in milligrams per liter (mg/L) were recalculated to milliequivalents per liter (meq/L) to evaluate water chemistry and possible sources of groundwater recharge. In the absence of total bicarbonate data, reported total calcium carbonate ($CaCO_3$) concentrations were recalculated to bicarbonate ($HCO_3^-$) using a conversion factor from Hounslow (1995). To validate the general mineral data, a cation-anion balance error analysis was conducted using the groundwater data.

For geochemical plotting purposes, the most recent available data were used for wells near the Proposed Project Injection Well Facilities. The six wells included in the MRWPCA field program contained the most recent sampling (January or February 2014). Data from July 2012 through November 2013 were used for all other wells except the Ord Terrace well, which contained a more complete data set from September 2009.

#### 7.3.2.2. Analytical Accuracy Using Charge Balance and Cation/Anion Ratios

A cation-anion balance (also known as a charge balance) was calculated for the available analytical data. This is a method by which water quality analytical accuracy is checked to ensure that the water is electrically neutral (hence the term, *charge balance*). For an ideal charge balance, the sum of the anions in milliequivalents per liter (meq/L) should equal the sum of cations in meq/L (Hounslow, 1995).

The charge balance is usually expressed by the equation:

$$\textbf{Balance} = (\sum \text{cations} - \sum \text{anions}) / (\sum \text{cations} + \sum \text{anions}) * 100$$

If the calculated cation-anion balance is less than 10 percent, then the data are assumed to be accurate. If the resulting balance is greater than 10 percent, then one or more of the following conditions may apply:

- the data are inaccurate
- other constituents, such as trace metallic ions or organic ions, may have been present that were not analyzed
- the water was very acidic and hydrogen ions were not present.

Another accuracy check is the ratio of the total cations/total anions, which is also calculated in meq/L. If the ratio equals 1.0, or is at least between 0.90 and 1.10, the data are considered to be accurate. Because a limited number of cations and anions were analyzed, a cation-anion balance of less than 10 percent is assumed to be accurate. Results of the charge balance and cation/anion ratio are provided in Table 13.

**Table 13. Charge and Cation-Anion Balance for Groundwater Data Accuracy**

| Well Designation | Aquifer Screened | Total Cation/Anion Ratio | Target Ratio Accuracy | Charge Balance (%) | Target Balance Accuracy % |
|---|---|---|---|---|---|
| Darwin | Paso Robles | 0.84 | 0.9-1.10 | -8.81 | ≤ 10 |
| Military | Paso Robles | 0.91 | 0.9-1.10 | -4.851 | ≤ 10 |
| Seaside Mid. School | Paso Robles | 0.96 | 0.9-1.10 | -2.13 | ≤ 10 |
| MRWPCA MW-1 | Paso Robles | 1.018 | 0.9-1.10 | 0.87 | ≤ 10 |
| FO-7 Shallow | Paso Robles | 1.32 | 0.9-1.10 | 13.61 | ≤ 10 |
| PRITW Mission | Paso Robles | 0.84 | 0.9-1.10 | -8.70 | ≤ 10 |
| City of Seaside Muni 4 | Paso Robles | 0.97 | 0.9-1.10 | -1.44 | ≤ 10 |
| ASR-2 | Santa Margarita | 1.17 | 0.9-1.10 | 7.93 | ≤ 10 |
| ASR-3 | Santa Margarita | 0.78 | 0.9-1.10 | -12.65 | ≤ 10 |
| Ord Terrace Shallow | Santa Margarita | 0.94 | 0.9-1.10 | -3.15 | ≤ 10 |
| Ord Terrace Deep | Santa Margarita | 1.01 | 0.9-1.10 | 0.61 | ≤ 10 |
| ASR-1 (SMTIW) | Santa Margarita | 1.04 | 0.9-1.10 | 1.82 | ≤ 10 |
| Seaside Middle School | Santa Margarita | 0.84 | 0.9-1.10 | -8.23 | ≤ 10 |
| FO-7 Deep | Santa Margarita | 1.04 | 0.9-1.10 | 1.94 | ≤ 10 |
| ASR MW-1 | Santa Margarita | 1.037 | 0.9-1.10 | 1.82 | ≤ 10 |
| Paralta | Both | 1.016 | 0.9-1.10 | 0.80 | ≤ 10 |
| Ord Grove | Both | 2.00 | 0.9-1.10 | -0.12 | ≤ 10 |
| ASR Injectate | Treated Surface Water | 1.02 | 0.9-1.10 | 0.81 | ≤ 10 |
| GWR Pilot Water | GWR Pilot Plant | 1.05 | 0.9-1.10 | 2.50 | ≤ 10 |

As shown in Table 13, most of the data are within acceptable limits for both the cation/anion ratio and the charge balance. Wells with data slightly outside of the target accuracy limits (shaded values on Table 13 for either cation/anion ratio or charge balance) include Darwin, FO-7 shallow, PRTIW Mission, ASR-2, ASR-3, Seaside Middle School, and Ord Grove. In addition, the groundwater sample from FO-7 Shallow was associated with elevated turbidity that has likely interfered with the metals analytical data and impacted the accuracy check above. Results indicate that the data for wells that do not meet accuracy criteria are most susceptible to inaccurate metals analysis, but are still usable for overall water chemistry. For the purposes of this analysis, all data summarized in Table 13 are presented and reviewed; where water chemistry interpretations are consistent with other data sets in the same aquifer, data are judged reasonable for inclusion. Metals concentrations for the samples that do not meet accuracy criteria are judged less reliable and are not used solely for characterizations of water quality.

#### 7.3.2.3. Water Source Geochemical/Fingerprinting Diagrams

***Stiff Diagrams*** are straight-line plots of cation and anion concentrations in meq/L. Data points are plotted along four parallel horizontal axes on each side of a vertical axis.

Individual points are then connected to produce a polygonal pattern. The patterns or shapes of the polygons can be compared to typical standard patterns for groundwater or seawater or compared to polygons from other wells to identify samples of similar water chemistry. The most recent water quality samples (2009 – 2014) from the combined database were plotted as Stiff diagrams and displayed on a Proposed Project Injection Well Facilities study area map as shown on Figure 16. Diagrams are color-coded to indicate the well construction and the aquifer represented by the polygons. Yellow and green Stiff diagrams indicate a well screened in the Paso Robles Aquifer or the Santa Margarita Aquifer, respectively, while the orange Stiff diagrams indicate screens in both aquifers. Also shown on the map is a Stiff diagram representing the treated Carmel River water injectate for the ASR wellfields (labeled ASR injectate).

The stiff diagrams on Figure 16 show differences in the groundwater signatures between the shallow (Paso Robles) and deep (Santa Margarita) aquifers in the Seaside Basin. In general, wells screened in the Paso Robles Aquifer show lower concentrations of major ions, especially sodium (Na) and potassium (K), calcium (Ca), chloride (Cl), and bicarbonate ($HCO_3$). Concentrations of these ions are consistently higher in the deeper Santa Margarita Aquifer. Wells that are screened in both aquifers show a signature more similar to the deeper Santa Margarita water signature, indicating that the Santa Margarita Aquifer is contributing more water to the well than the Paso Robles Aquifer.

The ASR injectate has a geochemical signature that is different from most of the aquifer signatures in the basin. Because the injectate is sourced from surface water (i.e., the Carmel River system water), the water chemistry is less mineralized than the Seaside Basin ambient groundwater. The ionic concentrations for the ASR injectate are lower than in the Santa Margarita Aquifer and the injectate appears to have slightly higher magnesium and sulfate content than most wells in the Paso Robles Aquifer. Although not clearly demonstrated by the Stiff diagrams on Figure 16, recent TDS concentrations in the ASR-1 and ASR-2 wells indicate mixing with the injectate (HydroMetrics, March 2014).

***Trilinear (Piper) Diagrams*** allow characterization of water chemistry and comparison of water quality analyses. Cation (Ca, magnesium (Mg), and Na+K) concentrations in meq/L are expressed or normalized as a percentage of the total cations, which are plotted on a triangle in the lower left portion of the diagram. Total anions (carbonate ($CO_3$)+$HCO_3$, sulfate (S), and Cl) are plotted on a triangle in the lower right portion of the diagram. The cation-anion plots are then projected onto a central diamond-shaped area, combining both cation and anion distributions. Groundwater with similar geochemistry will generally plot together in similar locations; therefore, groundwater from different sources may be identified by their bulk or intrinsic chemical compositions, which also may be classified as to water type.

The water quality analytical data from the Proposed Project Injection Well Facilities study area wells are plotted on the Trilinear diagram on Figure 17. Data from wells screened in the Paso Robles (yellow) Aquifer, the Santa Margarita Aquifer (green), and both aquifers (orange) are color-coded on the diagram to facilitate aquifer comparisons. Data from an ASR injectate sample (blue) and a sample from the Proposed Project recycled water (GWR) pilot plant (purple) are also included for comparison. Details of the sample from the GWR pilot plant are provided in section 7.3.4.

The Trilinear diagram (Figure 17) shows that groundwater in both aquifers range from neutral-type to sodium-potassium-type (for cations) and bicarbonate-carbonate-type, to neutral-type, to chloride-type (for anions). In the diamond portion of the diagram, the groundwater samples from both shallow and deep aquifers are generally clustered together toward the center, suggesting that shallow aquifer groundwater is mixing with deep aquifer groundwater. There is some slight differentiation among the two aquifers. Most of the groundwater samples from the Paso Robles wells (yellow) group toward a more sodium-chloride (saline) signature (Figure 17).

The ASR injectate appears slightly different from the groundwater signature, especially with respect to bicarbonate (lower) and sulfate (slightly higher). Several samples from ASR wells plot close to the ASR injectate sample, indicating mixing of the two waters.

The GWR pilot plant recycled water plots as sodium-potassium-type and bicarbonate-carbonate-type mostly because of the added calcium carbonate, calcium chloride and carbon dioxide gas used to stabilize the AWTF water. The signature appears more chemically distinct and plots near the edge of other data points.

***Schoeller (Water Source/Fingerprint) Diagrams**.* Although the Trilinear diagram may be used to differentiate between some water chemistry signatures, differences are often indistinguishable except in percentage amounts. Schoeller diagrams plot the actual concentrations in meq/L of specific cations and anions and can offer a more detailed assessment of water chemistry. Schoeller diagrams are therefore used in conjunction with Trilinear diagrams for typing or fingerprinting different water sources. In general, water from similar sources (e.g., sources may include surface water, groundwater influenced by surface recharge, regional older groundwater) will often plot in a similar pattern on a Schoeller diagram. Cations and anions are shown on the diagram's x-axis while actual concentrations are depicted on the diagram's y-axis. Concentration points are then connected providing a "linear" pattern or "fingerprint" for each analysis.

Figure 18 shows the Schoeller diagram analysis for the Proposed Project Injection Well Facilities study area wells. Samples are color-coded similar to the Trilinear diagram to facilitate analysis. ASR injectate and GWR pilot plant recycled water analyses are also shown for comparison purposes.

The Schoeller diagram confirms the interpretation from the Stiff diagrams in that the Paso Robles Aquifer (yellow) contains groundwater at lower ionic concentrations than the Santa Margarita Aquifer (green). For wells screened in both aquifers (i.e., Paralta, Luzern, and Ord Grove – shown in orange), the Schoeller signature is more similar to the Santa Margarita Aquifer, indicating more contribution from that aquifer to the well sample. However, because there is some overlap in the signatures, it also appears that there is infiltration/mixing of groundwater from the upper to lower aquifer.

The ASR injectate (blue) also appears to be influencing the Santa Margarita Aquifer. GWR pilot plant recycled water, shown for future comparison purposes only, has a unique signature with lower concentrations of Mg and $SO_4$. This signature is similar to Schoeller signatures for advanced treated (RO) water samples that Todd Groundwater has observed for other recycled water projects.

***Brine Differentiation (BDP) Plots***. The Brine Differentiation Plot (BDP) was developed by Hounslow (1995) to differentiate brine-contaminated waters from waters of other origins using major constituents commonly available in a water quality analysis. Molar concentrations of calcium divided by calcium plus sulfate on the vertical axis and sodium divided by sodium plus chloride on the horizontal axis are plotted on this type of diagram. The BDP also allows for waters to be plotted in a finite range from 0 to 1.0 on both axes and to determine mixing lines if present. Also, fields for brines, evaporates (i.e., precipitated salts), and seawater can be delineated. One of the advantages of the BDP is that straight- and curved-line mixing ratios can be shown, particularly if end member concentrations (such seawater or brackish water) are known.[9] To determine different water sources, the BDP can be used in conjunction with the Schoeller Diagram.

The BDP on Figure 19 for study area wells shows scattered analytical data without a discernible straight- or curve-line mixing of groundwater. However, the ASR injectate plots close to the ASR wells as expected and plots in a distinct area from other wells. The BDP appears to be a better indicator than the other plots of the mixing of injectate with groundwater in the ASR wells where most of the injection has occurred (ASR-1 and ASR-2). Finally, it is important to note that the GWR pilot plant sample signature is quite distinctive and separate, confirming the Schoeller Diagram signature. These data indicate that Proposed Project product water will be sufficiently distinct from groundwater to allow for use as an intrinsic tracer in tracking the injected recycled water in the subsurface. An *intrinsic tracer* refers to a naturally occurring constituent or compounds already present in water that can distinguish the sample from ambient groundwater. The term is used in opposition to an *extrinsic tracer* – one that is artificially introduced into groundwater (e.g., boron). Per the SWRCB Regulations, the tracer study conducted to validate residence time can use an intrinsic tracer if approved by the Division of Drinking Water and with a safety factor applied (0.67 month credit per month of time estimated using the intrinsic tracer).

#### 7.3.2.4. Concentrations of TDS in Groundwater

As indicated from the geochemical analysis, the ionic concentrations and water chemistry signatures are generally distinct between the Paso Robles and the Santa Margarita aquifers. This interpretation is also mirrored in the concentrations of TDS in groundwater in the Proposed Project Injection Well Facilities study area. Figure 20 shows a map of recent (2012 - 2014) TDS concentration ranges for the samples used in the analysis.

Using the data ranges in the legend, Figure 20 indicates that all of the TDS measurements in the wells were below the California secondary maximum contaminant level (MCL) Upper

[9] End members are waters having two distinct isotopic or chemical compositions with other samples ranging between the two.

Consumer Acceptance Contaminant Level Range of 1,000 mg/L, although some were above the Recommended Consumer Acceptance Contaminant Level Range of 500 mg/L. TDS levels ranged from 190 mg/L in FO-7 Shallow (Paso Robles Aquifer) to 668 mg/L in ASR-2 (Santa Margarita Aquifer). In general, wells screened in the Paso Robles Aquifer have lower TDS concentrations than in the Santa Margarita Aquifer with the 500 mg/L level serving as a reasonable dividing concentration for comparative purposes. For example, all wells screened only in the Paso Robles Aquifer are below 500 mg/L (green on Figure 20). Most of the Santa Margarita wells have recent concentrations above 500 mg/L (yellow on Figure 20), except Paralta (screened in both aquifers), SMS Deep, ASR-3, and FO-7 Deep. The wells did not show a wide variation in TDS concentrations over time.

### 7.3.3. Potential Constituents of Concern and Other Groundwater Analyses

To supplement the characterization of general groundwater chemistry, the water quality database was reviewed for potential constituents of concern defined for this assessment as regulated constituents (those with MCLs) and constituents associated with former military activities at Fort Ord. Some of these constituents had not been analyzed previously in groundwater beneath the Proposed Project Injection Well Facilities area. To address this data gap, groundwater from the six wells sampled in the field program (Table 12 in Section 7.2.1.3) have been analyzed for more than 300 constituents/parameters. In addition to regulated constituents and former Fort Ord constituents, the six groundwater samples were also analyzed for CECs as defined in the SWRCB Recycled Water Policy and other constituents not previously monitored routinely in local groundwater.

#### 7.3.3.1. Constituents Exceeding California Primary MCLs

For the more than 300 constituents and parameters analyzed in each of the six wells for this monitoring event, only two wells, FO-7 Shallow and MRWPCA MW-1, detected any constituents that did not meet the California primary MCLs for drinking water standards. These detections, along with turbidity values, are summarized in Table 14.

## Table 14. Constituents Exceeding California Primary MCLs

| Analyte | Method | Units | MDL | FO-7 Deep | FO-7 Shallow | MRWPCA MW-1 | California Primary MCL |
|---|---|---|---|---|---|---|---|
| **Turbidity** | **SM2130B** | **NTU** | **0.040** | **10** | **550** | **71** | **5*** |
| Aluminum (Al) | EPA 200.8 | µg/L | 8.0 | | 3,700 | 2,700 | 1,000 |
| Arsenic (As) | EPA 200.8 | µg/L | 0.28 | | 210 | | 10 |
| Barium (Ba) | EPA 200.8 | µg/L | 0.12 | | 1,200 | | 1,000 |
| Chromium (Cr) Total | EPA 200.8 | µg/L | 0.32 | | 790 | | 50 |
| Lead (Pb) Total | EPA 200.8 | µg/L | 0.080 | | 42 | | 15 |
| Gross Alpha | 7110B | pCi/L | 3.00 | | 125 ±5 | | 15 |
| Gross Beta | 7110B | pCi/L | 4.0 | | 114 ±2 | | 50 |
| Combined Radium | calculated | pCi/L | 1.00 | | 38.3 ±2.4 | | 5 |

*5 NTU is a secondary MCL; turbidity is included on the table for comparison purposes only.

As shown in Table 14, the only constituents that were analyzed at concentrations above primary MCLs were five metals and several radiogenic parameters. These constituents are the ones most affected by elevated turbidity in groundwater samples; as shown on the table, the well with the most exceedances (FO-7 Shallow) is the well with the highest turbidity value (550 NTU). Further, the only other well with an exceedance (MRWPCA MW-1) also detected elevated turbidity (71 NTU). FO-7 Deep did not detect any constituents above primary MCLs, but the slightly elevated turbidity value of 10 NTU correlated to slightly elevated detections in other metals (see Appendix D, Table D-1B). No exceedances of primary MCLs were recorded in any of the wells with turbidity values of 10 NTU or less.

Due to the relatively slow velocities within groundwater systems and the natural filtering associated with aquifer materials, groundwater does not typically contain solids that would result in the elevated turbidity values shown above. Rather, it is more likely that aquifer particles or other solids are being entrained in the groundwater samples and interfering with the laboratory analysis. Collectively, these data indicate that suspended small particles of aquifer material or pre-development solids are being analyzed by the laboratory methods (i.e., causing analysis interference) rather than dissolved constituents on which water quality standards are based. Therefore, the concentrations of certain metals and radiogenic parameters are not representative of actual concentrations in groundwater.

As previously discussed, the small-diameter casings and deep water table have limited the ability to develop these three monitoring wells in order to produce a turbid-free groundwater sample for analysis. As such, future sampling programs will incorporate techniques such as field filtering to minimize the effects of turbidity.

#### 7.3.3.2. Former Fort Ord Constituents

Given the historical land use of the former Fort Ord lands, the MRWPCA field program included groundwater analyses for chemicals of concern associated with former Fort Ord activities. The six groundwater samples from the MRWPCA field program were analyzed for 17 explosive compounds (nitroaromatics and nitramines) by U.S. EPA Method 8330B. In addition, two metals associated with explosive compounds (beryllium and lead) were also analyzed. These data were compared to available California primary drinking water MCLs and California Notification Levels (NLs)[10] and are summarized in Table 15.

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[10] NLs are non-regulatory, health-based advisory levels established by the SWRCB Division of Drinking Water (formerly CDPH) for contaminants in drinking water for which MCLs have not been established. A NL represents the concentration of a contaminant in drinking water that the Division of Drinking Water has determined does not pose a significant health risk, but warrants notification to the local governing body.

## Table 15. Groundwater Analyses for Explosives and Associated Metals

| Constituent | Wells with Detections* | Minimum Reporting Limit (RL) | Detected or Reported Concentration | California Primary MCL | California NL | Comments |
|---|---|---|---|---|---|---|
| | | µg/L | | | | |
| **Explosives*** | | | | | | |
| HMX (cyclotetramethylene tetranitramine) | None | 0.099-0.12 | ND | None | 350 | |
| RDX (cyclotrimethylene trinitramine) (cyclonite) | None | 0.099-0.12 | ND | None | 0.3 | |
| 1,3,5- TNB (trinitrobenzene) | None | 0.20-0.22 | ND | None | None | |
| 1,3-dinitobenzene | None | 0.098-0.12 | ND | None | None | |
| 3,5-dinitoaniline | None | 0.098-0.30 | ND | None | None | |
| TETRYL (2,4,6 trinitro-phenylmethyl-nitramine) | None | 0.10-0.12 | ND | None | None | |
| nitrobenzene | None | 0.099-0.12 | ND | None | None | |
| 4-Amino-2,6-dinitrotoluene | None | 0.098-0.11 | ND | None | None | |
| 2-amino-4,6-dinotrotoluene | None | 0.098-0.11 | ND | None | None | |
| 2,4,6-trinitrotoluene (TNT) | None | 0.098-0.11 | ND | None | 1 | |
| 2,6-DNT (dinitrotoluene) | FO-7 Shallow | 0.20 | 0.070*** | None | None | high turbidity |
| | FO-7 Deep | 0.23 | 0.064*** | None | None | slightly turbid |
| | ASR MW-1 | 0.10 | 0.037*** | None | None | |
| 2,4-DNT (dinitrotoluene) | None | 0.10 | ND | None | None | |
| 2-nitrotoluene | None | 0.11 | ND | None | None | |
| 4-nitrotoluene | None | 0.098-0.12 | ND | None | None | |
| 3-nitrotoluene | None | 0.098-0.12 | ND | None | None | |
| NG (nitroglycerine) (triniroglycerol) | None | 0.99-1.2 | ND | None | None | |
| pentaerythritol tetranitrate | None | 0.49-0.56 | ND | None | None | |
| **Metals**** | | | | | | |
| Beryllium (Be) | ASR-2 | 0.050 | 0.7 | 4.0 | | |
| | FO-7 Shallow | 0.020 | 0.68 | | | high turbidity |
| | MRWPCA MW-1 | 0.020 | 0.044 | | | turbid |
| Lead (Pb) | ASR-1 | 0.020 | 0.78 | 15.0 | | |
| | ASR-2 | 0.010 | 3.0 | | | |
| | FO-7 Shallow | 0.020 | **42.0** | | | high turbidity |
| | FO-7 Deep | 0.080 | 1.3 | | | slightly turbid |
| | PRTIW: Mission Memorial | 0.020 | 0.061 | | | |
| | MRWPCA MW-1 | 0.020 | 1.3 | | | turbid |
| | Paralta | 0.001 | 3.0 | | | |

**Notes:**

* Nitroaromatics and nitramines by U.S. EPA Method 8330B: Samples received and submitted by Alpha Analytical Laboratory, Ukiah, CA to ALS Environmental (ALS), Kelso, WA on February 5, 2014; analyzed by ALS on February 8, 2014.

****** Metals by U.S. EPA Method 200.8 analyzed by Alpha Analytical Laboratory, Ukiah, CA, February 5-11, 2014.

***Constituent also detected in laboratory blank indicating a laboratory contaminant that may not be present in groundwater. All detections were below Reporting Limits (J values) and are not quantifiable.

ug/L = micrograms per liter or parts per billion (ppb)

MCL = Maximum Contaminant Level for drinking water

ND = Not detected above the method detection level for any of the samples from the six wells.

As shown in Table 15, the only explosive constituent detected in groundwater samples was 2,6-DNT (dinitrotoluene). This constituent was also detected in laboratory blank samples, which are samples of laboratory water (not groundwater) analyzed for quality assurance/quality control (QA/QC) purposes. Detections of this constituent at similar levels in the laboratory blank sample indicate that 2,6-DNT is likely a laboratory contaminant and not actually present in groundwater. Although the constituent may be present in several groundwater *samples*, the laboratory blank data suggest that it was introduced into the samples in the laboratory. Further, detections of 2,6-DNT in FO-7 Shallow, FO-7 Deep, and ASR MW-1 were below the laboratory reporting level (RL), meaning that the concentration of 2.6-DNT in samples is too low to be quantified. Given the laboratory QA/QC data for 2,6-DNT, the low levels of the detections, and the absence of additional explosives in groundwater, data indicate that groundwater has not been impacted locally from explosives associated with former Fort Ord activities.

For the metals analysis, both beryllium and lead – as naturally occurring substances – were detected in several groundwater wells above the reporting limits. Beryllium was detected in groundwater collected from ASR-2, FO-7 Shallow, and MRWPCA MW-1, although all of the detections met the California Primary MCL for drinking water. Other wells in the database did not detect beryllium above the laboratory reporting limits.

Lead was also detected in groundwater collected from ASR-1, ASR-2, FO-7 Shallow, FO-7 Deep, Mission Memorial PRTIW, MRWPCA MW-1, and Paralta. The detection in FO-7 Shallow (42 ug/L) was above the MCL (15 ug/L), but appears anomalous with respect to other detections of lead in the database. The concentration of 42 ug/L is the highest concentration in the database by an order of magnitude, which included lead analyses from 13 wells sampled from 2011 through 2014. The second highest concentration was detected in ASR-2 at 3.0 ug/L (also included on Table 15). Except for FO-7 Shallow, all of the detections were below the MCL for lead.

As previously mentioned, the 2014 sampling of FO-7 Shallow was the first time that this small-diameter monitoring well had been sampled for water quality since its original sampling upon well completion. Sampling produced a highly turbid sample (550 NTU), likely relating to the inability to properly develop the well when installed in 1994 as a water level monitoring well. As such, the metals analytical data are likely the result of particle interference and are not likely representative of dissolved lead concentrations in groundwater.

Given the absence of explosives and the relatively low levels of beryllium and lead (with the exception of FO-7 Shallow where data appear to be inaccurate as explained above), the data do not indicate that former Fort Ord activities have impacted groundwater in the existing wells near the Proposed Project Injection Well Facilities site.

#### 7.3.3.3. Constituents of Emerging Concern

As defined in the Recycled Water Policy, constituents of emerging concern (CECs) are chemicals in personal care products (PCPs), pharmaceuticals including antibiotics, antimicrobials, agricultural and household chemicals, hormones, food additives, transformation products and inorganic constituents. These chemicals have been detected in trace amounts in surface water, wastewater, recycled water, and groundwater and have been added to the monitoring requirements for any project involving recharge of recycled water.

The SWRCB Recycled Water Policy CEC monitoring requirements were based on the recommendations of an expert panel. As part of the SWRCB Regulations for injection projects, a project sponsor must recommend CECs for monitoring in recycled water and groundwater in the Engineering Report in addition to the Recycled Water Policy CEC requirements. For injection projects that produce recycled water using RO and AOP, the monitoring requirements in the Recycled Water Policy only apply to recycled water prior to and after treatment (no groundwater sampling). The following CECs are health-based indicators, treatment/performance based indicators, or both as shown below:

- 17-*β*-estradiol - steroid hormone (health-based indicator)
- Caffeine – stimulant (health-based and performance-based indicator)
- N-nitrosodimethylamine (NDMA) – disinfection byproduct (health-based and performance-based indicator)
- Triclosan – antimicrobial (health-based indicator)
- N,N-diethyl-metatoluamide (DEET) – personal care product (performance-based indicator)
- Sucralose – food additive (performance-based indicator)

None of the CECs currently have either primary MCLs for drinking water. For NDMA, the current NL is 0.01 μg/L.

To provide baseline conditions for these CECs in the Seaside Groundwater Basin, the six wells sampled in the recent MRWPCA field program were analyzed for the six CECs and other pharmaceuticals/PCPs included in U.S. EPA Laboratory methods 1625M and 1694 (APCI and ESI+). Groundwater samples were analyzed from ASR MW-1, City of Seaside 4, FO-7 Shallow, FO-7 Deep, PRTIW Mission Memorial, and MRWPCA MW-1. Full results are provided in Appendix D, Table D-1N. Detections of the six CECs are summarized in Table 16.

## Table 16. Groundwater Sample Analyses for CECs

| Constituent* | Wells with Detections** | Minimum Reporting Limit (RL) | Detected or Reported Concentration | Comments |
|---|---|---|---|---|
| | | µg/L*** | | |
| NDMA (nitrosodimethylamine) | PRTIW (Mission Memorial) | 0.002 | 0.0054 | NL =0.01 |
| 17-β-estradiol | None | 0.001 | ND | |
| Triclosan | None | 0.002 | ND | |
| Caffeine | FO-7 Deep | 0.001 | 0.0027 | |
| | MRWPCA MW-1 | | 0.0068 | |
| DEET (n,n-diethyl-m-toluamide) | FO-7 Deep | 0.001 | 0.0023 | |
| | MRWPCA MW-1 | | 0.0060 | |
| Sucralose | None | 0.005 | ND | |

**Notes:**

* NDMA by EPA Method 1625M; 17-β-estradiol and triclosan by EPA Method 1694-APCI; caffeine, DEET, and sucralose by U.S. EPA 1694-ESI+.

** Groundwater analyzed from wells ASR-1, City of Seaside 4, FO-7 Shallow, FO-7 Deep, PRTIW Mission Memorial, and MRWPCA MW-1.

*** Analyses reported on laboratory analytical data sheets in nanograms per liter (ng/L) or parts per trillion. Converted to micrograms per liter (µg/L) or parts per billion (ppb).

Samples received by Alpha Analytical Laboratory, Ukiah, CA; submitted to Weck Laboratories, Inc. (Weck), City of Industry, CA, on February 5, 2014; analyzed by Weck from February 11 to February 19, 2014.

MCL = Maximum Contaminant Level for drinking water.

ND = Not detected.

NL = Notification level.

As indicated in Table 16, NDMA was detected in groundwater collected from the PRTIW well at 0.0054 µg/L (below the NL); caffeine was detected in FO-7 Deep and MRWPCA MW-1 at 0.0027 and 0.0068 µg/L, respectively (below the Drinking Water Equivalent Level [DWEL] of 0.35 µg/L per Anderson et al., 2010).[11] DEET was detected in FO-7 Deep and MRWPCA MW-1 at 0.0023 and 0.0060 µg/L, respectively (below the DWEL of 81 µg/L per Intertox, 2009). Estradiol (17-β), triclosan, and sucralose were not detected above reporting limits in groundwater collected from any of the six wells.

These data represent the first time that CECs have been analyzed in the Seaside Basin and serve as initial background data. The data will be confirmed through future groundwater sampling events that will support the monitoring program proposed in the Proposed Project's Engineering Report. Nonetheless, only a few constituents were detected at very low levels (all less than 0.01 ug/L) and meet advisory or safe health concentrations.

[11] The DWEL is the amount of a substance in drinking water that can be ingested daily over a lifetime without appreciable risk.

#### 7.3.3.4. Local Anthropogenic Impacts or Contaminant Plumes

A search of the study area was conducted on the California Department of Toxic Substances Control (DTSC) *EnviroStor* web site (www.envirostor.dtsc.ca.gov) and the SWRCB *Geotracker* web site (http://geotracker.waterboards.ca.gov). The goal of the search was to identify any potential industrial sites or activities that could contribute to groundwater contamination from previous site uses, spills, and/or chemical releases in the Proposed Project Injection Well Facilities study area.

Both *EnviroStor* and *Geotracker* listed the 28,016-acre Fort Ord Military Reservation as an active Federal Superfund site and listed munitions as the contaminant of primary concern. Additionally, *Geotracker* identified two adjacent sites on the former Fort Ord lands as gasoline contamination sites: (1) the 14th Engineers Motor Pool and (2) Building 511. These are active sites currently undergoing investigations and are located about 1.8 miles to the northeast. However, both sites are outside of the groundwater basin and are not a threat to groundwater in the Proposed Project Injection Well Facilities area.

Other environmental sites have been identified in the basin, including numerous leaking underground storage tank sites, but none were in the Proposed Project Injection Well Facilities area. Specifically, there were no environmental contaminant sites identified in the area between Proposed Project recharge and downgradient extraction wells. Replenishment activities would not be expected to impact any contaminant plumes, if any, located outside of this area.

### 7.3.4. Proposed Project Recycled Water Quality

Trussell Technologies, Inc. (Williams, et al., 2014) provided recycled water samples to Todd Groundwater in support of the MRWPCA field program. The samples were developed to represent the Proposed Project product water quality for the purposes of laboratory tests and geochemical analyses. The samples were RO permeate collected from the MRWPCA GWR pilot advanced water treatment plant. Trussell Technologies stabilized the RO permeate using a bench-scale post-treatment stabilization unit to better approximate the water quality anticipated for the product water from the proposed AWTF.

To develop the bench-scale water samples, Trussell Technologies used several strategies for full-scale RO permeate stabilization to mimic goals established for the OCWD's Groundwater Replenishment System (GWRS), a similar project that used advanced treatment to meet regulatory requirements. (See Section 3.3.6.2, for more information on the OCWD's GWRS) The first chemical stabilization step consisted of the addition of calcium as calcium chloride ($CaCl_2$) and sodium hydroxide (NaOH) to increase alkalinity. Then, $CO_2$ gas was bubbled into the RO water to decrease the pH to a target goal. This process produced approximately 32 L of product water for incorporation into the field program.

These samples - referred to herein as stabilized pilot water samples or pilot water - closely represent the final Proposed Project recycled water quality for the purposes of the field program objectives. The primary objective was to use representative recycled water samples to conduct laboratory leaching tests on vadose zone cores. These data have supported geochemical modeling (summarized in the following sections). Details of the leaching tests and geochemical modeling results are presented in a separate report on the field program (Todd Groundwater, February 2015).

To support the EIR impacts analysis herein, the GWR pilot plant water samples were also analyzed for general minerals, physical characteristics, and metals. The GWR pilot plant water was analyzed by McCampbell Analytical Laboratory. The analytical methods and sample results are presented in Table 17.

### Table 17. Stabilized Pilot Water Analysis

| Analyte | Method | Units | Reporting Limit (RL) | Results | MCL or NL | Basin Plan Objective or Guideline[e] |
|---|---|---|---|---|---|---|
| ***Inorganics:*** | | | | | | |
| **Alkalinity (total)** | SM 2320B | mg/L | 0.10 | **37.4** | --- | --- |
| **Ammonia ($NH_3$) (total as nitrogen)** | EPA 350.1 | mg/L | 0.10 | **1.3** | --- | <5 |
| **Bicarbonate ($HCO_3^-$)** | SM 2320B | mg/L | 1.00 | **37.4** | --- | <90 |
| Carbonate ($CO_3^{2-}$) | SM 2320B | mg/L | 1.00 | ND | --- | --- |
| **Chloride ($Cl^-$)** | EPA 300.15 | mg/L | 1.00 | **21.0** | 250[b] | <106 |
| **Chlorine ($Cl_2$)** | SM 4500-Cl DE | mg/L | 0.40 | **2.9** | --- | --- |
| **Dissolved oxygen (DO) @ 21.8 °C** | SM 4500 OG | mg DO/L | 1.00 | **8.94** | --- | --- |
| Hydroxide ($OH^-$) | SM 2320B | mg/L | 1.00 | ND | --- | --- |
| Sulfate* | | mg/L | 0.5 | ND | 250[b] | --- |
| ***Physical Parameters:*** | | | | | | |
| **Langelier Saturation Index @ 21.8 °C** | calculated | – | – | **–1.6** | --- | --- |
| **Oxidation-Reduction Potential (ORP) @22.3 °C** | SM 2580B | mV | 10.0 | **629.0** | --- | --- |
| **pH @ 25 °C** | SM 4500H+B | pH units | 0.05 | **7.45** | --- | Normal Range |
| Specific conductivity (EC) @ 25 °C | SM 2510B | µmohs/cm or µS/cm | 10.0 | **127.0** | 900[b] | <750 |
| **Total Dissolved Solids (TDS)** | SM 2540C | mg/L | 10.0 | **74.0** | 500[b] | 480 |
| ***Metals (cations):*** | | | | | | |
| Antimony (Sb) | EPA 200.8 | µg/L | 0.50 | ND | 6[c] | --- |
| Arsenic (As) | EPA 200.8 | µg/L | 0.50 | ND | 10[c] | 100 |
| Barium (Ba) | EPA 200.8 | µg/L | 5.0 | ND | 1,000[c] | --- |
| Beryllium (Be) | EPA 200.8 | µg/L | 0.50 | ND | 4[c] | 100 |
| Cadmium (Cd) | EPA 200.8 | µg/L | 0.25 | ND | 5[c] | 10 |
| **Calcium (Ca)** | EPA 200.8 | µg/L | 1,000 | **9,200** | --- | --- |
| Chromium (Cr) | EPA 200.8 | µg/L | 0.50 | ND | 50[c] | 100 |
| Cobalt (Co) | EPA 200.8 | µg/L | 0.50 | ND | --- | 50 |
| Copper (Cu) | EPA 200.8 | µg/L | 0.50 | ND | 1,000[a] | 200 |
| Iron (Fe) | EPA 200.8 | µg/L | 20.0 | ND | 300[a] | 5,000 |
| Lead (Pb) | EPA 200.8 | µg/L | 0.50 | ND | 15[c] | 5,000 |
| Magnesium (Mg) | EPA 200.8 | µg/L | 20.0 | ND | --- | --- |
| Manganese (Mn) | EPA 200.8 | µg/L | 20.0 | ND | 50[a] | 200 |
| **Mercury (Hg)** | EPA 200.8 | µg/L | 0.025 | **0.032** | 2[c] | 10 |
| Molybdenum (Mo) | EPA 200.8 | µg/L | 0.50 | ND | --- | 10 |
| Nickel (Ni) | EPA 200.8 | µg/L | 0.50 | ND | 100[c] | 200 |
| Selenium (Se) | EPA 200.8 | µg/L | 0.50 | ND | 50[c] | 20 |
| Silver (Ag) | EPA 200.8 | µg/L | 0.19 | ND | 100[a] | --- |
| **Sodium (Na)** | EPA 200.8 | µg/L | 1,000 | **18,000** | --- | <69,000 |
| Thallium (Tl) | EPA 200.8 | µg/L | 0.50 | ND | 2[c] | --- |
| Vanadium (V) | EPA 200.8 | µg/L | 0.50 | ND | 50[d] | 100 |
| **Zinc (Zn)** | EPA 200.8 | µg/L | 5.0 | **5.5** | 5,000[a] | |

Notes:
GWR pilot plant water provided by Trussell Technologies, Oakland, CA delivered to TODD Groundwater on February 12, 2014.
Received and analyzed by McCampbell Analytical, Inc., Pittsburg, CA on February 13-26, 2014.
* Sulfate ($SO_4$) analysis proved by Trussell Technologies.
µg/L = micrograms per liter or parts per billion (ppb). mg/L = milligrams per liter or parts per million (ppm).
mV = millivolts. µmohs/cm = micomohs per centimeter equivalent to microSiemans per centimeter (µS/cm).
EC = Electrical conductivity. EPA = U.S. Environmental Protection Agency. ND = Not detected or below reporting limit (RL).
SM = Standard Method.

a. Secondary MCL.
b. Secondary MCL recommended range.
c. Primary MCL.
d. NL.
e. Groundwater objectives for protection of the municipal and domestic supply use are MCLs and not repeated in this column. The numbers in the column are the more stringent of the guidelines for irrigation or objectives for agricultural water use.
f. Part of SAR determination.

### 7.3.5. Geochemical Compatibility Analysis

When two water types with different water chemistry are mixed (such as the Proposed Project recycled water and groundwater), the compatibility of the waters requires examination. Geochemical reactions in the groundwater system in the vicinity of the well and in the aquifer beyond could potentially result in precipitation or dissolution of constituents (e.g., precipitation of silica or dissolution of metals). These reactions could contribute to clogging in the well and/or pore throats or alter groundwater quality thorough dissolution in the vadose zone or aquifer. In particular, injection in the vadose zone could lead to leaching of natural or anthropogenic constituents that could impact groundwater quality. A geochemical assessment is also helpful in identifying potential adverse reactions that may lead to well scaling or biofouling.

The potential for geochemical incompatibility would be addressed at the proposed AWTF by including a stabilization step in the treatment process to ensure that recycled water is stabilized and non-corrosive. Other injection projects such as the OCWD GWRS provide chemical stabilization for these purposes. Further, no adverse impacts have been observed at the nearby ASR wellfields where ASR injectate has a different water chemistry than native groundwater; this injectate has some similar components of water chemistry to the Proposed Project recycled water that are relevant to compatibility.

To estimate geochemical issues that would need to be addressed through treatment design or operational adjustments at the AWTF, a geochemical assessment was performed using the data from the MRWPCA field program (Todd Groundwater, February 2015). The GWR pilot plant water was provided to McCampbell Laboratories under chain of custody protocol to use in laboratory leaching tests on vadose zone core samples. Stabilized GWR pilot plant water was used for the laboratory extraction process of nine core samples and analyzed for a suite of constituents to provide a preliminary estimate of leaching potential. These tests provide a conservative estimate of the potential for leaching constituents from the vadose zone during injection associated with the Proposed Project. The analysis is considered conservative because the GWR pilot plant water is slightly more aggressive (as indicated by the negative value of the Langelier Saturation Index on Table 17) than the anticipated final AWTF water.

Due to the unconsolidated nature of the core samples and limitations with extraction methods, the laboratory results were compromised by elevated turbidity in some of the leachate samples (Todd Groundwater, February 2015). Notwithstanding the limitations of the results, the leaching tests provided valuable information on which constituents represented the highest potential for leaching and identified potential geochemical reactions that warranted further investigation through geochemical modeling.

Geochemical modeling was conducted with a series of PHREEQC and PHAST geochemical model codes by Mahoney Geochemical Consulting LLC, Lakewood, CO (See Appendix G in Todd Groundwater, February 2015). The modeling was used to analyze the potential for dissolution (leaching) of chromium, arsenic, and lead from the vadose zone sediments (including samples from the Aromas Sand and Paso Robles Aquifer).

The modeling indicated that trace amounts of chromium adsorbed onto the hydrous ferric oxide coatings of the sand grains represented the highest potential for leaching. However, this leaching does not represent a long-term effect due to the limited total amount of chromium available in the sediments. The maximum concentration in the zone of saturation was estimated to be about 4.0 ug/L after one year of injection – a concentration substantially below the total chromium MCL of 50 ug/L.

Although arsenic and lead were also determined to be present in vadose zone sediments, those constituents were more strongly adsorbed to the oxides than chromium. Consequently, only small amounts are predicted to be released into solution as the injected water flows through the Aromas Sand, resulting in sustained but low concentrations of about 4 µg/L for arsenic and approximately 0.7 µg/L for lead. Concentrations in the zone of saturation meet water quality standards. None of the analyses indicated that groundwater concentrations would exceed regulatory standards for any of the leached constituents.

Additional geochemical analyses indicated that aquifer clogging from calcite precipitation would be unlikely due to the low concentrations of calcium and bicarbonate. Extensive biofouling of injection wells was also evaluated and determined to be unlikely given that the low concentrations of nitrogen and phosphorus in the AWTF product water would not tend to stimulate microbial growth.

In addition to impacts from the vadose zone wells, the analysis examined the potential for impacts to the Santa Margarita Aquifer from recharge into deep injection wells. Results indicated that the potential for such impacts were unlikely. Risk of trace metal desorption during injection of recycled water into the Santa Margarita Formation was inferred from previous studies of injected Carmel River water. The two injected water types have similar pH and oxidation-reduction potential, and are therefore expected to have similar effects with respect to adsorption/desorption processes. Previous studies found no indications that significant metal concentrations would be released into solution, and those results can reasonably be extended to injection of recycled water.

None of the modeling results indicated that groundwater would be geochemically incompatible with AWTF product water or that the project would have a significant impact on groundwater quality. Complete results of the geochemical analyses and modeling are presented in the draft report on the MRWPCA field program (Todd Groundwater, February 2015).

In addition to this work, to support the assessment of compliance with the SWRCB Regulations and the CRWQCB and the pilot testing, a one-year monitoring program was conducted from July 2013 to June 2014 for five of the potential source waters. Regular monthly and quarterly sampling was carried out for the RTP secondary effluent, agricultural wash water, and Blanco Drain drainage water. Limited sampling of stormwater from Lake El Estero was performed due to seasonal availability, and there was one sampling event for the Tembladero Slough drainage water.

An assessment conducted by Nellor (2015) reviewed the analytical results of source water monitoring, the water quality results of the GWR pilot plant testing (using ozone, MF, and RO), the stabilized RO sample (see Table 17 in this report), information on the predicted performance and water quality of the proposed full-scale AWT Facility based on other existing groundwater replenishment projects, and related research/studies. Based on the results of that assessment, the Proposed Project will comply with the:

- SWRCB Regulations (for groundwater replenishment), including MCLs, NLs, total organic carbon, and other numeric water quality-based requirements; and
- Central Coast Water Quality Control Plan objectives and guidelines for protection of groundwater uses (municipal and domestic water supply, agricultural water supply, and industrial use).

### 7.3.6. Salt and Nutrient Management Plan

A Salt and Nutrient Management Plan (SNMP) has been prepared for the Seaside Basin to comply with requirements in the SWRCB's Recycled Water Policy (HydroMetrics, March 2014). The SNMP was developed with basin stakeholder input through the Seaside Basin Watermaster and has been adopted by the MPWMD Board. The final SNMP has been submitted to the CRWQCB.

As documented in the SNMP and confirmed herein, ambient groundwater generally exceeds Basin Plan objectives for TDS in many areas of the basin, while nitrate and chloride concentrations generally meet Basin Plan objectives. As indicated by the water quality analyses of the stabilized GWR pilot plant water (discussed above), TDS, nitrate, and chloride all meet Basin Plan objectives. Further, these concentrations are generally lower than average concentrations in groundwater. As such, recharge of the Seaside Basin using the Proposed Project recycled water would not adversely impact salt and nutrient loading in the basin and would provide benefits to local groundwater quality.

## 7.4. POTENTIAL GROUNDWATER QUALITY IMPACTS

The assessment of potential impacts from the Proposed Project on local groundwater resources is based on the preceding characterization of groundwater and recycled water.

### 7.4.1. Thresholds of Significance

Appendix G of the 2013 CEQA Guidelines provides the primary question relating to potential GWR impacts on groundwater quality is as follows:

> *Would the project violate any water quality standards or otherwise degrade water quality?*

The following factors were developed for the Proposed Project to clarify how this question would be applied in the impact analyses. Implementation of the Proposed Project would be considered to have a significant impact on groundwater quality if:

- The Proposed Project, taking into consideration the proposed treatment processes and groundwater attenuation and dilution, were to:
    - Impact groundwater so that it would not meet a water quality standard (e.g., Basin Plan beneficial uses and water quality objectives, including drinking water MCLs established to protect public health).
    - Degrade groundwater quality subject to California Water Code statutory requirements for the Division of Drinking Water, and to the SWRCB Anti-degradation Policy and Recycled Water Policy.
- The Proposed Project were to result in changes to basin recharge such that it would adversely affect groundwater quality by exacerbating seawater intrusion.

### 7.4.2. Potential Degradation of Groundwater Quality

As described in the previous sections, the Proposed Project recycled water would be treated and stabilized to meet all drinking water quality objectives. As shown on Table 17 and discussed above, TDS (74 mg/L) and nitrogen (1.3 mg/L as total N) would also meet Basin Plan objectives. Further, the Proposed Project recycled water is expected to be higher quality water than ambient groundwater with respect to TDS, chloride, and nitrate. As such, the Proposed Project would not result in the groundwater failing to meet groundwater objectives or beneficial uses. Rather, the Proposed Project recycled water would have a beneficial effect on local groundwater quality from the injection of high quality water that meets objectives and has low TDS and chloride concentrations.

### 7.4.3. Impacts on Seawater Intrusion

As demonstrated by the modeling by HydroMetrics (Appendix C) and discussed above (Section 7.1.2.2.2), the Proposed Project is not expected to cause water levels to fall below elevations that are protective against seawater intrusion.

The Proposed Project would incorporate operational monitoring to track impacts on water levels from recharge and pumping. Real-time modifications can be incorporated into the operation of the Proposed Project to address any short-term water level declines, if needed. For example, during the primary pumping period, more water can be directed to the deeper aquifer where existing water level declines are more widespread.

The Proposed Project would provide basin replenishment to meet the primary objective of increasing basin production to replace a portion of the CalAm water supply as required by state orders. The impact analysis indicates that the Proposed Project would not exacerbate seawater intrusion. However, it is noted that seawater intrusion cannot be prevented by this project alone. Water levels are below sea level at the coast in the Santa Margarita Aquifer and the Proposed Project would not raise levels over the long term. However, the short term rise in water levels associated with the Proposed Project during the winter when pumping is less will prevent significant water level declines during the summer when pumping increases. A more complete analysis of water level impacts associated with the Proposed Project is provided in the TM in Appendix C.

### 7.4.4. Geochemical Compatibility of GWR Product Water and Groundwater

As discussed in Section 7.3.5 above, the results of the MRWPCA field program and geochemical modeling indicate that injection of project recycled water through both vadose zone wells and deep injection wells will not have a significant adverse impact on groundwater quality (Todd Groundwater, February 2015). A brief summary of key conclusions from the analysis are provided below:

- Chemicals associated with the former Fort Ord activities, including soluble nitroaromatic compounds (explosives), perchlorate, or certain organic constituents, were not detected in core samples or groundwater samples and are not expected to impact groundwater quality.
- Potential changes in injected recycled water quality beneath vadose zone wells from geochemical reactions between recycled water and formation materials along vertical flow paths are small. The analysis of leaching of chromium, arsenic, and lead indicated that concentrations in the zone of saturation are expected to be very low and would meet water quality standards.
- Aquifer clogging by calcite precipitation is unlikely to be a problem for the Proposed Project. In the Aromas Sand, calcium and bicarbonate concentrations are below saturation levels. Ambient groundwater in the Paso Robles Formation is at saturation with respect to calcite, but given the pH of the injected water, calcite would not be expected to precipitate.
- Biofouling would not likely pose a problem for the injection wells because the injected water is very low in nitrogen and phosphorus and would not tend to stimulate microbial growth.
- Based on the water chemistry of the GWR pilot plant water and observations from the ASR wellfield, adverse impacts from geochemical incompatibility are unlikely in the Santa Margarita Aquifer in the vicinity of the deep injection wells.

### 7.4.5. Conclusions of the Impacts Assessment for Groundwater Quality

Based on the groundwater characterization, recent groundwater sampling results, stabilized pilot water quality/chemistry and projected AWTF water quality (i.e., highly treated recycled water), and results from the MRWPCA field program, the following conclusions are offered:

- Stabilized GWR pilot plant water samples and projected AWTF product water meet SWRCB Regulations for groundwater replenishment projects and Basin Plan groundwater quality standards, including drinking water MCLs. Further, the treatment processes that would be incorporated into the AWTF would be selected and operated to ensure that all water quality standards would be met in both the recycled water and groundwater. A monitoring program would document project performance.
- Stabilized GWR pilot plant water samples and projected AWTF product water exhibit much lower concentrations of TDS and chloride than in ambient groundwater and would be expected to provide a localized benefit to groundwater quality. Such a benefit would expand over time with continuous injection from the Proposed Project wells.
- No documented groundwater contamination or contaminant plumes have been identified in the Proposed Project area. Therefore, injection associated with the Proposed Project would not exacerbate existing groundwater contamination or cause plumes of contaminants to migrate.
- Injection of AWTF recycled water would not degrade groundwater quality. A monitoring plan would be implemented to meet CRWQCB and SWRCB Division of Drinking Water requirements.
- The Proposed Project recycled water would be stabilized as part of the AWTF to ensure no adverse geochemical impacts. Geochemical modeling associated with the MRWPCA field program indicated that no adverse groundwater quality impacts are expected from leaching or other geochemical reactions.
- The Proposed Project would result in both higher and lower water levels in wells throughout the basin at various times. Although water levels would be slightly lower during some time periods, the difference is generally small and judged insignificant.
- Modeling indicates that the Proposed Project would not lower water levels below protective levels in coastal wells and would not exacerbate seawater intrusion.

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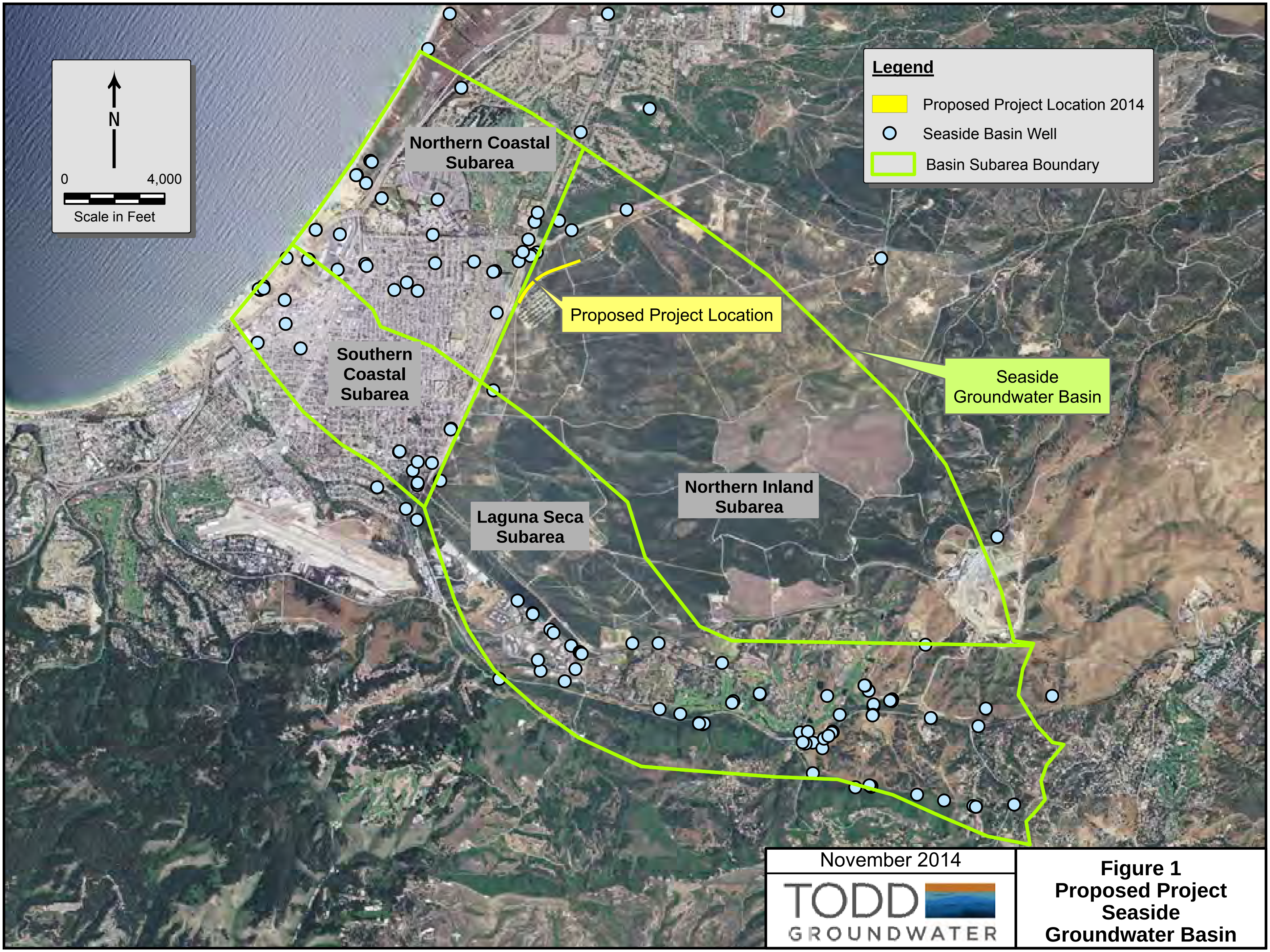
# FIGURES




November 2014

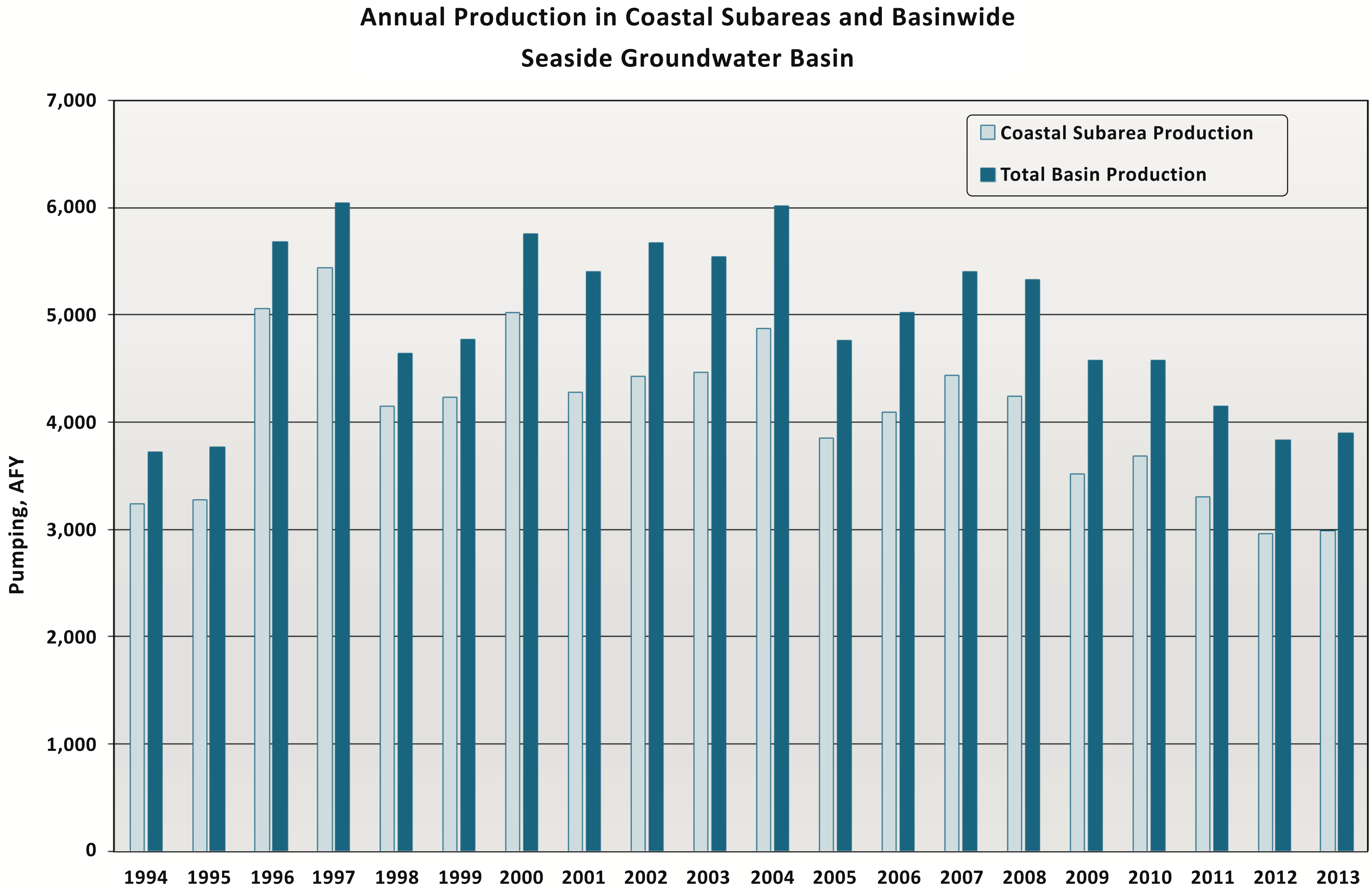
TODD GROUNDWATER

**Figure 1**
**Proposed Project**
**Seaside Groundwater Basin**


August 2014

TODD GROUNDWATER

**Figure 2**
**Proposed GWR**
**Project Location Map**

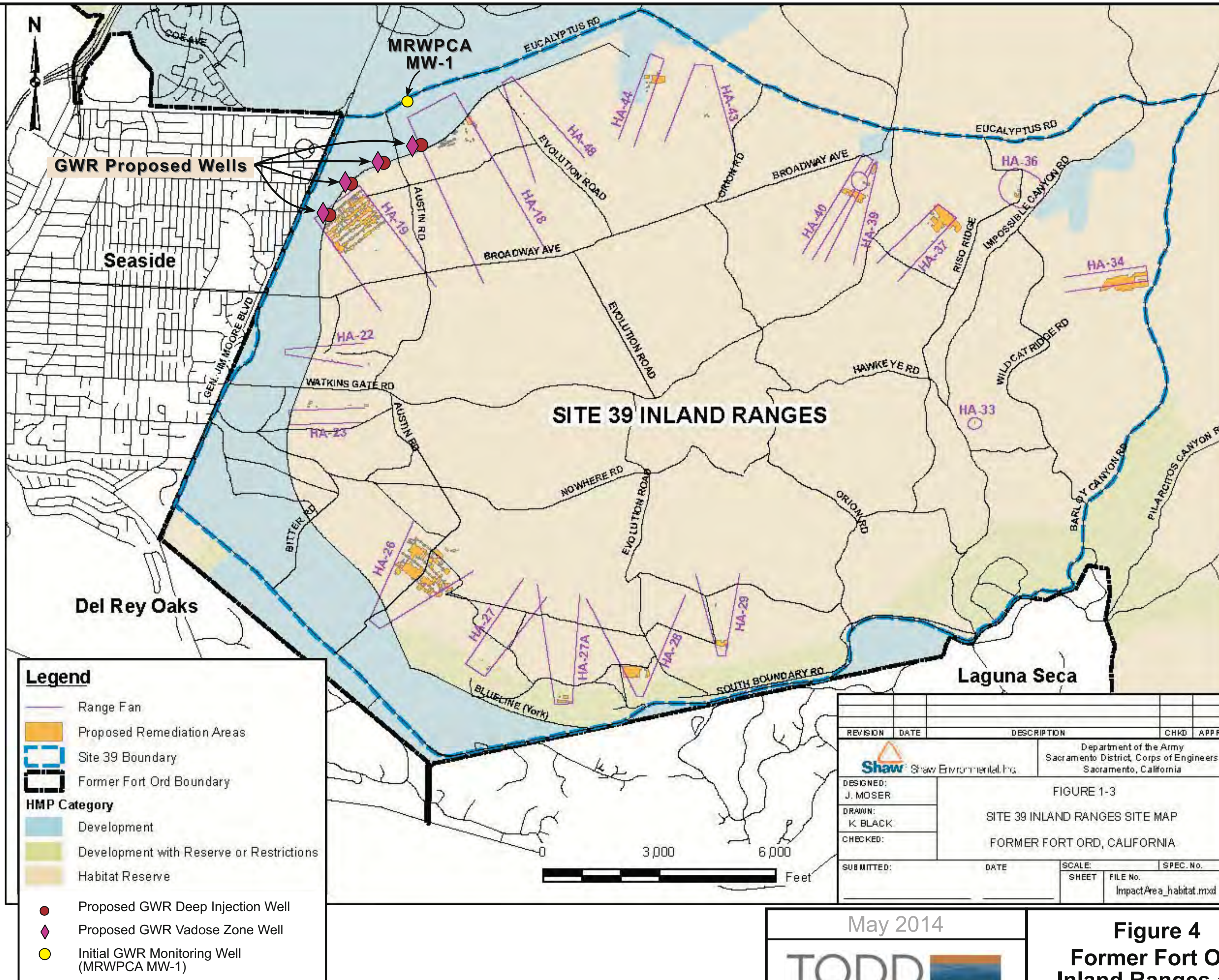



**Notes:** 1994 - 2001 data by Reporting Period (July 1- June 30). 2001 - 2013 data by Water Year (October 1 - September 30). Pumping data do not include ASR injection or recovery amounts.

May 2014

TODD GROUNDWATER

**Figure 3**
**Coastal and Basin-wide Groundwater Production**

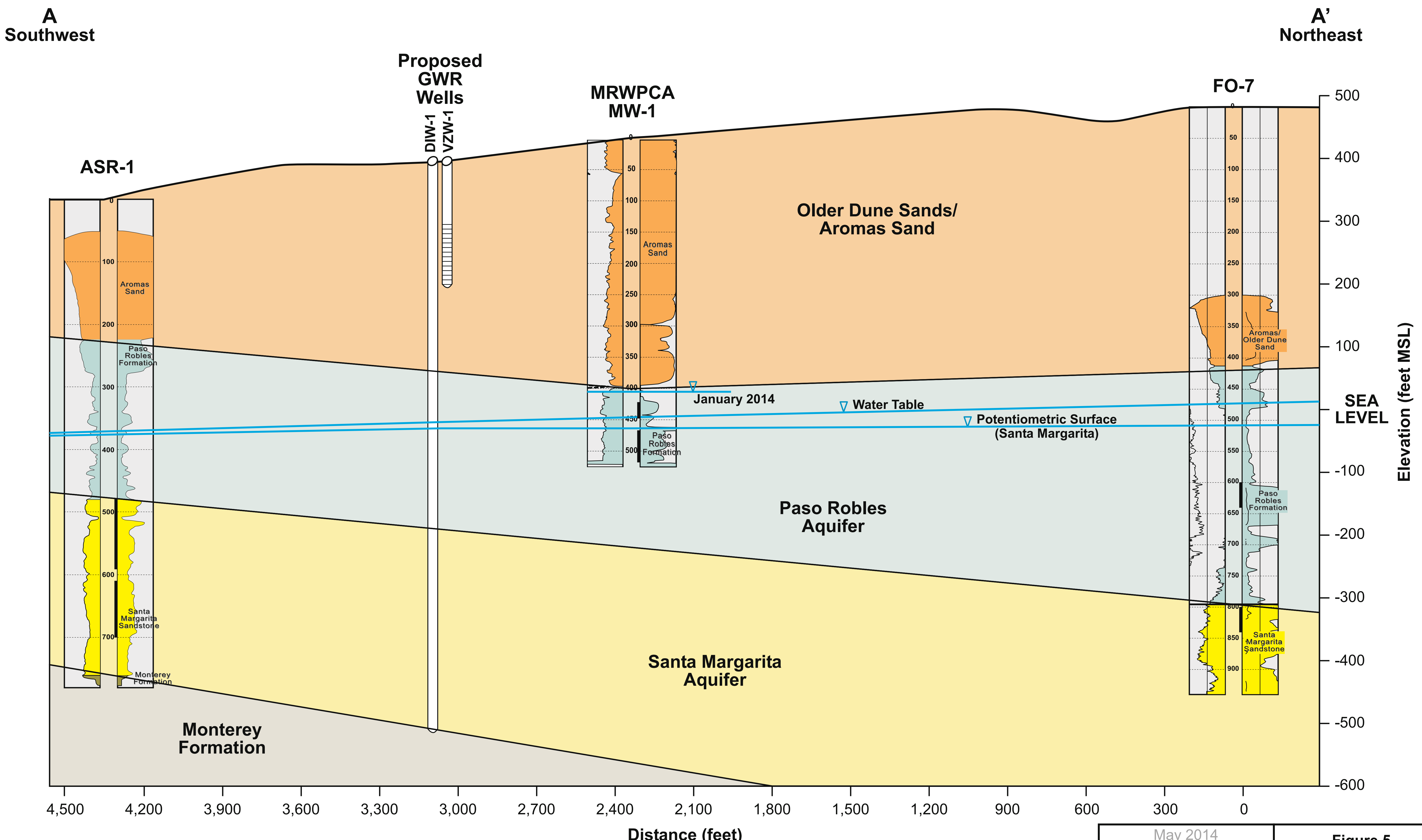



Modified from: Shaw Environmental, 2009.

May 2014

TODD GROUNDWATER

**Figure 4**
**Former Fort Ord Inland Ranges and Proposed Project Wells**



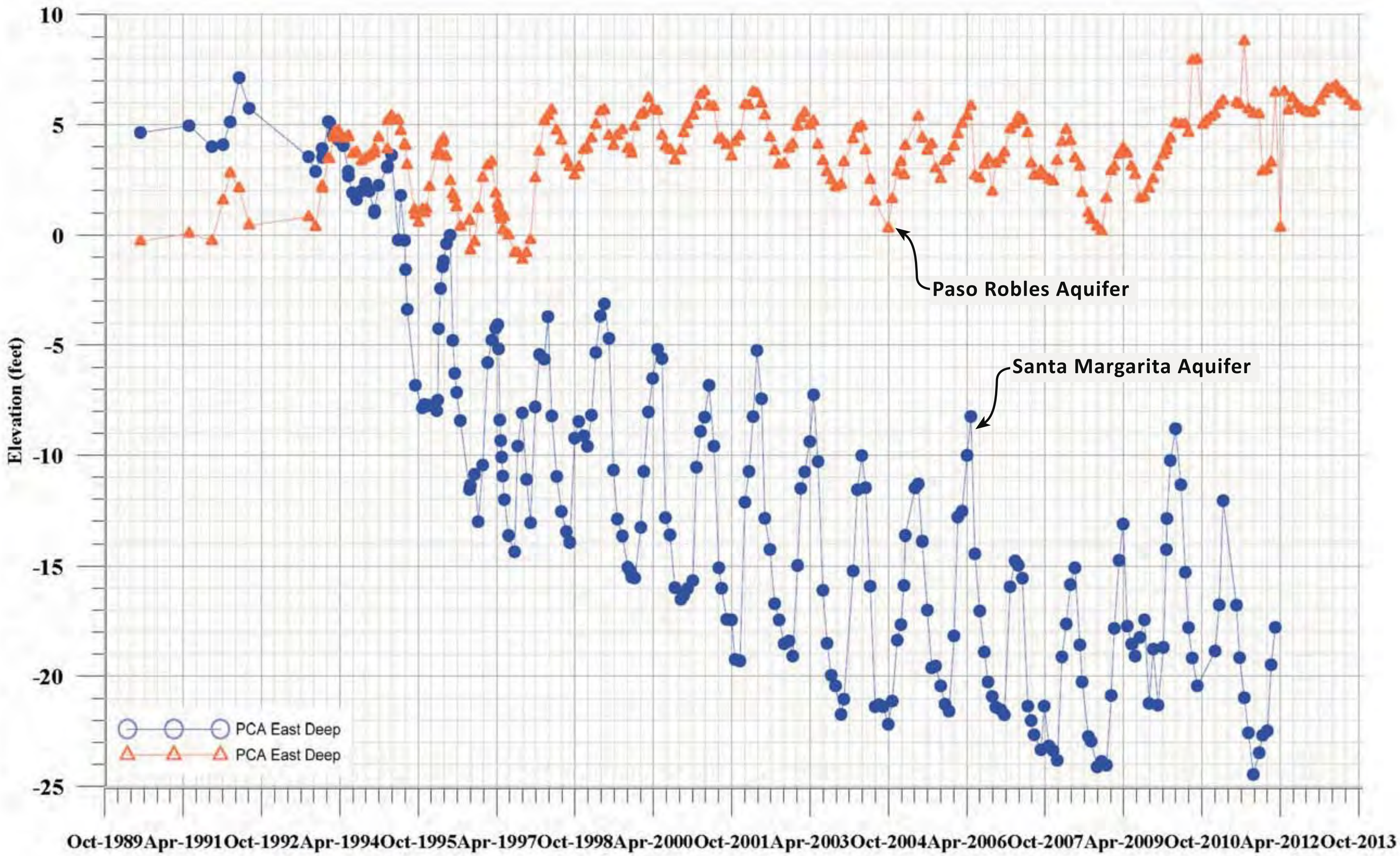

Vertical Exaggeration 2.4x

Water levels from July/August 2013 contour maps in HydroMetrics, December 2013.
Water table in MRWPCA MW-1 measured by Todd Groundwater, January 2014.

May 2014

TODD GROUNDWATER

**Figure 5**
**Cross Section A - A' across Proposed Project Site**




MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

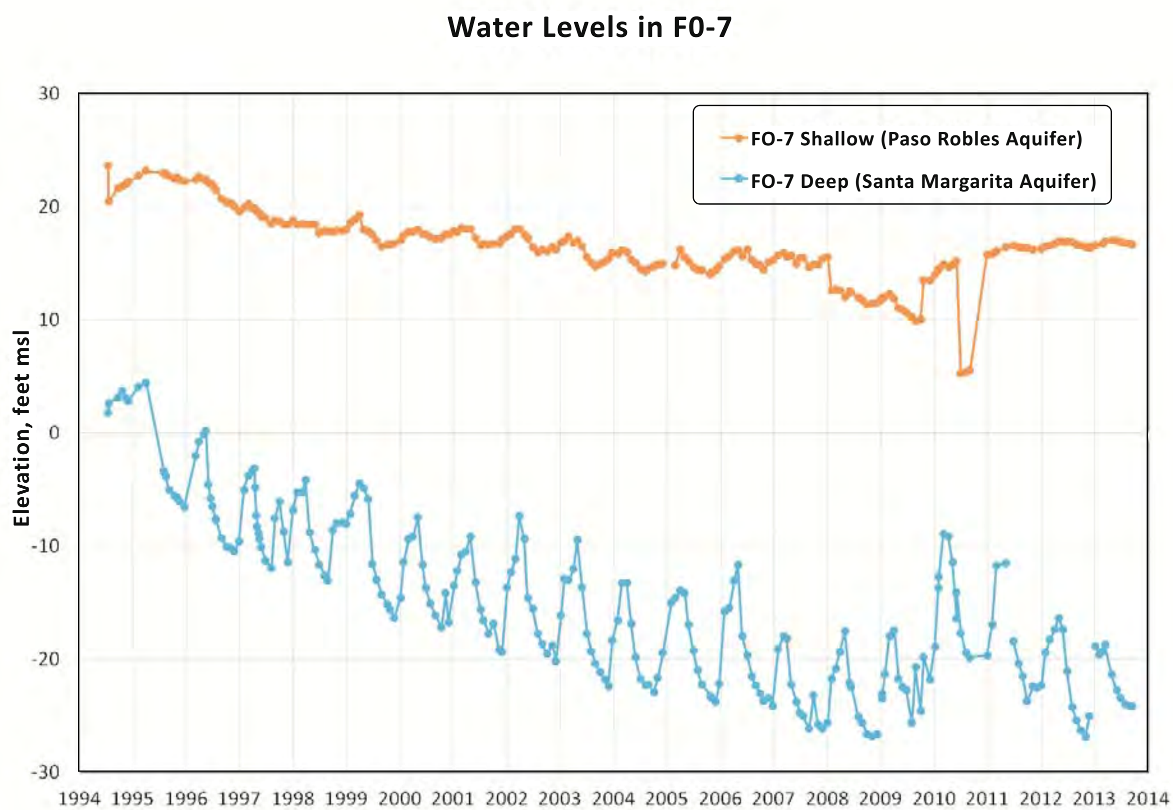
**PCA East (Deep) (15S/1E-15K4)**
Screened from 650-700 (Tsm)
Wellhead Elevation 68.54 MSL
DWR Driller Log No. 338402
Datasource: MPWMD

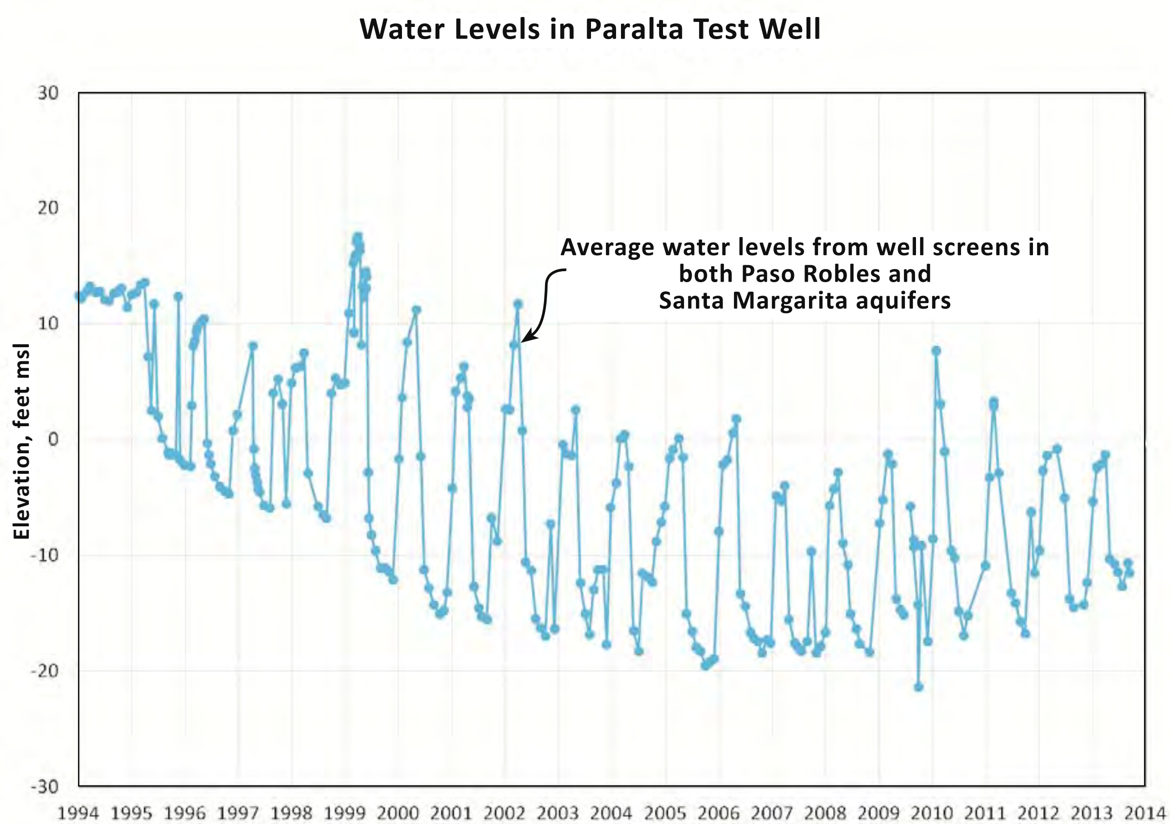
**PCA East (Shallow) (15S/1E-15K5)**
Screened from 350-400 (QTp)
Wellhead Elevation 68.51 MSL
DWR Driller Log No. 338402
Datasource: MPWMD

May 2014

TODD GROUNDWATER

**Figure 6**
**Long-term Hydrograph**
**Coastal Subareas**

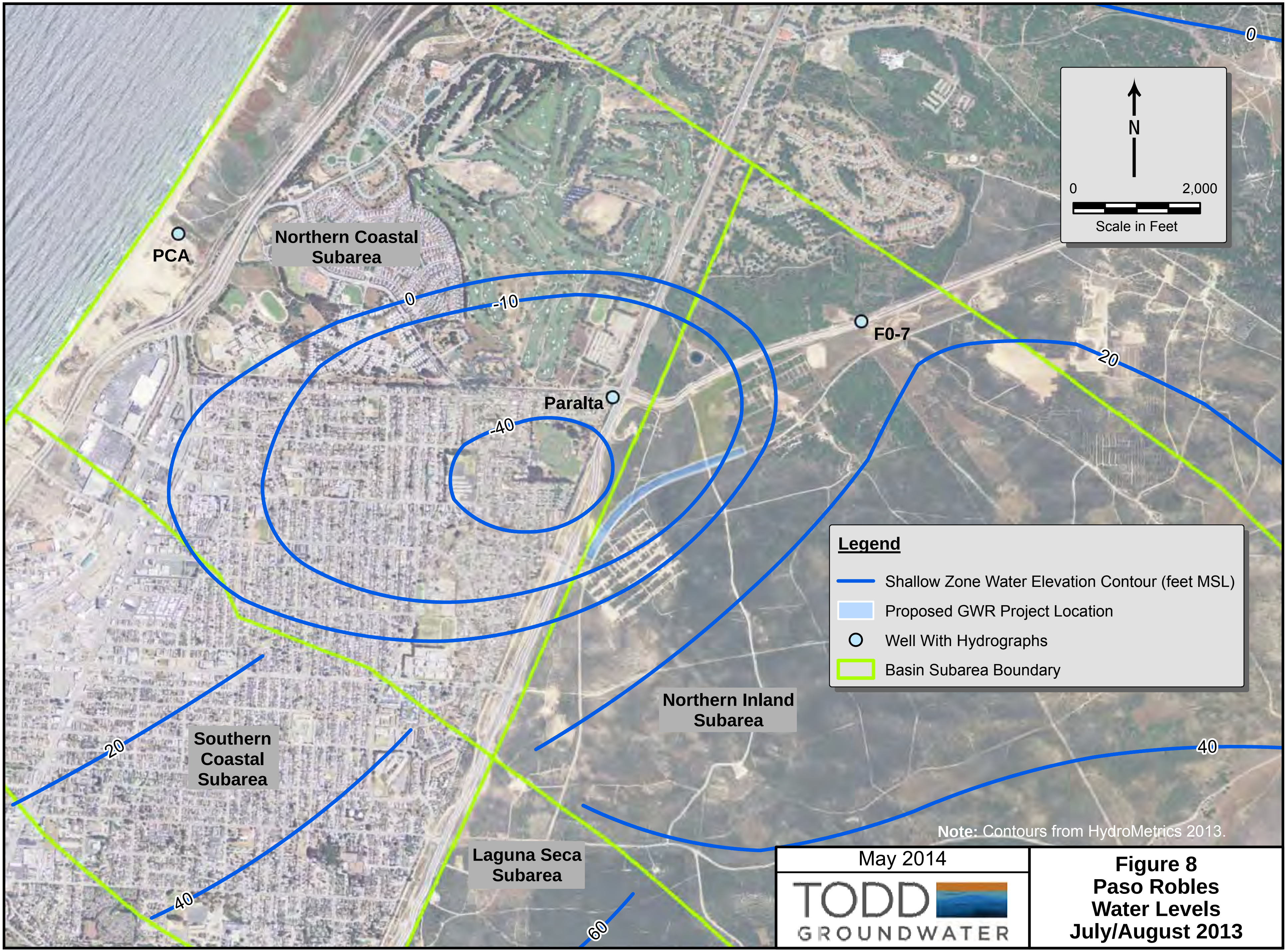



May 2014

TODD GROUNDWATER

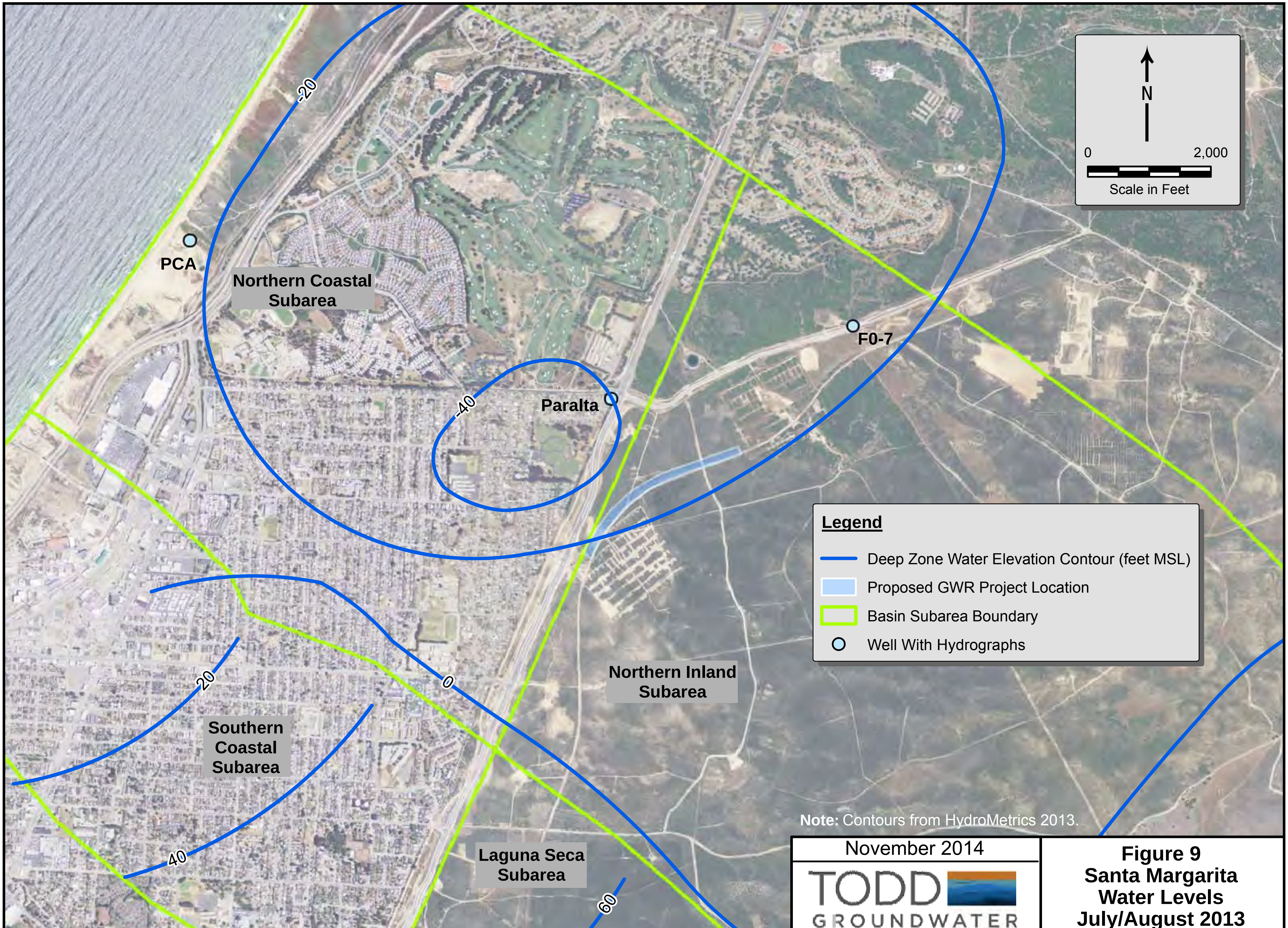
**Figure 7**
**Hydrographs near Proposed Project Area**




May 2014

TODD GROUNDWATER

**Figure 8**
**Paso Robles**
**Water Levels**
**July/August 2013**

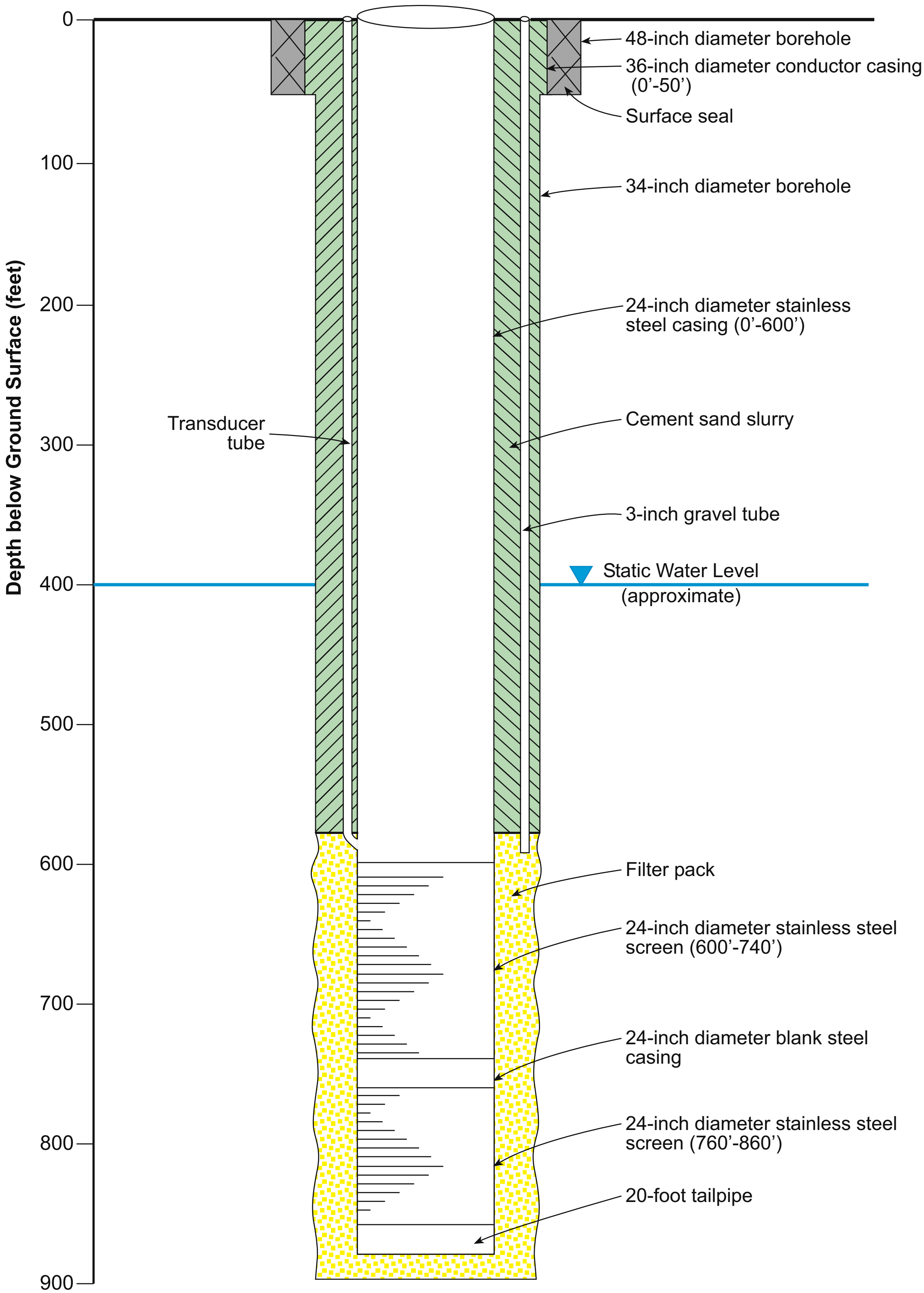



November 2014

TODD GROUNDWATER

**Figure 9**
**Santa Margarita Water Levels**
**July/August 2013**


**Figure 10**
**Proposed Project Components**

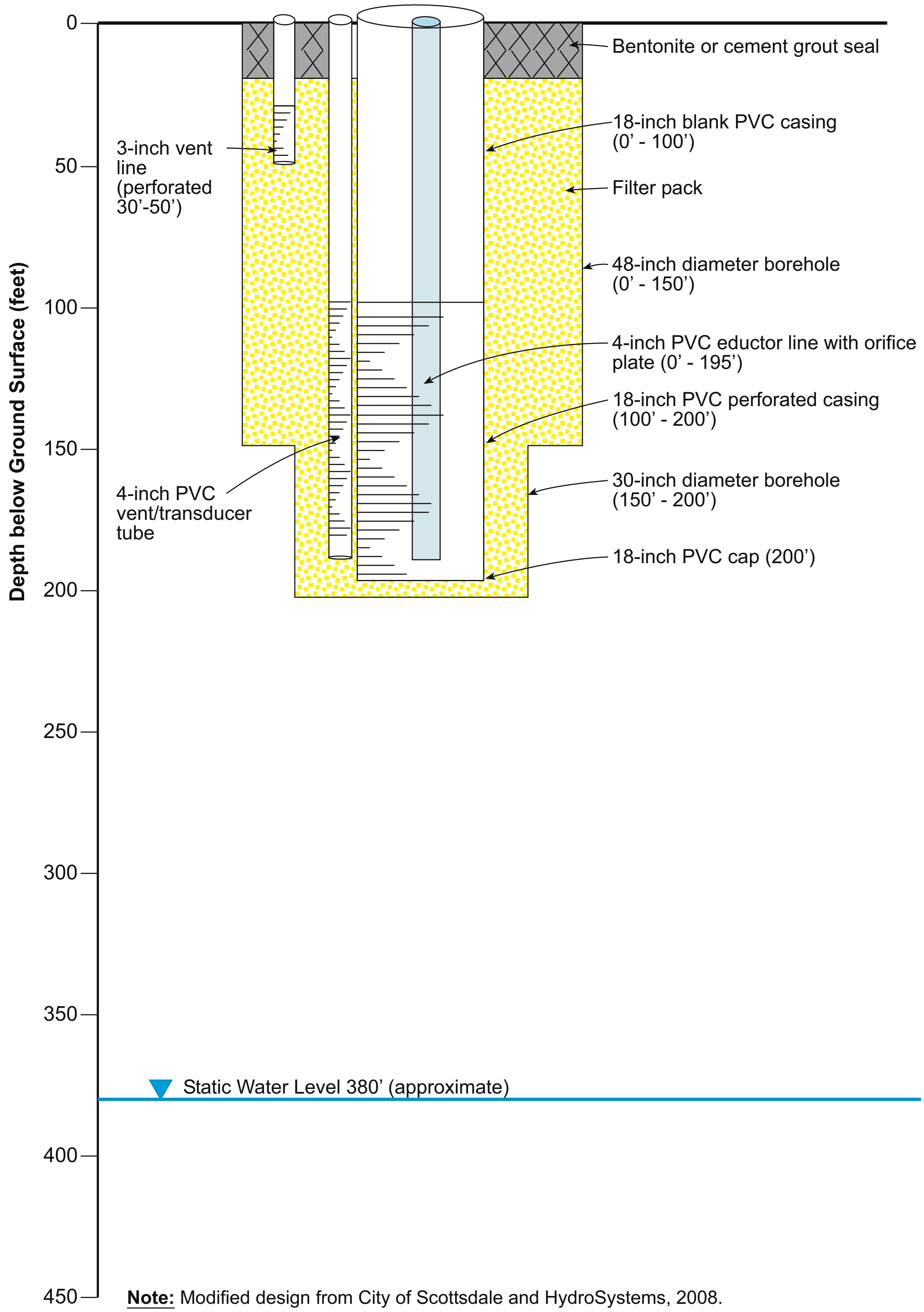



**Note:** Some design components incorporated from Pueblo Water Resources, 2002.

August 2014

TODD GROUNDWATER

**Figure 11**
**Proposed Deep Injection Well Construction Diagram**
**GWR Project**

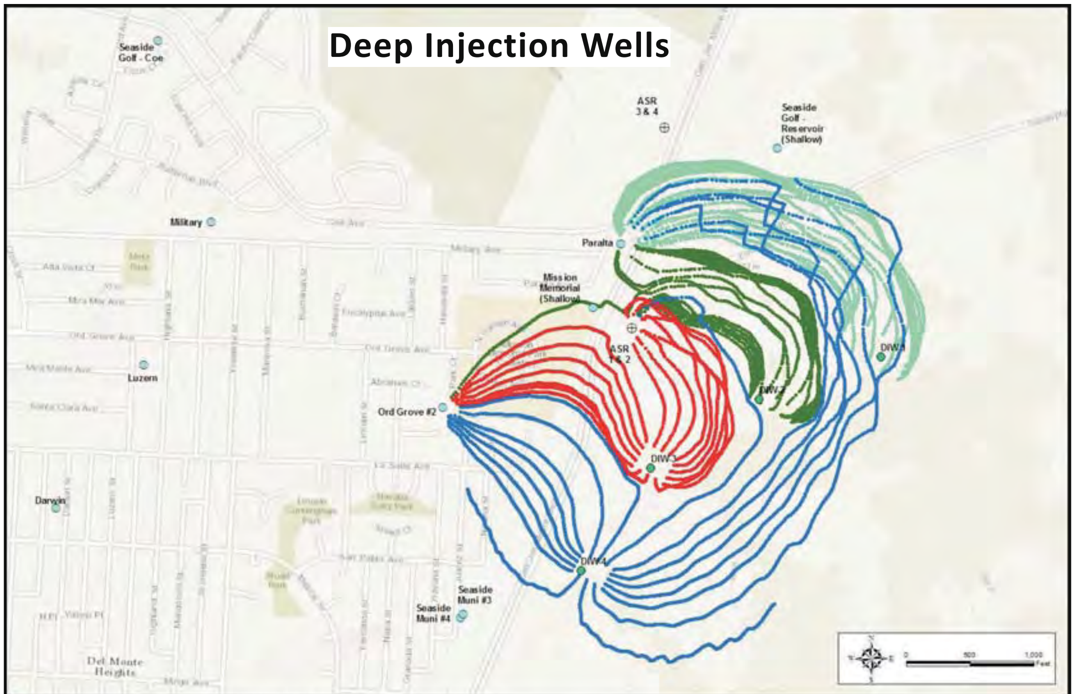



**Note:** Modified design from City of Scottsdale and HydroSystems, 2008.

November 2014

TODD GROUNDWATER

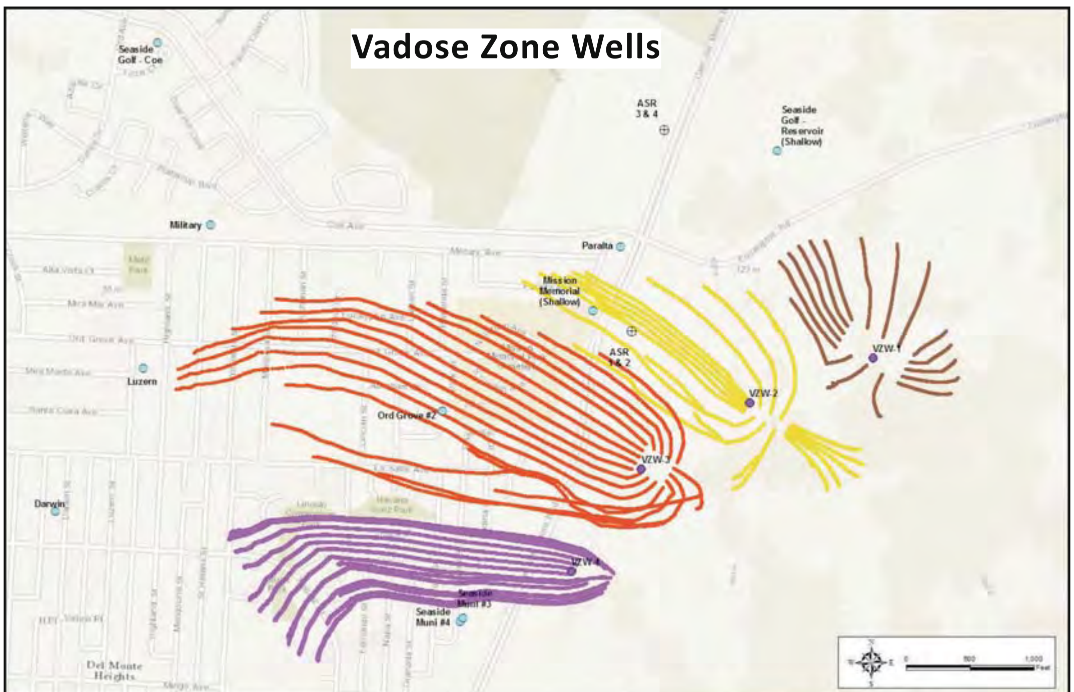
**Figure 12**
**Proposed Vadose Zone Well Construction Diagram GWR Project**




GWR Deep Injection Well
ASR Well
Production Well

Particle Flow Paths from GWR Deep Injection Wells
DIW-1
DIW-2
DIW-3
DIW-4

**Particle Paths from a Single Release in Deep Injection Wells**




GWR Vadose Zone Well
ASR Well
Production Well

Particle Flow Paths from GWR Vadose Zone Wells
VZW-1
VZW-2
VZW-3
VZW-4

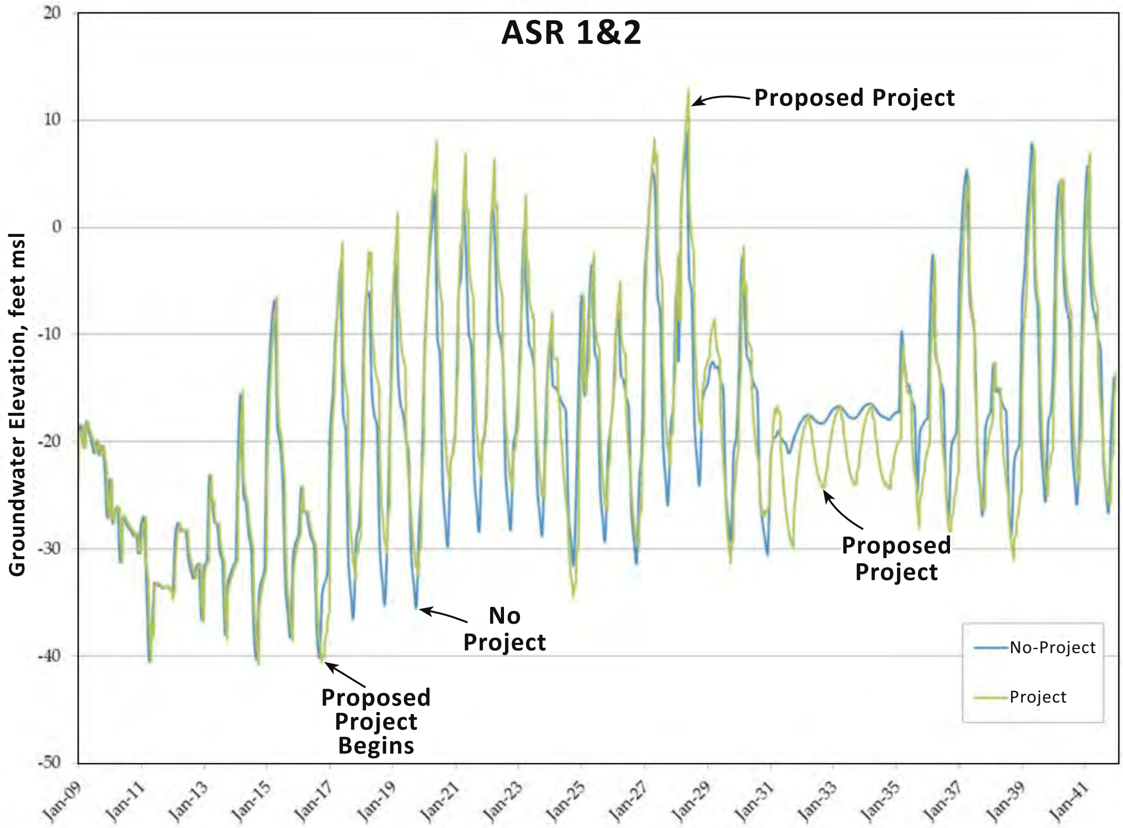
**Particle Paths from a Single Release in Vadose Zone Wells**

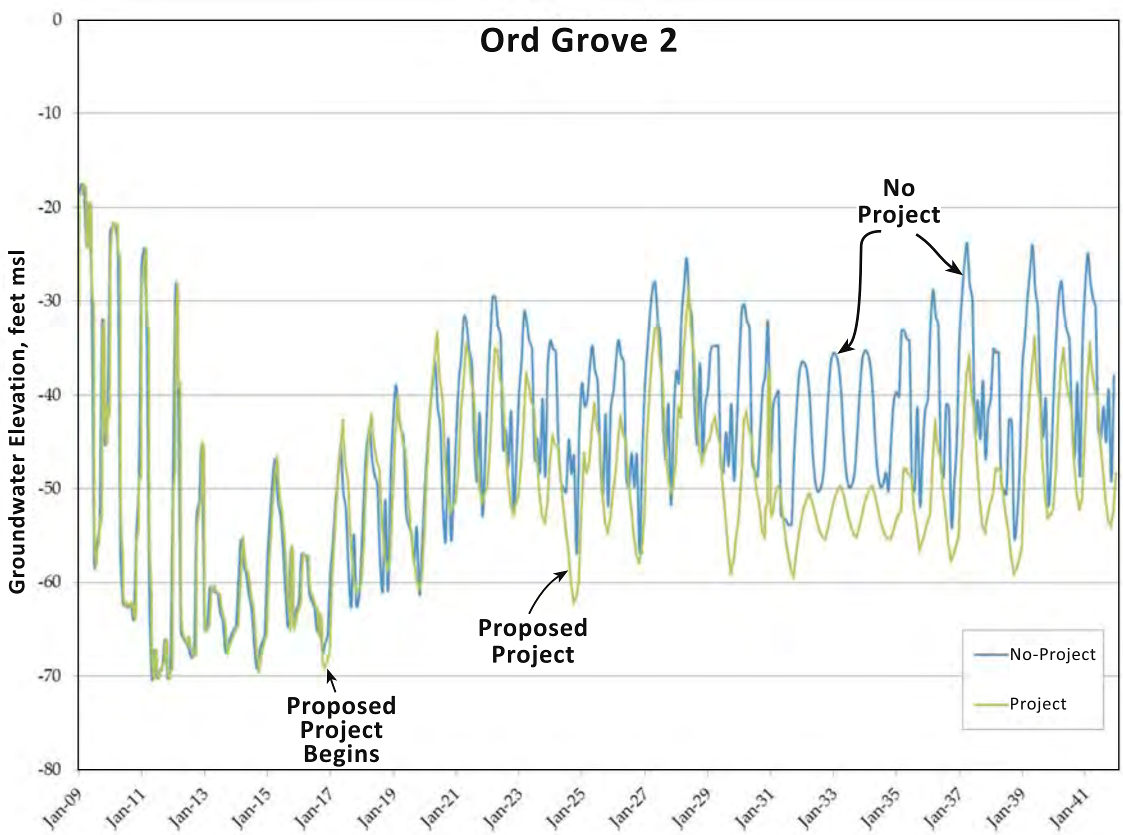
Source: Hydrometrics, November 2014 (See Technical Memorandum in Appendix C)

November 2014

TODD GROUNDWATER

**Figure 13**
**Modeled Flowpaths Proposed Project**



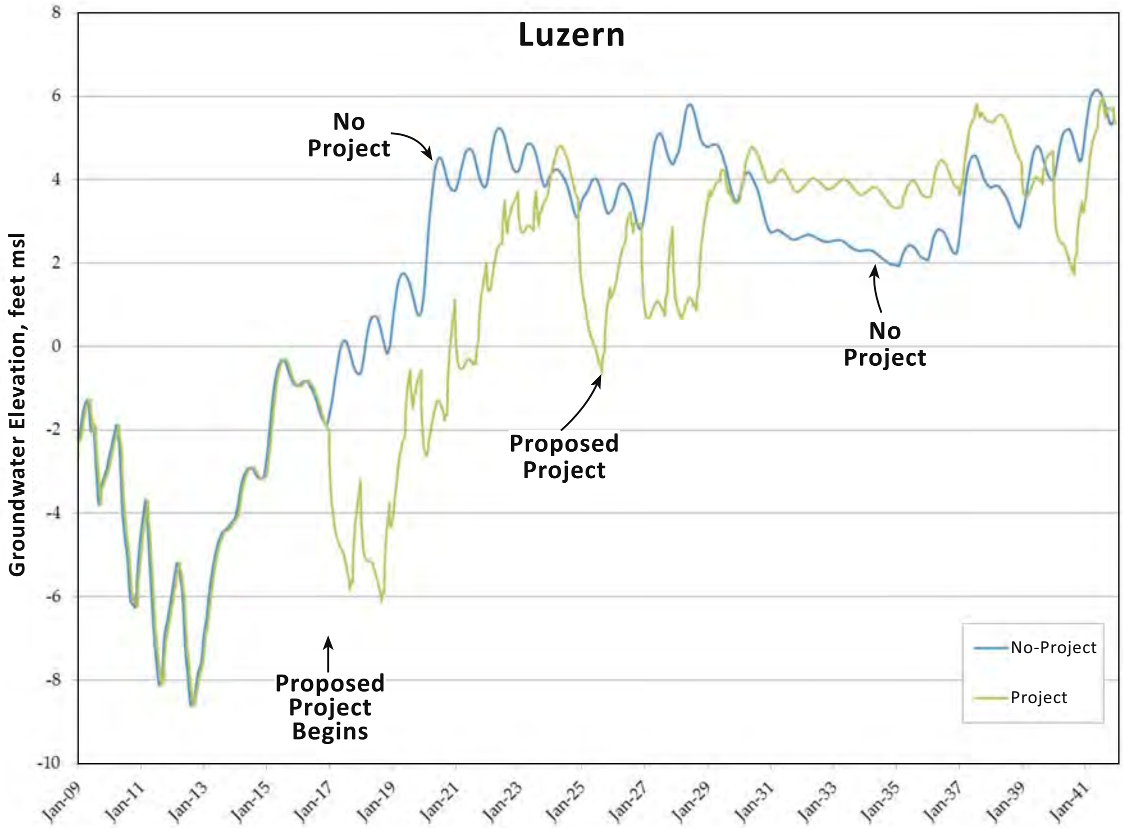



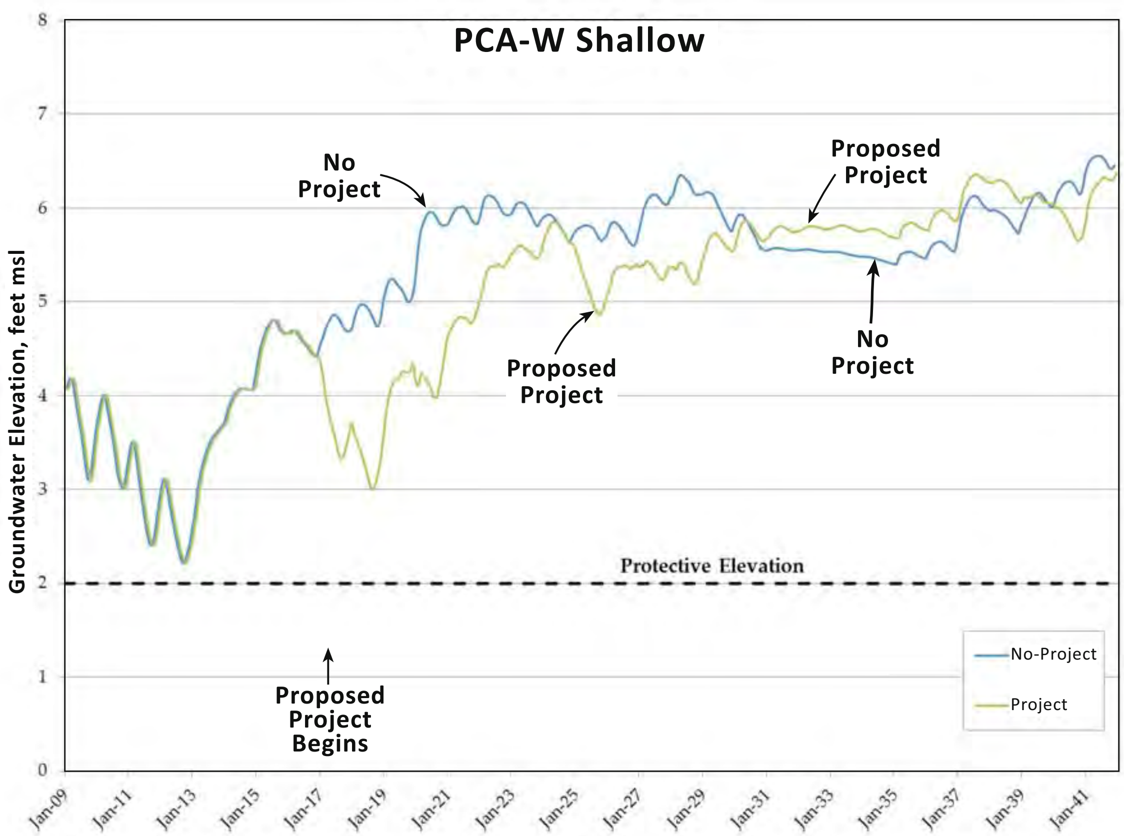

Source: Hydrometrics, November 2014 in Appendix C

November 2014

TODD GROUNDWATER

**Figure 14**
**Proposed Project Impacts to Deep Water Levels**




Source: Hydrometrics, November 2014 in Appendix C

November 2014

TODD GROUNDWATER

**Figure 15**
**Proposed Project Impacts to Shallow Water Levels**

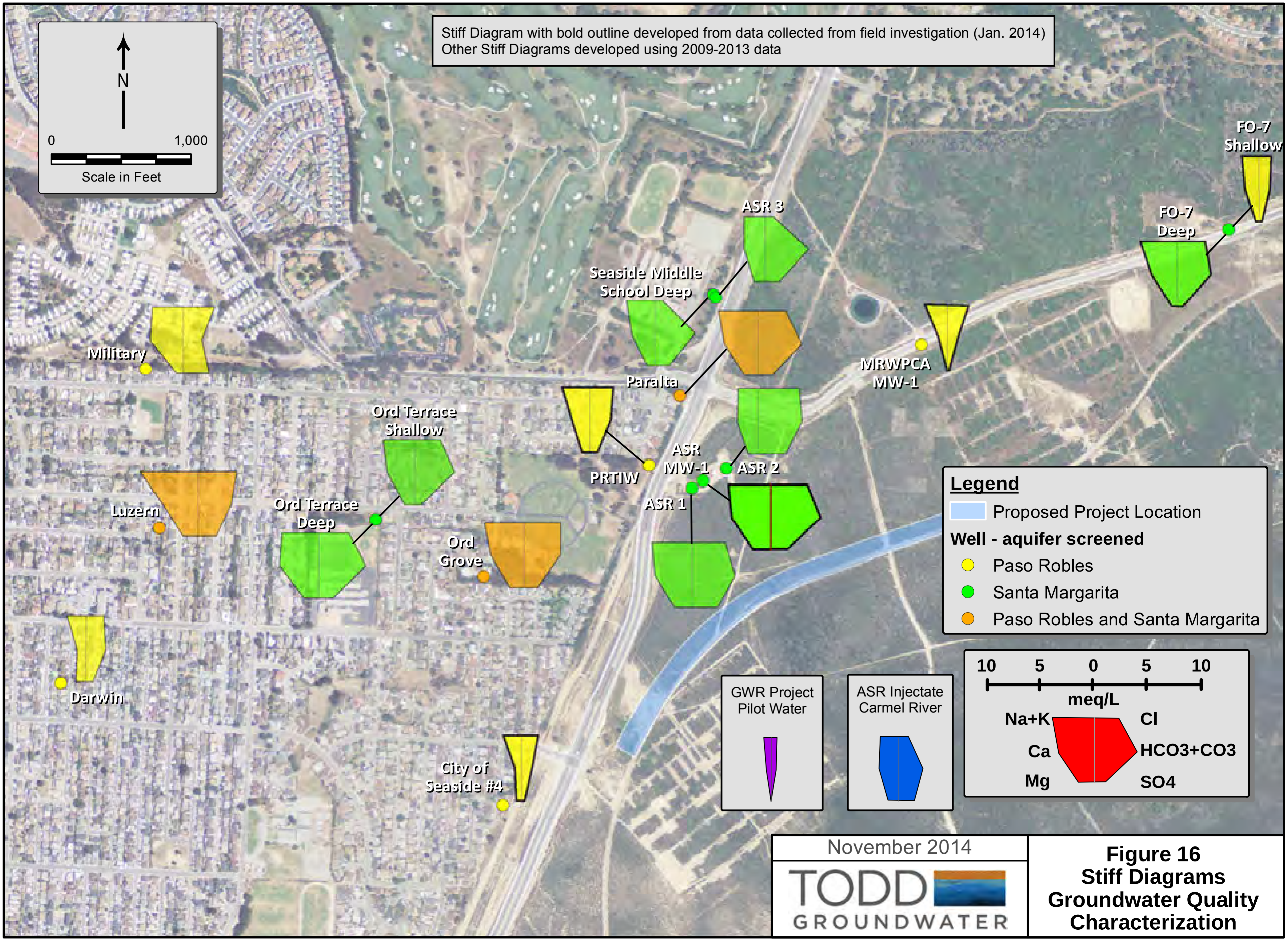
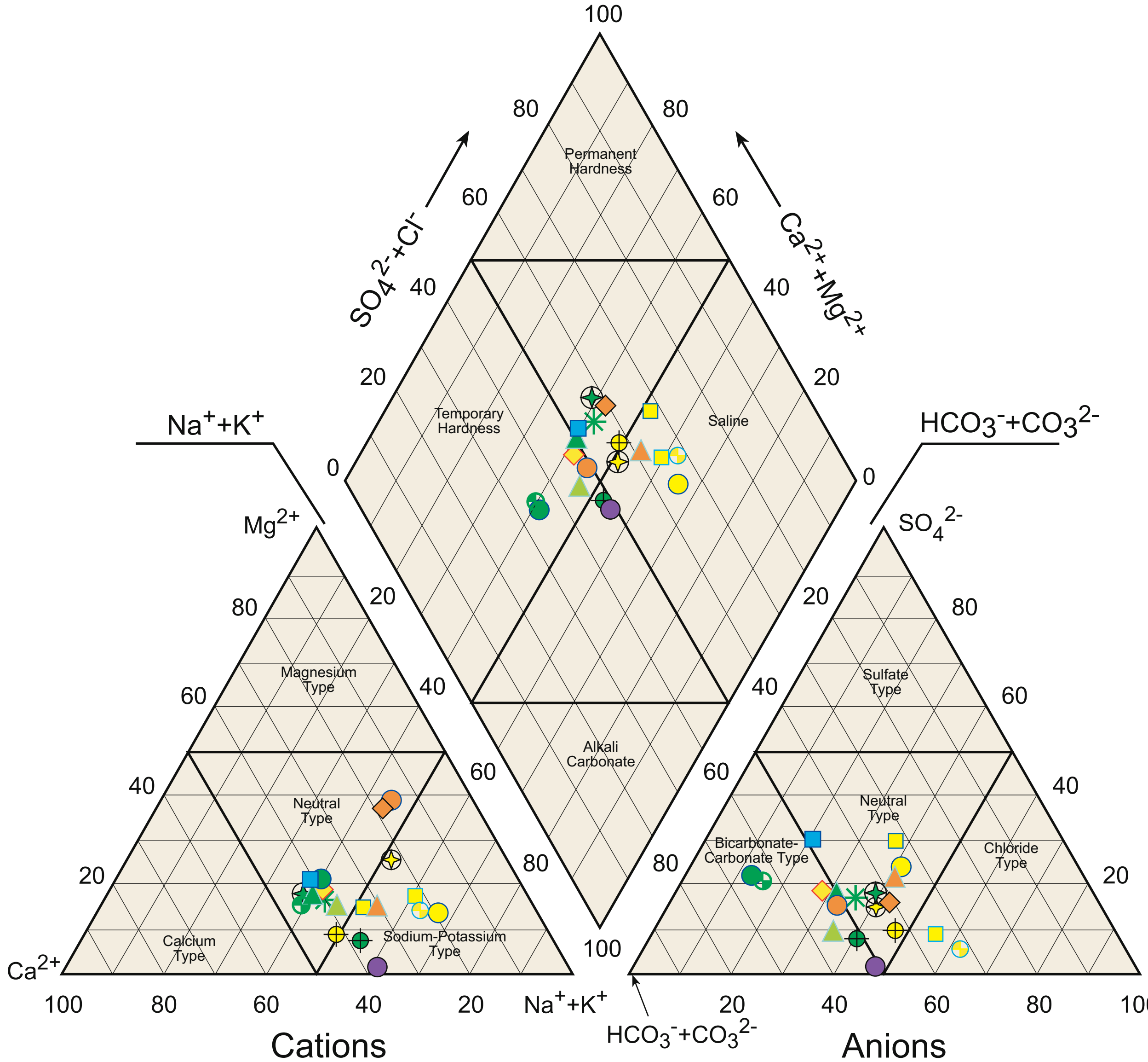



**Figure 16**
**Stiff Diagrams**
**Groundwater Quality Characterization**




**Legend**

**Paso Robles Aquifer**
- Darwin
- Military
- Seaside Middle School Shallow
- City of Seaside 4
- MRWPCA MW-1
- FO-7 Shallow
- PRITW Mission Memorial

**Both Aquifers**
- Paralta
- Luzern
- Ord Grove

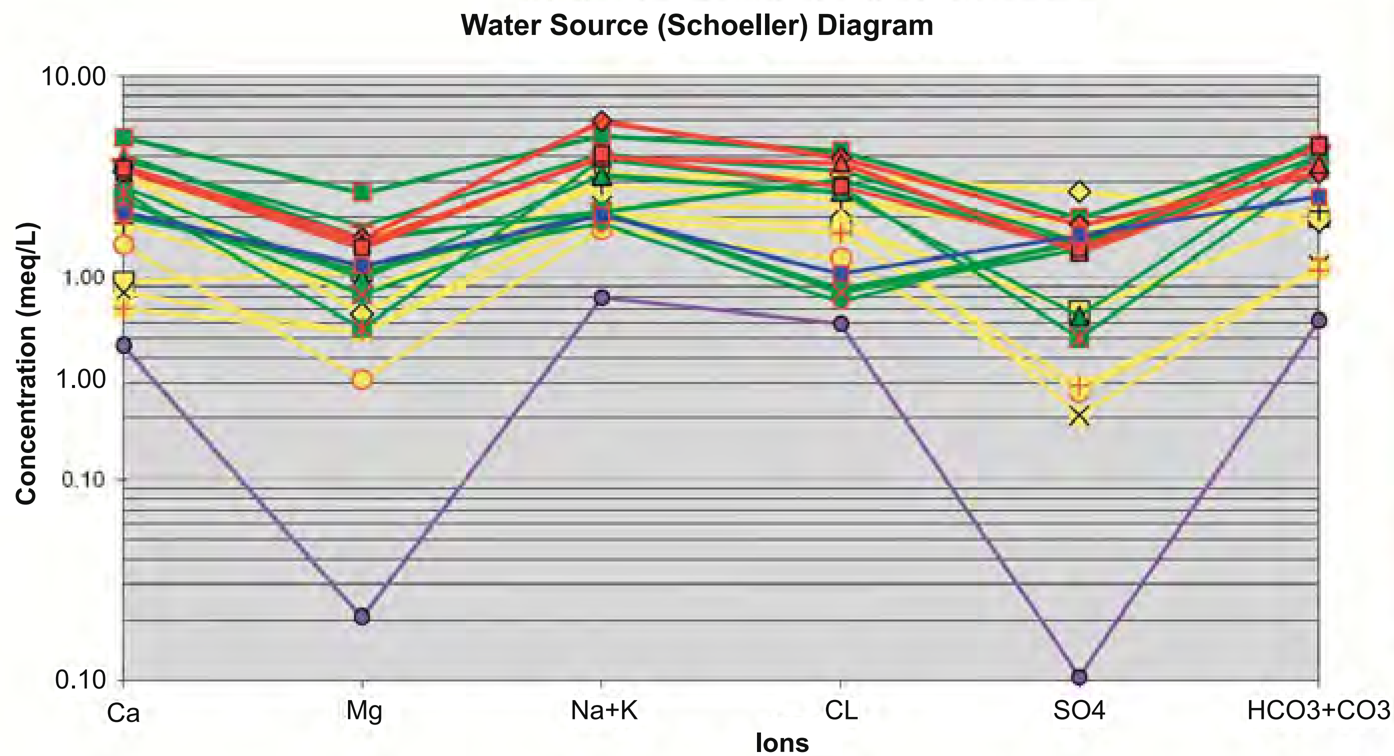
**Santa Margarita Aquifer**
- ASR-2
- ASR-3
- Ord Terrace
- ASR-1
- Ord Terrace Shallow
- Seaside Middle School Deep
- FO-7 Deep
- ASR MW-1

**ASR Injectate**
- ASR Injectate - Carmel River
- GWR Pilot Water

May 2014

TODD GROUNDWATER

**Figure 17**
**Trilinear Diagram**
**Groundwater Chemistry**
**near Proposed Project**




**Legend**

**Paso Robles Aquifer**
- Darwin
- Military
- Seaside Middle School Shallow
- MRWPCA MW-1
- PRITW Mission Memorial
- FO-7 Shallow
- City of Seaside 4

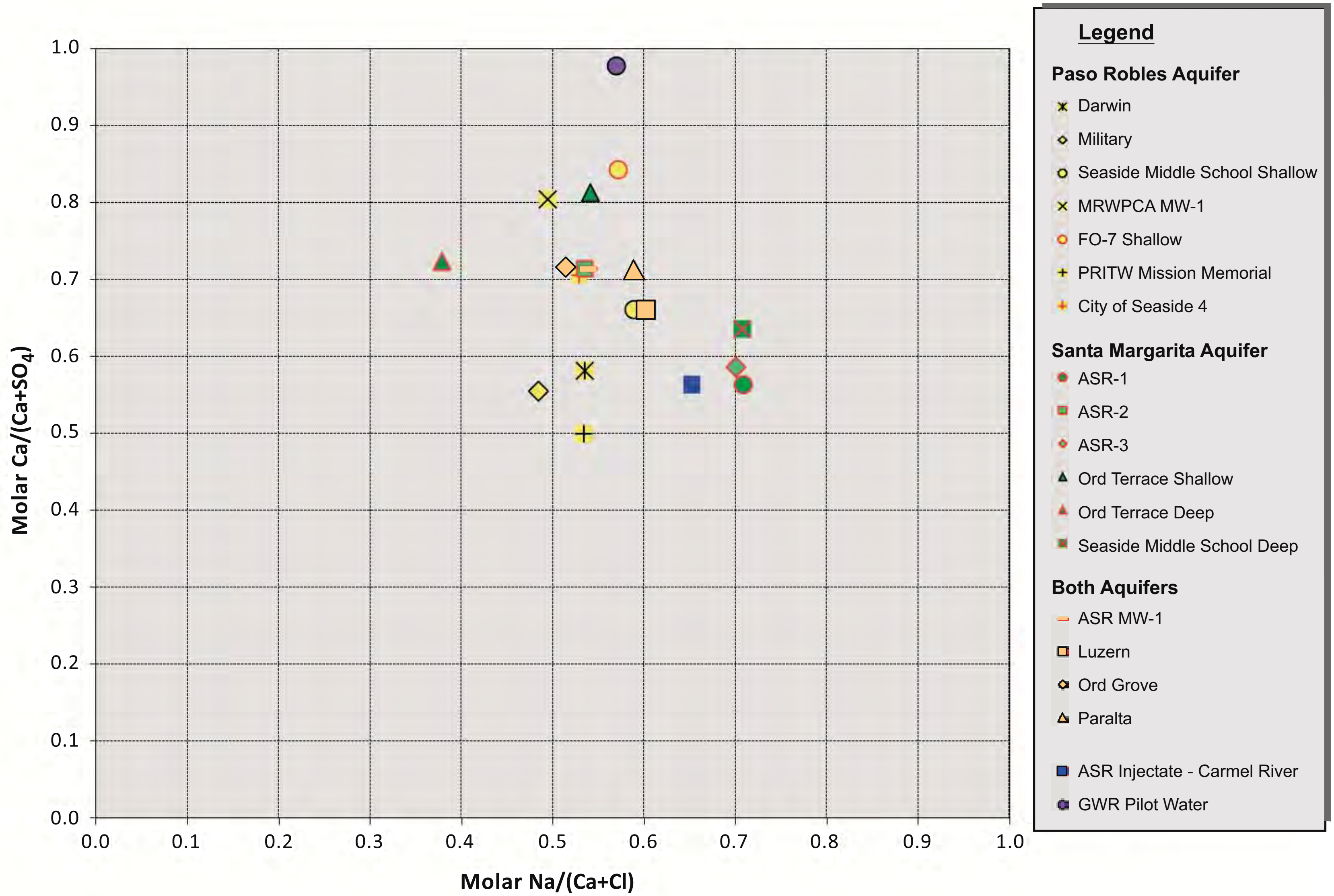
**Santa Margarita Aquifer**
- ASR-1
- ASR-2
- ASR-3
- Ord Terrace Shallow
- Ord Terrace Deep
- Seaside Middle School Deep
- FO-7 Deep
- ASR MW-1

**Both Aquifers**
- Luzern
- Ord Grove
- Paralta
- ASR Injectate - Carmel River
- GWR Pilot Water

May 2014

TODD GROUNDWATER

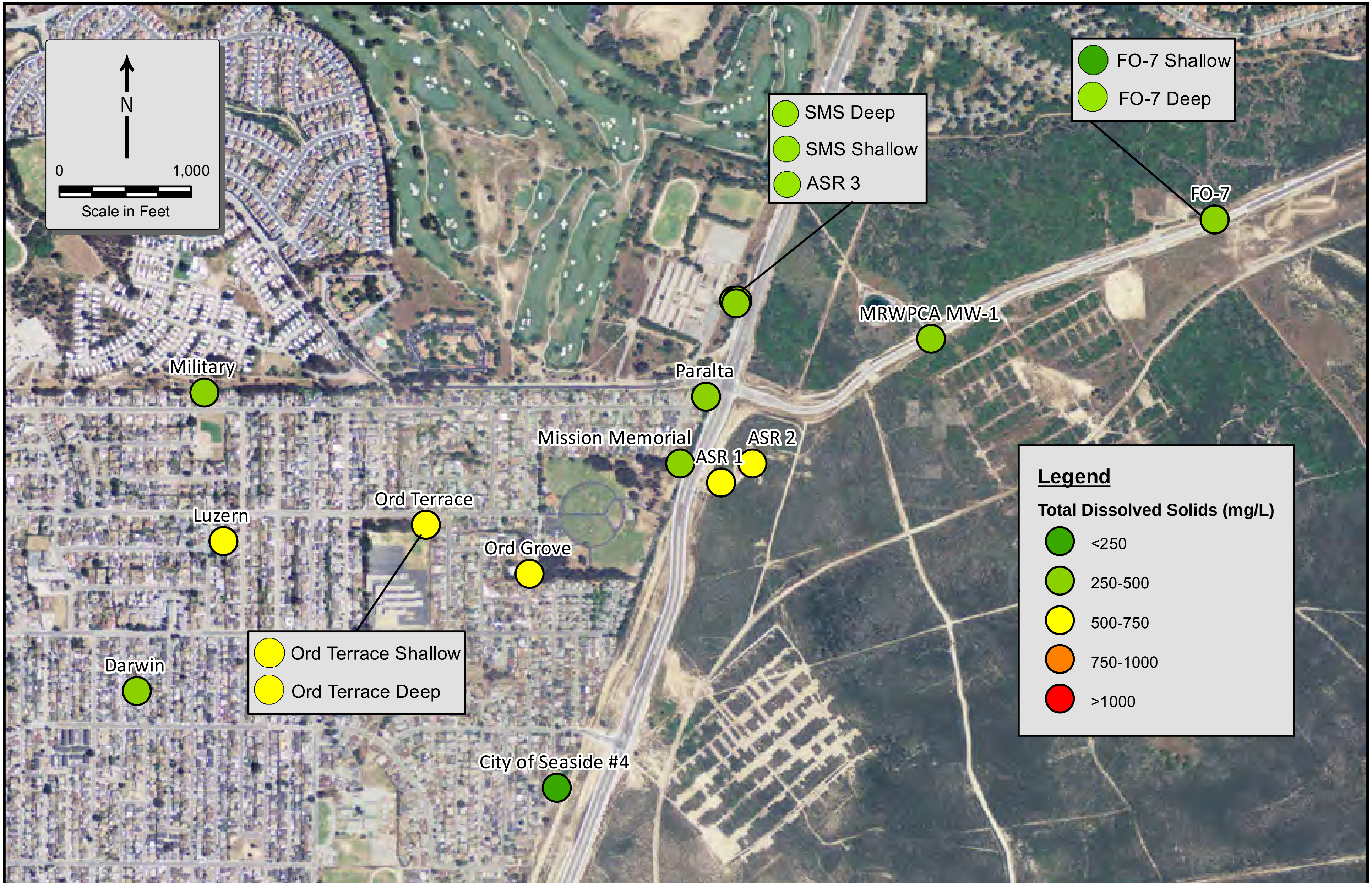
**Figure 18**
**Schoeller Diagram Wells near Proposed Project**




November 2014

TODD GROUNDWATER

**Figure 19**
**Brine Differentiation Plot**
**Wells near Proposed Project**




May 2014

TODD GROUNDWATER

**Figure 20**
**Total Dissolved Solids in Groundwater near Proposed Project**

# APPENDIX A

## Todd Groundwater Technical Memorandum Selection of Recharge Location for GWR Project, Seaside Groundwater Basin, May 29, 2014

TODD GROUNDWATER

May 29, 2014

# TECHNICAL MEMORANDUM

**To:** Bob Holden, PE
Monterey Regional Water Pollution Control Agency (MRWPCA)

**From:** Phyllis Stanin, Vice President/Principal Geologist

**Re:** Selection of Recharge Location for GWR Project
Seaside Groundwater Basin

Monterey Regional Water Pollution Control Agency (MRWPCA) has been developing the Groundwater Replenishment (GWR) Project (also, Proposed Project), which involves advanced treatment of various water sources for conveyance and recharge into the Seaside Groundwater Basin (Seaside Basin). In that basin, declining water levels and overdraft conditions have placed drinking water aquifers at risk of seawater intrusion. These conditions have resulted in court-imposed limits on groundwater extraction for drinking water. The Proposed Project offers a reliable source of recharge to increase basin yield without exacerbating the risk of seawater intrusion.

Over the last several years, MRWPCA has considered various locations for recharge in the Seaside Basin. Two preliminary recharge locations were identified and evaluated in 2009 during early project development. The western-most location consists of two parcels along Highway 1 and is referred to as the former Coastal Location (Figure A-1). An eastern location, referred to as the former Inland Location, was delineated as a strip of land along Eucalyptus Road, which crossed the northern boundary of the Seaside Groundwater Basin (Figure A-1). As shown on Figure A-1, the current proposed location is a curved strip of land about 2,000 feet southwest of the former Inland Location. The purpose of this memorandum is to document the selection of the proposed location for implementation of the GWR project.

## BACKGROUND

In 2013, the former Inland Location was re-located to an adjacent parcel approximately 2,000 feet southwest based on hydrogeologic and engineering criteria including:

- ensure that recharged water remains within the Seaside Basin
- locate recharge immediately upgradient of pumping depressions to mitigate declining water levels
- decrease conveyance and pumping costs by re-locating to areas of lower ground surface elevations.

The proposed recharge location (or *proposed location*) consists of a relatively narrow strip of land approximately 3,000 feet in length (Figure A-1). The strip is located along a parcel boundary between proposed development by the City of Seaside and open space associated with former Fort Ord lands. The parcel, currently owned by the Fort Ord Reuse Authority (FORA), will be conveyed to the City of Seaside when remediation activities on certain other former Fort Ord lands have been completed.

Although both the proposed location and former Coastal Location have benefits for the development of the Proposed Project, the proposed location on Figure A-1 has been selected for implementation. That location is currently under evaluation in an Environmental Impact Report (EIR) being prepared by MRWPCA. The selection of the proposed location instead of the former Coastal Location also involved hydrogeologic, engineering, and cost considerations.

In July 2013, the Seaside Basin Watermaster (Watermaster) conducted an evaluation of recharge at various inland and coastal locations, including the southern parcel of the former Coastal Location (Figure A-2). For that evaluation, HydroMetrics WRI (HydroMetrics), applied a basin-wide groundwater flow model to simulate changes in water levels resulting from recharge of various amounts and at various locations within the basin (HydroMetrics, July 19, 2013). That analysis provided technical information relevant to the selection of the proposed location. The results of the Watermaster modeling and the selection of the proposed location are described in this memorandum.

## PROJECT OBJECTIVES

In order to meet the Proposed Project's primary objective of providing recharge to the Seaside Groundwater Basin to replace a portion of Cal-Am's water supply, the Proposed Project must:

- be cost effective
- comply with water quality regulations
- meet Cal-Am's scheduling needs.

Secondary project objectives include:

- assist in preventing seawater intrusion in the Seaside Basin
- assist in diversifying Monterey County's water supply portfolio
- provide additional water that could be used for crop irrigation through the Salinas Valley Reclamation Project and Castroville Seawater Intrusion Project system.

## HYDROGEOLOGIC CONSIDERATIONS

Hydrogeologic conditions at the former Coastal Location were compared to the proposed location in order to select the optimal site for GWR project development as summarized in the following sections.

**Injection Capacity is less certain at the former Coastal Location.**

Different characteristics in hydrostratigraphy of the Santa Margarita Aquifer have been documented at the former Coastal Location that could impact implementation of the Proposed Project. A 2007 field investigation conducted by the Watermaster resulted in an improved understanding of the coastal hydrostratigraphy near the former Coastal Location (Feeney, 2007). During that investigation, four deep monitoring wells were installed along the coast as part of a sentinel monitoring program to protect against seawater intrusion. Two of these wells, SBWM-3 and SBWM-4, are within 2,000 feet and 1,350 feet from the former Coastal Location, respectively. Figure A-2 shows these two wells and the outline of the southern parcel of the former Coastal Location (labeled *MRWPCA South Location*) (HydroMetrics, July 19, 2013).

Data from these two wells indicate significant differences in the Santa Margarita Aquifer compared to inland areas. In brief, the Santa Margarita Aquifer – the primary target for the Proposed Project – may be thin or absent at the former Coastal Location. This interpretation is illustrated on a cross section developed by Feeney (2007). A portion of that cross section including the two monitoring wells close to the former Coastal Location is shown on Figure A-3. The approximate location of the former Coastal Location is projected onto the section. As shown on the figure, the Santa Margarita Aquifer is interpreted to be very thin (less than 100 feet thick) in SBWM-4 and absent in SBWM-3. The section is replaced with a relatively thick sequence of the Purisima Formation. Although the Purisima Formation appears to be hydraulically connected to the Santa Margarita Aquifer and may also function as an aquifer, the formation appears to be less permeable based on geologic and geophysical logs (Feeney, 2007). In addition, the permeability of this unit was assigned a lower hydraulic conductivity value in the basin-wide groundwater flow model (HydroMetrics, 2009).

Decreased permeability would likely result in a lower injection rate, which would require more wells than are currently planned at the proposed location for the same amount of recharge. In addition, injection wells in a low permeability formation may be more susceptible to clogging. Deep aquifers may have limited storage if porosity is also lower. At a minimum, the former Coastal Location would require an additional deep aquifer testing program to determine the feasibility of deep injection wells prior to project implementation. Such a program would negatively impact project objectives by affecting both the cost and schedule of the Proposed Project.

In contrast, the Santa Margarita Aquifer near the proposed location is approximately 300 feet thick, with relatively high permeability. Within about 1,000 feet to 1,300 feet of the proposed location, four successful ASR wells are screened in the Santa Margarita Aquifer and operated for both injection and recovery. These wells have relatively high transmissivity values of about 100,000 gallons per day per foot (gpd/ft) and relatively high specific capacities that range from about 27 gallons per minute per foot of drawdown (gpm/ft dd) to more than 60 gpm/ft dd (Padre, 2002; Pueblo, 2012). These observations suggest that fewer wells would be needed at the proposed location, reducing project costs.

**The Proposed Location is upgradient of existing production wells.**
The water level contour map on Figure A-2 shows contours of the potentiometric surface of the Santa Margarita Aquifer (equivalent to the *Deep Zone* as labeled on the map). Contours indicate that water levels are below sea level throughout the Northern Coastal Subarea and are deeper than -60 feet below mean sea level (msl) in the area of numerous production wells (black circles), forming a pumping depression (Figure A-2). The proposed location is located upgradient of numerous production wells and closer to the pumping depression than the former Coastal Location. Most of the production wells shown in this area are owned and operated by Cal-Am and will be pumped to recover recycled water being recharged by the Proposed Project. Essentially all of the recharged water will flow toward these wells under existing groundwater flow conditions.

**Deeper water table at the proposed location allows more storage in the vadose zone.**
The water table beneath the proposed location occurs at an average depth of about 400 feet below ground surface (bgs). Further, data from a recent MRWPCA field program indicate very high porosity and permeability values in the vadose zone, providing a large storage volume for recharge of recycled water.

In contrast, the water table beneath the former Coastal Location is only about 115 feet bgs. The relatively shallow water table limits vadose zone storage. Under these conditions, mounding of the recharge water could reduce injection rates over time.

**Recharge at the Former Coastal Location would result in project water being lost to ocean outflow.**
Injection in both deep and shallow wells will result in groundwater mounding and radial groundwater flow away from the injection wells. Depending on the then-current water levels, recharged water would flow both inland toward the pumping depression and coastal toward the ocean. This groundwater flow pattern would result in some amount of recharge being lost to ocean outflow that could not be recovered through existing wells. The mound would provide some protection against seawater intrusion that would allow water levels to be lowered inland through increased pumping. However, there is uncertainty associated with the lateral and vertical extent of mounding at the former Coastal Location; it is unclear what adverse impacts would result from allowing water levels to decline inland. In summary, a portion of the recharged water may not be recoverable.

## ENGINEERING AND COST CONSIDERATIONS

In addition to the hydrogeologic considerations, several components of the preliminary GWR project design were factors in the location selection process. For example, a conceptual project design developed in 2009 indicated higher project costs with the former Coastal Location. At that time, both the former Inland and Coastal locations were assumed to connect to the proposed Regional Urban Water Augmentation Pipeline (RUWAP), which enters the basin along General Jim Moore Boulevard as shown on Figure A-1 (see the purple line labeled proposed pipeline). For the former Coastal Location, a connecting pipeline would have to be routed through residential and urban development and then across both parcels of the former Coastal Location. For the former Inland Location (and the proposed location), a connecting pipeline could be routed to Eucalyptus Road. Preliminary costs developed for the water supply lines indicated higher costs for the routing to the former Coastal Location. Given the hydrogeologic uncertainty at the former Coastal Location, more project wells would have to be connected and maintained, also resulting in increased costs.

## GROUNDWATER MODELING

The groundwater modeling conducted by the Watermaster allowed comparison of the effectiveness of various recharge locations for protection against seawater intrusion. Although these simulations were not conducted specifically to evaluate the Proposed Project, the modeling simulates the aquifer response to injection at both inland and coastal locations similar to those evaluated for the Proposed Project. Model results were summarized in a Technical Memorandum titled *Groundwater Modeling Results of Coastal Injection in the Seaside Basin* (HydroMetrics, July 2013). Relevant sections of that memorandum are summarized below.

Two modeling scenarios, referred to as Scenario 0 and Scenario 1, simulated 1,000 AFY of injection at each of two locations including an inland and coastal location. Figure A-2 shows a map from the HydroMetrics memorandum that identifies the modeled injection locations. The simulated coastal locations are shown by red parcels labeled “Modeled Coastal Injection Locations[1]” in the map legend of Figure A-2. The simulated inland location is shown by an arrow (labeled *Inland Injection Location* on Figure A-2) and coincides with the ASR wellfield located near the proposed GWR project location (also labeled on Figure A-2).

The effectiveness of each injection location was judged by the ability to raise water levels in coastal wells to levels protective of seawater intrusion. These protective levels had been established by the Watermaster in previous evaluations (HydroMetrics, December 2013). To illustrate the model results, simulated water levels in a nearby coastal monitoring well cluster, MSC Shallow and MSC Deep, are shown on Figure A-4. Results for other coastal wells vary, but Scenarios 0 and 1 track similarly (with a difference of only a few feet or less) for the four wells presented in the memorandum (HydroMetrics, July 2013). Although the figure contains results from numerous model scenarios (Scenarios 0 through 7 as shown on the legend), Scenario 0 and Scenario 1 are the comparable results from the coastal and inland injection locations. Except for Baseline and Scenario 0, all scenarios involve injection at the coastal location and vary amounts and timing of recharge. Although the curves are difficult to differentiate on Figure A-4, the curves from Scenarios 0 and 1 are labeled and track very closely for both of the well clusters.

Results of the simulations indicate that injection at the former Coastal Location raises coastal water levels higher and faster than inland injection, but only by a small amount (less

[1] The HydroMetrics northernmost coastal location is the same as the southern parcel of the former GWR Coastal Location – compare Figures A-1 and A-2. HydroMetrics reports that modeling results were very similar between the two coastal locations shown on Figure A-2.

than two feet). The memorandum concludes that coastal injection achieves protective water levels one to ten years faster than inland injection, depending on the well. This means that the coastal injection curves labeled on Figure A-4 for both MSC Shallow and Deep reach the line labeled Protective Water Level before the inland injection curves (also labeled on Figure A-4). While this conclusion is correct, the inland injection curves are very close to the line and demonstrate that injection inland is also effective at raising water levels near the coast.

Further, Scenario 5 shows that coastal injection of 1,900 AFY raises water levels very high in both clusters, and within about 35 feet of the ground surface. With the GWR project injection of approximately 3,500 AFY, water levels would rise even higher, suggesting that the former Coastal Location has limited storage. Scenario 4 indicated that protective water levels at the coast could be maintained at about 850 AFY, significantly below the water available for injection for the Proposed Project. In addition, a significant portion of the injected water leaves the basin as coastal outflow, potentially limiting the amount of water that could be recovered.

While the modeling suggests that the former Coastal Location may be slightly more effective at achieving protective water levels in a shorter amount of time, the inland location also raises water levels along the coast and has more storage.

## SUMMARY

Based on the hydrogeologic analysis, preliminary project design including costs, and recent groundwater modeling by the Watermaster, the following conclusions can be made.

- The proposed location provides more hydrogeologic certainty than the former Coastal Location for project development. The Santa Margarita Aquifer may be thin or absent at the former Coastal Location.
- A deep aquifer testing program to reduce this uncertainty would adversely impact the project's schedule and cost.
- More injection wells may be required at the former Coastal Location for the same amount of recharge at an inland location, reducing the cost effectiveness of the project.
- The proposed location is close to proven ASR wells in the Santa Margarita Aquifer with favorable injection rates.
- The proposed location is adjacent to and upgradient of most of the water supply wells that will recover the Proposed Project's recharged water.
- The proposed location provides sufficient storage to accommodate all of the GWR project water. Both locations are not needed. Storage at the former Coastal Location is less certain.
- Injection at the former Coastal Location would increase loss of GWR water to ocean outflow, potentially reducing the amount of GWR water that could be recovered.
- Water supply lines and conveyance costs may be more expensive for the former Coastal Location.

- The proposed location is more supportive of the primary project objectives than the former Coastal Location.
- Although the former Coastal Location may be more effective at meeting the secondary project objective of assistance in preventing seawater intrusion, the proposed location also meets that objective. Specifically, the proposed location supports an increase in basin production without exacerbating the risk for seawater intrusion.

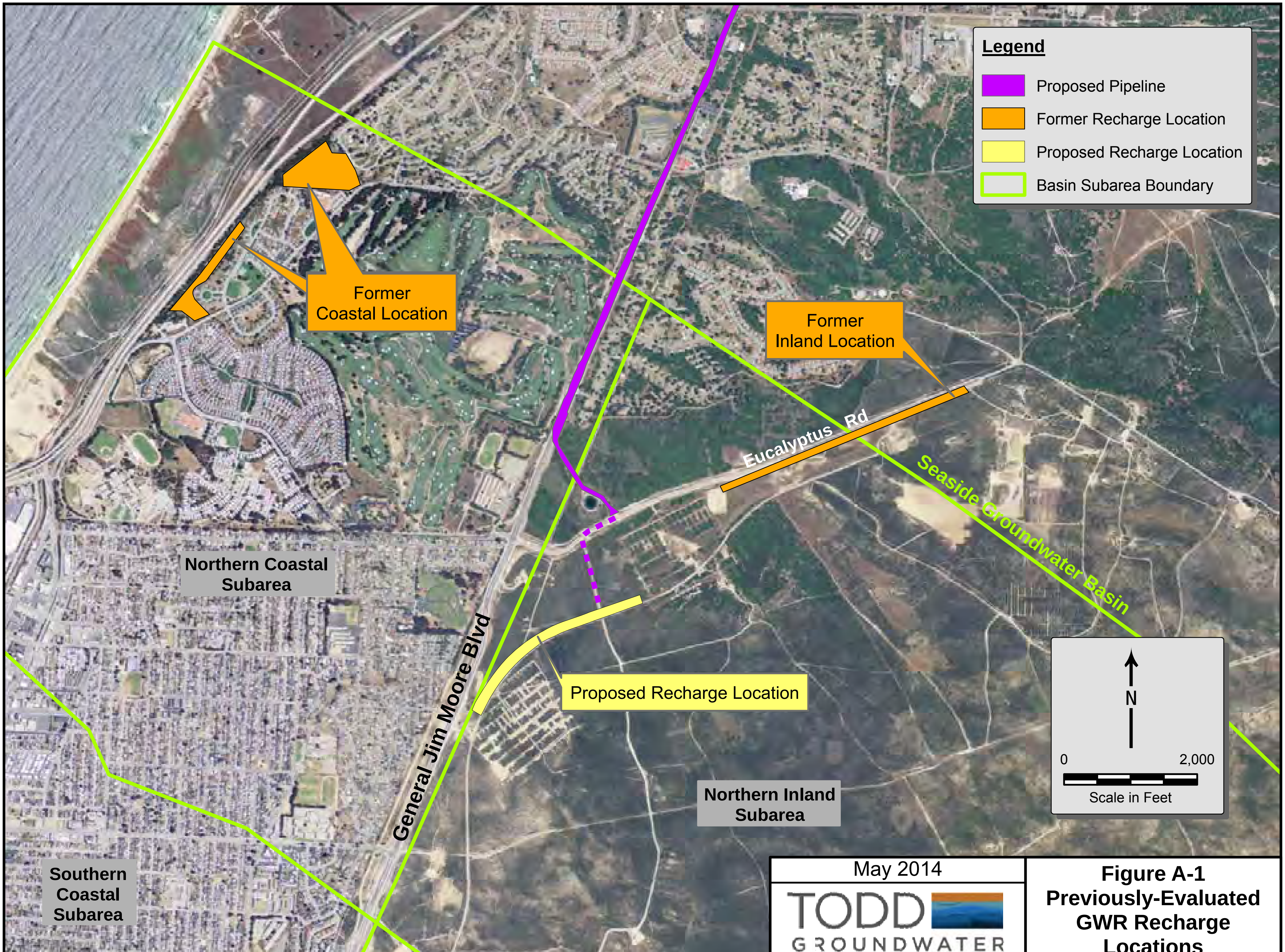
## REFERENCES

Feeney, Martin B., PG, CHg, Seaside Groundwater Basin Watermaster, Seawater Sentinel Wells Project, Summary of Operations, For Seaside Groundwater Basin Watermaster, with assistance from Pueblo Water Resources, Inc., October 2007.

HydroMetrics WRI (HydroMetrics), Water Year 2013, Seawater Intrusion Analysis Report, Seaside Basin, Monterey County, California, prepared for: Seaside Basin Watermaster, December 2013.

HydroMetrics Water Resources Inc. (HydroMetrics), Technical Memorandum, To: Seaside Groundwater Basin Board of Directors, From: Georgina King and Derrik Williams, July 19, 2013, Subject: Groundwater Modeling Results of Coastal Injection in the Seaside Basin.

HydroMetrics Water Resources Inc. (HydroMetrics), Seaside Groundwater Basin Modeling and Protective Groundwater Elevations, prepared for: Seaside Basin Watermaster, November 2009.




May 2014

TODD GROUNDWATER

**Figure A-1**
**Previously-Evaluated GWR Recharge Locations**

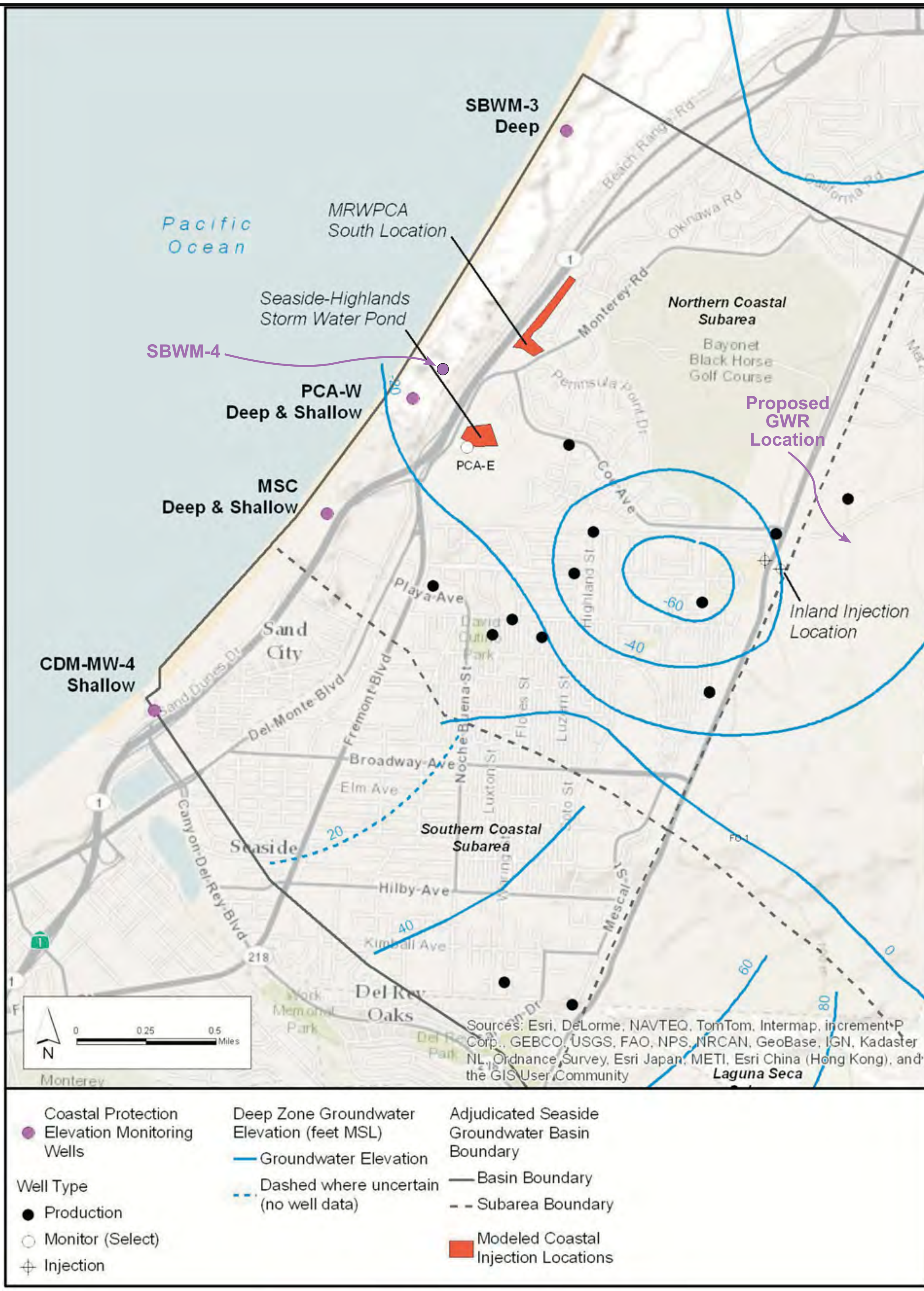


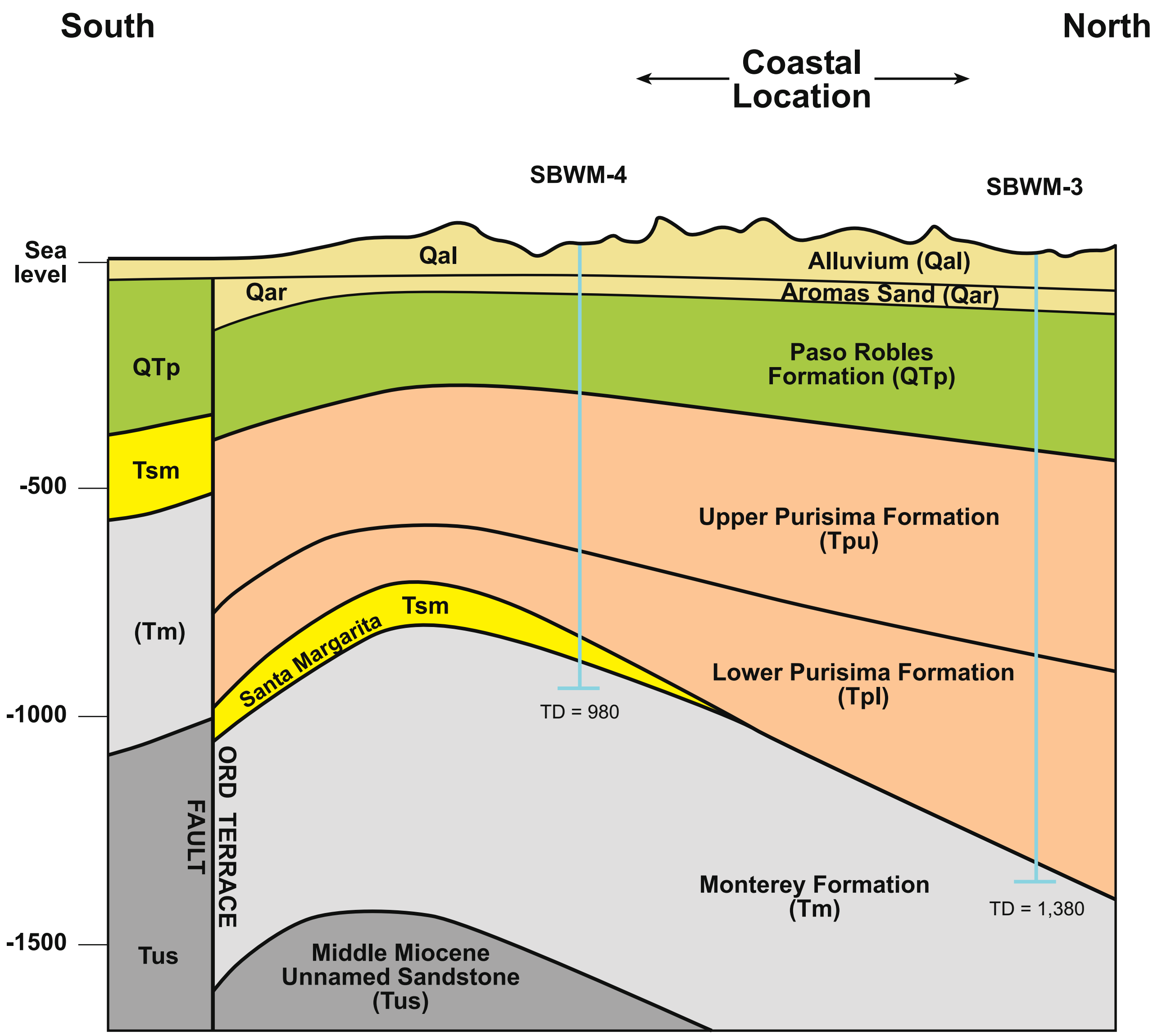

*Figure 1: Modeled Injection Locations*

Modified from: HydroMetrics, July 19, 2013.

April 2014

TODD GROUNDWATER

**Figure A-2**
**Modeled Coastal Injection Location**




From: Feeney (2007), reproduced from a portion of Figure 3 with labels and colors added.

May 2014

TODD GROUNDWATER

**Figure A-3**
**Hydrogeology near the Former Coastal Location**

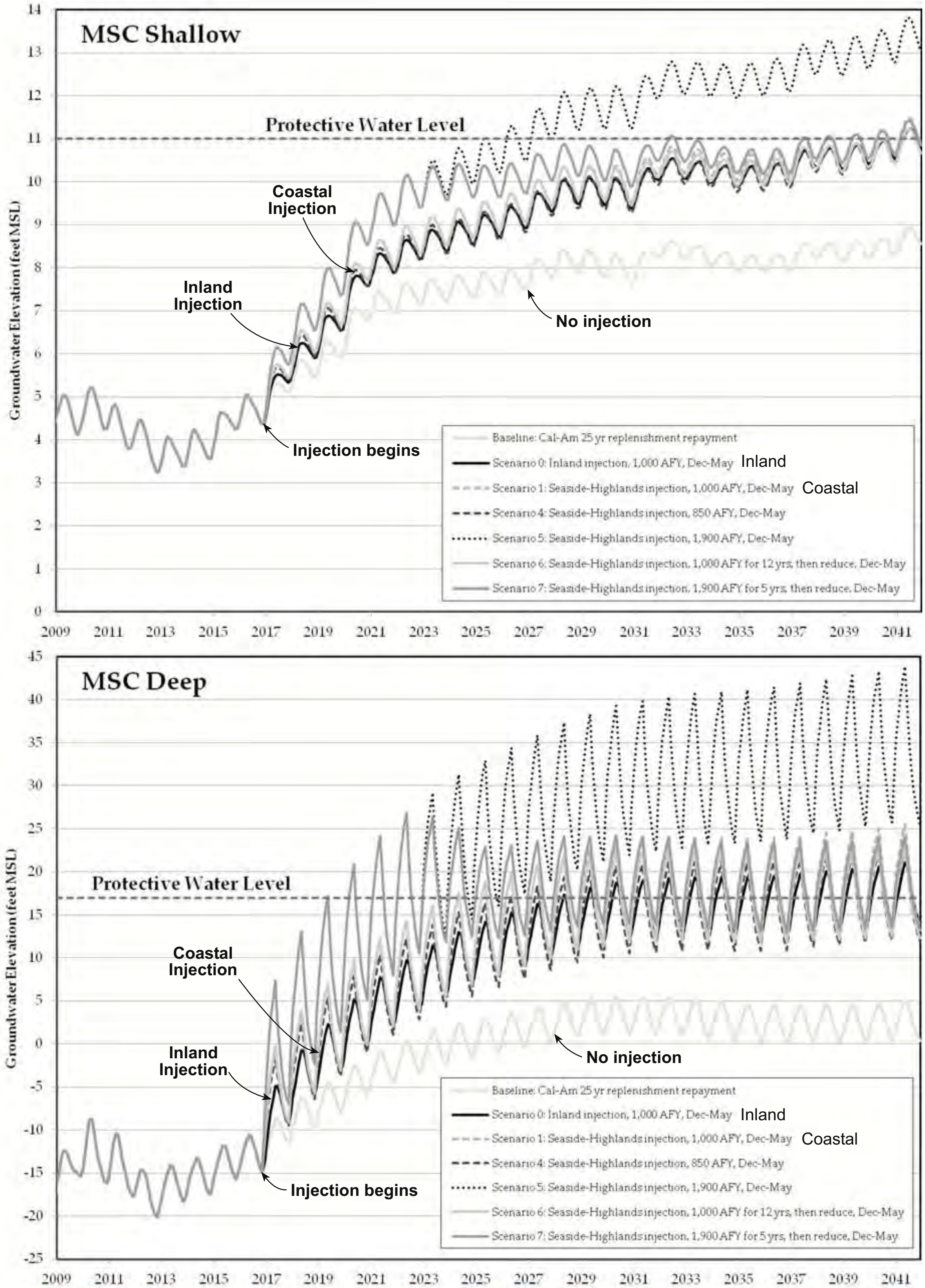



*Figure 2: Predicted Groundwater Elevations and Protective Elevations for the MSC Wells*

From: HydroMetrics, July 19, 2013.

April 2014

TODD GROUNDWATER

**Figure A-4**
**Coastal Injection Modeling Results**

# APPENDIX B

## HydroMetrics Memorandum

## Groundwater Replenishment Project Development Modeling, October 2, 2013

HydroMetrics WRI
519 17th Street, Suite 500
Oakland, CA 94612

Mr. Bob Holden
Monterey Regional Water Pollution Control District
5 Harris Court, Bldg. D
Monterey, CA 93940

October 2, 2013

Subject: Groundwater Replenishment Project Development Modeling

Dear Mr. Holden:

The letter below discusses the results of modeling completed in support of the Groundwater Replenishment Project (GWR) project development efforts.

The GWR is a central component of the Monterey Regional Water Pollution Control Agency's (MRWPCA's) plans to maintain a sustainable supply of fresh water to its customers. The GWR will recharge an average of 3,500 acre-feet (AF) of water into the Seaside groundwater basin throughout the year. This recharge will be matched by an increase of 3,500 AF per year of additional extraction from the basin. While this strategy produces no net change to the average water balance of the basin, the location and the timing of recharge and extraction may alter the flow dynamics of the basin. The impact that the recharged water has, whether it will produce additional storage that can be extracted or whether it force extra water to flow offshore or into the Salinas basin, depends upon the details of the project.

## Background and Approach

Our simulations incorporated certain assumptions about the recharge and pumping. These assumptions were detailed discussed in a letter from HydroMetrics WRI dated August 29, 2013. We assumed the recharge will be distributed evenly throughout the year. The increased pumping will follow a seasonal cycle based upon the observed current seasonal water demand of Cal-

Am customers. The additional extraction of GWR water is projected to occur entirely through six existing wells:

- ASR 1- 4
- Ord Grove #2
- Paralta
- Luzern
- Playa #3
- Plumas #4

Tentative sites have been selected for the placement of GWR vadose zone wells and deep injection wells. Up to four vadose zone wells have been proposed for delivering water into the shallow Paso Robles formation, and up to three deep injection wells have been proposed for injecting water into the deep Santa Margarita formation.

Four model simulations were conducted to investigate the impact of different strategies for recharging the GWR water. These simulations consisted of one baseline scenario in which no GWR water is recharged or extracted, and three scenarios in which the GWR water is recharged to the Paso Robles and Santa Margarita formation in varying proportions. The proportion of water recharged into each formation is shown in Table 1.

**Table 1: Recharge Distribution in Model Scenarios**

| | Percent Recharged into Paso Robles | Percent Recharged into Santa Margarita |
|---|---|---|
| **Scenario 1** | 100% | 0% |
| **Scenario 2** | 0% | 100% |
| **Scenario 3** | 20% | 80% |

The first and second scenario are included as end-member cases to predict the most extreme impacts expected from the project, and to compare the behavior of shallow versus deep injection. The third scenario recharges water in accordance with the historical pumping distribution in the Seaside basin: historically, Cal-Am extracts approximately 80% of its water from the deeper Santa Margarita Formation and 20% from the shallow Paso Robles Formation.

## Model Setup

To model the scenarios, HydroMetrics WRI extended the 2012 TAC baseline model. The baseline model originally simulated the Seaside Basin through 2030. The model was extended from 2030 through 2041 for these simulations. The year 2041 was chosen using the assumption that Cal-Am's repayment would begin in 2017, and the repayment would take 25 years.

All boundary conditions for the added simulation period are held constant at their 2030 levels. These include the general head boundaries along the coast, constant head boundaries adjacent to the Salinas Basin, and all no flow boundaries.

The same hydrology (rainfall and recharge) used in previous model runs was applied to the baseline scenario and all pumping scenarios. To extend the hydrology through the predictive period, the 1987 through 2008 hydrology data were repeated for model years 2009 through 2030, and 2031 through 2041 (Figure 1). Because there are only 22 years of hydrology data between 1987 and 2008, these 22 years have been repeated in succession through 2041. By using this hydrology, even during the period January 2009 to present when actual hydrology is known, the model runs can be used to compare relative groundwater levels but not to assess absolute Basin conditions.

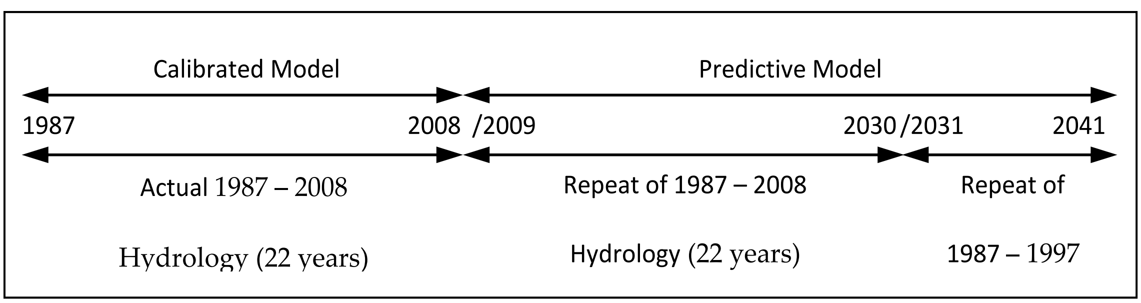



**Figure 1: Repetition of Hydrology for Predictive Model**

Deep injection is simulated in the model as wells that are located in the fifth, and lowest, model layer using MODFLOW's well package. The vadose zone wells are simulated in the model by applying water to the surface of the appropriate model cells using MODFLOW's recharge package. While conceptually the water is applied near the surface, the recharge package will deliver this water to the shallowest layer that remains saturated during any stress period. As a result, the water recharged through the vadose zone wells is not always applied to the top model layer, and the application layer varies throughout the simulation.

## Performance Measures

The GWR's purpose is to provide potable water to Cal-Am. Water recharged by GWR must be available for extraction by Cal am wells. Performance measures must therefore show that the recharged water is not lost to the ocean or nearby basins. Two criteria were used to assess each scenario's performance: whether the project increased outflow to the ocean, and whether the project increased or decreased overall storage in the basin. Because the recharge of GWR water is intended solely for storage and reuse in the short term, we believe that the ideal scenario would result in no long-term changes in the amount of water stored in the basin and would not alter the flow that occurs through any of the basin boundaries. Therefore, the best scenario is the one that is most similar to the baseline.

### Coastal Outflow Criterion

Outflow from the Seaside Basin to the ocean was the primary criterion used to assess project performance. A project that increases the amount of outflow to the ocean is theoretically recharging water that cannot be captured by Cal-Am. The best scenarios are those that do not increase outflow to the ocean.

The amount of water flowing to the ocean was estimated by analyzing the flow at every cell along the model's general head boundary (GHB) that simulates the ocean boundary. These flows were summarized for all cells within boundaries of the adjudicated basin. Only flows directed from the basin to the ocean were summarized: inflow from the ocean was not part of the performance criterion.

Figure 1 through Figure 4 show the results for model layers 1, 3, 4, and all for all layers combined. Layer 2 is not shown because it only experienced inflow and layer 5 is not shown because we have assumed that the Santa Margarita aquifer is not directly connected to the ocean. Each figure comprises two graphs. The top graph shows the overall outflow rates in acre-feet per day for each scenario and for the entire model period. The bottom graph shows the difference in the outflow rate between the recharge scenarios and the baseline scenario. On this figure positive values indicate that a scenario has more outflow than the baseline, and negative values indicate that a scenario has less outflow than the baseline.

Scenario 1, with 100% of recharge occurring through the vadose wells, has the greatest outflow for each of the model layers. Scenarios 2 and 3 have outflows that are much more similar to the baseline, with scenario 2 tending to have less outward flow than baseline and scenario 3 switching between less and more outward flow than baseline over time.

A comparison of the outflow from layer 1 (Figure 1) and the outflow from all layers (Figure 4) reveals that most of the increased total outflow are accounted for by layer 1. This is the layer in which recharge usually occurs, and which is most removed from the deep Santa Margarita formation from which the majority of Cal-Am's water is pumped. This demonstrates that concentrating recharge in the shallow Paso Robles Formation will results in water flowing tot the coast without percolating into the deeper formations.

These results suggest that scenario 2 with 100% of water injected through the deep injection wells will lose the least amount of water to the coast, while scenario 3, with 80% injected through the deep injection wells, and 20% through the vadose wells will have the least overall impact on the flow along the coast.

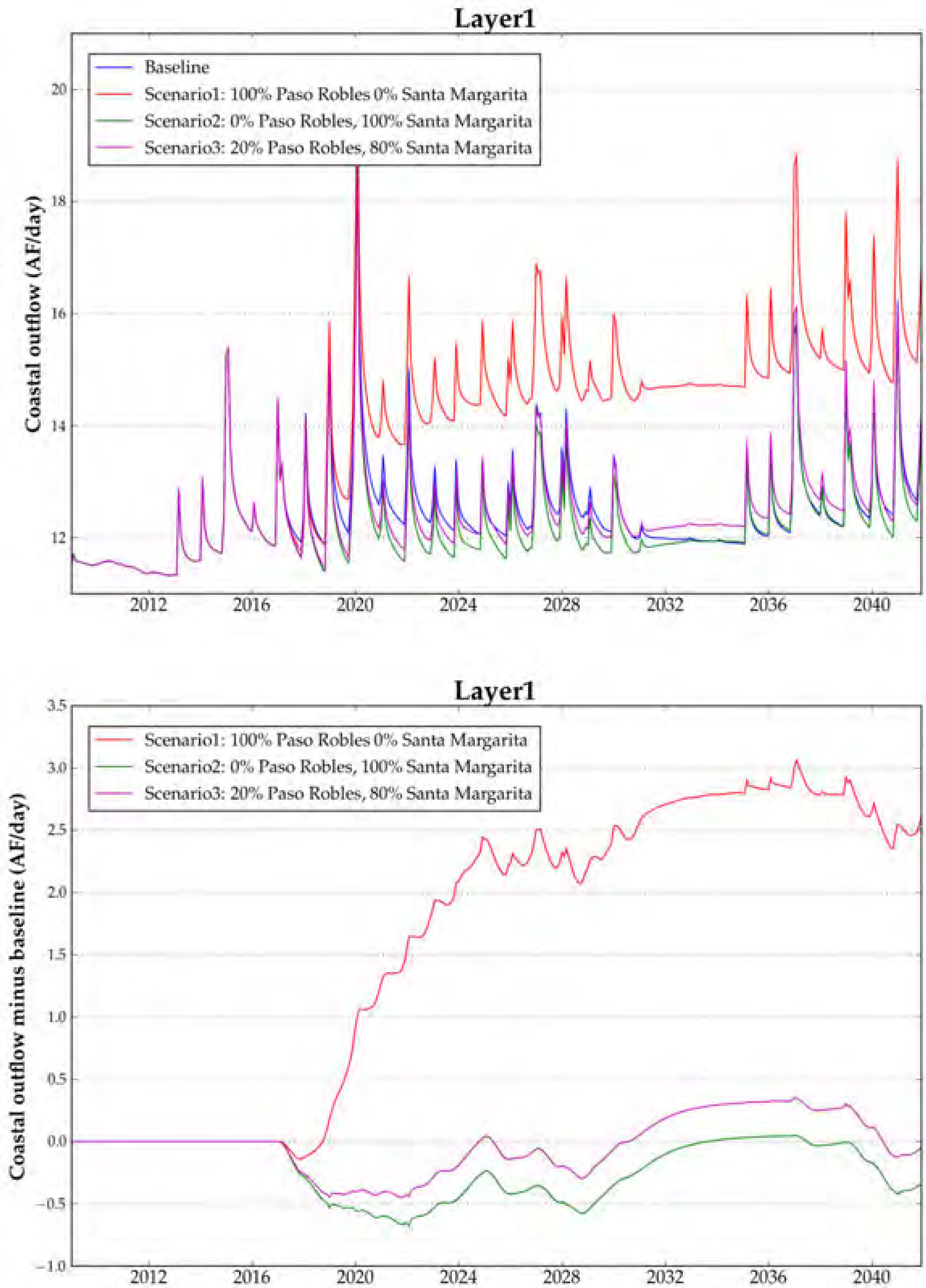
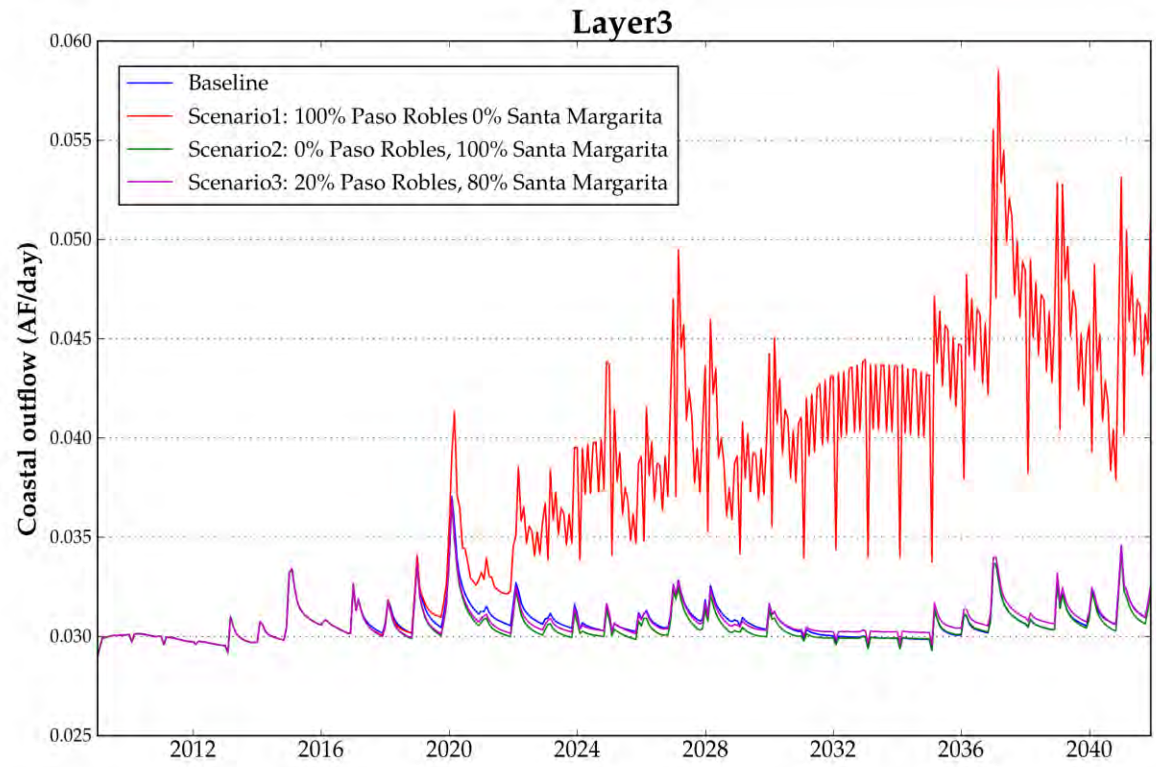



**Figure 1: Coastal Outflow along Layer 1 General Head Boundary**



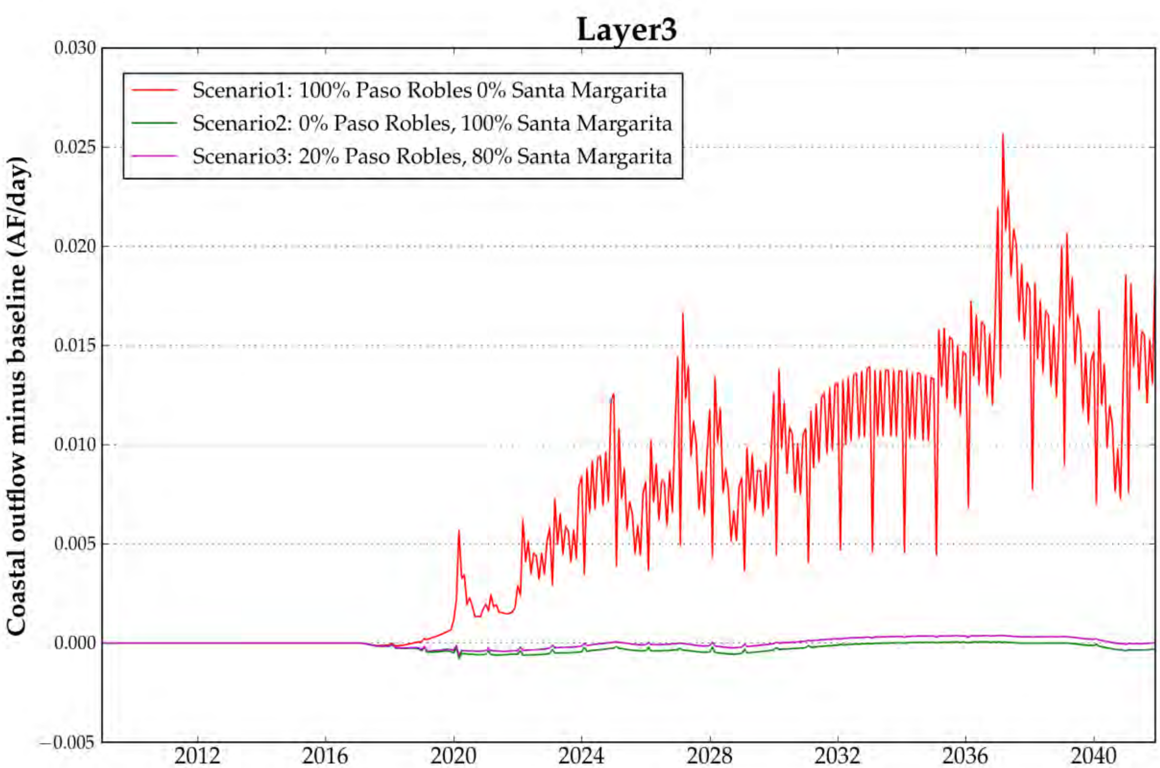
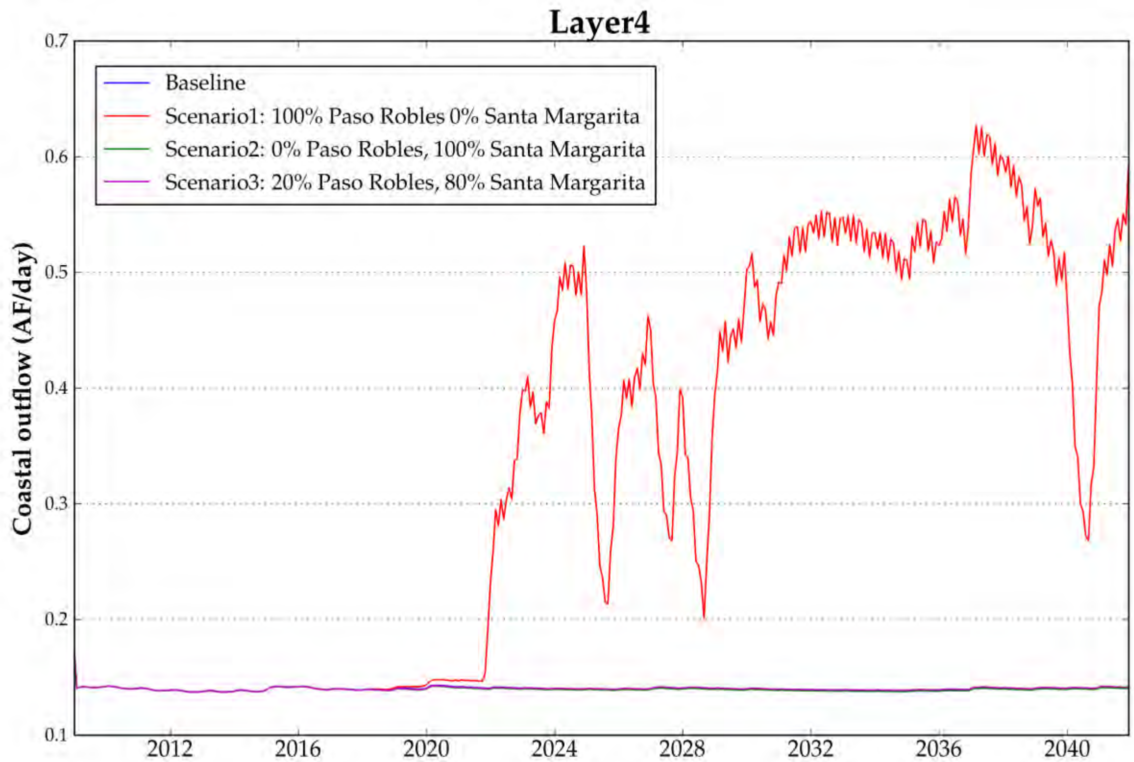




**Figure 2: Coastal Outflow along Layer 3 General Head Boundary**



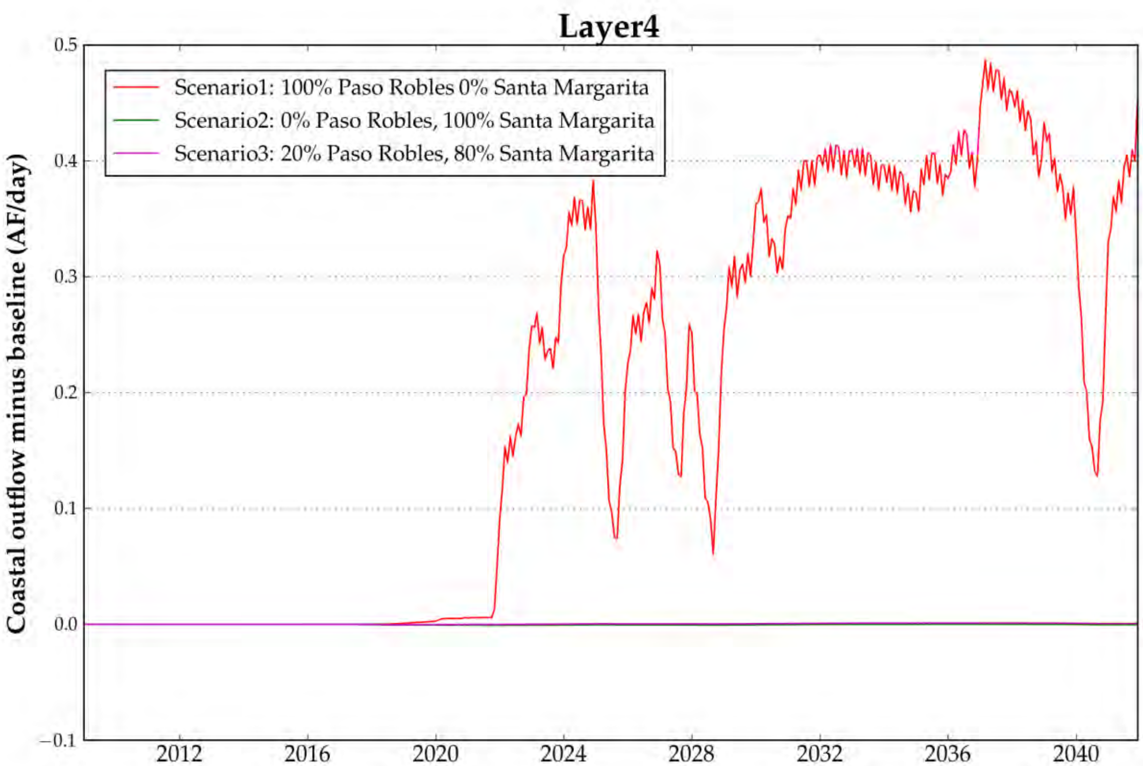
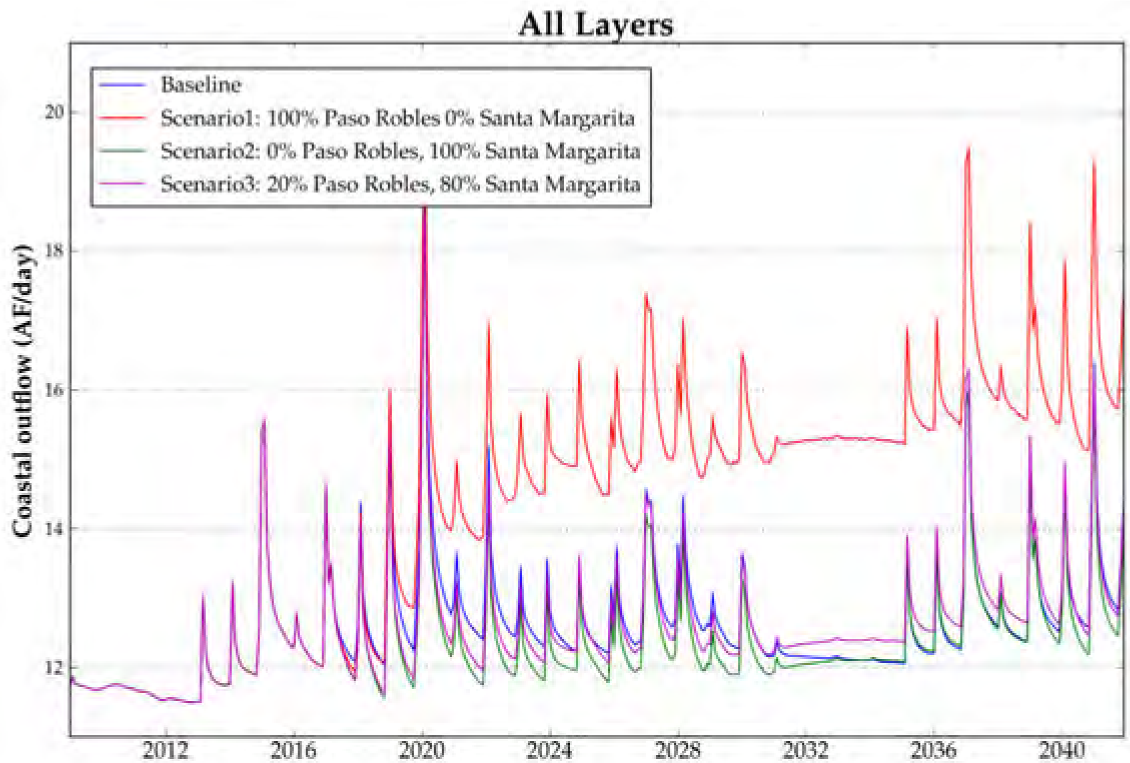




**Figure 3: Coastal Outflow along Layer 4 General Head Boundary**



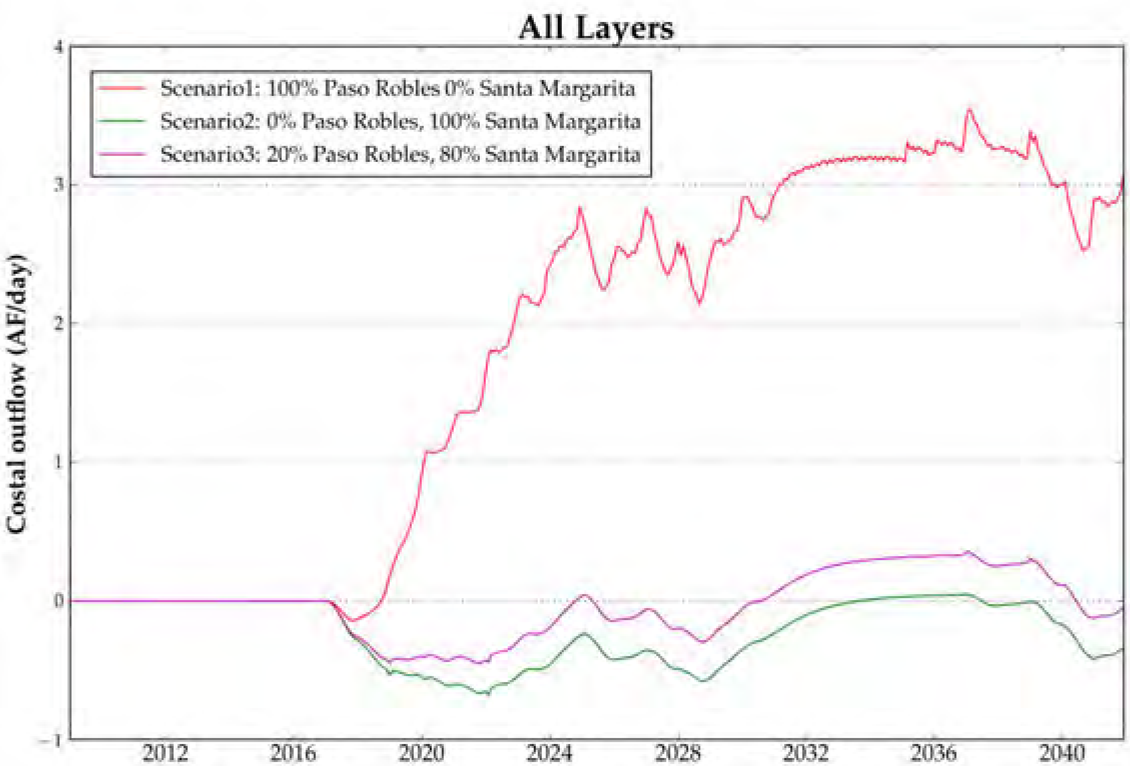




**Figure 4: Coastal Outflow along Layers 1-4 General Head Boundaries**

**Storage Changes Criterion**

The change in the amount of water stored in the basin under each simulation was a second criterion for assessing the impact caused by GWR recharge. A basin in which inflows and outflows are balanced over time will have no average change in storage (at the same time that it will have stable water levels). The inflows and outflows of the Seaside Basin are not currently balanced, but as stated above, it is not the goal of the GWR project to change the water balance. As with the outflow criterion, the changes in storage for each scenario were compared to those of the baseline to assess the performance of each scenario, with the smallest difference indicating the least impact.

Table 2 shows the total volumetric changes in storage, with positive numbers indicating increases in the amount of water in storage and negative numbers indicating decreases in the amount of water in storage. The imbalance present in scenario 1 between the shallow layers that are recharged and the deep layers that are preferably pumped can be plainly seen. Under this scenario there is a large increase in storage in the shallow layers and a large decrease in storage in deep layer 5. These results show that the largest changes occur within the adjudicated basin, but that there are also differences in the storage occurring outside of the adjudicated basin. This indicates that changes in flow are taking place along the inland boundaries and not just the coastal boundary. This was not investigated further.

Table 3 shows the difference in the volumetric storage changes for each scenario compared to the baseline, and Table 4 expresses these as a percent of the total volume of GWR water. Positive values indicate that a scenario has more water in storage than baseline conditions and negative values indicate that a scenario has less water in storage than baseline conditions. These results indicate that scenarios 2 and 3 do a much better than scenario 1 at minimizing changes in the basin relative to the baseline. Each scenario shows changes in storage that only a few percent of the total water recharged (and extracted) with the GWR project. Scenario 2 appears better if the scope is limited to the adjudicated basin while scenario 3 appears better if the entire model region is considered.

### Table 2: Total Change in Storage (AF)

| Scenario | Adjudicated Basin | | | | | | Outside of Adjudicated | Entire Model |
|---|---|---|---|---|---|---|---|---|
| | Layer1 | Layer2 | Layer3 | Layer4 | Layer5 | All Layers | | |
| Baseline | 1,794 | 95 | -198 | -858 | -3,738 | -2,905 | -35,079 | -37,984 |
| Scenario1 | 2,895 | 19,406 | 5,871 | 3,664 | -15,626 | 16,211 | -49,993 | -33,782 |
| Scenario2 | 1,697 | -78 | -17 | -824 | -1,528 | -749 | -32,498 | -33,247 |
| Scenario3 | 1,772 | 2,651 | 786 | -364 | -4,723 | 121 | -36,811 | -36,690 |

+ : More into Storage (higher water levels/ pressure)

- : Less into Storage (lower water levels/ pressure)

### Table 3: Difference from Baseline

| Scenario | Adjudicated Basin | | | | | | Outside of Adjudicated | Entire Model |
|---|---|---|---|---|---|---|---|---|
| | Layer1 | Layer2 | Layer3 | Layer4 | Layer5 | All Layers | | |
| Scenario1 | 1,102 | 19,311 | 6,070 | 4,523 | -11,889 | 19,116 | -14,914 | 4,202 |
| Scenario2 | -97 | -173 | 182 | 34 | 2,210 | 2,156 | 2,581 | 4,737 |
| Scenario3 | -22 | 2,556 | 984 | 495 | -986 | 3,026 | -1,732 | 1,294 |

+ : More into Storage (higher water levels/ pressure)

- : Less into Storage (lower water levels/ pressure)

### Table 4: Difference from Baseline as Percent of Total Recharged Water (AF)

| Scenario | Adjudicated Basin | | | | | | Outside of Adjudicated | Entire Model |
|---|---|---|---|---|---|---|---|---|
| | Layer1 | Layer2 | Layer3 | Layer4 | Layer5 | All Layers | | |
| Scenario1 | 1.2% | 21.8% | 6.9% | 5.1% | -13.5% | 21.6% | -16.9% | 4.8% |
| Scenario2 | -0.1% | -0.2% | 0.2% | 0.0% | 2.5% | 2.4% | 2.9% | 5.4% |
| Scenario3 | 0.0% | 2.9% | 1.1% | 0.6% | -1.1% | 3.4% | -2.0% | 1.5% |

+ : More into Storage (higher water levels/ pressure)

- : Less into Storage (lower water levels/ pressure)

## Conclusion

These analyses suggest that recharging between 80% and 100% of GWR water into the Santa Margarita formation through deep injection wells will result in minimal disturbance to the basin and to only small amounts of water being lost to outflow from basin. These results are consistent with the idea that the water should be delivered into the same formations from which water is drawn.

If you have any questions, do not hesitate to contact me.

Sincerely,

Derrik Williams

Derrik Williams, President
HydroMetrics Water Resources Inc.

# APPENDIX C

## HydroMetrics Technical Memorandum

## GWR Project EIR: Project Modeling Results, January 12, 2015

1814 Franklin St, Suite 501
Oakland, CA 94612

# TECHNICAL MEMORANDUM

To: Bob Holden/MRWPCA

From: Stephen Hundt and
Derrik Williams

Date: January 12, 2015

Subject: GWR Project EIR: Project Modeling Results

## Executive Summary

The Monterey Regional Water Pollution Control Agency (MRWPCA) is developing a Groundwater Replenishment (GWR) project for the Seaside Basin. This project will recharge the Seaside groundwater basin with high quality purified water. The current analysis seeks to assess the environmental impacts of operating the GWR project, in fulfillment of the GWR project's Environmental Impact Report (EIR) requirement.

The calibrated groundwater model of the Seaside Groundwater Basin (HydroMetrics WRI, 2009) was used to estimate impacts from the GWR Project. A predictive model incorporating reasonable future hydrologic conditions was developed for this impact analysis. The groundwater model was calibrated through 2008; therefore the predictive model begins in 2009. The predictive model simulates a 33 year period: from 2009 through 2041.

Simulated future Carmel River flows were based on historical flow records. The amount of Carmel River water available for winter injection into the Seaside Basin was estimated by Monterey Peninsula Water Management District (MPWMD) staff. They compared historical daily streamflows with minimum streamflow requirements for each day, and then identified how much water could be extracted from the Carmel River for injection each month.

Future water demand for Cal-Am was estimated from historical demands for the period 2001-2010. Roughly two-thirds of the total Cal-Am demand was predicted to be met by extraction of native groundwater, injected Carmel River water, and injected GWR water. The monthly pumping rate within each year was distributed in proportion to the total monthly demand, with modifications made to compensate for capacity reductions caused by ASR injection.

Model results show that the GWR project is generally neutral compared to the no project conditions. Groundwater elevations are generally similar under the project conditions as under the no project conditions, with increasing groundwater elevations experienced under both scenarios. These higher groundwater levels will tend to slow or stop seawater intrusion.

Particle tracking was used to estimate the travel time of GWR water from the point of recharge to the closest point of extraction. Particle tracking showed that the shortest travel time for any recharged GWR water is about 11 months. Travel times of less than 12 months occur in 5 years out of the 25-year simulation period when the GWR project is in operation.

# Project Description

The Monterey Regional Water Pollution Control Agency (MRWPCA) is developing a Groundwater Replenishment (GWR) project for the Seaside Basin. This project will recharge the Seaside groundwater basin with high quality purified water and deliver lesser quality recycled water to the Castroville Seawater Intrusion Project (CSIP). California American Water Company (Cal-Am) will recover 3,500 AFY of the recharged water through existing production wells in the basin, based on demand and well capacity/availability. The project will also include a groundwater banking program that will build a drought reserve account of up to 1,000 AF of water in the Seaside Basin during normal and wet years. The extra recharge during normal and wet years will be offset by an increase in CSIP deliveries and a corresponding decrease in Seaside groundwater basin injection during dry years when water is in the reserve account. The locations of the project's facilities, along with other operating production wells, are shown on Figure 1.

HydroMetrics Water Resources Inc. (WRI) has completed groundwater flow and particle tracking simulations of the proposed GWR project. This simulation was undertaken to predict impacts on groundwater levels and the fate and travel time of injected GWR water. This modeling was completed in support of the GWR project's environmental impact report (EIR).


*Figure 1: Production and GWR Injection Well Locations*

# Model Background and Assumptions

The calibrated groundwater model of the Seaside Groundwater Basin (HydroMetrics WRI, 2009) was used to estimate the impacts from the GWR Project. A predictive model incorporating reasonable future hydrologic conditions was developed for this impact analysis. The groundwater model was calibrated through 2008; therefore the predictive model begins in 2009. The predictive model simulates a 33 year period: from 2009 through 2041. The GWR project was assumed to start in October 2016 and was operating throughout the remaining 25 years of the simulation. Recent estimates indicate that the project start-up may be delayed until late 2017, but the project was simulated with the previous start date to provide an additional year of analysis.

## PREDICTED HYDROLOGY ASSUMPTIONS

The hydrology (rainfall and recharge) used to calibrate the groundwater model was applied to the predictive model. To extend the hydrology through the predictive period, the 1987 through 2008 hydrology data were used to simulate model years 2009 through 2030, and the 1987 through 1997 hydrology data were then repeated for 2031 through 2041 (Figure 2). This is the approach that has been adopted for all predictive models of the Seaside Basin since 2009. By using this hydrology, even during the period January 2009 to present when actual hydrology is known, the model runs can be used to compare relative groundwater levels but not to assess absolute Basin conditions.

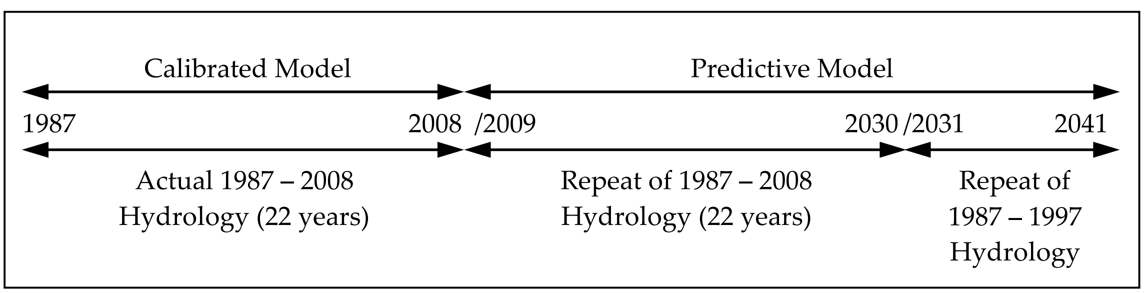



*Figure 2: Repetition of Hydrology for Predictive Model*

## PREDICTED CARMEL RIVER FLOW AND INJECTION ASSUMPTIONS

Monterey Peninsula Water Management District (MPWMD) estimated the amount of Carmel River water available for ASR injection for the predictive simulation based on historical streamflow records. Because the future simulated hydrology is based on the historical hydrology between 1987 and 2008, the future streamflows are expected to be the same as the historical streamflows. MPWMD staff compared historical daily streamflows between water year 1987 and water year 2008 with minimum streamflow requirements for each day. This allowed MPWMD to identify how many days in each month ASR water could be extracted from the Carmel River. Using a daily diversion rate of 20 acre-feet per day, MPWMD calculated how many acre-feet of water from the Carmel River could be injected into the ASR system each month. Figure 3 shows the estimated available monthly ASR injection volumes for the predictive simulation. Appendix A includes the historic and projected ASR Wells Site injection schedule that was developed by MPWMD. The Carmel River water available for injection was divided between the ASR 1&2 Well Site and the ASR 3&4 Well Site according to the historic division.

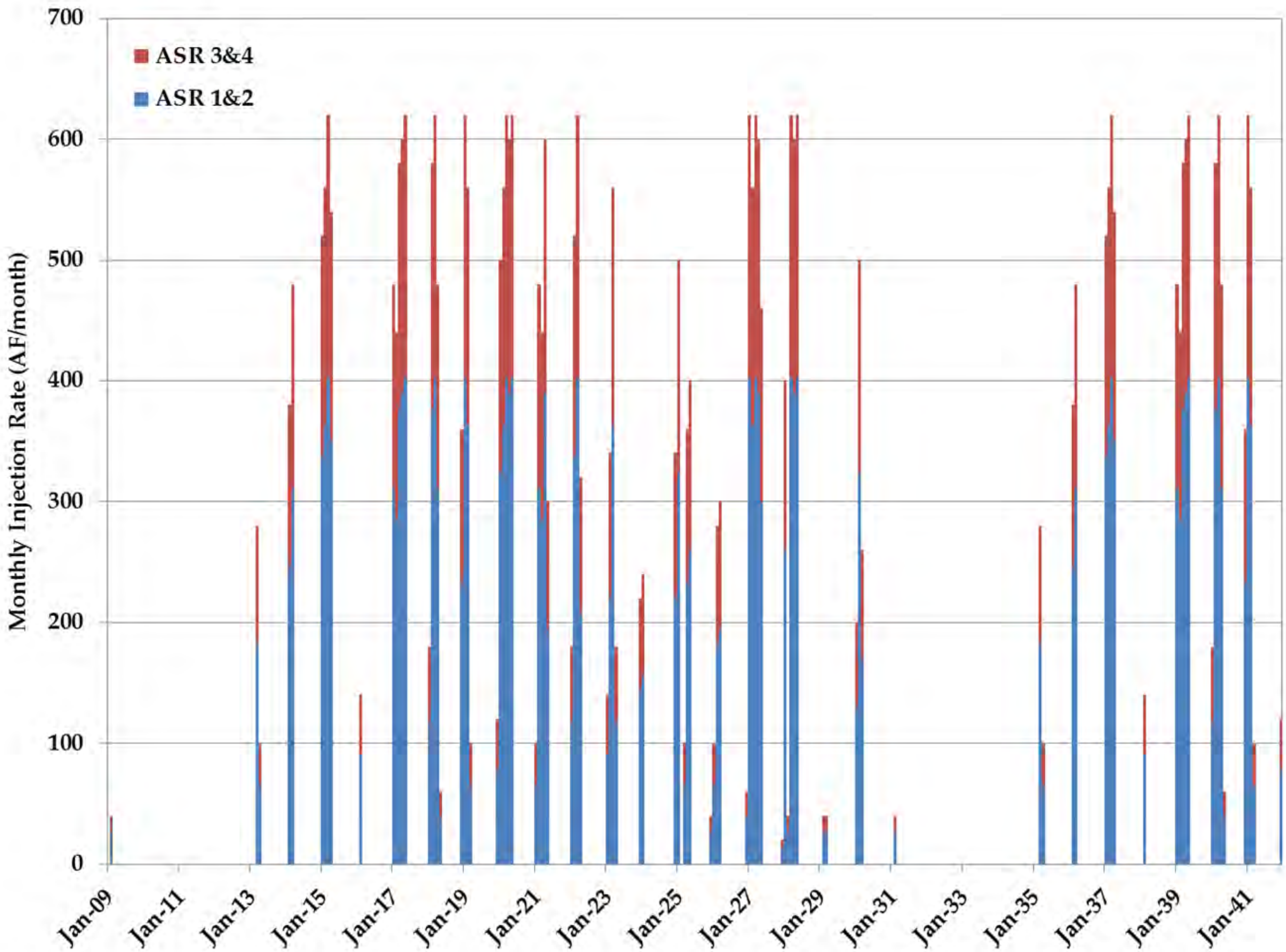



*Figure 3: Estimated Monthly Carmel River ASR Injection Volumes*

## PREDICTED GWR RECHARGE ASSUMPTIONS

GWR Project water is recharged through four deep wells and four vadose zone wells in the predictive model. The simulated GWR project recharges varying volumes of water each year, with an average of 3500 acre-feet recharged per year. Of this, 90% of the water is delivered to the Santa Margarita aquifer through four deep injection wells, and the remaining 10% is delivered to the Paso Robles aquifer through four vadose zone well. The amount of water recharged each year depends upon whether the predicted hydrology is in a drought or non-drought year, and upon the rules for banking and delivering water to CSIP. Figure 4 shows the volume of water recharged by the GWR project for each water year. While the annual recharge of GWR water varies from year to year, the recovery of water through Cal-Am's pumping wells is maintained at a constant 3500 acre-feet every year. A monthly recharge schedule that includes an accounting and description of the CSIP banking and delivery program is shown on the 11 x 17 sized table at the end of this technical memorandum.

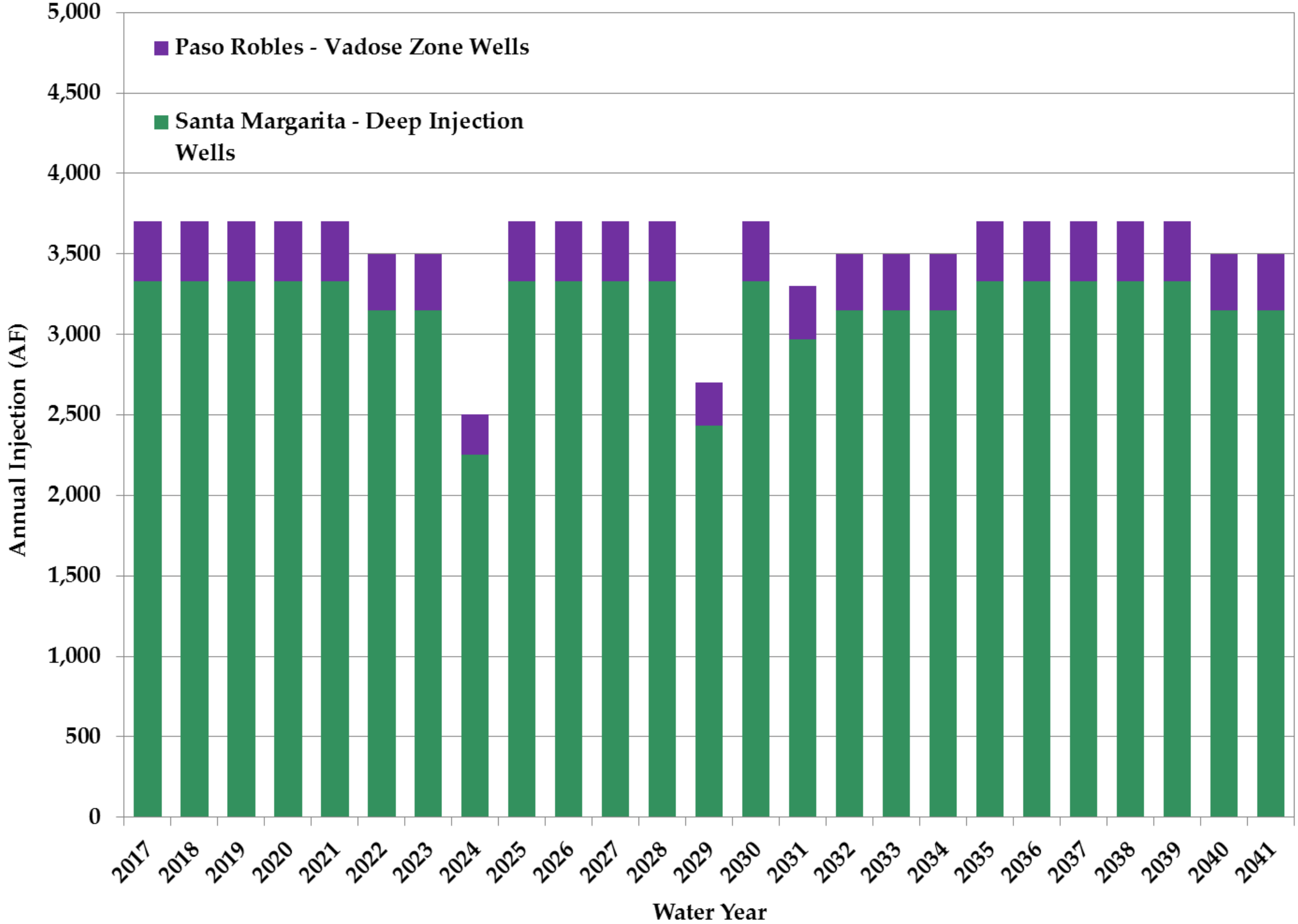



*Figure 4: Annual GWR Recharge*

## PREDICTED PUMPING ASSUMPTIONS

HydroMetrics WRI made a number of assumptions about future pumping rates by various entities in the Seaside Basin. These assumptions were consistent with assumptions developed for previous modeling exercises in the basin. Pumping assumptions were developed for standard producers, alternative producers, golf courses, and Cal-Am.

### WATER YEAR 2009 THROUGH WATER YEAR 2012 PUMPING

Actual pumping and injection data for all wells from January 2009 through December 2012 are included in the predictive simulation.

### MUNICIPAL PUPMPING FROM WATER YEAR 2013 ONWARDS

Predicted pumping by the City of Seaside and the City of Sand City follows the triennial reductions prescribed in the Amended Decision (California American Water v. City of Seaside et al., 2007). These pumping reductions are designed to reduce basin-wide pumping to the approximate safe yield of 3,000 acre-feet per year by 2021.

### CAL-AM PUMPING FROM WATER 2013 ONWARDS

A number of assumptions were necessary to estimate Cal-Am's monthly pumping rates and pumping distribution. Assumptions about Cal-Am's future pumping constraints and future demands are discussed below.

#### Cal-Am Pumping Constraints

Predicted Cal-Am pumping comes from the five existing Cal–Am wells, and two ASR sites. The five existing Cal-Am wells are:

- Luzern #2
- Ord Grove #2
- Paralta
- Playa #3
- Plumas #4

Data supplied by Cal-Am show that the pumping capacity of their five existing wells is 3,653 gallons per minute, or 16 acre-feet per day. Based on conversations with the Monterey Peninsula Water Management District (MPWMD), we assumed that each

ASR well site could produce 1,750 gallons per minute. The total pumping capacity of all seven wells is therefore 7,153 gallons per minute, or 31.6 acre-feet per day.

Information from MPWMD helped determine when ASR wells are unavailable for pumping. MPWMD developed the future injection and extraction schedule of the ASR wells based upon their historical monthly operation from October 1986 to 2008. This historical timeframe aligns with the observed climate and hydrologic pattern that are used to specify the future climate and hydrologic pattern in the groundwater model. The MPWMD injection and extraction schedule identifies months when ASR wells are not available to pump groundwater, either because they are being used for injection or they are resting. For months when the ASR wells were not available, Cal-Am's pumping capacity was set to 16.1 acre-feet per day. For months when the ASR wells were available, Cal-Am's pumping capacity was set to 31.6 acre-feet per day.

**Cal-Am Water Demand**

The monthly distribution of Cal-Am's total water demand was used to estimate a likely monthly distribution of future pumping. The total demand from Cal-Am customers in the Seaside Basin is currently supplied from a variety of sources. Groundwater pumping may become a more significant source of Cal-Am's supply in the future. Cal-Am's historical demand numbers were provided by MPWMD. The values are based on average water deliveries for the years 2001-2010.

Table 1 shows the calculations used to estimate Cal-Am's future monthly pumping demand. The current average monthly demand, shown in acre-feet in the second column, is the measured demand provided by MPWMD. It is worth noting that the maximum monthly demand of 1,490 acre-feet (48 acre-feet per day) far exceeds the assumed combined well capacity of about 31.6 acre-feet per day.

The third column shows the percentage of Cal-Am's demand by month. We assumed that the maximum demand month of July represents a time when Cal-Am is pumping at its full capacity of 31.6 acre-feet per day. The demand for each other month, shown in column 4, was scaled as a percentage of this full capacity. For example, we calculated that Cal-Am only pumps 64% of its capacity in March, because the March demand is only 64% of the July demand. Column 5 shows the amount of water Cal-Am would likely pump in any month. Column 5 values are calculated by multiplying the percentages in column 4 by the full pumping capacity of 31.6 acre-feet per day.

*Table 1: Cal-Am Estimated Seasonal Demand*

| Month | Cal-Am Current Average Monthly Demand (AF) | Percent of Annual Production | Percent of July Production | Estimated Future Monthly Pumping (AF) |
|---|---|---|---|---|
| October | 1242 | 8.96% | 0.83 | 816 |
| November | 1005 | 7.25% | 0.67 | 660 |
| December | 900 | 6.49% | 0.60 | 591 |
| January | 871 | 6.28% | 0.58 | 572 |
| February | 814 | 5.87% | 0.55 | 534 |
| March | 947 | 6.83% | 0.64 | 622 |
| April | 1049 | 7.57% | 0.70 | 689 |
| May | 1307 | 9.43% | 0.88 | 858 |
| June | 1400 | 10.10% | 0.94 | 919 |
| July | 1490 | 10.75% | 1.00 | 978 |
| August | 1469 | 10.60% | 0.99 | 965 |
| September | 1363 | 9.84% | 0.92 | 895 |

Based on these calculations, Cal-Am's total future annual pumping demand is 9,099 acre-feet per year.

**Annual water available for Cal-Am pumping**

Cal-Am's future pumping from the Seaside basin will be drawn from three pools of water:

- Native groundwater
- Groundwater replenishment (GWR) project water
- Aquifer storage and recovery (ASR) project water

The availability of these resources is graphed on Figure 5. This graph consists of the three components listed above.

- The native water (red) is subject to triennial reductions through 2021. After 2021, the amount of pumping native water is held constant. This pool of water also includes pumping for Security National Guaranty, Inc. (SNG, a groundwater pumper) development which increases from 2013 through 2017.

- GWR water (green) is projected to become available in 2017, and supply 3500 acre-feet every year.
- ASR water (blue) availability is subject to weather conditions. The maximum amount that can be pumped annually is 1,500 acre-feet. Less is pumped during dry years.

The dashed purple line on Figure 5 is Cal-Am's estimated total future annual pumping demand of 9,099 acre-feet per year. The water available for pumping from the three pools of water is projected to be less than the pumping demand for all years. The dashed orange line is the annual demand that Cal-Am could reasonably pump, given the reductions in capacity that take place when the ASR wells are unavailable for extraction.

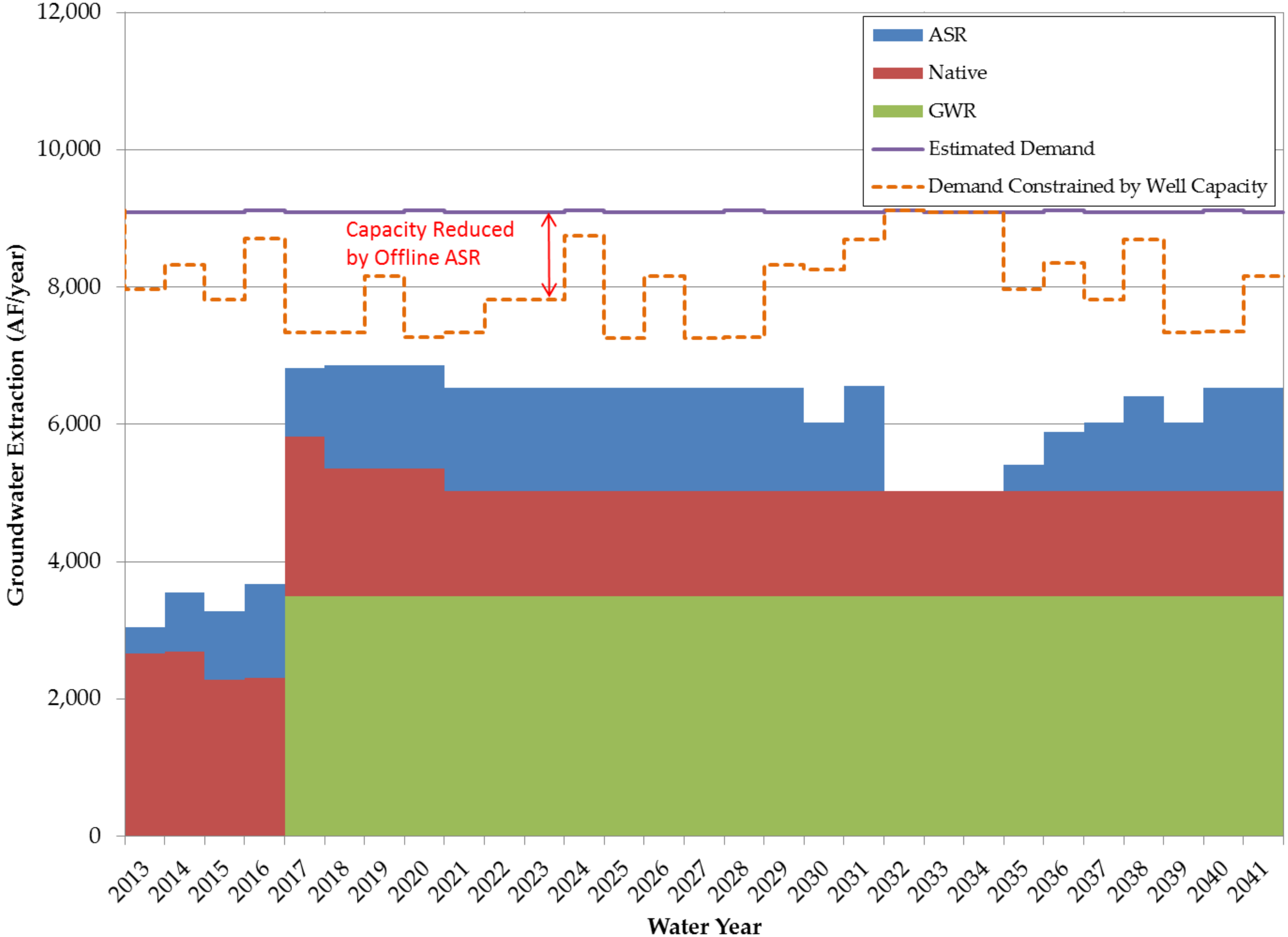



*Figure 5: Annual Cal-Am Water Allocation by Water Right Source*

**Pumping Allocation by Well**

When no ASR water is being extracted, Cal-Am's monthly pumping from the Seaside Basin is allocated among their available wells with the following order of preference:

- Ord Grove #2
- Paralta
- ASR wells
- Luzern
- Playa #3
- Plumas #4

The total demand during any month was first allocated to the Ord Grove Well up to its capacity. Demand was then allocated to the Paralta Well up to its capacity, and so on. The ASR wells are considered unavailable for extraction if they are injecting water, or have injected water at any time during the previous 3 months. The projected injection schedule was used to flag months during which the ASR wells would be unavailable. During months when ASR wells are not available for pumping, the order of preference continues directly from the Paralta Well to the Luzern well. This generally occurs during early summer, when total pumping is high and the ASR has recently injected excess spring rainfall. Figure 6 shows the monthly pumping by well.

When ASR water is being extracted, the ASR wells are preferentially used to extract ASR water. If the ASR wells' capacity is inadequate to extract all ASR water, the remaining ASR water is allocated to the remaining wells as described above. If the ASR wells' capacity is greater than the ASR water allocated during a month, then the ASR wells remain available to extract native and GWR water up to their remaining capacity.

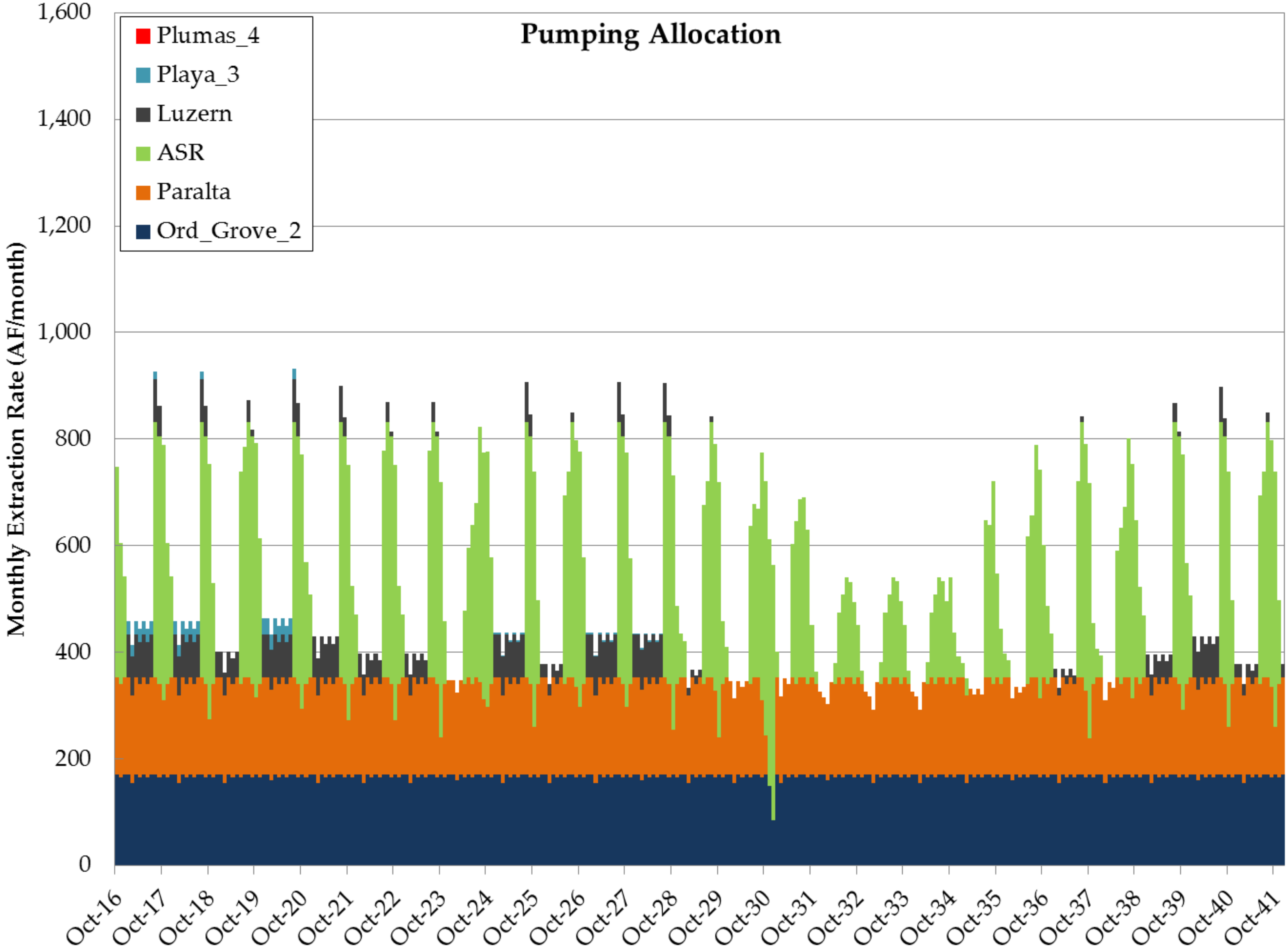



*Figure 6: Monthly Pumping Totals by Well*

## GOLF COURSE PUMPING FROM WATER YEAR 2013 ONWARDS

Predicted golf course pumping is based on the hydrologic year. For example, pumping in January 2015 equals the amount pumped in January 1993, because the simulated 2015 hydrology is based on 1993 hydrology. This ensures that the demand corresponds to the hydrology. If the amount pumped by a Producer pre-adjudication exceeded the Producer's adjudicated right, pumping was capped at the Producer's adjudicated amount.

Additional golf course pumping adjustments accounted for in the simulation are:

- The Bayonet and Blackhorse golf courses pump no water until September, 2016. This is based on an in-lieu replenishment program the City of Seaside has with its golf course pumping. Under this program, Marina Coast Water District provides water in-lieu of the City pumping from the Seaside Basin. The City expects to start pumping its golf course wells again starting September 2016.

- In 2007, Bayonet and Black Horse golf courses had irrigation upgrades that have reduced irrigation demand by approximately 10% from historical amounts.

- The City of Seaside expects to begin pumping an average of 360 AFY from its wells for golf course supply starting in September 2016. These projected quantities were used rather than basing demand on the hydrology year.

## PREDICTED ALTERNATIVE PRODUCER AND PRIVATE PUMPING

Predicted alternative producer pumping is set at measured Water Year (WY) 2011 volumes from WY 2013 onwards. All other pumpers that are not covered by the Decision, including Cal Water Service and private wells, also pump at WY 2011 volumes from WY 2013 onwards.

Pumping exceptions taken into account in the simulation are:

- Water for SNG, which is an Alternative Producer, is supplied from Cal-Am wells under an agreement with Cal-Am. When the SNG site is developed they will be supplied with water by Cal-Am, who will use SNG's water right of 149.7 acre-feet/year. Currently there is no production from the SNG well. Based on input from the property owner, Ed Ghandour, project construction is planned to start in 2013, and use 25 AFY of water. Water usage thereafter is estimated to be:

- 2014 -  30 AFY
- 2015 – 50 AFY
- 2016 onwards – 70 AFY

## No-Project Scenario

Prior to simulating impacts from GWR injection, a No-Project scenario was run to establish baseline conditions. The No-Project scenario included all of the assumptions on future hydrology, future ASR injection, future municipal pumping, and future alternative producer pumping discussed above. No GWR injection was included in the No-Project scenario.

Cal-Am pumping in the No-Project scenario was estimated using the same assumptions detailed above. The only difference is that no GWR water was available for extraction. The total annual amount of water pumped by Cal-Am is shown on Figure 7. The monthly pumping by well for the No-Project scenario is shown in Figure 8.

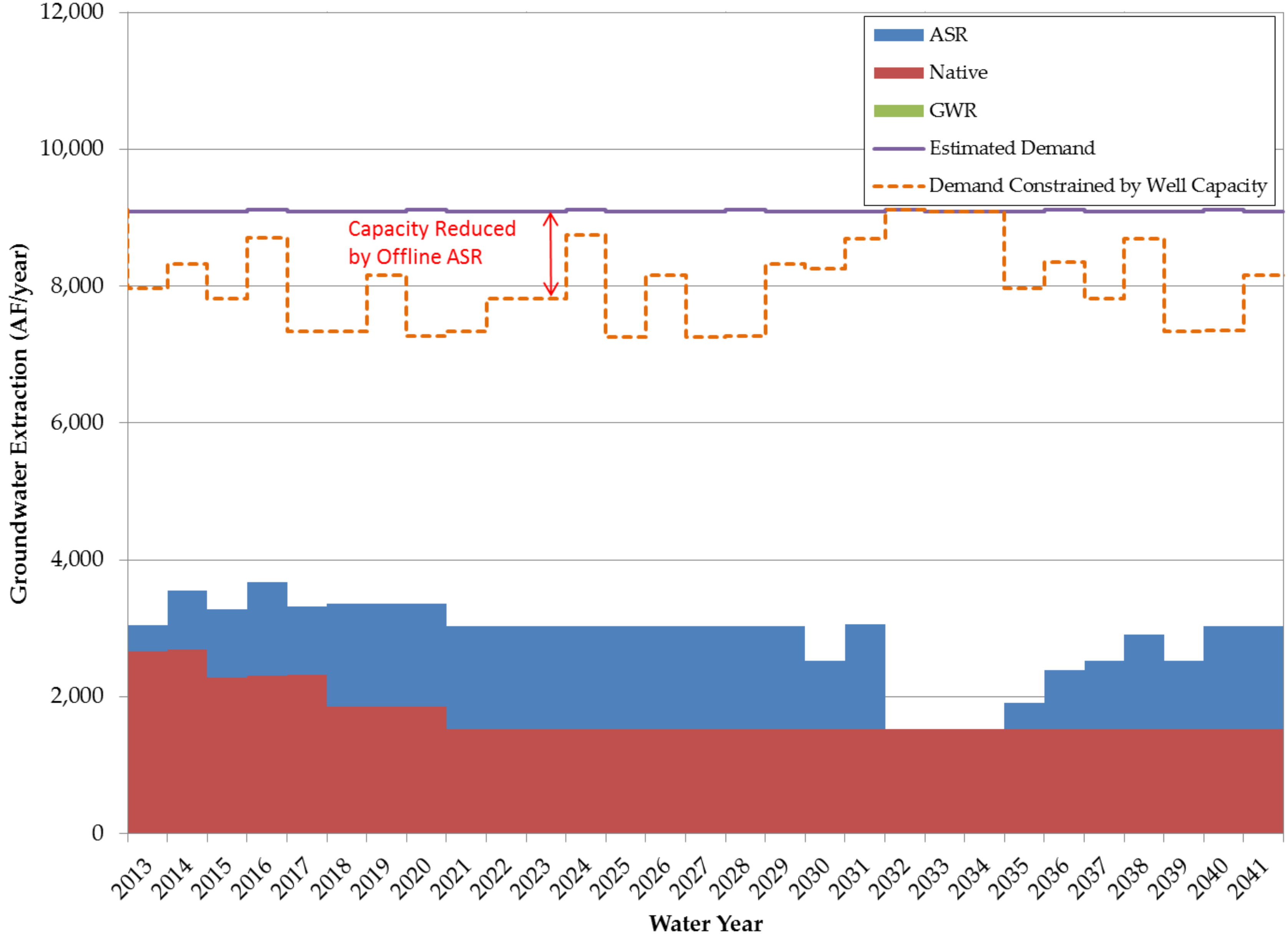



*Figure 7: Annual Cal-Am Water Allocation by Water Right Source for No-Project Scenario*

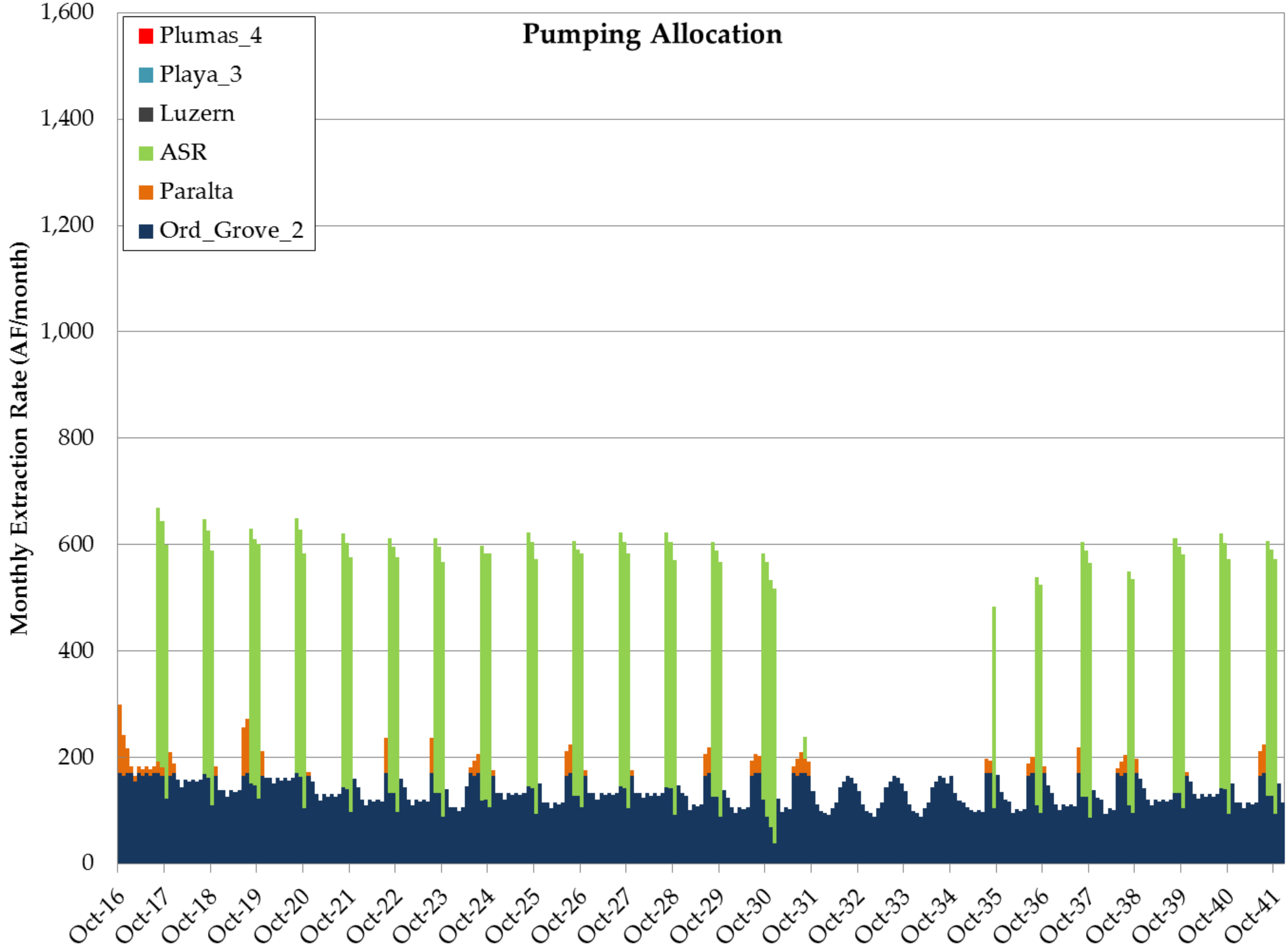



*Figure 8: Monthly Pumping Totals by Well for No-Project Scenario*

# Particle Tracking Approach

Particle tracking was conducted to estimate the fate and transport of GWR water under the Project Scenario. Particles were first introduced around all eight GWR Project injection wells on the simulated period corresponding to October 1, 2016. A new set of particles was released into the model at the beginning of every month until the end of the simulation in 2042. Each month, 40 particles were released from each injection well. Every particle was tracked through the model until it terminated at an extraction well, or until the end of the simulation period in 2042. By introducing the particles continuously, we ensured that there were particles introduced and tracked during times when the travel times would be the fastest.

Particles were placed along the edges of each of the model cells that contained the injection and vadose wells. This strategy is necessary to ensure that the particles are carried outward in all directions in the same manner that water would travel radially from a well. Placing many particles at the exact location of the well results in only a single path taken by all particles. While the approach of placing particles around the edge of the model cell gives a more accurate picture of the dispersal pattern of the water from the injection wells, it also places particles closer to the extraction wells, effectively resulting in faster simulated travel times.

Particles are captured by wells not when they reach the exact location of the extraction wells, but when they reach the edge of the cell that contains an extraction well. This also leads to faster simulated travel times. The results shown below should therefore be considered conservative estimates.

# Model Results

## GROUNDWATER ELEVATION RESULTS

The impact of the GWR project on groundwater elevations was determined by comparing results from the Project scenario with results from the No-Project scenario. The No-Project scenario simulates future groundwater conditions without the GWR project.

Simulated groundwater elevations from the three scenarios were compared at the following seven wells:

- ASR 1&2
- City of Seaside #3
- Ord Grove #2
- Paralta
- Luzern
- PCA-West (Shallow)
- PCA-West (Deep)

Figure 9 shows the location of these wells and the GWR injection wells. These wells span the area between the GWR injection wells and the coast. Several of the major recovery wells for the GWR project water are included in this set of wells.

Hydrographs for simulated groundwater elevations under the No-Project and Project scenarios are shown on Figure 10 through Figure 16. The blue lines represent the simulated static groundwater elevation under the No-Project scenario and the green lines represent the simulated static groundwater elevation under the with-Project scenario. Over the simulation period, the with-Project hydrographs deviate both below and above the No-Project hydrographs for several wells. The long term groundwater elevation trends of the with-Project hydrographs, however, are generally similar to the long-term trends of the No-Project hydrographs.

The largest relative reduction in groundwater levels under the with-Project scenarios are observed in the Ord Grove #2 well during the drought simulated between 2030 and 2035. During this period, the behaviors of the Ord Grove #2 hydrographs differ in several ways from the other deep wells: ASR wells #1 and #2, City of Seaside well #3, the Paralta well, and PCA-West Deep well. In all wells, there are large seasonal fluctuations throughout the simulation period that greatly diminish during the drought years. These drought year fluctuations tend to remain larger for the with-Project scenarios than for the No-Project scenarios and produce with-Project water levels that rise above No-Project water levels at their peak and fall below at their trough. In the Ord Grove #2 well, seasonal fluctuations under the with-Project scenario diminish during drought years, but not under the No-Project scenario. The with-Project groundwater elevations remain consistently lower than the No-Project groundwater elevations during the drought period.

There are several factors that control the seasonal fluctuations that occur in simulated groundwater elevations and help to explain the behavior of the Ord Grove #2 well hydrographs. First, the extraction and injection cycle of the ASR wells have a large impact on the seasonal cycles of nearby wells. ASR water is injected during the wet season, lifting groundwater elevations, and extracted during the dry season, dropping groundwater elevations. Injection and extraction of ASR water ceases entirely during the drought years leading to diminished fluctuations in groundwater elevations during these years.

For the with-Project scenarios, injection and extraction of GWR water does not cease, therefore with-Project scenarios experience greater groundwater level fluctuations than the no-Project scenario during the drought years. A second important factor controlling seasonal fluctuations are the seasonal pumping cycles of nearby (and coincident) production wells. Pumping tends to be heavier during the dry season, leading to declining water levels, and lighter during the wet season, leading to recovering water levels. This appears to be the most important factor causing the behavior seen in the Ord Grove #2 well. Figure 17 shows the pumping schedule of the Ord Grove #2 well for the No-Project and with-Project scenarios. While pumping fluctuates greatly under the No-Project scenario, the well is operated close to capacity during all months of the with-Project scenario. This general pattern continues during the drought period, with extended periods of light pumping during the winter months. This behavior compares closely to the Ord Grove #2 hydrographs, where the no-Project scenario sees greater fluctuations during the drought years than the with-Project scenarios. This helps to explain why the magnitude of fluctuations is higher in the Ord Grove #2 well, and why it appears to be much less sensitive to the ASR injection and extraction than its own pumping cycle.

The Luzern well and PCA-West Shallow well show relative reductions in groundwater elevations of one to six feet over the medium term of the simulations. At each of these wells the predicted groundwater elevations for the with-Project scenarios fall below the No-Project elevations soon after the GWR project comes online. Groundwater elevations then slowly recover to exceed or match the no-Project groundwater elevations by the end of the simulation. This behavior is likely a result of how the injection and additional pumping from the GWR project are distributed within the basin. The Luzern and PCA-West Shallow wells pump from the upper aquifers, not the Santa Margarita aquifer which receives most of the GWR injection. In the upper aquifer, the drop in groundwater elevation due to additional pumping from the Luzern and PCA-West Shallow wells is observed immediately. However the groundwater elevation rise due to both injection in the underlying aquifer and percolation of water through the upper aquifer is delayed. Wells screened in the underlying Santa Margarita aquifer do not show this delayed response because the pressure from GWR injection is transmitted quickly through the aquifer.

Comparing with-Project and No-Project Hydrographs of the PCA-West wells allows us to evaluate how the GWR project may impact seawater intrusion in the Seaside Basin. The simulated groundwater elevations at the PCA-West Deep well are very similar for the with-Project and No-Project scenarios, indicating that the GWR Project would not worsen the potential for seawater intrusion at this location. As previously discussed, hydrographs at the PCA-West Shallow well show relative reductions over the medium term for the Project Scenarios. While the initial relative decline is up to two feet, groundwater elevations remain above the predictive groundwater elevation for this location, and steadily rise to above four feet higher than protective elevations. Therefore, it does not appear that the GWR project would cause this location to become vulnerable to seawater intrusion.


*Figure 9: Locations of Wells with Groundwater Elevation Comparisons*

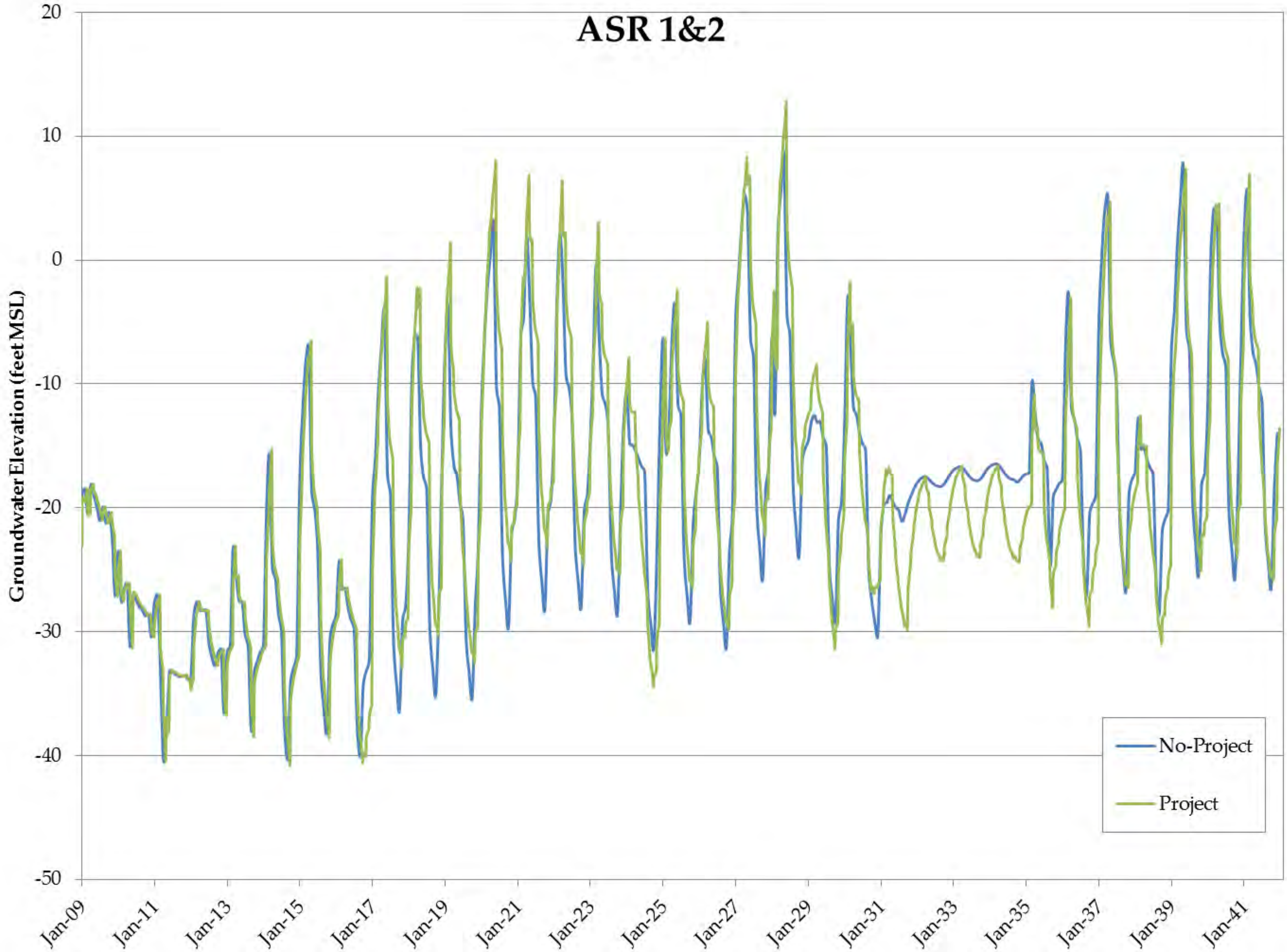



*Figure 10: Predicted Static Groundwater Elevations at ASR 1&2 Wells*

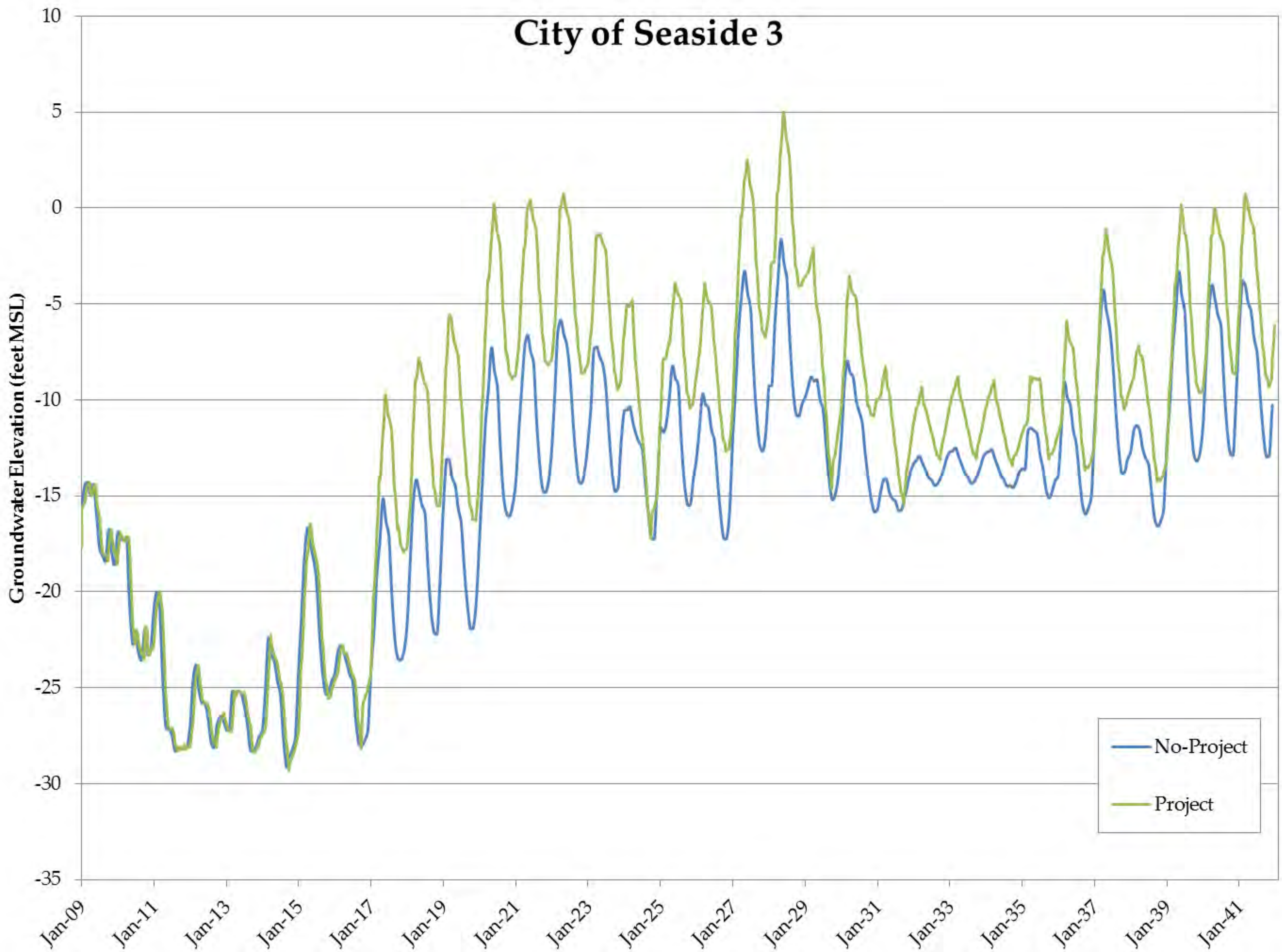



*Figure 11: Predicted Static Groundwater Elevations at City of Seaside 3 Well*

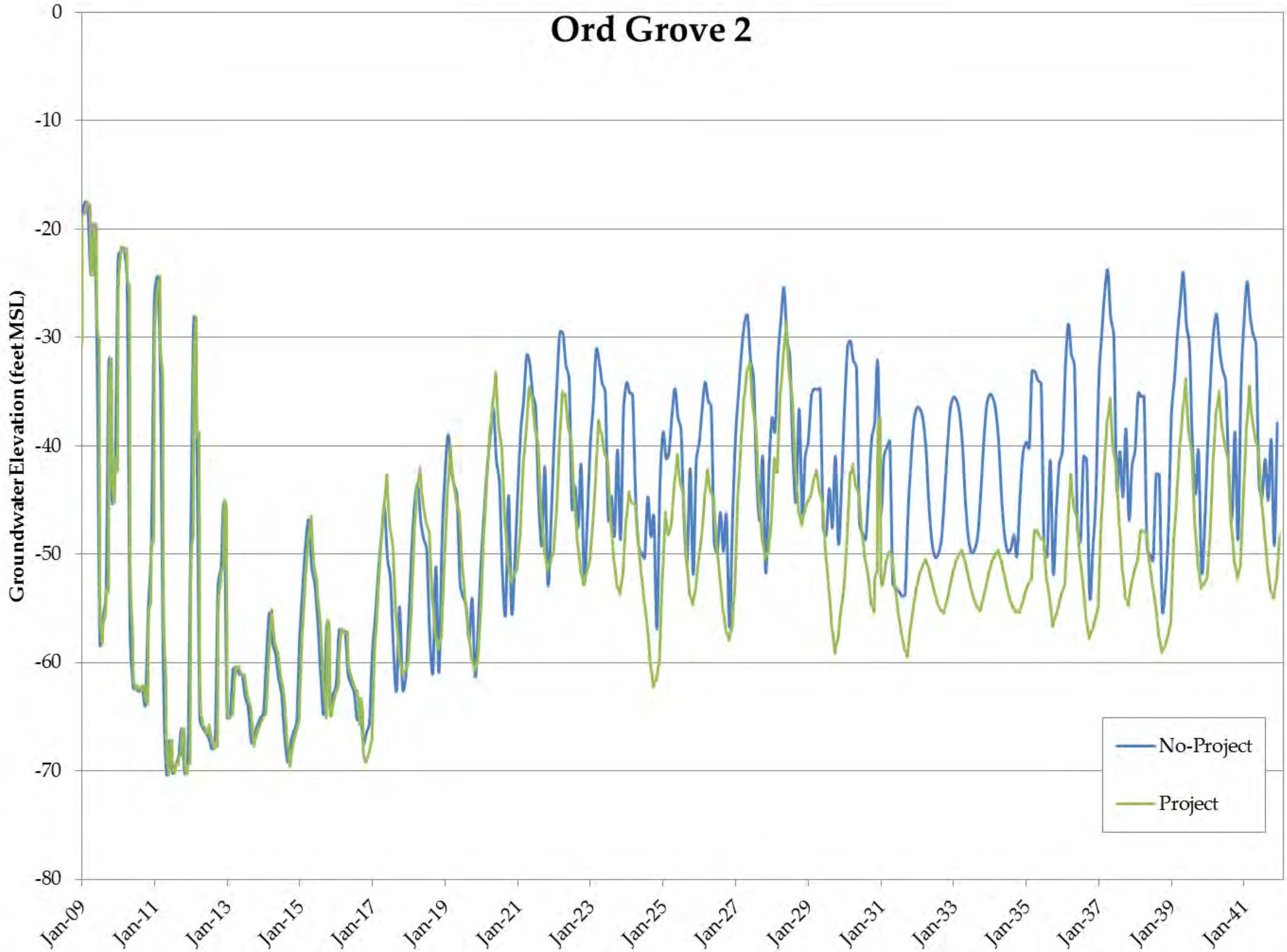



*Figure 12: Predicted Static Groundwater Elevations at Ord Grove 2 Well*

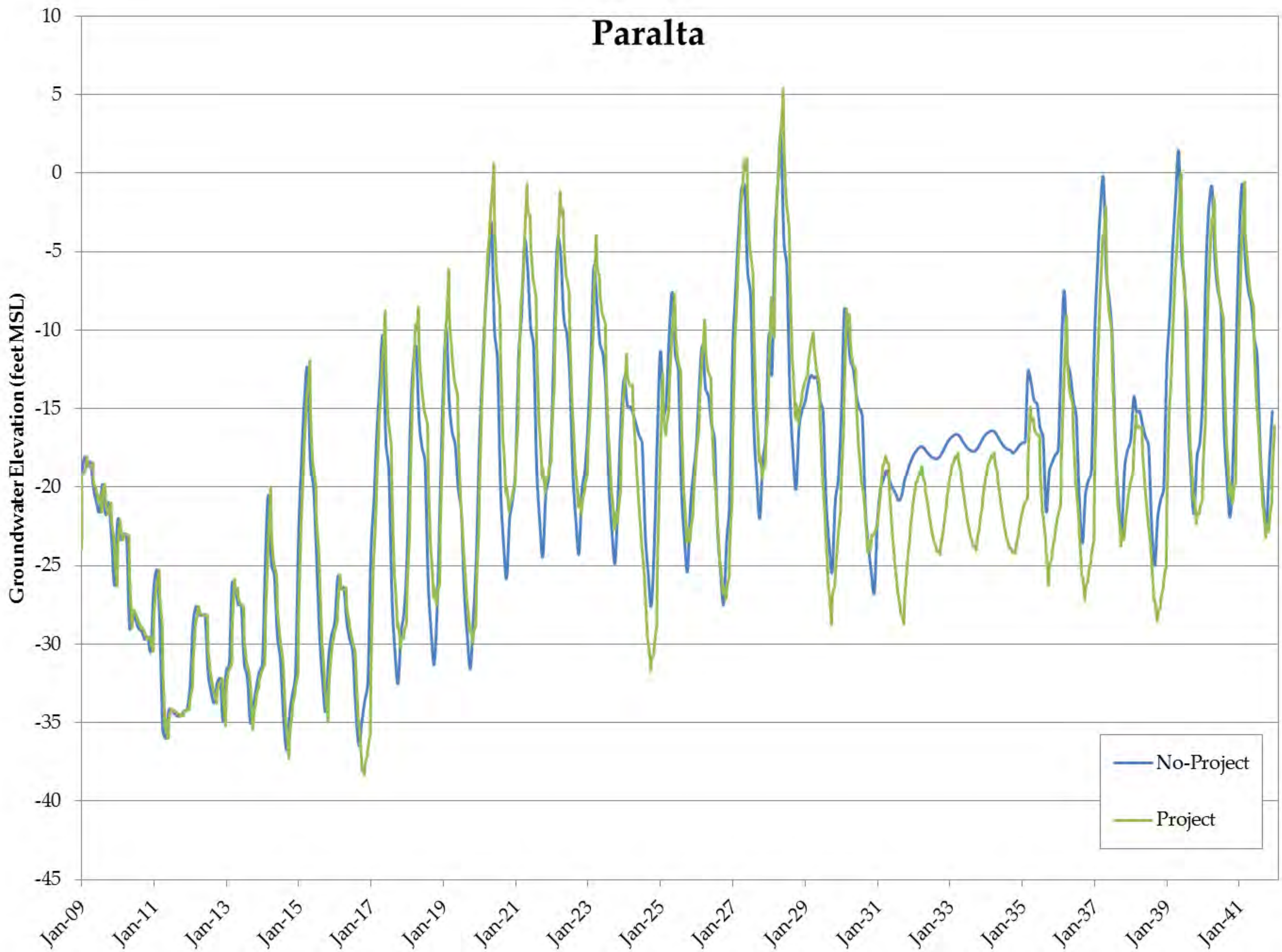



*Figure 13: Predicted Static Groundwater Elevations at Paralta Well*

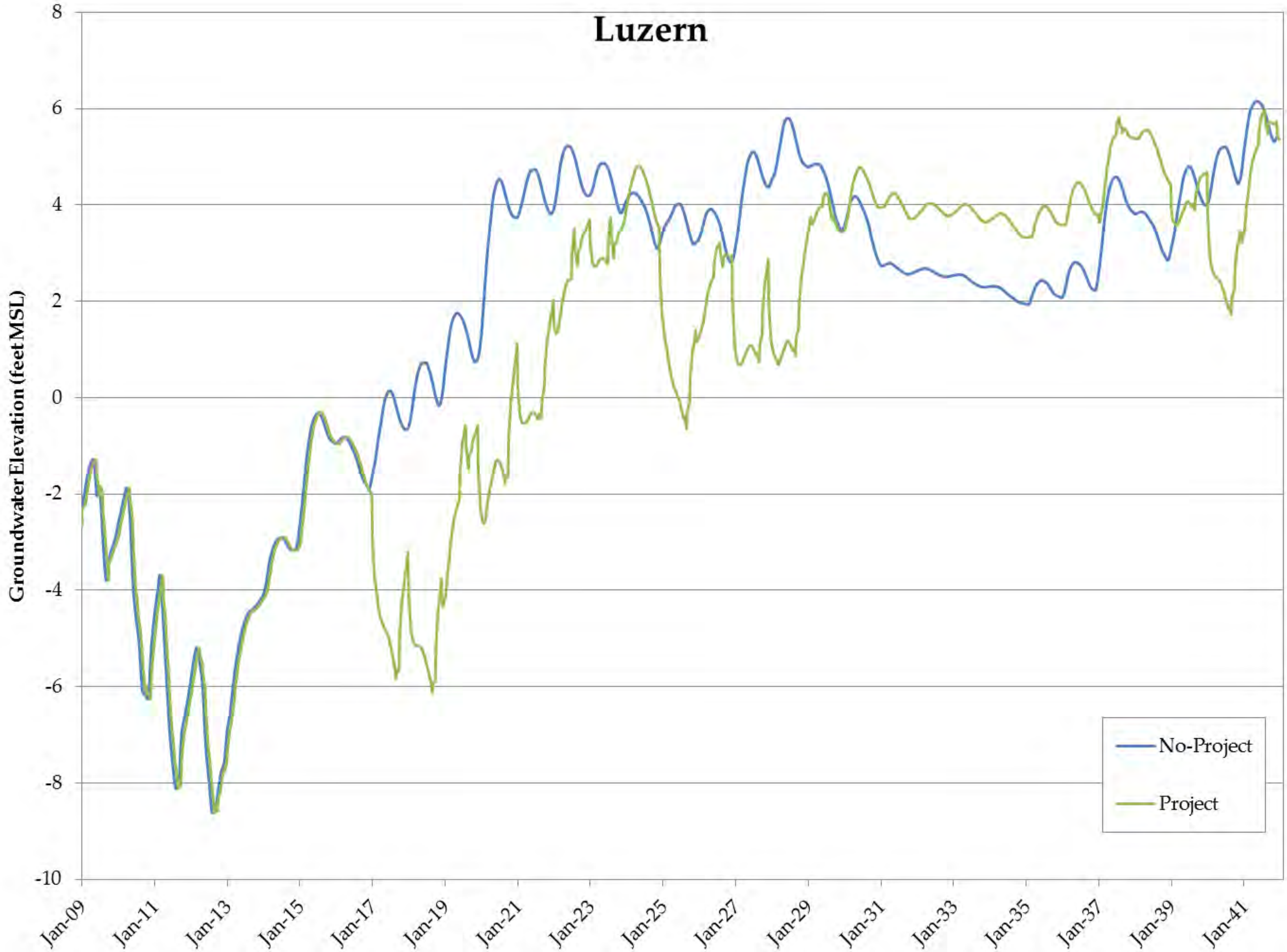



*Figure 14: Predicted Static Groundwater Elevations at Luzern Well*

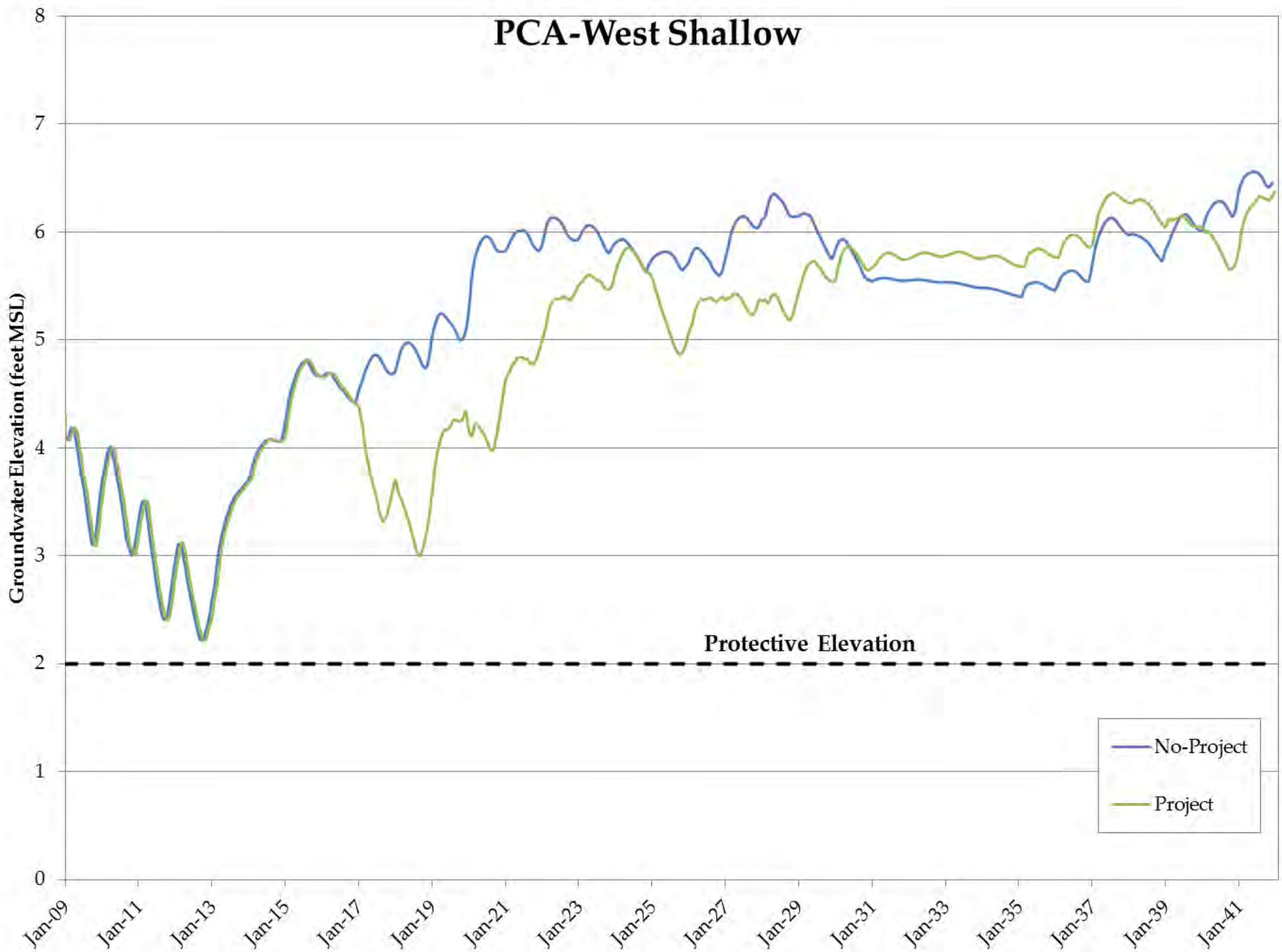



*Figure 15: Predicted Static Groundwater Elevations at PCA-West Shallow Well*

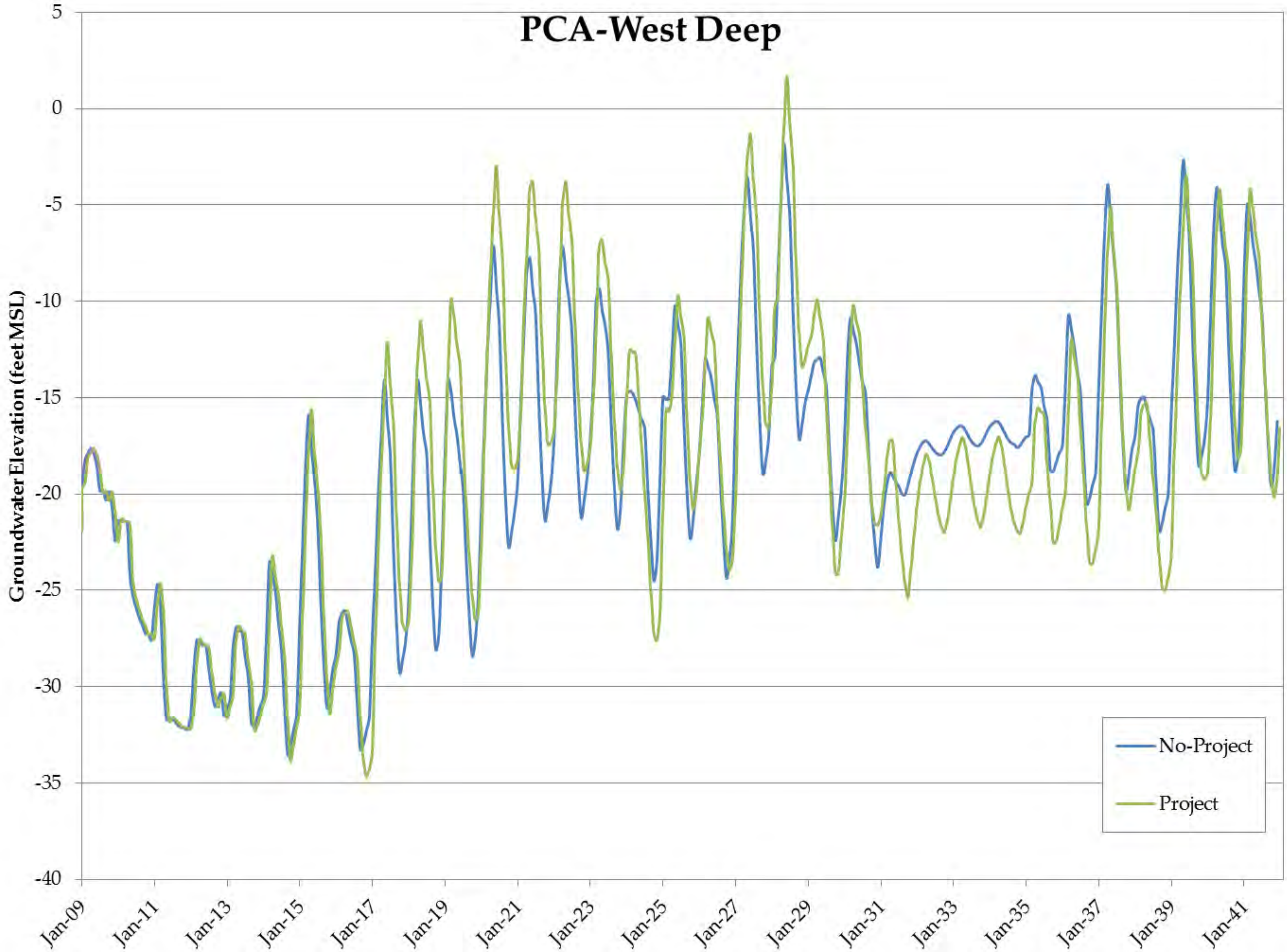
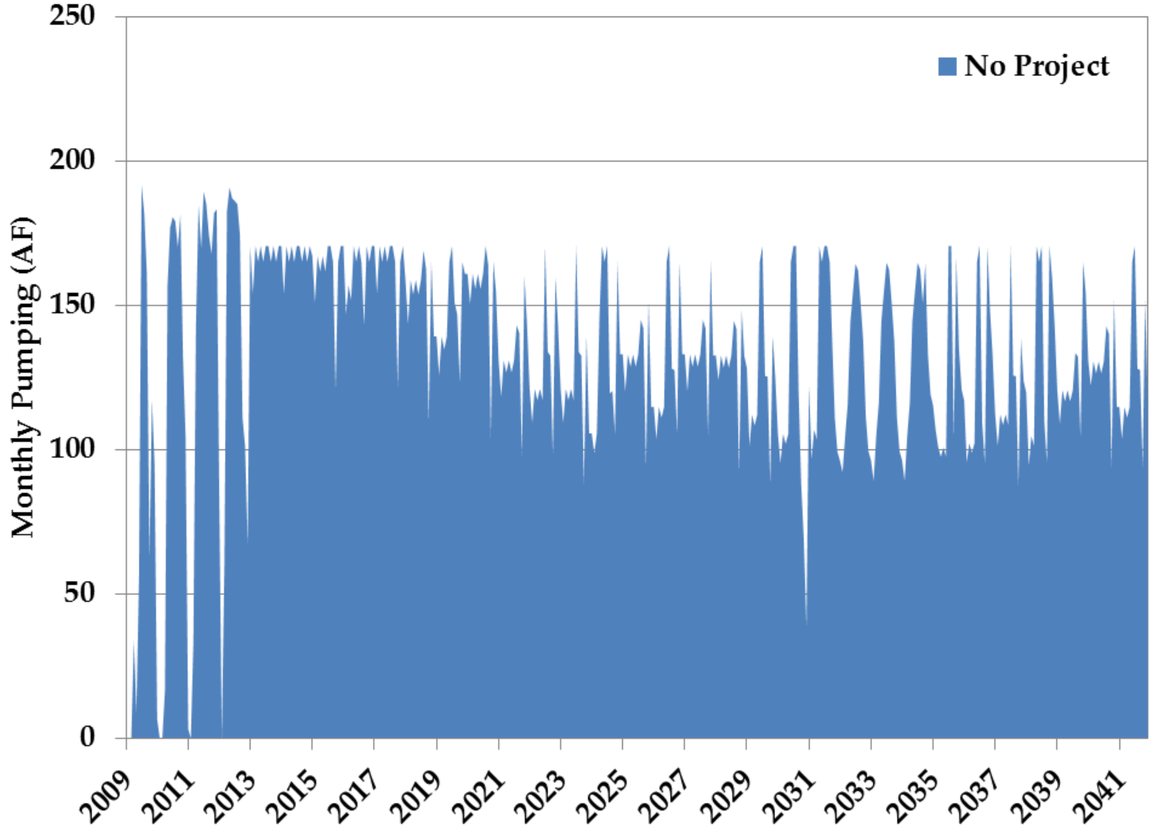



*Figure 16: Predicted Static Groundwater Elevations at PCA-West Deep Well*



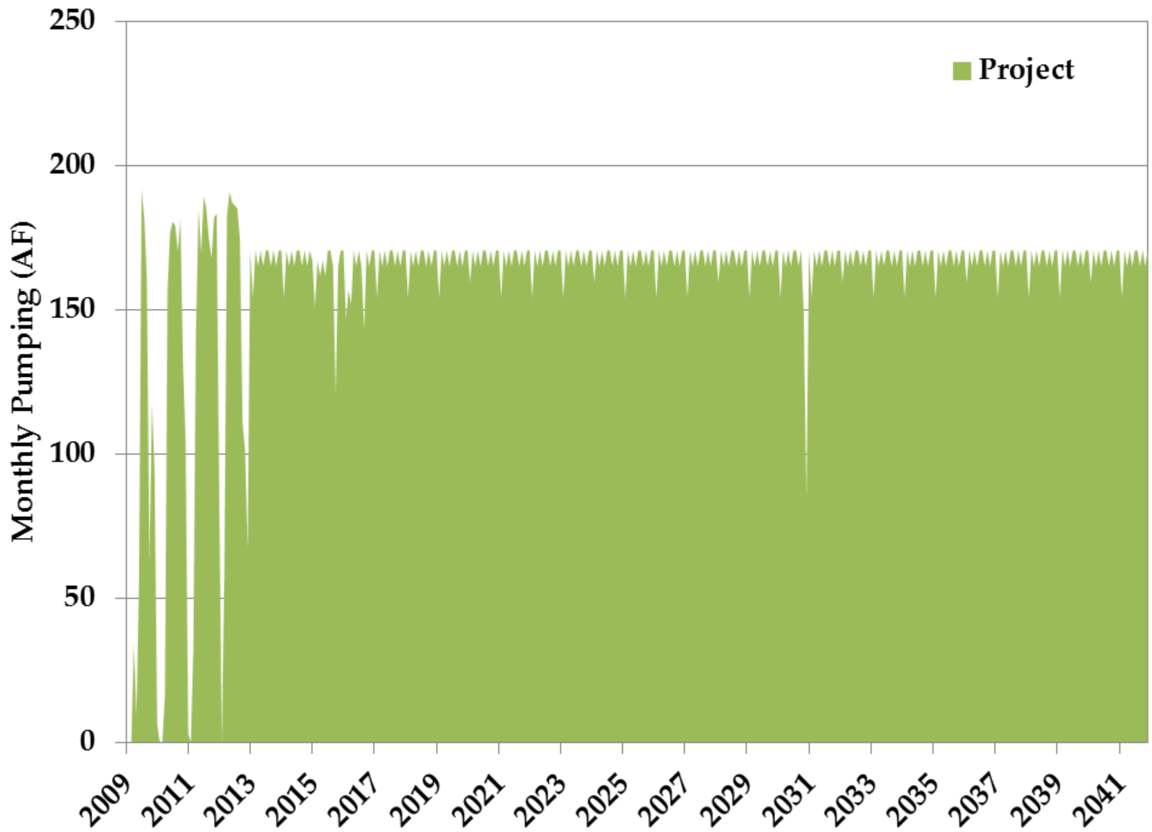




*Figure 17: Pumping Rates for Ord Grove #2 Well*

## PARTICLE TRACKING RESULTS

Figure 18 shows how travel times between the GWR Project injection wells and the nearest extraction wells vary depending upon time of release. The horizontal axis represents the time at which groups of particles were released from the injection wells and the vertical axis represents time in days it took for the fastest particle to reach an extraction well. Each dot represents the time travelled by the fastest particle. The light blue, green, red, and dark blue dots show travel times from the locations of the deep injection wells DIW-1, DIW-2, DIW-3, and DIW-4, respectively. The black, yellow, orange, and magenta dots show travel times from the locations of the vadose zone wells VZW-1, VZW-2, VZW-3, and VZW-4, respectively.

The fastest particles are those released from well DIW-3, and captured at the ASR 1&2 Well Site. The fastest time any particle takes to travel from an injection well to a nearby extraction well is approximately 327 days. Travel times from deep injection well DIW-1 are the next fastest; taking approximately 724 days for the fastest particles to reach the ASR 3&4 Well Site. The fastest particles released at the remaining wells take between 2 and 14 years to reach an extraction well, with particles released from vadose zone well VZW-1 never reaching an extraction well after 24 years of simulation.

For most of the wells, there is a notable variation throughout the simulation in the minimum travel time taken by the released particles. For all four deep injection wells, the variations in travel times are strongly influenced by the ASR wells. These ASR wells both inject and extract water throughout the simulation period, thereby impacting groundwater gradients. These ASR wells sometimes draw particles in and sometimes repel them, creating greatly different trajectories depending on when a particle approaches the ASR wells. For example, particles that are released from well DIW-3 in the early winter and captured by wells ASR 1&2 in the late fall experience the fastest travel times. These particles approach the ASR 1&2 wells during the summer pumping season and are captured before any injection begins in the winter. Particles that approach the ASR wells during the simulated drought of 2030-2034 experience less seasonal variation in travel times. During this period, particles encounter no injection of Carmel River water that would repel them from their path and less pumping that to draw them toward a well.

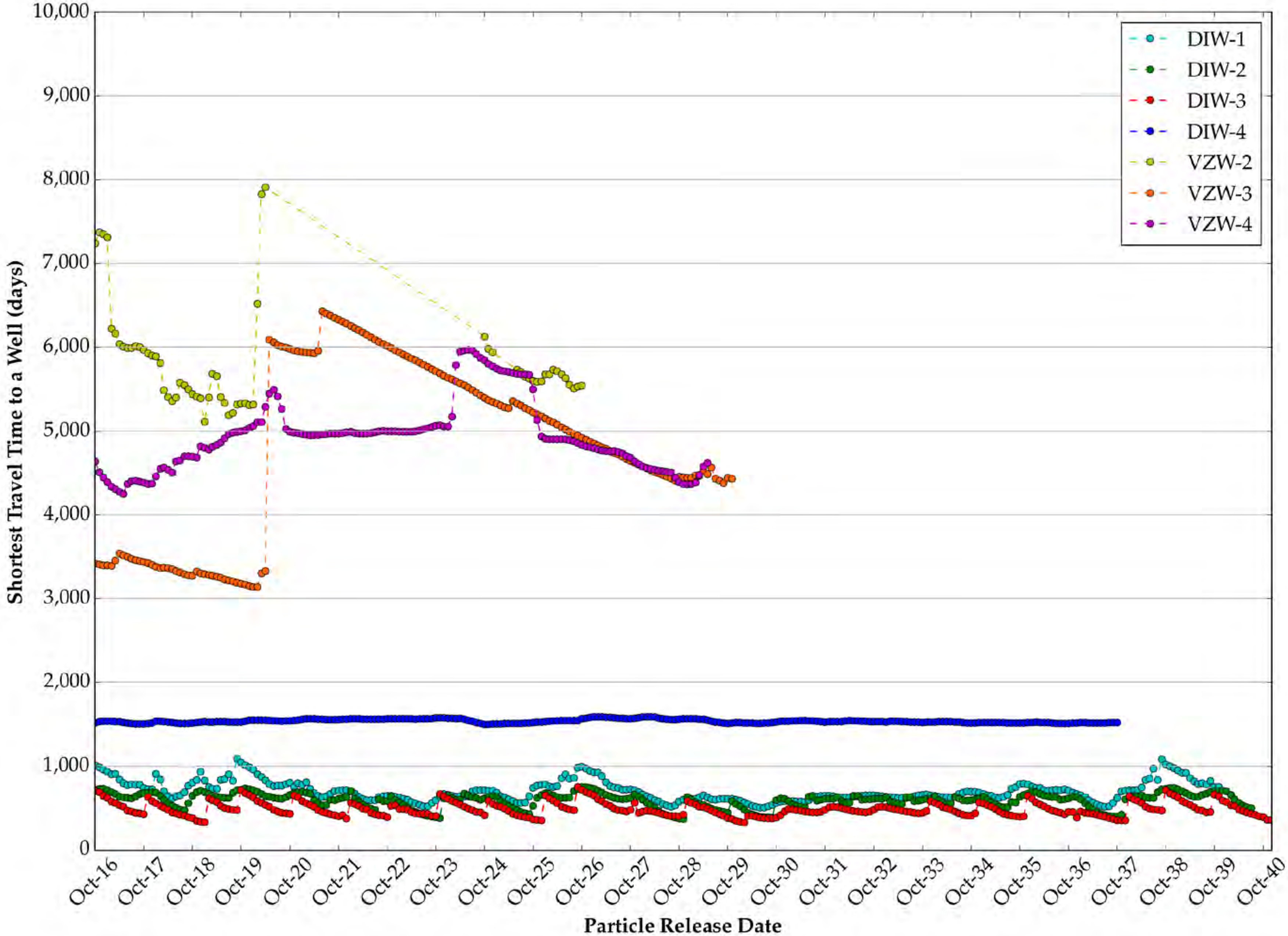



*Figure 18: Fastest Travel Times to a Pumping Well*

The vadose zone wells also display variations in minimum travel times throughout the simulation. These particles are initially released at shallow depths, above the influence of the large-capacity injection and extraction wells. The dynamics of the shallow layers in the model are mostly influenced by fluctuations in natural recharge and by the vadose zone injection itself. Variations in these factors can lead to saturation or desaturation of shallow model cells which in turn cause rapid changes in vertical and horizontal gradients in these cells. This type of behavior is likely to explain the stepped changes in minimum travel times that are seen in vadose zone wells VZW-2, VZW-3, and VZW-4.

The only production wells that capture particles released from the eight injection locations are the two ASR Well Sites, the Ord Grove #2 well; the Paralta well; and the Luzern well. The following tables summarize how particles from each injection site are captured by nearby wells under the Project scenario.

Table 2 shows the fastest travel times between each injection location and the six groups of extraction wells. A value is not shown if there was no particle travelling between the two wells.

*Table 2: Fastest Travel Times between Injection and Extraction Wells, in days*

| Extraction Well | Well of Origin | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | DIW-1 | DIW-2 | DIW-3 | DIW-4 | VZW-1 | VZW-2 | VZW-3 | VZW-4 |
| ASR 1&2 | - | 371 | 327 | 1,780 | - | - | - | - |
| ASR 3&4 | 724 | - | - | 3,074 | - | - | - | - |
| Luzern | - | - | - | - | - | - | 3,140 | - |
| Ord Grove | 3,718 | 1,952 | 1,052 | 1,497 | - | - | - | 4,250 |
| Paralta | 506 | 521 | 852 | 2,076 | - | 5,114 | - | - |

Note: — = no particle traveling between wells

Table 3 shows the percent of particles injected at each of the injection locations that were captured by each extraction well. This table only shows the fate of the captured particles – not the fate of all particles. As a result, the columns add to 100% for each scenario, even though most of the particles released from the vadose zone wells were not captured by the end of the simulation. The Paralta and Ord Grove 2 well capture the greatest share of the particles even though it takes considerably longer for particles to travel to these two wells, as shown on Table 2.

*Table 3: Percent of Particles Travel between Injection and Extraction Wells*

| Extraction Well | Well of Origin | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | DIW-1 | DIW-2 | DIW-3 | DIW-4 | VZW-1 | VZW-2 | VZW-3 | VZW-4 |
| ASR 1&2 | - | 16% | 44% | 3% | - | - | - | - |
| ASR 3&4 | 34% | - | - | 3% | - | - | - | - |
| Luzern | - | - | - | - | - | - | 100% | - |
| Ord Grove | 3% | 2% | 44% | 55% | - | - | - | 100% |
| Paralta | 63% | 82% | 12% | 39% | - | 100% | - | - |

Note: — = no particle traveling between wells

Figure 19 and Figure 20 show the path each particle takes from its initial injection location to either an extraction well or its final location when the simulation ends. Separate maps for paths originating from deep injection wells and paths originating from vadose zone wells are included. The particle tracks shown on each figure display the fate of particles that were released in the model period corresponding to February, 2030. This date was selected as it is the release period with the fastest travel times.

The particle path figures show that the northwestern-directed groundwater flow field dominates the migration of particles from the vadose zone wells while the local dynamics of the many deep injection and extraction wells dominate the migration of the particles from the deep injection wells. As noted above, there are several particle paths that fluctuate towards and away from the ASR wells before the particles are captured. These fluctuations are the result of the injection and extraction pattern at the ASR wells.

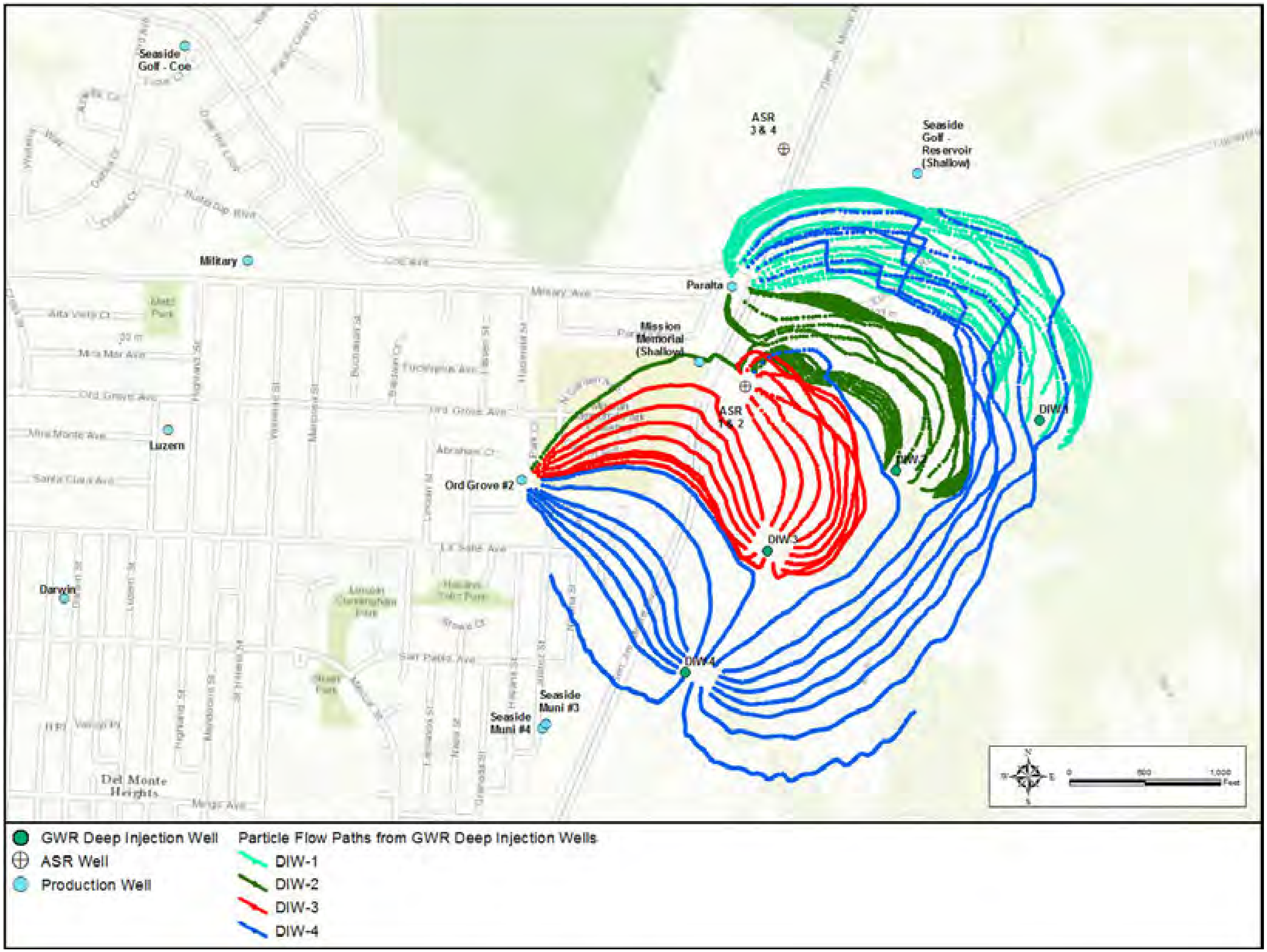



*Figure 19: Particle Paths from a Single Release in Deep Injection*

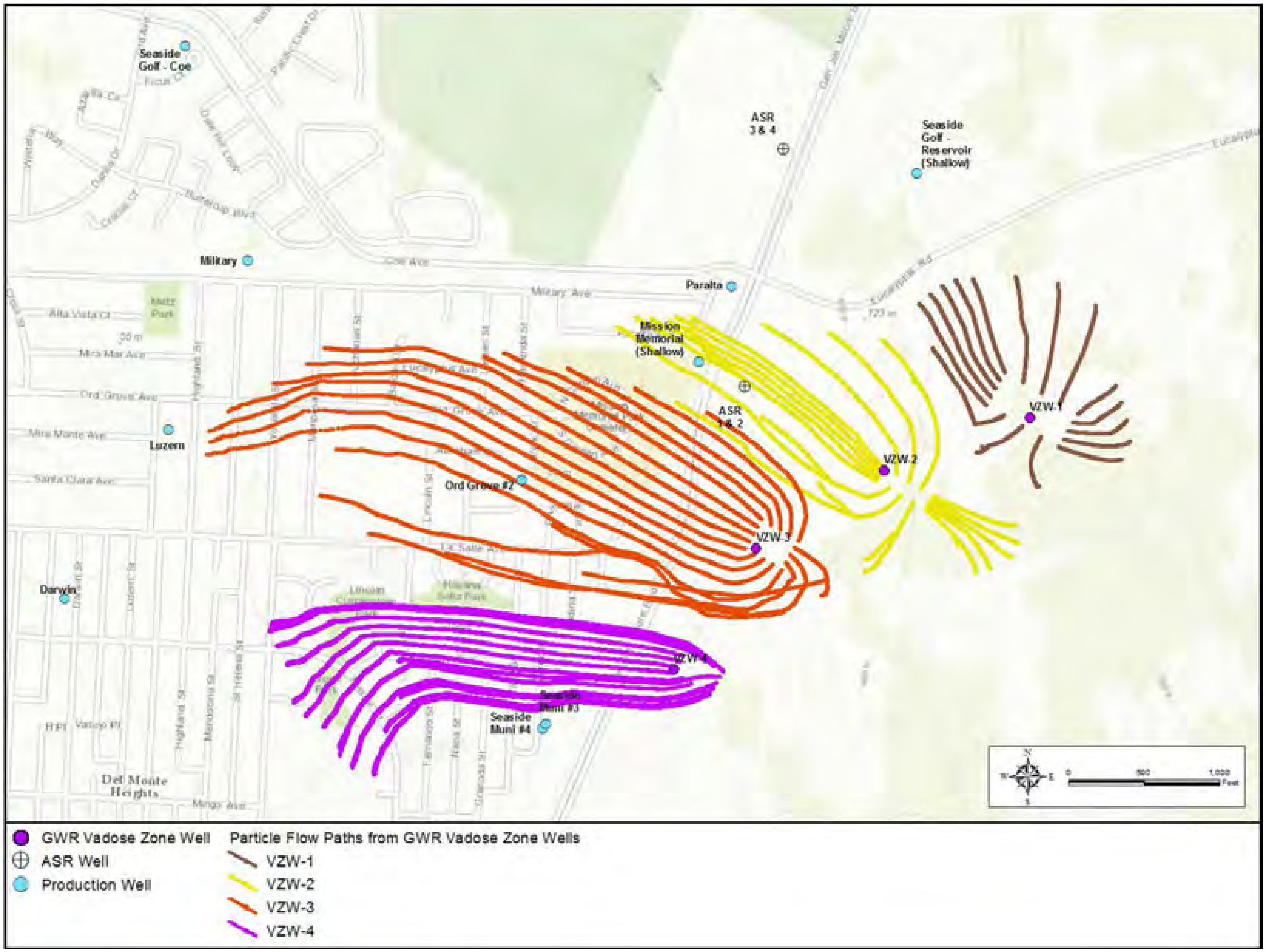



*Figure 20: Particle Paths from a Single Release in Vadose Zone*

Figure 21 and Figure 22 show the greatest particle extent from each injection location at four separate times. Separate maps for paths originating from deep injection wells and paths originating from vadose zone wells are included. Four times are shown: 90 days (yellow), 180 days (orange), 270 days (red), and 360 days (blue). These contours show the same general spatial pattern as Figure 19 and Figure 20 but represent the extent of all particles at any time rather than individual paths. The fourth (blue) contour, representing 360 days, is 33 days shorter than was taken by the fastest particle to travel from injection well DIW-3 to the ASR 1&2 Well Site.

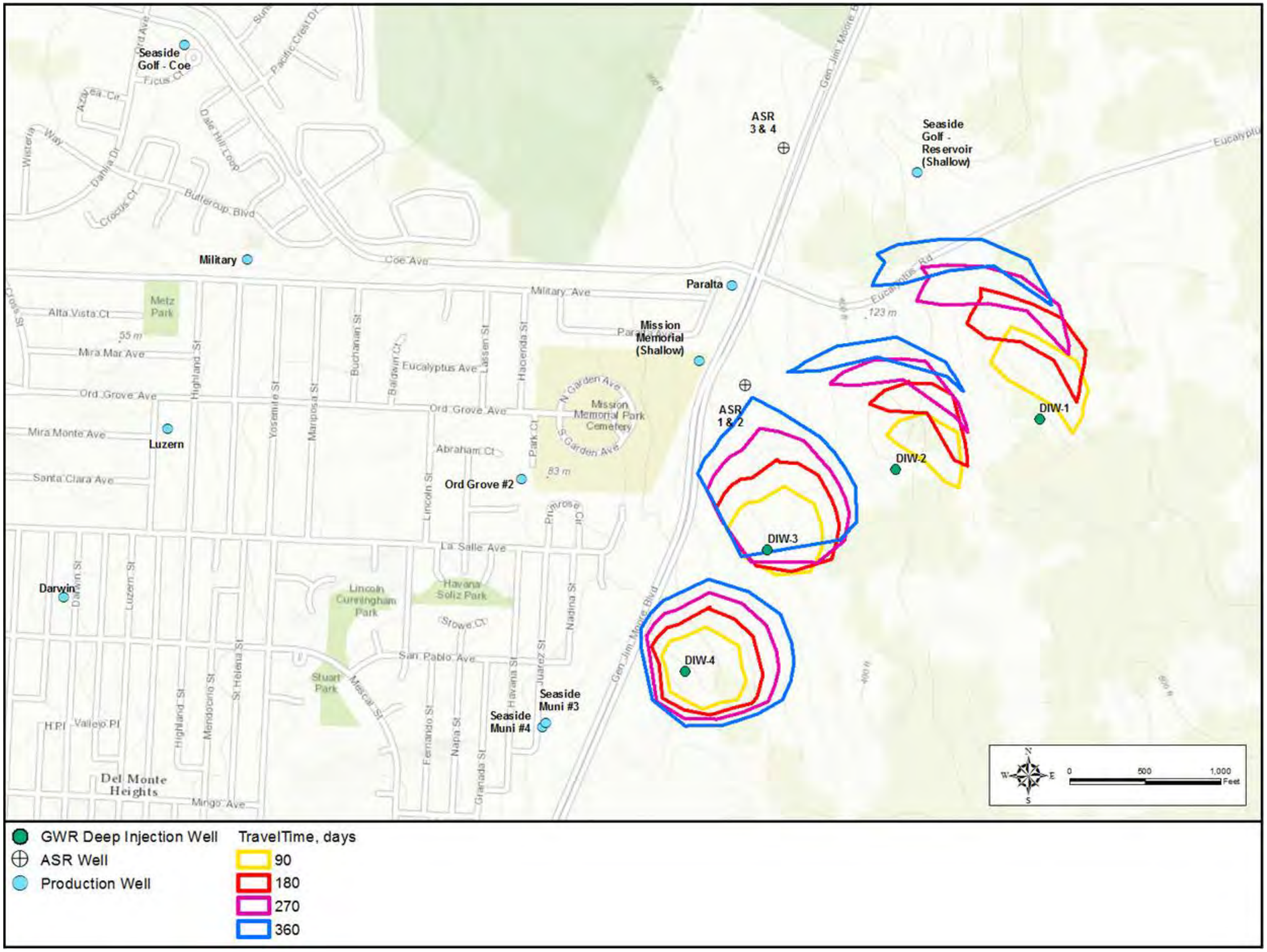



*Figure 21: Travel Time Extents from Deep Injection Wells*

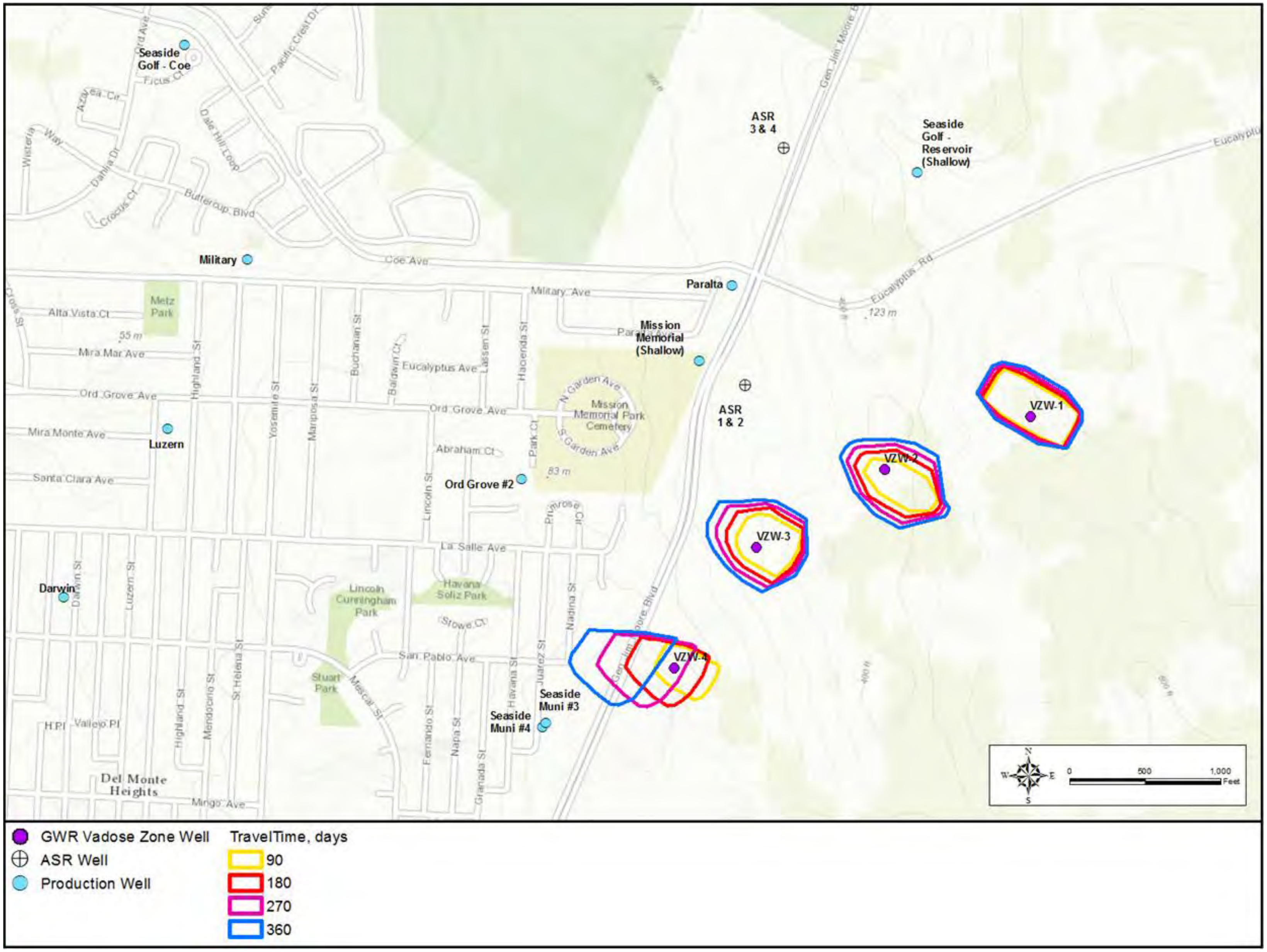



*Figure 22: Travel Time Extents from Vadose Zone Wells*

# References

*California American Water v. City of Seaside et al.* Monterey County Superior Court, Case Number M66343, filed in Monterey County Superior Court on March 27, 2006, amended on February 9, 2007

HydroMetrics Water Resources Inc. 2009. *Seaside groundwater basin modeling and protective groundwater elevations*, prepared for Seaside basin watermaster, November, 151 p.

## *Planned Project Water Injection Schedule and CSIP Storage and Delivery Operation*

| Water Year | Simulated Historical Climate Water Year | Salinas Station Precip (% of Ave.) | Drought Year Criteria (<75% of Average) | Injection Delivery Schedule | Injection Volume (AF) | Annual Recycled Water to CSIP (AF) | Drought Reserve Change (AF) | Cumulative Drought Reserve (AF) | Injection Delivery Schedule (AFM) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Total |
| 2017 | 1995 | 131% | | A | 3,700 | - | 200 | 200 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2018 | 1996 | 95% | | A | 3,700 | - | 200 | 400 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2019 | 1997 | 123% | | A | 3,700 | - | 200 | 600 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2020 | 1998 | 240% | | A | 3,700 | - | 200 | 800 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2021 | 1999 | 98% | | A | 3,700 | - | 200 | 1,000 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2022 | 2000 | 114% | | B | 3,500 | - | - | 1,000 | 297 | 288 | 297 | 297 | 268 | 297 | 288 | 297 | 288 | 297 | 297 | 288 | 3,500 |
| 2023 | 2001 | 93% | | B | 3,500 | - | - | 1,000 | 297 | 288 | 297 | 297 | 268 | 297 | 288 | 297 | 288 | 297 | 297 | 288 | 3,500 |
| 2024 | 2002 | 74% | Drought | G | 2,500 | 1,000 | (1,000) | - | 297 | 288 | 297 | 297 | 268 | 297 | 124 | 128 | 124 | 128 | 128 | 124 | 2,500 |
| 2025 | 2003 | 94% | | A | 3,700 | - | 200 | 200 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2026 | 2004 | 82% | | A | 3,700 | - | 200 | 400 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2027 | 2005 | 148% | | A | 3,700 | - | 200 | 600 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2028 | 2006 | 118% | | A | 3,700 | - | 200 | 800 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2029 | 2007 | 73% | Drought | D | 2,700 | 1,000 | (800) | - | 331 | 321 | 331 | 331 | 299 | 331 | 124 | 128 | 124 | 128 | 128 | 124 | 2,700 |
| 2030 | 2008 | 79% | | A | 3,700 | - | 200 | 200 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2031 | 1987 | 60% | Drought | E | 3,300 | 400 | (200) | - | 331 | 321 | 331 | 331 | 299 | 331 | 222 | 229 | 222 | 229 | 229 | 222 | 3,300 |
| 2032 | 1988 | 40% | Drought | F | 3,500 | 200 | - | - | 331 | 321 | 331 | 331 | 299 | 331 | 255 | 263 | 255 | 263 | 263 | 255 | 3,500 |
| 2033 | 1989 | 63% | Drought | F | 3,500 | 200 | - | - | 331 | 321 | 331 | 331 | 299 | 331 | 255 | 263 | 255 | 263 | 263 | 255 | 3,500 |
| 2034 | 1990 | 57% | Drought | F | 3,500 | 200 | - | - | 331 | 321 | 331 | 331 | 299 | 331 | 255 | 263 | 255 | 263 | 263 | 255 | 3,500 |
| 2035 | 1991 | 88% | | A | 3,700 | - | 200 | 200 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2036 | 1992 | 90% | | A | 3,700 | - | 200 | 400 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2037 | 1993 | 140% | | A | 3,700 | - | 200 | 600 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2038 | 1994 | 83% | | A | 3,700 | - | 200 | 800 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2039 | 1995 | 131% | | A | 3,700 | - | 200 | 1,000 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2040 | 1996 | 95% | | B | 3,500 | - | - | 1,000 | 297 | 288 | 297 | 297 | 268 | 297 | 288 | 297 | 288 | 297 | 297 | 288 | 3,500 |
| 2041 | 1997 | 123% | | B | 3,500 | - | - | 1,000 | 297 | 288 | 297 | 297 | 268 | 297 | 288 | 297 | 288 | 297 | 297 | 288 | 3,500 |

| Injection Delivery Schedule (AF/month) | | | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| before drought reserve complete | wet/normal year | A | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| after drought reserve complete | wet/normal year | B | 297 | 288 | 297 | 297 | 268 | 297 | 288 | 297 | 288 | 297 | 297 | 288 | 3,500 |
| before drought reserve complete | drought year (min. AWTF delivery) | C | 331 | 321 | 331 | 331 | 299 | 331 | 107 | 111 | 107 | 111 | 111 | 107 | 2,601 |
| before drought reserve complete | drought year (1,000 AF to CSIP) | D | 331 | 321 | 331 | 331 | 299 | 331 | 124 | 128 | 124 | 128 | 128 | 124 | 2,700 |
| before drought reserve complete | drought year (400 AF to CSIP) | E | 331 | 321 | 331 | 331 | 299 | 331 | 222 | 229 | 222 | 229 | 229 | 222 | 3,300 |
| before drought reserve complete | drought year (200 AF to CSIP) | F | 331 | 321 | 331 | 331 | 299 | 331 | 255 | 263 | 255 | 263 | 263 | 255 | 3,500 |
| after drought reserve complete | drought year (1,000 AF to CSIP) | G | 297 | 288 | 297 | 297 | 268 | 297 | 124 | 128 | 124 | 128 | 128 | 124 | 2,500 |

## *APPENDIX A:*
## *MPWMD HISTORIC AND PROJECTED ASR WELL SITE INJECTION*

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| Before | Oct-86 | 1986/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Nov-86 | 1986/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-86 | 1986/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-87 | 1987/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Feb-87 | 1987/2 | 40 | 26 | 14 | NO | Y | Y | N | N |
| Before | Mar-87 | 1987/3 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Apr-87 | 1987/4 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | May-87 | 1987/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jun-87 | 1987/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jul-87 | 1987/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-87 | 1987/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Sep-87 | 1987/9 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Oct-87 | 1987/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Nov-87 | 1987/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-87 | 1987/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-88 | 1988/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Feb-88 | 1988/2 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Mar-88 | 1988/3 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Apr-88 | 1988/4 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | May-88 | 1988/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jun-88 | 1988/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jul-88 | 1988/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-88 | 1988/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Sep-88 | 1988/9 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Oct-88 | 1988/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Nov-88 | 1988/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-88 | 1988/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-89 | 1989/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Feb-89 | 1989/2 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Mar-89 | 1989/3 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Apr-89 | 1989/4 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | May-89 | 1989/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jun-89 | 1989/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jul-89 | 1989/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-89 | 1989/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Sep-89 | 1989/9 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Oct-89 | 1989/10 | 0 | 0 | 0 | YES | N | N | Y | Y |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| Before | Nov-89 | 1989/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-89 | 1989/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-90 | 1990/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Feb-90 | 1990/2 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Mar-90 | 1990/3 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Apr-90 | 1990/4 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | May-90 | 1990/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jun-90 | 1990/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jul-90 | 1990/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-90 | 1990/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Sep-90 | 1990/9 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Oct-90 | 1990/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Nov-90 | 1990/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-90 | 1990/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-91 | 1991/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Feb-91 | 1991/2 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Mar-91 | 1991/3 | 280 | 182 | 98 | NO | Y | Y | N | N |
| Before | Apr-91 | 1991/4 | 100 | 65 | 35 | NO | Y | Y | N | N |
| Before | May-91 | 1991/5 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jun-91 | 1991/6 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jul-91 | 1991/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-91 | 1991/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Sep-91 | 1991/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-91 | 1991/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Nov-91 | 1991/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-91 | 1991/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-92 | 1992/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Feb-92 | 1992/2 | 380 | 247 | 133 | NO | Y | Y | N | N |
| Before | Mar-92 | 1992/3 | 480 | 312 | 168 | NO | Y | Y | N | N |
| Before | Apr-92 | 1992/4 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | May-92 | 1992/5 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jun-92 | 1992/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jul-92 | 1992/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-92 | 1992/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-92 | 1992/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-92 | 1992/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Nov-92 | 1992/11 | 0 | 0 | 0 | YES | N | N | Y | Y |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| Before | Dec-92 | 1992/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-93 | 1993/1 | 520 | 338 | 182 | NO | Y | Y | N | N |
| Before | Feb-93 | 1993/2 | 560 | 364 | 196 | NO | Y | Y | N | N |
| Before | Mar-93 | 1993/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| Before | Apr-93 | 1993/4 | 540 | 351 | 189 | NO | Y | Y | N | N |
| Before | May-93 | 1993/5 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jun-93 | 1993/6 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jul-93 | 1993/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-93 | 1993/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-93 | 1993/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-93 | 1993/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-93 | 1993/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-93 | 1993/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-94 | 1994/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Feb-94 | 1994/2 | 140 | 91 | 49 | NO | Y | Y | N | N |
| Before | Mar-94 | 1994/3 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Apr-94 | 1994/4 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | May-94 | 1994/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jun-94 | 1994/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jul-94 | 1994/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-94 | 1994/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-94 | 1994/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-94 | 1994/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Nov-94 | 1994/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-94 | 1994/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-95 | 1995/1 | 480 | 312 | 168 | NO | Y | Y | N | N |
| Before | Feb-95 | 1995/2 | 440 | 286 | 154 | NO | Y | Y | N | N |
| Before | Mar-95 | 1995/3 | 580 | 377 | 203 | NO | Y | Y | N | N |
| Before | Apr-95 | 1995/4 | 600 | 390 | 210 | NO | Y | Y | N | N |
| Before | May-95 | 1995/5 | 620 | 403 | 217 | NO | Y | Y | N | N |
| Before | Jun-95 | 1995/6 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jul-95 | 1995/7 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Aug-95 | 1995/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-95 | 1995/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-95 | 1995/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-95 | 1995/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-95 | 1995/12 | 0 | 0 | 0 | YES | N | N | Y | Y |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| Before | Jan-96 | 1996/1 | 180 | 117 | 63 | NO | Y | Y | N | N |
| Before | Feb-96 | 1996/2 | 580 | 377 | 203 | NO | Y | Y | N | N |
| Before | Mar-96 | 1996/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| Before | Apr-96 | 1996/4 | 480 | 312 | 168 | NO | Y | Y | N | N |
| Before | May-96 | 1996/5 | 60 | 39 | 21 | NO | Y | Y | N | N |
| Before | Jun-96 | 1996/6 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jul-96 | 1996/7 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Aug-96 | 1996/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-96 | 1996/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-96 | 1996/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-96 | 1996/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-96 | 1996/12 | 360 | 234 | 126 | NO | Y | Y | N | N |
| Before | Jan-97 | 1997/1 | 620 | 403 | 217 | NO | Y | Y | N | N |
| Before | Feb-97 | 1997/2 | 560 | 364 | 196 | NO | Y | Y | N | N |
| Before | Mar-97 | 1997/3 | 100 | 65 | 35 | NO | Y | Y | N | N |
| Before | Apr-97 | 1997/4 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | May-97 | 1997/5 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jun-97 | 1997/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jul-97 | 1997/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-97 | 1997/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-97 | 1997/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-97 | 1997/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-97 | 1997/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-97 | 1997/12 | 120 | 78 | 42 | NO | Y | Y | N | N |
| Before | Jan-98 | 1998/1 | 500 | 325 | 175 | NO | Y | Y | N | N |
| Before | Feb-98 | 1998/2 | 560 | 364 | 196 | NO | Y | Y | N | N |
| Before | Mar-98 | 1998/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| Before | Apr-98 | 1998/4 | 600 | 390 | 210 | NO | Y | Y | N | N |
| Before | May-98 | 1998/5 | 620 | 403 | 217 | NO | Y | Y | N | N |
| Before | Jun-98 | 1998/6 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jul-98 | 1998/7 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Aug-98 | 1998/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-98 | 1998/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-98 | 1998/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-98 | 1998/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-98 | 1998/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-99 | 1999/1 | 100 | 65 | 35 | NO | Y | Y | N | N |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| Before | Feb-99 | 1999/2 | 480 | 312 | 168 | NO | Y | Y | N | N |
| Before | Mar-99 | 1999/3 | 440 | 286 | 154 | NO | Y | Y | N | N |
| Before | Apr-99 | 1999/4 | 600 | 390 | 210 | NO | Y | Y | N | N |
| Before | May-99 | 1999/5 | 300 | 195 | 105 | NO | Y | Y | N | N |
| Before | Jun-99 | 1999/6 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jul-99 | 1999/7 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Aug-99 | 1999/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-99 | 1999/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-99 | 1999/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-99 | 1999/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-99 | 1999/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-00 | 2000/1 | 180 | 117 | 63 | NO | Y | Y | N | N |
| Before | Feb-00 | 2000/2 | 520 | 338 | 182 | NO | Y | Y | N | N |
| Before | Mar-00 | 2000/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| Before | Apr-00 | 2000/4 | 320 | 208 | 112 | NO | Y | Y | N | N |
| Before | May-00 | 2000/5 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jun-00 | 2000/6 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jul-00 | 2000/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-00 | 2000/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-00 | 2000/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-00 | 2000/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-00 | 2000/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-00 | 2000/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-01 | 2001/1 | 140 | 91 | 49 | NO | Y | Y | N | N |
| Before | Feb-01 | 2001/2 | 340 | 221 | 119 | NO | Y | Y | N | N |
| Before | Mar-01 | 2001/3 | 560 | 364 | 196 | NO | Y | Y | N | N |
| Before | Apr-01 | 2001/4 | 180 | 117 | 63 | NO | Y | Y | N | N |
| Before | May-01 | 2001/5 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jun-01 | 2001/6 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jul-01 | 2001/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-01 | 2001/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-01 | 2001/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-01 | 2001/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-01 | 2001/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-01 | 2001/12 | 220 | 143 | 77 | NO | Y | Y | N | N |
| Before | Jan-02 | 2002/1 | 240 | 156 | 84 | NO | Y | Y | N | N |
| Before | Feb-02 | 2002/2 | 0 | 0 | 0 | NO | N | N | N | N |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| Before | Mar-02 | 2002/3 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Apr-02 | 2002/4 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | May-02 | 2002/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jun-02 | 2002/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jul-02 | 2002/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-02 | 2002/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-02 | 2002/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-02 | 2002/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-02 | 2002/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-02 | 2002/12 | 340 | 221 | 119 | NO | Y | Y | N | N |
| Before | Jan-03 | 2003/1 | 500 | 325 | 175 | NO | Y | Y | N | N |
| Before | Feb-03 | 2003/2 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Mar-03 | 2003/3 | 100 | 65 | 35 | NO | Y | Y | N | N |
| Before | Apr-03 | 2003/4 | 360 | 234 | 126 | NO | Y | Y | N | N |
| Before | May-03 | 2003/5 | 400 | 260 | 140 | NO | Y | Y | N | N |
| Before | Jun-03 | 2003/6 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jul-03 | 2003/7 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Aug-03 | 2003/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-03 | 2003/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-03 | 2003/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-03 | 2003/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-03 | 2003/12 | 40 | 26 | 14 | NO | Y | Y | N | N |
| Before | Jan-04 | 2004/1 | 100 | 65 | 35 | NO | Y | Y | N | N |
| Before | Feb-04 | 2004/2 | 280 | 182 | 98 | NO | Y | Y | N | N |
| Before | Mar-04 | 2004/3 | 300 | 195 | 105 | NO | Y | Y | N | N |
| Before | Apr-04 | 2004/4 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | May-04 | 2004/5 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jun-04 | 2004/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jul-04 | 2004/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-04 | 2004/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-04 | 2004/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-04 | 2004/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-04 | 2004/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-04 | 2004/12 | 60 | 39 | 21 | NO | Y | Y | N | N |
| Before | Jan-05 | 2005/1 | 620 | 403 | 217 | NO | Y | Y | N | N |
| Before | Feb-05 | 2005/2 | 560 | 364 | 196 | NO | Y | Y | N | N |
| Before | Mar-05 | 2005/3 | 620 | 403 | 217 | NO | Y | Y | N | N |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| Before | Apr-05 | 2005/4 | 600 | 390 | 210 | NO | Y | Y | N | N |
| Before | May-05 | 2005/5 | 460 | 299 | 161 | NO | Y | Y | N | N |
| Before | Jun-05 | 2005/6 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jul-05 | 2005/7 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Aug-05 | 2005/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-05 | 2005/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-05 | 2005/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-05 | 2005/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-05 | 2005/12 | 20 | 13 | 7 | NO | Y | Y | N | N |
| Before | Jan-06 | 2006/1 | 400 | 260 | 140 | NO | Y | Y | N | N |
| Before | Feb-06 | 2006/2 | 40 | 26 | 14 | NO | Y | Y | N | N |
| Before | Mar-06 | 2006/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| Before | Apr-06 | 2006/4 | 600 | 390 | 210 | NO | Y | Y | N | N |
| Before | May-06 | 2006/5 | 620 | 403 | 217 | NO | Y | Y | N | N |
| Before | Jun-06 | 2006/6 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jul-06 | 2006/7 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Aug-06 | 2006/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-06 | 2006/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-06 | 2006/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-06 | 2006/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-06 | 2006/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-07 | 2007/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Feb-07 | 2007/2 | 40 | 26 | 14 | NO | Y | Y | N | N |
| Before | Mar-07 | 2007/3 | 40 | 26 | 14 | NO | Y | Y | N | N |
| Before | Apr-07 | 2007/4 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | May-07 | 2007/5 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jun-07 | 2007/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jul-07 | 2007/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-07 | 2007/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-07 | 2007/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-07 | 2007/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-07 | 2007/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-07 | 2007/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-08 | 2008/1 | 200 | 130 | 70 | NO | Y | Y | N | N |
| Before | Feb-08 | 2008/2 | 500 | 325 | 175 | NO | Y | Y | N | N |
| Before | Mar-08 | 2008/3 | 260 | 169 | 91 | NO | Y | Y | N | N |
| Before | Apr-08 | 2008/4 | 0 | 0 | 0 | NO | N | N | N | N |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| Before | May-08 | 2008/5 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jun-08 | 2008/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jul-08 | 2008/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-08 | 2008/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Sep-08 | 2008/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-08 | 2008/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-08 | 2008/11 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Dec-08 | 2008/12 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 1 | Jan-09 | 1987/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 2 | Feb-09 | 1987/2 | 40 | 26 | 14 | NO | Y | Y | N | N |
| 3 | Mar-09 | 1987/3 | 0 | 0 | 0 | NO | N | N | N | N |
| 4 | Apr-09 | 1987/4 | 0 | 0 | 0 | NO | N | N | N | N |
| 5 | May-09 | 1987/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 6 | Jun-09 | 1987/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 7 | Jul-09 | 1987/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 8 | Aug-09 | 1987/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 9 | Sep-09 | 1987/9 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 10 | Oct-09 | 1987/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 11 | Nov-09 | 1987/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 12 | Dec-09 | 1987/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 13 | Jan-10 | 1988/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 14 | Feb-10 | 1988/2 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 15 | Mar-10 | 1988/3 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 16 | Apr-10 | 1988/4 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 17 | May-10 | 1988/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 18 | Jun-10 | 1988/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 19 | Jul-10 | 1988/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 20 | Aug-10 | 1988/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 21 | Sep-10 | 1988/9 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 22 | Oct-10 | 1988/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 23 | Nov-10 | 1988/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 24 | Dec-10 | 1988/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 25 | Jan-11 | 1989/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 26 | Feb-11 | 1989/2 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 27 | Mar-11 | 1989/3 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 28 | Apr-11 | 1989/4 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 29 | May-11 | 1989/5 | 0 | 0 | 0 | YES | N | N | Y | Y |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| 30 | Jun-11 | 1989/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 31 | Jul-11 | 1989/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 32 | Aug-11 | 1989/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 33 | Sep-11 | 1989/9 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 34 | Oct-11 | 1989/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 35 | Nov-11 | 1989/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 36 | Dec-11 | 1989/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 37 | Jan-12 | 1990/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 38 | Feb-12 | 1990/2 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 39 | Mar-12 | 1990/3 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 40 | Apr-12 | 1990/4 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 41 | May-12 | 1990/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 42 | Jun-12 | 1990/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 43 | Jul-12 | 1990/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 44 | Aug-12 | 1990/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 45 | Sep-12 | 1990/9 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 46 | Oct-12 | 1990/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 47 | Nov-12 | 1990/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 48 | Dec-12 | 1990/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 49 | Jan-13 | 1991/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 50 | Feb-13 | 1991/2 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 51 | Mar-13 | 1991/3 | 280 | 182 | 98 | NO | Y | Y | N | N |
| 52 | Apr-13 | 1991/4 | 100 | 65 | 35 | NO | Y | Y | N | N |
| 53 | May-13 | 1991/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 54 | Jun-13 | 1991/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 55 | Jul-13 | 1991/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 56 | Aug-13 | 1991/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 57 | Sep-13 | 1991/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 58 | Oct-13 | 1991/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 59 | Nov-13 | 1991/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 60 | Dec-13 | 1991/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 61 | Jan-14 | 1992/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 62 | Feb-14 | 1992/2 | 380 | 247 | 133 | NO | Y | Y | N | N |
| 63 | Mar-14 | 1992/3 | 480 | 312 | 168 | NO | Y | Y | N | N |
| 64 | Apr-14 | 1992/4 | 0 | 0 | 0 | NO | N | N | N | N |
| 65 | May-14 | 1992/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 66 | Jun-14 | 1992/6 | 0 | 0 | 0 | YES | N | N | Y | Y |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| 67 | Jul-14 | 1992/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 68 | Aug-14 | 1992/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 69 | Sep-14 | 1992/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 70 | Oct-14 | 1992/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 71 | Nov-14 | 1992/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 72 | Dec-14 | 1992/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 73 | Jan-15 | 1993/1 | 520 | 338 | 182 | NO | Y | Y | N | N |
| 74 | Feb-15 | 1993/2 | 560 | 364 | 196 | NO | Y | Y | N | N |
| 75 | Mar-15 | 1993/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 76 | Apr-15 | 1993/4 | 540 | 351 | 189 | NO | Y | Y | N | N |
| 77 | May-15 | 1993/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 78 | Jun-15 | 1993/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 79 | Jul-15 | 1993/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 80 | Aug-15 | 1993/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 81 | Sep-15 | 1993/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 82 | Oct-15 | 1993/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 83 | Nov-15 | 1993/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 84 | Dec-15 | 1993/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 85 | Jan-16 | 1994/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 86 | Feb-16 | 1994/2 | 140 | 91 | 49 | NO | Y | Y | N | N |
| 87 | Mar-16 | 1994/3 | 0 | 0 | 0 | NO | N | N | N | N |
| 88 | Apr-16 | 1994/4 | 0 | 0 | 0 | NO | N | N | N | N |
| 89 | May-16 | 1994/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 90 | Jun-16 | 1994/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 91 | Jul-16 | 1994/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 92 | Aug-16 | 1994/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 93 | Sep-16 | 1994/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 94 | Oct-16 | 1994/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 95 | Nov-16 | 1994/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 96 | Dec-16 | 1994/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 97 | Jan-17 | 1995/1 | 480 | 312 | 168 | NO | Y | Y | N | N |
| 98 | Feb-17 | 1995/2 | 440 | 286 | 154 | NO | Y | Y | N | N |
| 99 | Mar-17 | 1995/3 | 580 | 377 | 203 | NO | Y | Y | N | N |
| 100 | Apr-17 | 1995/4 | 600 | 390 | 210 | NO | Y | Y | N | N |
| 101 | May-17 | 1995/5 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 102 | Jun-17 | 1995/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 103 | Jul-17 | 1995/7 | 0 | 0 | 0 | NO | N | N | N | N |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| 104 | Aug-17 | 1995/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 105 | Sep-17 | 1995/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 106 | Oct-17 | 1995/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 107 | Nov-17 | 1995/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 108 | Dec-17 | 1995/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 109 | Jan-18 | 1996/1 | 180 | 117 | 63 | NO | Y | Y | N | N |
| 110 | Feb-18 | 1996/2 | 580 | 377 | 203 | NO | Y | Y | N | N |
| 111 | Mar-18 | 1996/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 112 | Apr-18 | 1996/4 | 480 | 312 | 168 | NO | Y | Y | N | N |
| 113 | May-18 | 1996/5 | 60 | 39 | 21 | NO | Y | Y | N | N |
| 114 | Jun-18 | 1996/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 115 | Jul-18 | 1996/7 | 0 | 0 | 0 | NO | N | N | N | N |
| 116 | Aug-18 | 1996/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 117 | Sep-18 | 1996/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 118 | Oct-18 | 1996/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 119 | Nov-18 | 1996/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 120 | Dec-18 | 1996/12 | 360 | 234 | 126 | NO | Y | Y | N | N |
| 121 | Jan-19 | 1997/1 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 122 | Feb-19 | 1997/2 | 560 | 364 | 196 | NO | Y | Y | N | N |
| 123 | Mar-19 | 1997/3 | 100 | 65 | 35 | NO | Y | Y | N | N |
| 124 | Apr-19 | 1997/4 | 0 | 0 | 0 | NO | N | N | N | N |
| 125 | May-19 | 1997/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 126 | Jun-19 | 1997/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 127 | Jul-19 | 1997/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 128 | Aug-19 | 1997/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 129 | Sep-19 | 1997/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 130 | Oct-19 | 1997/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 131 | Nov-19 | 1997/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 132 | Dec-19 | 1997/12 | 120 | 78 | 42 | NO | Y | Y | N | N |
| 133 | Jan-20 | 1998/1 | 500 | 325 | 175 | NO | Y | Y | N | N |
| 134 | Feb-20 | 1998/2 | 560 | 364 | 196 | NO | Y | Y | N | N |
| 135 | Mar-20 | 1998/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 136 | Apr-20 | 1998/4 | 600 | 390 | 210 | NO | Y | Y | N | N |
| 137 | May-20 | 1998/5 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 138 | Jun-20 | 1998/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 139 | Jul-20 | 1998/7 | 0 | 0 | 0 | NO | N | N | N | N |
| 140 | Aug-20 | 1998/8 | 0 | 0 | 0 | NO | N | N | Y | Y |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| 141 | Sep-20 | 1998/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 142 | Oct-20 | 1998/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 143 | Nov-20 | 1998/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 144 | Dec-20 | 1998/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 145 | Jan-21 | 1999/1 | 100 | 65 | 35 | NO | Y | Y | N | N |
| 146 | Feb-21 | 1999/2 | 480 | 312 | 168 | NO | Y | Y | N | N |
| 147 | Mar-21 | 1999/3 | 440 | 286 | 154 | NO | Y | Y | N | N |
| 148 | Apr-21 | 1999/4 | 600 | 390 | 210 | NO | Y | Y | N | N |
| 149 | May-21 | 1999/5 | 300 | 195 | 105 | NO | Y | Y | N | N |
| 150 | Jun-21 | 1999/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 151 | Jul-21 | 1999/7 | 0 | 0 | 0 | NO | N | N | N | N |
| 152 | Aug-21 | 1999/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 153 | Sep-21 | 1999/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 154 | Oct-21 | 1999/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 155 | Nov-21 | 1999/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 156 | Dec-21 | 1999/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 157 | Jan-22 | 2000/1 | 180 | 117 | 63 | NO | Y | Y | N | N |
| 158 | Feb-22 | 2000/2 | 520 | 338 | 182 | NO | Y | Y | N | N |
| 159 | Mar-22 | 2000/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 160 | Apr-22 | 2000/4 | 320 | 208 | 112 | NO | Y | Y | N | N |
| 161 | May-22 | 2000/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 162 | Jun-22 | 2000/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 163 | Jul-22 | 2000/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 164 | Aug-22 | 2000/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 165 | Sep-22 | 2000/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 166 | Oct-22 | 2000/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 167 | Nov-22 | 2000/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 168 | Dec-22 | 2000/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 169 | Jan-23 | 2001/1 | 140 | 91 | 49 | NO | Y | Y | N | N |
| 170 | Feb-23 | 2001/2 | 340 | 221 | 119 | NO | Y | Y | N | N |
| 171 | Mar-23 | 2001/3 | 560 | 364 | 196 | NO | Y | Y | N | N |
| 172 | Apr-23 | 2001/4 | 180 | 117 | 63 | NO | Y | Y | N | N |
| 173 | May-23 | 2001/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 174 | Jun-23 | 2001/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 175 | Jul-23 | 2001/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 176 | Aug-23 | 2001/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 177 | Sep-23 | 2001/9 | 0 | 0 | 0 | NO | N | N | Y | Y |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| 178 | Oct-23 | 2001/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 179 | Nov-23 | 2001/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 180 | Dec-23 | 2001/12 | 220 | 143 | 77 | NO | Y | Y | N | N |
| 181 | Jan-24 | 2002/1 | 240 | 156 | 84 | NO | Y | Y | N | N |
| 182 | Feb-24 | 2002/2 | 0 | 0 | 0 | NO | N | N | N | N |
| 183 | Mar-24 | 2002/3 | 0 | 0 | 0 | NO | N | N | N | N |
| 184 | Apr-24 | 2002/4 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 185 | May-24 | 2002/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 186 | Jun-24 | 2002/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 187 | Jul-24 | 2002/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 188 | Aug-24 | 2002/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 189 | Sep-24 | 2002/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 190 | Oct-24 | 2002/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 191 | Nov-24 | 2002/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 192 | Dec-24 | 2002/12 | 340 | 221 | 119 | NO | Y | Y | N | N |
| 193 | Jan-25 | 2003/1 | 500 | 325 | 175 | NO | Y | Y | N | N |
| 194 | Feb-25 | 2003/2 | 0 | 0 | 0 | NO | N | N | N | N |
| 195 | Mar-25 | 2003/3 | 100 | 65 | 35 | NO | Y | Y | N | N |
| 196 | Apr-25 | 2003/4 | 360 | 234 | 126 | NO | Y | Y | N | N |
| 197 | May-25 | 2003/5 | 400 | 260 | 140 | NO | Y | Y | N | N |
| 198 | Jun-25 | 2003/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 199 | Jul-25 | 2003/7 | 0 | 0 | 0 | NO | N | N | N | N |
| 200 | Aug-25 | 2003/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 201 | Sep-25 | 2003/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 202 | Oct-25 | 2003/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 203 | Nov-25 | 2003/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 204 | Dec-25 | 2003/12 | 40 | 26 | 14 | NO | Y | Y | N | N |
| 205 | Jan-26 | 2004/1 | 100 | 65 | 35 | NO | Y | Y | N | N |
| 206 | Feb-26 | 2004/2 | 280 | 182 | 98 | NO | Y | Y | N | N |
| 207 | Mar-26 | 2004/3 | 300 | 195 | 105 | NO | Y | Y | N | N |
| 208 | Apr-26 | 2004/4 | 0 | 0 | 0 | NO | N | N | N | N |
| 209 | May-26 | 2004/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 210 | Jun-26 | 2004/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 211 | Jul-26 | 2004/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 212 | Aug-26 | 2004/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 213 | Sep-26 | 2004/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 214 | Oct-26 | 2004/10 | 0 | 0 | 0 | NO | N | N | Y | Y |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| 215 | Nov-26 | 2004/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 216 | Dec-26 | 2004/12 | 60 | 39 | 21 | NO | Y | Y | N | N |
| 217 | Jan-27 | 2005/1 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 218 | Feb-27 | 2005/2 | 560 | 364 | 196 | NO | Y | Y | N | N |
| 219 | Mar-27 | 2005/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 220 | Apr-27 | 2005/4 | 600 | 390 | 210 | NO | Y | Y | N | N |
| 221 | May-27 | 2005/5 | 460 | 299 | 161 | NO | Y | Y | N | N |
| 222 | Jun-27 | 2005/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 223 | Jul-27 | 2005/7 | 0 | 0 | 0 | NO | N | N | N | N |
| 224 | Aug-27 | 2005/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 225 | Sep-27 | 2005/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 226 | Oct-27 | 2005/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 227 | Nov-27 | 2005/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 228 | Dec-27 | 2005/12 | 20 | 13 | 7 | NO | Y | Y | N | N |
| 229 | Jan-28 | 2006/1 | 400 | 260 | 140 | NO | Y | Y | N | N |
| 230 | Feb-28 | 2006/2 | 40 | 26 | 14 | NO | Y | Y | N | N |
| 231 | Mar-28 | 2006/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 232 | Apr-28 | 2006/4 | 600 | 390 | 210 | NO | Y | Y | N | N |
| 233 | May-28 | 2006/5 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 234 | Jun-28 | 2006/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 235 | Jul-28 | 2006/7 | 0 | 0 | 0 | NO | N | N | N | N |
| 236 | Aug-28 | 2006/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 237 | Sep-28 | 2006/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 238 | Oct-28 | 2006/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 239 | Nov-28 | 2006/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 240 | Dec-28 | 2006/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 241 | Jan-29 | 2007/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 242 | Feb-29 | 2007/2 | 40 | 26 | 14 | NO | Y | Y | N | N |
| 243 | Mar-29 | 2007/3 | 40 | 26 | 14 | NO | Y | Y | N | N |
| 244 | Apr-29 | 2007/4 | 0 | 0 | 0 | NO | N | N | N | N |
| 245 | May-29 | 2007/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 246 | Jun-29 | 2007/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 247 | Jul-29 | 2007/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 248 | Aug-29 | 2007/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 249 | Sep-29 | 2007/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 250 | Oct-29 | 2007/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 251 | Nov-29 | 2007/11 | 0 | 0 | 0 | YES | N | N | Y | Y |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| 252 | Dec-29 | 2007/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 253 | Jan-30 | 2008/1 | 200 | 130 | 70 | NO | Y | Y | N | N |
| 254 | Feb-30 | 2008/2 | 500 | 325 | 175 | NO | Y | Y | N | N |
| 255 | Mar-30 | 2008/3 | 260 | 169 | 91 | NO | Y | Y | N | N |
| 256 | Apr-30 | 2008/4 | 0 | 0 | 0 | NO | N | N | N | N |
| 257 | May-30 | 2008/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 258 | Jun-30 | 2008/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 259 | Jul-30 | 2008/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 260 | Aug-30 | 2008/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 261 | Sep-30 | 2008/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 262 | Oct-30 | 2008/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 263 | Nov-30 | 2008/11 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 264 | Dec-30 | 2008/12 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 265 | Jan-31 | 1987/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 266 | Feb-31 | 1987/2 | 40 | 26 | 14 | NO | Y | Y | N | N |
| 267 | Mar-31 | 1987/3 | 0 | 0 | 0 | NO | N | N | N | N |
| 268 | Apr-31 | 1987/4 | 0 | 0 | 0 | NO | N | N | N | N |
| 269 | May-31 | 1987/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 270 | Jun-31 | 1987/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 271 | Jul-31 | 1987/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 272 | Aug-31 | 1987/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 273 | Sep-31 | 1987/9 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 274 | Oct-31 | 1987/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 275 | Nov-31 | 1987/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 276 | Dec-31 | 1987/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 277 | Jan-32 | 1988/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 278 | Feb-32 | 1988/2 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 279 | Mar-32 | 1988/3 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 280 | Apr-32 | 1988/4 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 281 | May-32 | 1988/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 282 | Jun-32 | 1988/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 283 | Jul-32 | 1988/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 284 | Aug-32 | 1988/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 285 | Sep-32 | 1988/9 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 286 | Oct-32 | 1988/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 287 | Nov-32 | 1988/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 288 | Dec-32 | 1988/12 | 0 | 0 | 0 | YES | N | N | Y | Y |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| 289 | Jan-33 | 1989/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 290 | Feb-33 | 1989/2 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 291 | Mar-33 | 1989/3 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 292 | Apr-33 | 1989/4 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 293 | May-33 | 1989/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 294 | Jun-33 | 1989/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 295 | Jul-33 | 1989/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 296 | Aug-33 | 1989/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 297 | Sep-33 | 1989/9 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 298 | Oct-33 | 1989/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 299 | Nov-33 | 1989/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 300 | Dec-33 | 1989/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 301 | Jan-34 | 1990/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 302 | Feb-34 | 1990/2 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 303 | Mar-34 | 1990/3 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 304 | Apr-34 | 1990/4 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 305 | May-34 | 1990/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 306 | Jun-34 | 1990/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 307 | Jul-34 | 1990/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 308 | Aug-34 | 1990/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 309 | Sep-34 | 1990/9 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 310 | Oct-34 | 1990/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 311 | Nov-34 | 1990/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 312 | Dec-34 | 1990/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 313 | Jan-35 | 1991/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 314 | Feb-35 | 1991/2 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 315 | Mar-35 | 1991/3 | 280 | 182 | 98 | NO | Y | Y | N | N |
| 316 | Apr-35 | 1991/4 | 100 | 65 | 35 | NO | Y | Y | N | N |
| 317 | May-35 | 1991/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 318 | Jun-35 | 1991/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 319 | Jul-35 | 1991/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 320 | Aug-35 | 1991/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 321 | Sep-35 | 1991/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 322 | Oct-35 | 1991/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 323 | Nov-35 | 1991/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 324 | Dec-35 | 1991/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 325 | Jan-36 | 1992/1 | 0 | 0 | 0 | YES | N | N | Y | Y |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| 326 | Feb-36 | 1992/2 | 380 | 247 | 133 | NO | Y | Y | N | N |
| 327 | Mar-36 | 1992/3 | 480 | 312 | 168 | NO | Y | Y | N | N |
| 328 | Apr-36 | 1992/4 | 0 | 0 | 0 | NO | N | N | N | N |
| 329 | May-36 | 1992/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 330 | Jun-36 | 1992/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 331 | Jul-36 | 1992/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 332 | Aug-36 | 1992/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 333 | Sep-36 | 1992/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 334 | Oct-36 | 1992/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 335 | Nov-36 | 1992/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 336 | Dec-36 | 1992/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 337 | Jan-37 | 1993/1 | 520 | 338 | 182 | NO | Y | Y | N | N |
| 338 | Feb-37 | 1993/2 | 560 | 364 | 196 | NO | Y | Y | N | N |
| 339 | Mar-37 | 1993/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 340 | Apr-37 | 1993/4 | 540 | 351 | 189 | NO | Y | Y | N | N |
| 341 | May-37 | 1993/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 342 | Jun-37 | 1993/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 343 | Jul-37 | 1993/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 344 | Aug-37 | 1993/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 345 | Sep-37 | 1993/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 346 | Oct-37 | 1993/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 347 | Nov-37 | 1993/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 348 | Dec-37 | 1993/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 349 | Jan-38 | 1994/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 350 | Feb-38 | 1994/2 | 140 | 91 | 49 | NO | Y | Y | N | N |
| 351 | Mar-38 | 1994/3 | 0 | 0 | 0 | NO | N | N | N | N |
| 352 | Apr-38 | 1994/4 | 0 | 0 | 0 | NO | N | N | N | N |
| 353 | May-38 | 1994/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 354 | Jun-38 | 1994/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 355 | Jul-38 | 1994/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 356 | Aug-38 | 1994/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 357 | Sep-38 | 1994/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 358 | Oct-38 | 1994/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 359 | Nov-38 | 1994/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 360 | Dec-38 | 1994/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 361 | Jan-39 | 1995/1 | 480 | 312 | 168 | NO | Y | Y | N | N |
| 362 | Feb-39 | 1995/2 | 440 | 286 | 154 | NO | Y | Y | N | N |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| 363 | Mar-39 | 1995/3 | 580 | 377 | 203 | NO | Y | Y | N | N |
| 364 | Apr-39 | 1995/4 | 600 | 390 | 210 | NO | Y | Y | N | N |
| 365 | May-39 | 1995/5 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 366 | Jun-39 | 1995/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 367 | Jul-39 | 1995/7 | 0 | 0 | 0 | NO | N | N | N | N |
| 368 | Aug-39 | 1995/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 369 | Sep-39 | 1995/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 370 | Oct-39 | 1995/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 371 | Nov-39 | 1995/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 372 | Dec-39 | 1995/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 373 | Jan-40 | 1996/1 | 180 | 117 | 63 | NO | Y | Y | N | N |
| 374 | Feb-40 | 1996/2 | 580 | 377 | 203 | NO | Y | Y | N | N |
| 375 | Mar-40 | 1996/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 376 | Apr-40 | 1996/4 | 480 | 312 | 168 | NO | Y | Y | N | N |
| 377 | May-40 | 1996/5 | 60 | 39 | 21 | NO | Y | Y | N | N |
| 378 | Jun-40 | 1996/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 379 | Jul-40 | 1996/7 | 0 | 0 | 0 | NO | N | N | N | N |
| 380 | Aug-40 | 1996/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 381 | Sep-40 | 1996/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 382 | Oct-40 | 1996/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 383 | Nov-40 | 1996/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 384 | Dec-40 | 1996/12 | 360 | 234 | 126 | NO | Y | Y | N | N |
| 385 | Jan-41 | 1997/1 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 386 | Feb-41 | 1997/2 | 560 | 364 | 196 | NO | Y | Y | N | N |
| 387 | Mar-41 | 1997/3 | 100 | 65 | 35 | NO | Y | Y | N | N |
| 388 | Apr-41 | 1997/4 | 0 | 0 | 0 | NO | N | N | N | N |
| 389 | May-41 | 1997/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 390 | Jun-41 | 1997/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 391 | Jul-41 | 1997/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 392 | Aug-41 | 1997/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 393 | Sep-41 | 1997/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 394 | Oct-41 | 1997/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 395 | Nov-41 | 1997/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 396 | Dec-41 | 1997/12 | 120 | 78 | 42 | NO | Y | Y | N | N |

# APPENDIX D

## Todd Groundwater

## Groundwater Quality Analytical Program – Laboratory Summary
## Tables D-1 and D-1A through D-1P

## Table D-1: Groundwater Quality Analytical Program - Laboratory Summary

| Laboratory | Analytes | Tables |
|---|---|---|
| Alpha Analytical Laboratory | Anions | D-1A |
| Alpha Analytical Laboratory/McCampbell Analytical | Metals (Including Major Cations) and Cr(VI) | D-1B |
| Alpha Analytical Laboratory | Conventional Chemistry and Other Parameters | D-1C |
| Alpha Analytical Laboratory | Chlorinated Pesticides and PCBs | D-1D |
| Alpha Analytical Laboratory | Nitrogen and Phosphorus Pesticides | D-1E |
| Alpha Analytical Laboratory | Organic Analytes | D-1F |
| Alpha Analytical Laboratory | Chlorinated Acids | D-1G |
| Alpha Analytical Laboratory | Carbamates | D-1H |
| Alpha Analytical Laboratory | Other Organic Compounds | D-1I |
| Alpha Analytical Laboratory | Volatile Organic Compounds (VOCs) | D-1J |
| Alpha Analytical Laboratory UL Laboratory and Pace Analytical | Semivolatile Organic Compounds (VOCs)+Dioxin | D-1K |
| Alpha Analytical Laboratory | Haloacetic Acids | D-1L |
| ALS Environmental | Nitroaromatics and Nitramines (Explosives) | D-1M |
| Weck Laboratories, Inc. | Pharmaceuticals and Personal Care Products (PPCPs) | D-1N |
| UL Laboratory and GEL Laboratories | Radiogenic: Gross Alpha, Beta; Radium 226 and 228, Strontium 90 | D-1O |
| ZyMax Forensics | Stable Isotopes of oxygen and hydrogen in water, nitrogen and oxygen in nitrate | D-1P |
| Asbestos TEM Laboratories, Inc. | Asbestos | D-1C |
| Isotech | Tritium (enriched) | D-1O |

**Notes:**
For abbreviation explanations see notes at end of Table D-1P.

Table D-1A: Anions

| Analyte | Method | MDL | City of Seaside 4 | FO-7 Deep | FO-7 Shallow | MRWPCA MW-1 | PRTIW Mission Memorial | ASR MW-1 | Regulatory Requirements | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | mg/L | | | | | | | | Type |
| Bicarbonate ($HCO_3^-$) | SM2320B | 0.060 | 66 | 210 | 68 | 70 | 130 | 270 | – | – |
| Bromate ($BrO_3^-$) | EPA 300.1 | 0.005 | ND | ND | ND | ND | ND | ND | 0.010 | CSMCL-ESMCL |
| Chloride ($Cl^-$) | EPA 300.0 | 0.30 | 59 | 100 | 44 | 79 | 86 | 120 | 250 | CSMCL-ESMCL |
| Chlorite ($ClO_2^-$) | EPA 300.0 | 0.020 | ND | ND | ND | ND | ND | ND | 1.0 | CSMCL-ESMCL |
| Fluoride ($F^-$) | EPA 300.0 | 0.070 | ND | ND | ND | ND | ND | 0.15 | 2.0/4.0 | CPMCL/EPMCL |
| Nitrite as N | EPA 300.0 | 0.02 | ND | ND | ND | ND | ND | ND | 1.0 | CPMCL/EPMCL |
| Nitrate as $NO_3^-$ | EPA 300.0 | 0.20 | 13 | 0.60 | 2.4 | 2.7 | 11 | 0.42 | 45 | CPMCL/EPMCL |
| Sulfate ($SO_4^{2-}$) | EPA 300.0 | 0.090 | 14 | 24 | 13 | 9.9 | 89 | 73 | 250 | CPMCL/EPMCL |

## Table D-1B: Metals (Including Major Cations)

| Analyte | Method | Units | MDL | City of Seaside 4 | FO-7**** Deep | FO-7**** Shallow | MRWPCA MW-1**** | PRTIW Mission Memorial | ASR MW-1 | Regulatory Requirements | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Aluminum (Al) | EPA 200.8 | µg/L | 8.0 | ND | 170**** | 3,700**** | 2,700**** | 4.3 | 4.8 | 1,000/200 | CPMCL/CMCL |
| Antimony (Sb) | EPA 200.8 | µg/L | 0.080 | ND | 0.75 | 3.7 | 0.51 | 0.033 | 0.34 | 6 | CPMCL-EPMCL |
| Arsenic (As) | EPA 200.8 | µg/L | 0.28 | 1.2 | 7.6**** | 210**** | 2.8**** | 1.6 | 1.6 | 10 | CPMCL-EPMCL |
| Barium (Ba) | EPA 200.8 | µg/L | 0.12 | 26 | 72**** | 1,200**** | 40**** | 59 | 66 | 1,000/2000 | CPMCL/EPMCL |
| Beryllium (Be) (Total) | EPA 200.8 | µg/L | 0.080 | ND | ND | 0.68 | 0.044 | ND | ND | 4 | CPMCL-EPMCL |
| Boron (B) | EPA 200.8 | µg/L | 24 | 42*** | 140*** | 25*** | 36*** | 32*** | 90*** | – | – |
| Cadmium (Cd) Total | EPA 200.8 | µg/L | 0.080 | ND | ND | 3.3 | 0.15 | 0.10 | 0.51 | 5 | CPMCL-EPMCL |
| Calcium (Ca) Total | EPA 200.7 | mg/L | 0.010 | 14 | 53 | 29 | 17 | 37 | 76 | – | – |
| Chromium (Cr) Total | EPA 200.8 | µg/L | 0.32 | 3.6 | 1.7 | 790**** | 13**** | 3.4 | ND | 50/100 | CPMCL/CMCL |
| Cr(VI) | EPA 218.6 | µg/L | 0.050* | 3.4 | ND | 1.7 | 1.1 | 1.6 | ND | 10 | CPMCL** |
| Copper (Cu) Total | EPA 200.8 | µg/L | 0.16 | 1.1 | 1.6 | 14**** | 3.7 | 1.9 | 4.3 | 1,300/1,000 | CPMCL-EPMCL/ CSMCL-ESMCL |
| Iron (Fe) Total | EPA 200.8 | µg/L | 7.2 | ND | 1100**** | 80,000**** | 4,000**** | 67 | 21 | 300 | CSMCL-ESMCL |
| Lead (Pb) Total | EPA 200.8 | µg/L | 0.080 | ND | 1.3**** | 42**** | 1.3**** | 0.061 | 0.78 | 15 | CPMCL-EPMCL |
| Magnesium (Mg) Total | EPA 200.7 | mg/L | 0.0080 | 6.5 | 6.8 | 3.8 | 6.5 | 10 | 22 | – | CPMCL-EPMCL |
| Manganese (Mn) Total | EPA 200.8 | µg/L | 0.12 | 0.25 | 83**** | 20,000**** | 150**** | 1.1 | 23 | 50 | CSMCL-ESMCL |
| Mercury (Hg) Total | EPA 245.1 | µg/L | 0.060 | ND | ND | 0.11 | ND | ND | 0.85 | 2 | CPMCL-EPMCL |
| Nickel (Ni) Total | EPA 200.8 | µg/L | 0.24 | 0.54 | 2.8**** | 26**** | 8.1**** | 1.3 | 4.0 | 100 | CPMCLC |
| Potassium (Total) | EPA 200.7 | mg/L | 0.0080 | 2.0 | 3.7 | 3.6 | 3.4 | 3.1 | 5.1 | – | – |
| Selenium (Se) Total | EPA 200.8 | µg/L | 0.28 | 0.66*** | 1.8 | 1.3*** | 1.5*** | 2.2 | 1.8*** | 50 | CPMCL-EPMCL |
| Silver (Ag) Total | EPA 200.8 | µg/L | 0.080 | ND | ND | 0.11 | 0.028 | ND | ND | 2 | CPMCL-EPMCL |
| Sodium (Na) Total | EPA 200.7 | mg/L | 0.020 | 43 | 86 | 38 | 50 | 64 | 91 | – | – |
| Thallium (Tl) | EPA 200.8 | µg/L | 0.080 | ND | ND | 0.19 | 0.027 | 0.045 | ND | 2 | CPMCL-EPMCL |
| Uranium (U) | EPA 200.8 | pCi/l | 0.080 | ND | 1.6 | 0.62 | 0.33 | 0.20 | 1.3 | 20 | CPMCL |
| Vanadium (V) | EPA 200.8 | µg/L | 1.2 | 2.5 | 5.8**** | 34**** | 9.5**** | 1.6 | 0.76 | – | – |
| Zinc (Zn) | EPA 200.8 | µg/L | 2.0 | 2.9 | 52*** | 300*** | 69*** | 75*** | 25*** | 5,000 | CPMCL-EPMCL |

**Notes:** * Reporting Level or RL. ** Proposed April 15, 2014. *** Reported in laboratory blank. ****Analysis questionable due to high turbidity (see Table D-1C)

## Table D-1C: Conventional Chemistry and Other Parameters

| Analyte | Method | Units | MDL | City of Seaside 4 | FO-7 Deep | FO-7 Shallow | MRWPCA MW-1 | PRTIW Mission Memorial | ASR MW-1 | Regulatory Requirement | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Concentration | | | | | | | | Type |
| Asbestos by TEM (chrysotile/amphibole)* | EPA 100.2 | MFL | 0.1-1.1 | ND | ND | ND | ND | ND | ND | 7.0 | CSMCL-ESMCL |
| Bicarbonate ($HCO3^-$) | SM2320B | mg/L | 0.060 | 66 | 210 | 68 | 70 | 130 | 270 | – | – |
| Color | SM2120B | Color Units | 3.0 | ND | 4.0 | 4.0 | 28 | 6.0 | 3.0 | 15 | CSMCL |
| MBAS, calculated as LAS, mw 340 | SM5540C | mg/L | 0.030 | ND | ND | ND | ND | ND | ND | 5.0 | CSMCL-ESMCL |
| Odor | EPA 140.1 | T.O.N. | | ND | ND | ND | 1.4 | ND | ND | 3 | CSMCL-ESMCL |
| Perchlorate ($ClO_4^-$) | EPA 314.0 | µg/L | 0.90 | ND** | 1.9** | ND** | ND** | 1.1** | ND** | 6.0 | CPMCL |
| Specific Conductance (EC) | SM2510B | µmhos/cm or µS/cm | 1.0 | 340 | 660 | 280 | 270 | 440 | 900 | 900 | CSMCL |
| Total Dissolved Solids (TDS) | SM2540C | mg/L | 5.0 | 250 | 460 | 190 | 220 | 350 | 560 | 500 | CSMCL-ESMCL |
| Turbidity | SM2130B | NTU | 0.040 | 0.32 | 10 | 550 | 71 | 0.98 | 0.37 | 1/5 | CPMCL-EPMCL/ CSMCL-ESMCL |
| Nitrate + Nitrite as N | EPA 300.0 | mg/L | 0.0086 | 3.0 | 0.13 | 0.55 | 0.61 | 2.4 | 0.094 | 10 | CSMCL-ESMCL |
| Total Organic Carbon (TOC) | SM5310C | mg/L | 0.100 | 0.274 | 0.190 | 0.768 | 0.898** | 0.519** | 0.627 | – | – |
| Cyanide ($CN^-$) | 10-204-00-1X | mg/L | 0.0020 | 0.0028 | 0.0023 | ND | ND | ND | ND | 0.15/0.20 | CPMCL/EPMCL |

**Note:**
* Calculated asbestos structures >10 micrometers (µm)
** Detected in Laboratory Blank

Table D-1D: Chlorinated Pesticides and PCBs

| Analyte | Method | MDL | City of Seaside 4 | FO-7 Deep | FO-7 Shallow | MRWPCA MW-1 | PRTIW Mission Memorial | ASR MW-1 | Regulatory Requirements | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | µg/L | | | | | | | | Type |
| Aldrin | EPA 508 | 0.10 | ND | ND | ND | ND | ND | ND | – | – |
| Chloroneb | EPA 508 | 0.20 | ND | ND | ND | ND | ND | ND | – | – |
| Chlorbenzilate | EPA 508 | 2.0 | ND | ND | ND | ND | ND | ND | – | – |
| Chlorothalonil | EPA 508 | 0.030 | ND | ND | ND | ND | ND | ND | – | – |
| DCPA | EPA 508 | 0.020 | ND | ND | ND | ND | ND | ND | | |
| 4,4'-DDD | EPA 508 | 0.020 | ND | ND | ND | ND | ND | ND | – | – |
| 4,4'-DDE | EPA 508 | 0.020 | ND | ND | ND | ND | ND | ND | – | – |
| 4,4'-DDT | EPA 508 | 0.020 | ND | ND | ND | ND | ND | ND | – | – |
| Dieldrin | EPA 508 | 0.010 | ND | ND | ND | ND | ND | ND | – | – |
| Endosulfan I | EPA 508 | 0.020 | ND | ND | ND | ND | ND | ND | – | – |
| Endosulfan II | EPA 508 | 0.020 | ND | ND | ND | ND | ND | ND | – | – |
| Endosulfan sulfate | EPA 508 | 0.020 | ND | ND | ND | ND | ND | ND | – | – |
| Endrin | EPA 508 | 0.030 | ND | ND | ND | ND | ND | ND | 2.0 | CPMCL-EPMCL |
| Endrin aldehyde | EPA 508 | 0.020 | ND | ND | ND | ND | ND | ND | – | – |
| HCH-alpha (α-BHC) | EPA 508 | 0.010 | ND | ND | ND | ND | ND | ND | – | – |
| HCH-beta (β-BHC) | EPA 508 | 0.020 | ND | ND | ND | ND | ND | ND | – | – |
| HCH-delta (δ-BHC) | EPA 508 | 0.030 | ND | ND | ND | ND | ND | ND | – | – |
| HCH-gamma (γ-BHC) (Lindane) | EPA 508 | 0.010 | ND | ND | ND | ND | ND | ND | 0.2 | CPMCL-EPMCL |
| Heptachlor | EPA 508 | 0.010 | ND | ND | ND | ND | ND | ND | 0.01/0.4 | CPMCL/EPMCL |
| Heptachlor epoxide | EPA 508 | 0.010 | ND | ND | ND | ND | ND | ND | 0.01/0.2 | CPMCL/EPMCL |

Table 1D: Chlorinated Pesticides and PCBs (continued)

| Analyte | Method | MDL | City of Seaside 4 | FO-7 Deep | FO-7 Shallow | MRWPCA MW-1 | PRTIW Mission Memorial | ASR MW-1 | Regulatory Requirements | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | µg/L | | | | | | | | Type |
| Hexachlorobenzene | EPA 508 | 0.010 | ND | ND | ND | ND | ND | ND | 1.0 | CPMCL-EPMCL |
| Hexachlorocyclo-pentadiene | EPA 508 | 0.040 | ND | ND | ND | ND | ND | ND | 50 | CPMCL-EPMCL |
| Methoxychlor | EPA 508 | 0.020 | ND | ND | ND | ND | ND | ND | 30/40 | CPMCL/EPMCL |
| cis-Permethrin | EPA 508 | 0.070 | ND | ND | ND | ND | ND | ND | – | – |
| trans-Permethrin | EPA 508 | 0.090 | ND | ND | ND | ND | ND | ND | – | – |
| Propachlor | EPA 508 | 0.070 | ND | ND | ND | ND | ND | ND | – | – |
| Trifluralin | EPA 508 | 0.020 | ND | ND | ND | ND | ND | ND | – | – |
| PCB (Aroclor)-1016 | EPA 508 | 0.030 | ND | ND | ND | ND | ND | ND | 0.5 | CPMCL-EPMCL |
| PCB (Aroclor)-1221 | EPA 508 | 0.030 | ND | ND | ND | ND | ND | ND | 0.5 | CPMCL-EPMCL |
| PCB (Aroclor)-1232 | EPA 508 | 0.030 | ND | ND | ND | ND | ND | ND | 0.5 | CPMCL-EPMCL |
| PCB (Aroclor)-1242 | EPA 508 | 0.030 | ND | ND | ND | ND | ND | ND | 0.5 | CPMCL-EPMCL |
| PCB (Aroclor)-1248 | EPA 508 | 0.030 | ND | ND | ND | ND | ND | ND | 0.5 | CPMCL-EPMCL |
| PCB (Aroclor)-1254 | EPA 508 | 0.030 | ND | ND | ND | ND | ND | ND | 0.5 | CPMCL-EPMCL |
| PCB -(Aroclor)1260 | EPA 508 | 0.030 | ND | ND | ND | ND | ND | ND | 0.5 | CPMCL-EPMCL |
| Total PCBs | EPA 508 | 0.30 | ND | ND | ND | ND | ND | ND | 0.5 | CPMCL-EPMCL |
| Toxaphene | EPA 508 | 0.40 | ND | ND | ND | ND | ND | ND | 3 | CPMCL-EPMCL |
| Chlordane (tech) | EPA 508 | 0.030 | ND | ND | ND | ND | ND | ND | 0.1/2 | CPMCL/EPMCL |

## Table D-1E: Nitrogen and Phosphorus Pesticides

| Analyte | Method | MDL | City of Seaside 4 | FO-07 Deep | FO-07 Shallow | MRWPCA MW-1 | PRTIW Mission Memorial | ASR MW-1 | Regulatory Requirements | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | µg/L | | | | | | | | Type |
| Alachlor | EPA 507 | 0.50 | ND | ND | ND | ND | ND | ND | 2.0 | CPMCL-EPMCL |
| Atrazine | EPA 507 | 0.30 | ND | ND | ND | ND | ND | ND | – | – |
| Bromacil | EPA 507 | 0.50 | ND | ND | ND | ND | ND | ND | – | – |
| Butachlor | EPA 507 | 0.40 | ND | ND | ND | ND | ND | ND | – | – |
| Dimethoate | EPA 507 | 0.20 | ND | ND | ND | ND | ND | ND | – | – |
| Metolachlor | EPA 507 | 0.30 | ND | ND | ND | ND | ND | ND | – | – |
| Metribuzin | EPA 507 | 0.40 | ND | ND | ND | ND | ND | ND | – | – |
| Molinate | EPA 507 | 0.20 | ND | ND | ND | ND | ND | ND | 20 | CPMCL |
| Prometryn | EPA 507 | 0.50 | ND | ND | ND | ND | ND | ND | – | – |
| Propachlor | EPA 507 | 0.30 | ND | ND | ND | ND | ND | ND | – | – |
| Simazine | EPA 507 | 0.30 | ND | ND | ND | ND | ND | ND | 4.0 | CPMCL-EPMCL |
| Thiobencarb | EPA 507 | 0.20 | ND | ND | ND | ND | ND | ND | 70/1 | CPMCL/CSMCL |

Table D-1F: Organic Analytes

| Analyte | Method | MDL | City of Seaside 4 | FO-07 Deep | FO-07 Shallow | MRWPCA MW-1 | PRTIW Mission Memorial | ASR MW-1 | Regulatory Requirements | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | µg/L | | | | | | | | Type |
| 1,2-Dibromo-3-chloropropane | EPA 504.1 | 0.0040 | ND | ND | ND | ND | ND | ND | 0.2 | CPMCL-EPMCL |
| 1,2-Dibromoethane (EDB) | EPA 504.1 | 0.0050 | ND | ND | ND | ND | ND | ND | 0.5 | CPMCL-EPMCL |

## Table D-1G: Chlorinated Acids

| Analyte | Method | MDL | City of Seaside 4 | FO-7 Deep | FO-7 Shallow | MRWPCA MW-1 | PRTIW Mission Memorial | ASR MW-1 | Regulatory Requirements | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | µg/L | | | | | | | | Type |
| 2,4,5-T | EPA 515.1 | 0.40 | ND | ND | ND | ND | ND | ND | – | – |
| 2,4,5-TP (Silvex) | EPA 515.1 | 0.50 | ND | ND | ND | ND | ND | ND | | |
| 2,4-D | EPA 515.1 | 0.80 | ND | ND | ND | ND | ND | ND | – | – |
| 2,4-DB | EPA 515.1 | 4.0 | ND | ND | ND | ND | ND | ND | – | – |
| 4-Nitrophenol | EPA 515.1 | 0.70 | ND | ND | ND | ND | ND | ND | – | – |
| Acifluorfen | EPA 515.1 | 0.50 | ND | ND | ND | ND | ND | ND | – | – |
| Bentazon | EPA 515.1 | 0.40 | ND | ND | ND | ND | ND | ND | 18 | CPMCL |
| Dicamba | EPA 515.1 | 0.40 | ND | ND | ND | ND | ND | ND | – | – |
| Dichlorprop | EPA 515.1 | 1.0 | ND | ND | ND | ND | ND | ND | – | – |
| Dinoseb | EPA 515.1 | 0.80 | ND | ND | ND | ND | ND | ND | 7 | CPMCL-EPMCL |
| Pentachlorophenol | EPA 515.1 | 0.20 | ND | ND | ND | ND | ND | ND | 1 | CPMCL-EPMCL |
| Picloram | EPA 515.1 | 0.50 | ND | ND | ND | ND | ND | ND | 500 | CPMCL-EPMCL |

## Table D-1H: Carbamates

| Analyte | Method | MDL | City of Seaside 4 | FO-7 Deep | FO-7 Shallow | MRWPCA MW-1 | PRTIW Mission Memorial | ASR MW-1 | Regulatory Requirements | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | µg/L | | | | | | | | Type |
| 3-Hydroxycarbofuran | EPA 531.1 | 0.90 | ND | ND | ND | ND | ND | ND | – | – |
| Aldicarb | EPA 531.1 | 0.70 | ND | ND | ND | ND | ND | ND | 3 | EPMCL |
| Aldicarb sulfone | EPA 531.1 | 0.70 | ND | ND | ND | ND | ND | ND | 3 | EPMCL |
| Aldicarb sulfoxide | EPA 531.1 | 0.80 | ND | ND | ND | ND | ND | ND | 4 | EPMCL |
| Carbaryl | EPA 531.1 | 0.70 | ND | ND | ND | ND | ND | ND | – | – |
| Carbofuran | EPA 531.1 | 2.0 | ND | ND | ND | ND | ND | ND | 18/40 | CPMCL/EPMCL |
| Methiocarb | EPA 531.1 | 2.0 | ND | ND | ND | ND | ND | ND | – | – |
| Methomyl | EPA 531.1 | 2.0 | ND | ND | ND | ND | ND | ND | – | – |
| Oxamyl | EPA 531.1 | 0.80 | ND | ND | ND | ND | ND | ND | 50/200 | CPMCL/EPMCL |
| Propoxur (Baygon) | EPA 531.1 | 2.0 | ND | ND | ND | ND | ND | ND | – | – |

## Table D-1I: Other Organic Compounds

| Analyte | Method | MDL | City of Seaside 4 | FO-7 Deep | FO-7 Shallow | MRWPCA MW-1 | PRTIW Mission Memorial | ASR MW-1 | Regulatory Requirements | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | µg/L | | | | | | | | Type |
| Diquat | EPA 549.2 | 2.0 | ND | ND | ND | ND | ND | ND | 20 | CPMCL-EPMCL |
| Endothall | EPA 548.1 | 2.0 | ND | ND | ND | ND | ND | ND | 100 | CPMCL-EPMCL |
| Glyphosate | EPA 547 | 3.0 | ND | ND | ND | ND | ND | ND | 700 | CPMCL-EPMCL |

## Table D-1J: Volatile Organic Compounds (VOCs)

| Analyte | Method | MDL | City of Seaside 4 | FO-7 Deep | FO-7 Shallow | MRWPCA MW-1 | PRTIW Mission Memorial | ASR MW-1 | Regulatory Requirements | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | µg/L | | | | | | | | Type |
| Acetone | EPA 524.2 | 0.80 | ND | ND | 2.0 | ND | ND | ND | – | – |
| Acrylonitrile | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | – | – |
| Benzene | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | 1/5 | CPMCL/EPMCL |
| Bromobenzene | EPA 524.2 | 0.10 | ND | ND | ND | ND | ND | ND | – | – |
| Bromochloromethane | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | – | – |
| Bromodichloromethane | EPA 524.2 | 0.50 | ND | ND | ND | ND | ND | ND | 80 | CPMCL-EPMCL |
| Bromoform | EPA 524.2 | 0.50 | ND | ND | ND | ND | ND | ND | 80 | CPMCL-EPMCL |
| Bromomethane | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | – | – |
| n-Butylbenzene | EPA 524.2 | 0.10 | ND | ND | ND | ND | ND | ND | – | – |
| Sec-Butylbenzene | EPA 524.2 | 0.10 | ND | ND | ND | ND | ND | ND | 100/10 | CPMCL-EPMCL |
| Tert-Butylbenzene | EPA 524.2 | 0.10 | ND | ND | ND | ND | ND | ND | – | – |
| Carbon disulfide | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | – | – |
| Carbon tetrachloride | EPA 524.2 | 0.30 | ND | ND | ND | ND | ND | ND | 0.5/5 | CPMCL/EPMCL |
| Chlorobenzene | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | 70/100 | CPMCL/EPMCL |
| Chloroethane | EPA 524.2 | 0.10 | ND | ND | ND | ND | ND | ND | – | – |
| Chloroform | EPA 524.2 | 0.50 | ND | ND | ND | ND | 1.2 | 0.87 | 80 | CPMCL-EPMCL |
| Chloromethane | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | – | – |
| 2-Chlorotoluene | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | – | – |
| 4-Chlorotoluene | EPA 524.2 | 0.10 | ND | ND | ND | ND | ND | ND | – | – |
| Dibromochloromethane | EPA 524.2 | 0.50 | ND | ND | ND | ND | ND | ND | 80 | CPMCL-EPMCL |
| 1,2-Dibromo-3-chloropropane | EPA 524.2 | 0.36 | ND | ND | ND | ND | ND | ND | 0.2 | CPMCL-EPMCL |
| 1,2-Dibromethane (EDB) | EPA 524.2 | 0.14 | ND | ND | ND | ND | ND | ND | 0.05 | CPMCL-EPMCL |
| 1,2-Dichlorobenzene | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | 600 | CPMCL-EPMCL |
| 1,3-Dichlorobenzene | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | – | – |
| 1,4-Dichlorobenzene | EPA 524.2 | 0.10 | ND | ND | ND | ND | ND | ND | 5/75 | CPMCL/EPMCL |
| Trans-1,4-Dichloro-2-butene | EPA 524.2 | 0.095 | ND | ND | ND | ND | ND | ND | – | – |

Table D-1J: Volatile Organic Compounds (VOCs) (continued)

| Analyte | Method | MDL | City of Seaside 4 | FO-7 Deep | FO-7 Shallow | MRWPCA MW-1 | PRTIW Mission Memorial | ASR MW-1 | Regulatory Requirements | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | µg/L | | | | | | | | Type |
| Dichlorodifluoromethane | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | – | – |
| 1,1-Dichloroethane | EPA 524.2 | 0.10 | ND | ND | ND | ND | ND | ND | 5 | CPMCL |
| 1,2-Dichloroethane | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | 0.5/5 | CPMCL/EPMCL |
| 1,1-Dichloroethene | EPA 524.2 | 0.10 | ND | ND | ND | ND | ND | ND | 5 | CPMCL |
| Cis-1,2,-Dichloroethene | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | 6/70 | CPMCL/EPMCL |
| Trans-1,2-Dichloroethene | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | 10/100 | CPMCL/EPMCL |
| 1,2-Dichloropropane | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | 10/100 | CPMCL/EPMCL |
| 1,3-Dichloropropane | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | – | – |
| 2,2-Dichloropropane | EPA 524.2 | 0.10 | ND | ND | ND | ND | ND | ND | – | – |
| 1,1-Dichloropropene | EPA 524.2 | 0.10 | ND | ND | ND | ND | ND | ND | – | – |
| Cis-1,3-Dichloropropene | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | 0.5 | CPMCL |
| Trans-1,3,Dichloropropene | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | – | – |
| 1,3-Dichloropropene(total) | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | – | – |
| 2-Hexanone | EPA 524.2 | 0.097 | ND | ND | ND | ND | ND | ND | – | – |
| Ethylbenzene | EPA 524.2 | 0.10 | ND | ND | ND | ND | ND | ND | | |
| Hexachlorobuteadiene | EPA 524.2 | 0.30 | ND | ND | ND | ND | ND | ND | 1,200 | CPMCL |
| Isopropylbenzene | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | – | – |
| p-Isopropyltoluene | EPA 524.2 | 0.10 | ND | ND | ND | ND | ND | ND | – | – |
| Methyl ethyl ketone | EPA 524.2 | 0.40 | ND | ND | ND | ND | ND | ND | – | – |
| Methyl iodide | EPA 524.2 | 0.12 | ND | ND | ND | ND | ND | ND | – | – |
| Methyl isobutyl ketone | EPA 524.2 | 0.30 | ND | ND | ND | ND | ND | ND | – | – |
| Methylene chloride | EPA 524.2 | 0.40 | ND | ND | ND | ND | ND | ND | 5/5 | CPMCL/EPMCL |
| Naphthalene | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | – | – |
| n-Propylbenzene | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | – | – |
| Styrene | EPA 524.2 | 0.10 | ND | ND | ND | 0.18 | ND | ND | 100/100 | CPMCL/EPMCL |
| 1,1,1,2-Tetrachloroethane | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | – | – |
| 1,1,2,2-Tetrachloroethane | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | 1 | CPMCL |
| Tetrachloroethane | EPA 524.2 | 0.20 | ND | ND | ND | ND | 0.20 | ND | 5/5 | CPMCL/EPMCL |

Table D-1J: Volatile Organic Compounds (VOCs) (continued)

| Analyte | Method | MRL | City of Seaside 4 | FO-7 Deep | FO-7 Shallow | MRWPCA MW-1 | PRTIW Mission Memorial | ASR MW-1 | Regulatory Requirements | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | µg/L | | | | | | | | Type |
| Toluene | EPA 524.2 | 0.10 | ND | ND | ND | 2.0 | ND | ND | 150/1000 | CPMCL/EPMCL |
| 1,2,3-Trichlorobenzene | EPA 524.2 | 0.10 | ND | ND | ND | ND | ND | ND | – | – |
| 1,2,4-Trichlorobenzene | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | 5/70 | CPMCL/EPMCL |
| 1,1,1-Trichloroethane | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | 200/200 | CPMCL/EPMCL |
| 1,1,2-Trichloroethane | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | 5/5 | CPMCL/EPMCL |
| Trichloroethene | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | – | – |
| Trichlorofluoromethane | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | 150 | CPMCL |
| Trichlorotrifluoroethane | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | – | – |
| 1,2,3-Trichloropropane | EPA 524.2 | 0.13 | ND | ND | ND | ND | ND | ND | – | – |
| 1,2,4-Trimethylbenzene | EPA 524.2 | 0.10 | ND | ND | ND | ND | ND | ND | – | – |
| 1,3,5-Trimethylbenzene | EPA 524.2 | 0.10 | ND | ND | ND | ND | ND | ND | – | – |
| Vinyl chloride | EPA 524.2 | 0.10 | ND | ND | ND | ND | ND | ND | 0.5/2 | CPMCL/EPMCL |
| m,p-Xylene | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | – | – |
| o-Xylene | EPA 524.2 | 0.10 | ND | ND | ND | ND | ND | ND | – | – |
| Xylenes (total) | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | 1,750/10,000 | CPMCL/EPMCL |
| Trihalomethanes (total) | EPA 524.2 | 0.50 | ND | ND | ND | ND | 1.2 | 0.87 | – | – |
| Methyl tert-butyl ether | EPA 524.2 | 0.50 | ND | ND | ND | ND | ND | ND | – | – |
| Ethyl tert-butyl ether | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | – | – |
| Tert-amyl methyl ether | EPA 524.2 | 0.20 | ND | ND | ND | ND | ND | ND | – | – |

## Table D-1K: Semivolatile Organic Compounds (SVOCs)

| Analyte | Method | MRL | City of Seaside 4 | FO-7 Deep | FO-7 Shallow | MRWPCA MW-1 | PRTIW Mission Memorial | ASR MW-1 | Regulatory Requirements | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | µg/L | | | | | | | Type |
| Benzo (a) pyrene | EPA 525.2 | 0.080 | ND | ND | ND | ND | ND | ND | – | – |
| Di(2-ethylhexyl)adipate | EPA 525.2 | 0.40 | ND | ND | ND | ND | ND | ND | 400/400 | CPMCL/EPMCL |
| Di(2-ethylhexyl)phthalate | EPA 525.2 | 0.20 | ND | ND | ND | 0.29 | ND | ND | 4/6 | CPMCL/EPMCL |
| 2,3,7,8-Tetrachlorodibenzo-p-Dioxin* | EPA 1613 | 0.000005 | ND | ND | ND | ND | ND | ND | 0.00003 | CPMCL-EPMCL |

**Note:**
* Dioxin reported in pg/L; converted to µg/L

## Table D-1L: Haloacetic Acids

| Analyte | Methods | MRL | City of Seaside 4 | FO-07 Deep | FO-07 Shallow | MRWPCA MW-1 | PRTIW Mission Memorial | ASR MW-1 | Regulatory Requirement | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | µg/L | | | | | | | | Type |
| Monobromoacetic Acid | EPA 552.2 | 0.8 | ND | ND | ND | ND | ND | ND | 60 | CPMCL-EPMCL |
| Monochloroacetic Acid | EPA 552.2 | 1.1 | ND | ND | ND | ND | ND | ND | 60 | CPMCL-EPMCL |
| Dibromoacetic Acid | EPA 552.2 | 0.8 | ND | ND | ND | ND | ND | ND | 60 | CPMCL-EPMCL |
| Dichloroacetic Acid | EPA 552.2 | 1.0 | ND | ND | ND | ND | ND | ND | 60 | CPMCL-EPMCL |
| Trichloroacetic Acid | EPA 552.2 | 1.0 | ND | ND | ND | ND | ND | ND | 60 | CPMCL-EPMCL |
| Total Haloacetic Acids (HAA5) | EPA 552.2 | 1.0 | ND | ND | ND | ND | ND | ND | * | * |

**Note:**
* See individual analytes for regulatory requirements.

## Table D-1M: Nitroaromatics and Nitramines (Explosives)

| Analyte | Methods | MRL | City of Seaside 4 | FO-7 Deep | FO-7 Shallow | MRWPCA MW-1 | PRTIW Mission Memorial | ASR MW-1 | Regulatory Requirement | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | µg/L | | | | | | | | Type |
| HMX | 8330B | 0.098 | ND | ND | ND | ND | ND | ND | – | – |
| RDX | 8330B | 0.098 | ND | ND | ND | ND | ND | ND | – | – |
| 1,3,5-Trinitrobenzene | 8330B | 0.20 | ND | ND | ND | ND | ND | ND | – | – |
| 1,3-Dinitrobenzene | 8330B | 0.098 | ND | ND | ND | ND | ND | ND | – | – |
| 3,5-Dinitroaniline | 8330B | 0.098 | ND | ND | ND | ND | ND | ND | – | – |
| Tetryl | 8330B | 0.10 | ND | ND | ND | ND | ND | ND | – | – |
| Nitrobenzene | 8330B | 0.098 | ND | ND | ND | ND | ND | ND | – | – |
| 4-Amino-2,6-dinitrotoluene | 8330B | 0.098 | ND | ND | ND | ND | ND | ND | – | – |
| 2-Amino-4,6-dinitrotoluene | 8330B | 0.098 | ND | ND | ND | ND | ND | ND | – | – |
| 2,4,6-Trinitrotoluene | 8330B | 0.098 | ND | ND | ND | ND | ND | ND | – | – |
| 2,6-Dinitrotoluene | 8330B | 0.20 | ND | 0.064* | 0.070* | ND | ND | 0.037* | – | – |
| 2,4-Dinitrotoluene | 8330B | 0.098 | ND | ND | ND | ND | ND | ND | – | – |
| 2-Nitrotoluene | 8330B | 0.10 | ND | ND | ND | ND | ND | ND | – | – |
| 4-Nitrotoluene | 8330B | 0.098 | ND | ND | ND | ND | ND | ND | – | – |
| 3-Nitrotoluene | 8330B | 0.098 | ND | ND | ND | ND | ND | ND | – | – |
| Nitroglycerin | 8330B | 0.98 | ND | ND | ND | ND | ND | ND | – | – |
| Pentaerythritol Tetranitrate | 8330B | 0.49 | ND | ND | ND | ND | ND | ND | – | – |

**Note:**
***** Detected in laboratory blank sample; estimated J value.

## Table D-1N: Pharmaceutical and Personal Care Products (PPCPs)

| Analyte | Method | MRL | City of Seaside 4 | FO-7 Deep | FO-7 Shallow | MRWPCA MW-1 | PRTIW Mission | ASR MW-1 | Regulatory Requirements | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | µg/L | | | | | | | | Type |
| N-nitrosodiethylamine | EPA 1625M | 0.002 | ND | ND | NA | ND | ND | ND | – | – |
| N-nitrosodimethylamine | EPA 1625M | 0.002 | ND* | ND* | NA | ND | 0.0054 | ND | 0.01 | NL |
| N-nitrosodi-n-butylamine | EPA 1625M | 0.002 | ND | ND | NA | ND | ND | ND | – | – |
| N-nitrosodimethylethylene | EPA 1625M | 0.002 | ND | ND | NA | ND | ND | ND | – | – |
| N-Nitrosomorpholine | EPA 1625M | 0.002 | ND | ND | NA | ND | ND | ND | – | – |
| N-nitrosopiperdine | EPA 1625M | 0.002 | ND | ND | NA | ND | ND | ND | – | – |
| N-Nitrosopyrrolidine | EPA 1625M | 0.002 | ND | ND | NA | ND | ND | ND | – | – |
| 17-α-ethynlestradiol | EPA 1694M-API | 0.001 | ND | ND | ND | ND | ND | ND | – | – |
| 17-β-estradiol | EPA 1694M-API | 0.001 | ND | ND | ND | ND | ND | ND | – | – |
| Esdtrone | EPA 1694M-API | 0.001 | ND | ND | ND | ND | ND | ND | 0.0009-1.8 | DWEL |
| Progesterone | EPA 1694M-API | 0.001 | ND | ND | ND | ND | ND | ND | – | – |
| Testosterone | EPA 1694M-API | 0.001 | ND | ND | ND | ND | ND | ND | – | – |
| Bisphenol A | EPA 1694M-ESI− | 0.001 | 0.009* | 0.062* | ND* | 0.390* | ND* | 1.400* | – | – |
| Gemfibrozil | EPA 1694M-ESI− | 0.001 | ND | ND | ND | ND | ND | ND | – | – |
| Ibuprofen | EPA 1694M-ESI− | 0.001 | ND | ND | ND | ND | ND | ND | – | – |
| Iopromide | EPA 1694M-ESI− | 0.005 | ND | ND | ND | ND | ND | ND | – | – |
| Naproxen | EPA 1694M-ESI− | 0.001 | ND | ND | ND | ND | ND | ND | – | – |
| Salicylic acid | EPA 1694M-ESI− | 0.050 | 52 | ND | ND | ND | ND | ND | – | – |
| Triclosan | EPA 1694M-ESI− | 0.002 | ND | ND | ND | ND | ND | ND | 0.35-2,600 | DWEL |
| Aceltaminophen | EPA 1694M/ESI+ | 0.020 | ND | ND | ND | ND | ND | ND | – | – |
| Amoxicillin | EPA 1694M=ESI+ | 0.001 | ND | ND | ND | 0.014 | ND | ND | – | – |
| Atenolol | EPA 1694M-ESI+ | 0.001 | ND | ND | ND | ND | ND | ND | – | – |
| Atorvastatin | EPA 1694M-ESI+ | 0.001 | ND | ND | ND | ND | ND | ND | – | – |
| Azithromycin | EPA 1694M-ESI+ | 0.010 | ND | ND | ND | ND | ND | ND | – | – |
| Caffeine | EPA 1694M-ESI+ | 0.001 | ND | 0.0027 | ND | 0.0068 | ND | ND | 0.35 | DWEL |
| Carbamazepine | EPA 1694M-ESI+ | 0.001 | ND | ND | ND | ND | ND | ND | – | – |
| Ciprofloxacin | EPA 1694M-ESI+ | 0.005 | ND | ND | ND | 0.0059 | ND | ND | – | – |
| Cotinine | EPA 1694M-ESI+ | 0.002 | ND | ND | ND | ND | ND | ND | – | – |

## Table D-1N: Pharmaceutical and Personal Care Products (PPCPs) (continued)

| Analyte | Method | MRL | City of Seaside 4 | FO-7 Deep | FO-7 Shallow | MRWPCA MW-1 | PRTIW Mission Memorial | ASR MW-1 | Regulatory Requirement | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | µg/L | | | | | | | | Type |
| DEET | EPA 1694M-ESI+ | 0.001 | ND | 0.0023 | ND | 0.006 | ND | ND | 2.5-6,300 | DWEL |
| Diazepam | EPA 1694M-ESI+ | 0.001 | ND | ND | ND | ND | ND | ND | – | – |
| Fluoxetine | EPA 1694M-ESI+ | 0.001 | ND | ND | ND | ND | ND | ND | – | – |
| Methadone | EPA 1694M-ESI+ | 0.001 | ND | ND | ND | ND | ND | ND | – | – |
| Oxybenzone | EPA 1694M-ESI+ | 0.001 | ND | ND | 0.0012 | 0.087 | ND | ND | – | – |
| Phenyloin | EPA 1694M-ESI+ | 0.001 | ND | ND | ND | ND | ND | ND | – | – |
| Primidone | EPA 1694M-ESI+ | 0.001 | ND | ND | ND | ND | ND | ND | – | – |
| Sucralose | EPA 1694M-ESI+ | 0.005 | ND | ND | ND | ND | ND | ND | 175,000 | DWEL |
| Sulfamethoxazolke | EPA 1694M-ESI+ | 0.001 | ND | ND | ND | ND | ND | ND | – | – |
| TCEP | EPA 1694M-ESI+ | 0.001 | 0.0067 | ND | ND | 0.0064 | ND | ND | – | – |
| TCPP | EPA 1694M-ESI+ | 0.001 | 0.0052* | 0.0025* | 0.0026* | 0.011* | 0.0032* | 0.0016* | – | – |
| TDCPP | EPA 1694M-ESI+ | 0.001 | 0.0011 | 0.0031 | ND | 0.0038 | ND | ND | – | – |
| Trimethoprim | EPA 1694M-ESI+ | 0.001 | ND | ND | ND | ND | ND | ND | – | – |

**Notes:**
Laboratory analytical data sheets reported detected values in ng/L; converted to µg/L.
* Detected in laboratory blank sample
NA = Not analyzed for FO-7 Shallow because laboratory instrumental problems resulted in unsuccessful runs; insufficient sample volume remaining for re-analysis.

Table D-1O: Radiogenic

| Analyte | Method | DL | City of Seaside 4 | FO-7 Deep** | FO-7 Shallow** | MRWPCA MW-1** | PRTIW Mission Memorial | ASR MW-1 | Regulatory Requirement | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | pCi/L | | | | | | | | Type |
| Gross Alpha | 7110B | 3.00 | 0.29±0.39 | 3.0±0.5 | 125±5 | 6.3±1.2 | 8.7±1.2 | 2.8±1.1 | 15 | CPMCL-EPMCL |
| Gross Beta | 7110B | 4.0 | 1.4±0.5 | 4.5±0.5 | 114±2 | 7.5±1.1 | 8.8±0.9 | 5.6±1.0 | 50 | CPMCL-EPMCL |
| Radium 226 | 7500-RaB | 1.00 | 0.48±0.46 | 0.47±0.43 | 22±2.2 | 0.62±0.31 | 1.9±0.9 | 0.73±0.42 | †† | – |
| Radium 228 | 7500-Ra D | 1.00 | 0.11±0.38 | 0.44±0.38 | 16.3±1.2 | -0.08±0.51 | 2.2±07 | 0.45±0.45 | †† | – |
| Combined Radium | calculated | 1.00 | 0.59± | 0.91±0.57 | 38.3±2.4 | 0.54±0.60 | 4.1±0.7 | 1.18±0.62 | 5 †† | CPMCL-EPMCL |
| Strontium 90 | 905.0 | 2.00* | 0.339±0.692 | -0.439±0.720 | 0.748±1.140 | 0.090±1.070 | -1.27±0.850 | -0.883±0.948 | 8 | CPMCL-EPMCL |
| Tritium*** | Enriched | – | 0.07±0.1 (0.2233) | <1.0 (<3.19) | <1.00 (<3.19) | <1.0 (<3.19) | 0.75±0.16 (2.39) | <1.00 (<2.19) | (20,000) | CPMCL |
| Uranium | 200.8 | 0.080 | ND | 1.6 | 0.62 | 0.33 | 0.20 | 1.3 | 20/30† | CPMCL/EPMCL† |

**Notes:**
* MRL for strontium 90
** Turbid sample
*** Tritium (enriched) reported in tritium units (TU) where 1.0 TU = 3.19 pCi/L. Values in parenthesis are in pCi/L.
† In micrograms per liter (µg/L)
†† MCL for combined concentrations of Radium 226 and Radium 228

## Table D-1P: Stable Isotopes in Water and Nitrate

| Sample | Water ($H_2O$) | | | | Nitrate ($NO_3^-$) | | | |
|---|---|---|---|---|---|---|---|---|
| | $\delta^{18}O$ | | $\delta D$ | | $\delta^{15}N$ | | $\delta^{18}O$ | |
| | ‰ | 1σ | ‰ | 1σ | ‰ | 1σ | ‰ | 1σ |
| **Monitoring Wells:** | | | | | | | | |
| City of Seaside 4 | -6.62 | 0.06 | -44.27 | 0.32 | 1.4 | 0.2 | 0.7 | 0.4 |
| FO-7 Deep | -7.18 | 0.06 | -48.55 | 0.32 | * | 0.2 | * | 0.4 |
| FO-7 Shallow | -6.36 | 0.06 | -45.44 | 0.32 | 8.7 | 0.2 | 4.2 | 0.4 |
| MRWPCA MW-1 | -6.56 | .0.06 | -43.87 | 0.32 | 8.9 | 0.2 | 4.4 | 0.4 |
| PRTIW Mission Memorial | -6.14 | 0.06 | -40.68 | 0.32 | 2.5 | 0.2 | 1.3 | 0.4 |
| ASR MW-1 | -6.4 | 0.06 | -45.90 | 0.32 | * | 0.2 | * | 0.4 |

**Notes:**
* Analysis did not produce a reliable compound specific isotope analysis (CSIA) value.
δD = ratio of deuterium to hydrogen (D/H) against Vienna Standard Mean Ocean Water (VSMOW) standard
$\delta^{18}O$ = ratio of $1^8O/^{16}O$ against VSMOW standard
$\delta^{15}N$ = ratio of $^{15}N/^{14}N$ against standard of nitrogen in air
‰ = per mil or parts per thousand
1σ = analytical precision of one sigma

## General Notes for Tables D-1A to D-1P:

Samples collected from January 29-30, 2014 and February 3, 2014; received and analyzed, unless otherwise noted, by Alpha Analytical Laboratory, Inc., Ukiah, CA
– (dash) = no data reported
EPA = U.S. Environmental Protection Agency
CPMCL = California Department of Public Health (CDPH) Primary Maximum Contaminant Level
CSMCL = California Department of Public Health (CDPH) Secondary Maximum Contaminant Level
DWEL = U.S. EPA Drinking Water Equivalent Level; advisory only and not to be construed as legally enforceable Federal standards.
EPMCL = U.S. Environmental Protection Agency Primary Maximum Contaminant Level
ESMCL = U.S. Environmental Protection Agency Secondary Maximum Contaminant Level
NL = CDPH Notification Level – advisory in nature and not an enforceable standard
California MCL for Gross Beta = 50 pCi/L; U.S. EPA Primary MCL (EPMCL) = 4 millirems per year (mrem/yr)
CU = Color Units
MFL = Millions of fibers per liter
µg/L = micrograms per liter or parts per billion (ppb)
µS/cm = microSiemans per centimeter (formerly µmohs/cm)
mg/L = milligrams per liter or parts per million (ppm)
pg/L = picograms per liter or parts per quadtrillion (ppq)
pCi/L = picoCuries per liter
TU = tritium units
NTU = Nephelometric Turbidity Units
SM = Standard Method
MFL = Millions of fibers per liter
MRL = Minimum Reporting Limit
ND = Not detected or below MRL
TEM = Transmission Electron Microscope

# Appendix M rev

# Memorandum Regarding GWR Project EIR - Cumulative Projects Modeling Results for Seaside Groundwater Basin

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1814 Franklin St, Suite 501
Oakland, CA 94612

# TECHNICAL MEMORANDUM

To: Bob Holden/MRWPCA

From: Stephen Hundt and
Derrik Williams

Date: December 16, 2015

Subject: GWR Project EIR: Cumulative Projects Modeling Results

## Executive Summary

The Monterey Regional Water Pollution Control Agency (MRWPCA) is developing the Pure Water Monterey Groundwater Replenishment Project (GWR Project). This project will recharge the Seaside groundwater basin with high-quality purified recycled water. This water will be subsequently extracted from the Seaside Basin for urban potable use. The GWR Project is being developed in partnership with the Monterey Peninsula Water Management District with a goal of supplying water to users within California-American Water Company's (Cal-Am) Monterey Service area. Cal-Am is simultaneously developing a seawater desalination project that will provide water supplies to the Seaside Basin and Monterey Peninsula as part of its Monterey Peninsula Water Supply Project (MPWSP). These two projects can be operated independently, or jointly; however, if the GWR Project is implemented, the desalination plant proposed by Cal-Am would be reduced in size from 9.6-mgd to 6.4 mgd. The cumulative analysis in the GWR Project's Environmental Impact Report (EIR) assesses the environmental impacts of operating the smaller desalination plant and the GWR Project jointly. The GWR Project EIR refers to the joint operation of the two projects as the Cumulative Projects. The MPWSP EIR refers to the joint operation of the two projects as the Variant Project. Because this analysis considers and incorporates the impacts of past, present, and reasonably foreseeable future projects that involve the Seaside Groundwater Basin, this analysis can also be used as the basis for analysis of future cumulative conditions with and without implementation of the two projects analyses in the two EIRs.

The calibrated groundwater model of the Seaside Groundwater Basin (HydroMetrics WRI, 2009) was used to estimate impacts from the Cumulative Projects. A predictive

model incorporating reasonable future hydrologic conditions was developed for this impact analysis. The groundwater model was calibrated through 2008; therefore the predictive model begins in 2009. The predictive model simulates a 33 year period: from 2009 through 2041.

Simulated future Carmel River flows were based on historical flow records. The amount of Carmel River water available for winter injection into the Seaside Basin was estimated by Monterey Peninsula Water Management District (MPWMD) staff. They compared historical daily streamflows with minimum streamflow requirements for each day, and then identified how much water could be extracted from the Carmel River for injection each month.

Cal-Am provided average monthly projections of both the groundwater injection and groundwater pumping needed to meet their anticipated future demands for their Variant Project. These projections were incorporated into the predictive model to the degree possible. Some modifications to Cal-Am's projections were needed to compensate for anticipated pumping capacity shortfalls in specific future years.

One additional modification to Cal-Am's projected groundwater pumping schedule was necessary to ensure adequate water was available during a potential five-year drought. Cal-Am may need to suspend its planned groundwater repayment plan during three years of the five-year drought. This is a reasonable assumption, because all water purveyors are expected to fully use any available water supplies during a drought.

Model results show that the Cumulative Projects Scenario is generally neutral or beneficial compared to the No Project conditions. Groundwater elevations are generally higher under the Cumulative Projects conditions than under the No Project conditions. These higher groundwater levels will tend to slow or stop seawater intrusion.

Particle tracking was used to estimate the travel time of GWR water from the point of recharge to the closest point of extraction. Particle tracking showed that the shortest travel time for any recharged GWR water is 334 days. Travel times of less than 12 months occur for 10 years of the 25-year simulation period when the GWR Project is in operation.

# Project Description

The Monterey Regional Water Pollution Control Agency (MRWPCA) is developing a Groundwater Replenishment (GWR) project. This project will recharge the Seaside groundwater basin with high-quality purified recycled water. The GWR Project is being developed in partnership with the Monterey Peninsula Water Management District with a goal of supplying water to users within California-American Water Company's (Cal-Am) Monterey Service area. Cal-Am is simultaneously developing a seawater desalination project that will provide water supplies to the Seaside Basin in Monterey Peninsula as part of its Monterey Peninsula Water Supply Project (MPWSP). The locations of the two projects' facilities, along with other operating production wells, are shown on Figure 1.

These two projects can be operated independently, or jointly; however, if the GWR Project is implemented, the desalination plant proposed by Cal-Am would be reduced in size from 9.6-mgd to 6.4 mgd. The cumulative analysis in the GWR Project's Environmental Impact Report (EIR) assesses the environmental impacts of operating the smaller desalination plant and the GWR Project jointly. The GWR Project EIR refers to the joint operation of the two projects as the Cumulative Projects. The MPWSP EIR refers to the joint operation of the two projects as the Variant Project. Because this analysis considers and incorporates the impacts of past, present, and reasonably foreseeable future projects that involve the Seaside Groundwater Basin, this analysis can also be used as the basis for analysis of future cumulative conditions with and without implementation of the two projects analyses in the two EIRs.

HydroMetrics Water Resources Inc. (WRI) has completed groundwater flow and particle tracking simulations of the proposed joint operation of the GWR and desalination plant projects. These simulations were undertaken to predict impacts on groundwater levels and the fate and travel time of injected GWR water under the joint operation of these two projects. This modeling was completed in support of the GWR project's environmental impact report (EIR). The GWR Project's EIR is being developed in concurrence with the EIR for Cal-Am's desalination project. The simulations described below predict the impacts of the combined implementation of both the 6.4-mgd desalination plant and the proposed GWR Project. This modeling effort is generally consistent with the required cumulative analysis for both EIRs, based on a review of all past, present, and reasonably foreseeable future projects that may change the groundwater conditions in the Seaside Basin during the modeling period. For the remainder of this memorandum this joint project will be referred to as the Cumulative Projects.


*Figure 1: Production and GWR Injection Well Locations*

# Model Background and Assumptions

The calibrated groundwater model of the Seaside Groundwater Basin (HydroMetrics WRI, 2009) was used to estimate the impacts from the Cumulative Projects. A predictive model incorporating reasonable future hydrologic conditions was developed for this impact analysis. The groundwater model was calibrated through 2008; therefore the predictive model begins in 2009. The predictive model simulates a 33 year period: from 2009 through 2041.

## PREDICTED HYDROLOGY ASSUMPTIONS

The hydrology (rainfall and recharge) used to calibrate the groundwater model was applied to the predictive model. To extend the hydrology through the predictive period, the 1987 through 2008 hydrology data were used to simulate model years 2009 through 2030, and the 1987 through 1997 hydrology data were then repeated for 2031 through 2041 (Figure 2). This is the approach that has been adopted for all predictive models of the Seaside Basin since 2009. By using this hydrology, even during the period January 2009 to present when actual hydrology is known, the model runs can be used to compare relative groundwater levels, but not to assess absolute Basin conditions.

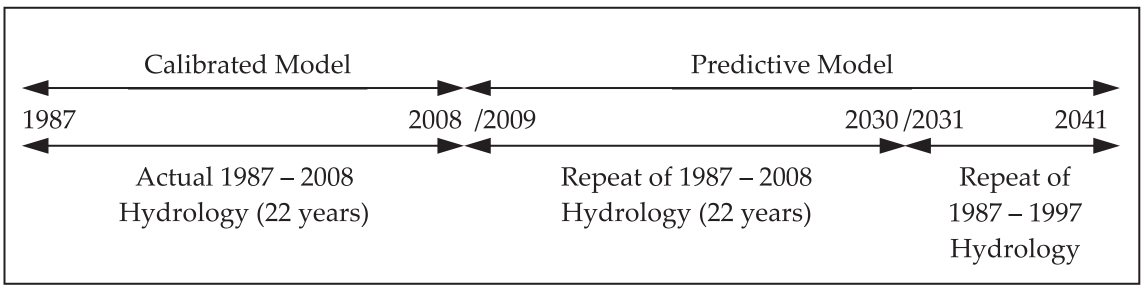


*Figure 2: Repetition of Hydrology for Predictive Model*

## PREDICTED CARMEL RIVER FLOW AND INJECTION ASSUMPTIONS

Monterey Peninsula Water Management District (MPWMD) estimated the amount of Carmel River water available for ASR injection for the predictive simulation based on historical streamflow records. Because the future simulated hydrology is based on the historical hydrology between 1987 and 2008, the future streamflows are expected to be the same as the historical streamflows. MPWMD staff compared historical daily streamflows between water year 1987 and water year 2008 with minimum streamflow requirements for each day. This allowed MPWMD to identify how many days in each month ASR water could be extracted from the Carmel River. Using a daily diversion rate of 20 acre-feet per day, MPWMD calculated how many acre-feet water from the Carmel River could be injected into the ASR system each month. Figure 3 shows the estimated available monthly ASR injection volumes for the predictive simulation. Appendix A includes the historic and projected ASR Wells Site injection schedule that was developed by MPWMD. The Carmel River water available for injection shown on Figure 3 was divided between the ASR 1&2 Well Site and the ASR 3&4 Well Site.

## PREDICTED GWR RECHARGE ASSUMPTIONS

The simulated GWR Project recharges varying volumes of water each year, with an average of 3500 acre-feet recharged per year. The amount of water recharged each year depends upon whether the predicted hydrology is in a drought or non-drought year, and upon a reasonable assumption of the rules for banking and delivering drought reserve water to the Castroville Seawater Intrusion Project (CSIP). In non-drought years, GWR Project deliveries to the Seaside Basin are 3700 acre-feet. This provides 3500 acre-feet for extraction by Cal-Am, and provides 200 acre feet groundwater storage for a Drought Reserve. The Drought Reserve is capped at 1000 acre feet. When the Drought Reserve is full and drought conditions do not exist, the GWR Project delivers 3500 acre feet to the Seaside Basin for extraction by Cal-Am. In drought years when Drought Reserve water is available, the GWR Project delivers less than 3500 acre-feet to the Seaside Basin, and Cal-Am draws from the Drought Reserve.

GWR Project water is recharged through four deep wells and four vadose zone wells in the predictive model. Of the GWR water delivered to the Seaside Basin, 90% of the water is injected into the Santa Margarita aquifer through four deep injection wells, and the remaining 10% is recharged into the Paso Robles aquifer through four vadose zone wells.

Figure 4 shows the volume of water recharged by the GWR Project for each water year in this modeling analysis. While the annual recharge of GWR water varies from year to year, the recovery of water through Cal-Am's pumping wells is maintained at a constant 3500 acre-feet every year in accordance with the GWR Project objectives. The monthly recharge schedule used for the model that includes an accounting and description of the CSIP Drought Reserve program is shown on the 11 x 17 sized table at the end of this technical memorandum.

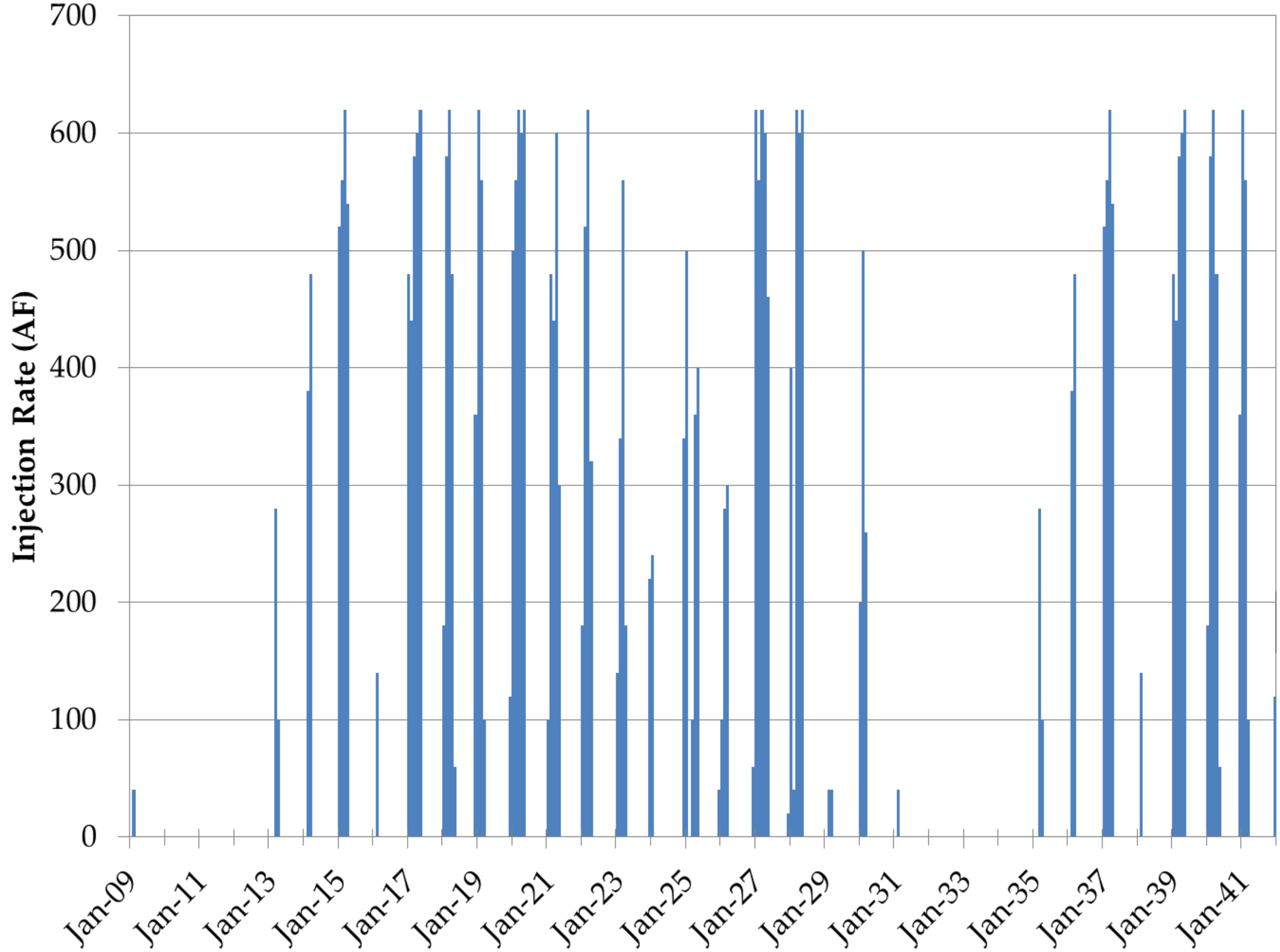


*Figure 3: Estimated Monthly Carmel River ASR Injection Volumes*

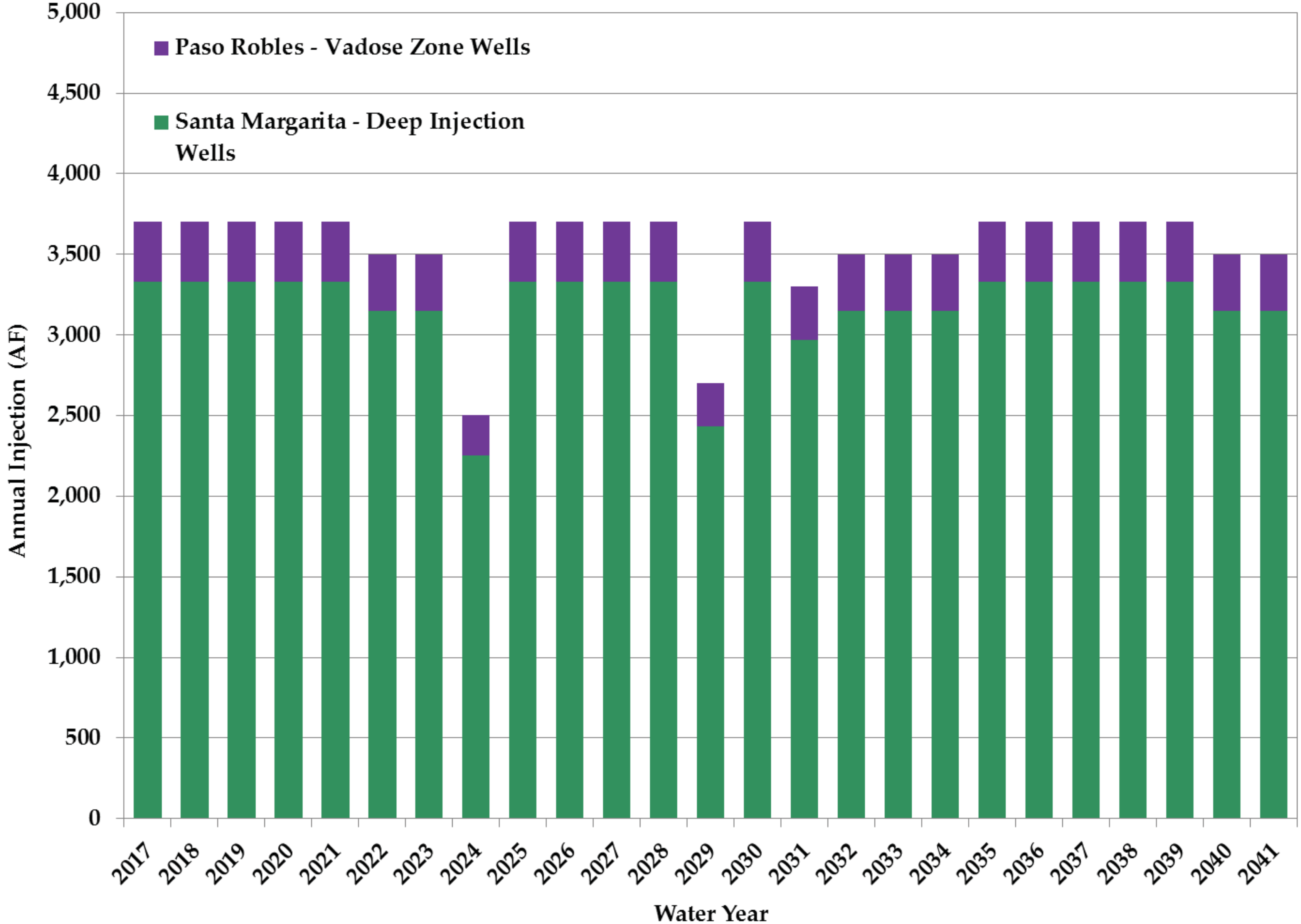


*Figure 4: Annual GWR Recharge*

## PREDICTED MPWSP DESALINATED WATER INJECTION ASSUMPTIONS

The MPSWP small desalination plant that is part of the MPSWP Variant Project will provide 590 acre-feet per year of desalinated water for injection through the ASR wells. This desalinated water injection will occur on a regular schedule between October and April of each year. For the predictive simulation, this desalinated water is injected entirely at the ASR 5&6 Well Site between October and February. Injection of desalinated water in March and April is allocated to either the ASR 1&2 Well Site or to the ASR 3&4 Well Site, depending on well availability. Moving the desalinated water injection away from the ASR 5&6 well site allows any disinfection byproducts in the groundwater around these wells to dissipate, as required by permit, prior to using them for extraction. ASR 5&6 wells are therefore available for pumping in May. Figure 5 shows the predicted injection rates of Carmel River and desalinated water for the three pairs of ASR wells over the simulation period.

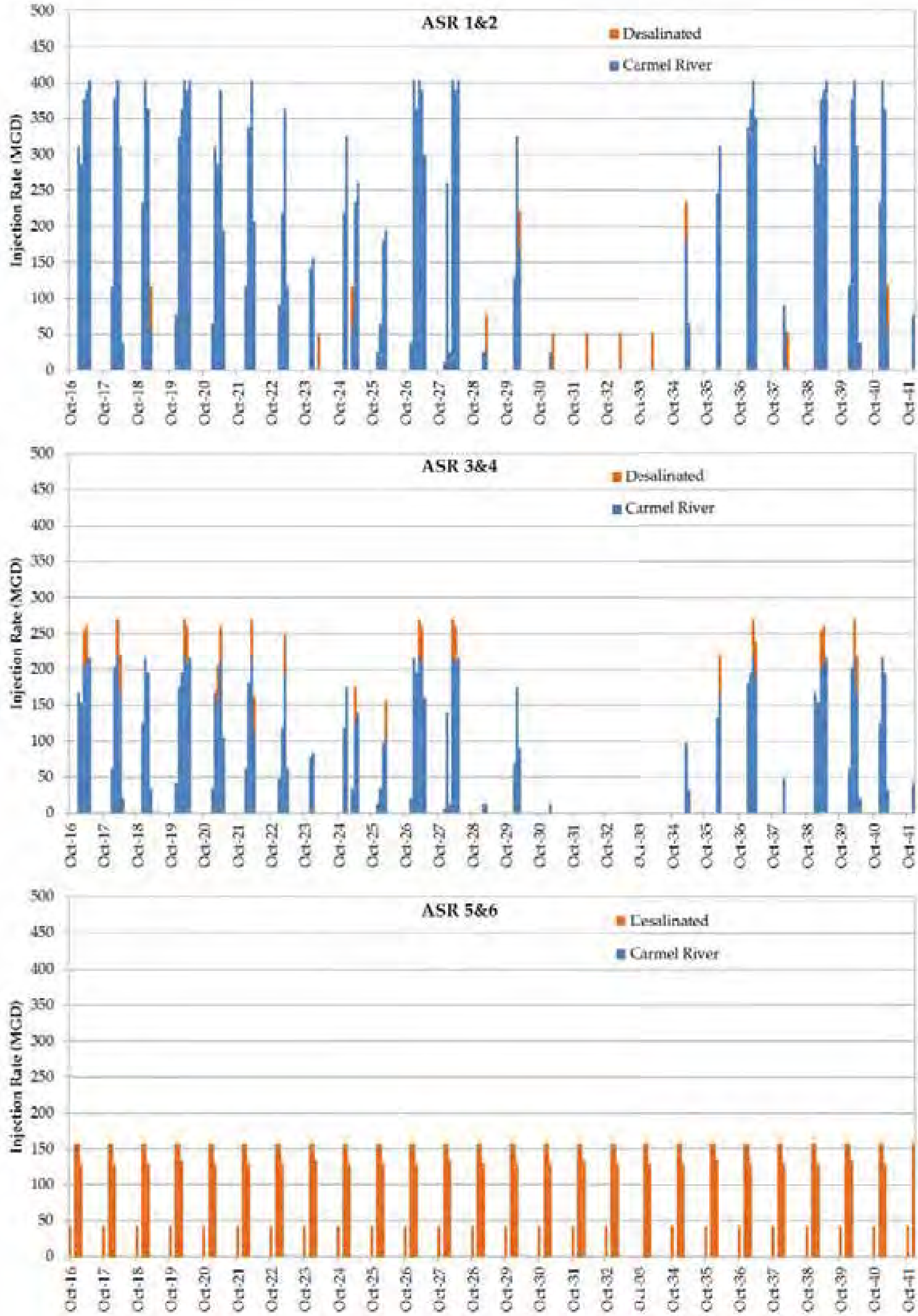


*Figure 5: Monthly ASR Injection of Carmel River and Desalinated Water*

## Predicted Cal-Am Monthly Supply and Demand Assumptions

Table 1 shows the average monthly supply and demand estimates provided by Cal-Am for the Cumulative Projects. This table was produced by Cal-Am as a part of their effort to analyze the groundwater impacts of the MPWSP Variant Project, and MPWMD and MRWPCA agreed to use it as the basis for the Cumulative Projects pumping and injection projections. Cal-Am's monthly supply and demand in the Cumulative Projects simulations was held as consistent as possible with Table 1. However, because the values on Table 1 represent average monthly supply and demand, adjustments were required to accommodate known constraints on well operations and water supply variability in the Seaside Basin.

Future Cal-Am pumping will come from five existing Cal–Am wells, two existing ASR sites, and one planned ASR site. These wells and ASR sites include:

- Luzern #2 Well
- Ord Grove #2 Well
- Paralta Well
- Playa #3 Well
- Plumas #4 Well
- ASR Wells 1&2 Site
- ASR Wells 3&4 Site
- ASR Wells 5&6 Site

Data supplied by Cal-Am show that the pumping capacity of their five existing wells is 5.26 million gallons per day (MGD), or approximately 16 acre-feet per day. Based on conversations with MPWMD, we assumed that each ASR well site could either produce 4.32 million gallons per day or inject 4.32 million gallons per day. The total pumping capacity of the five existing wells and three ASR well sites is therefore 18.22 million gallons per day, or approximately 55.8 acre-feet per day.

## *Table 1: Average Monthly CAW Supply and Demand*

| TYPICAL OPERATIONS BASED ON AVERAGE MONTHLY FLOWS – MPWSP VARIANT | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Average Monthly Flow (mgd) | | | | | | | | | | | | TOTAL (AFY) |
| | Jan | Feb | Mar | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec | |
| **Demand** | | | | | | | | | | | | | |
| Average Demand | 10.3 | 10.5 | 11.4 | 12.8 | 15.5 | 16.6 | 17.3 | 17.1 | 16.8 | 13.3 | 11.8 | 10.3 | 15,300 |
| Water Returned to Salinas Valley | 0.0 | 0.0 | 0.0 | 0.0 | 0.9 | 1.2 | 1.1 | 1.1 | 1.1 | 0.4 | 0.0 | 0.0 | 549 |
| **System Supplies** | | | | | | | | | | | | | |
| Carmel River to Distribution System | 5.7 | 5.7 | 5.7 | 5.2 | 2.2 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 5.7 | 3,376 |
| Seaside GW Production Wells to Distribution System | 0.0 | 0.0 | 0.0 | 1.0 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 0.5 | 0.0 | 770 |
| Sand City Desalinated Supplies to Distribution System | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 94 |
| Supplies Extracted from Seaside Groundwater Basin ASR System | 0.0 | 0.0 | 0.0 | 0.9 | 6.8 | 9.6 | 10.4 | 10.2 | 9.5 | 5.9 | 4.1 | 0.0 | 5,390 |
| MPWSP Desalinated Supplies to Distribution System | 4.5 | 4.7 | 5.6 | 5.6 | 5.3 | 4.8 | 4.6 | 4.7 | 5.1 | 5.3 | 6.2 | 4.5 | 5,671 |
| **Total Supplies to Distribution System** | **10.3** | **10.5** | **11.4** | **12.8** | **15.5** | **16.6** | **17.3** | **17.1** | **16.8** | **13.3** | **11.8** | **10.3** | **15,300** |
| **MPWSP Desalination Plant Operations** | | | | | | | | | | | | | |
| Desalinated Supplies for Distribution System | 4.5 | 4.7 | 5.6 | 5.6 | 5.3 | 4.8 | 4.6 | 4.7 | 5.1 | 5.3 | 6.2 | 4.5 | 5,671 |
| Desalinated Supplies for ASR Injection | 1.7 | 1.5 | 0.6 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.0 | 1.7 | 590 |
| Desalinated Supplies for Salinas Valley | 0.0 | 0.0 | 0.0 | 0.0 | 0.9 | 1.2 | 1.1 | 1.1 | 1.1 | 0.4 | 0.0 | 0.0 | 549 |
| **Total Desalinated Supplies** | **6.14** | **6.18** | **6.16** | **6.15** | **6.22** | **5.92** | **5.78** | **5.78** | **6.18** | **6.15** | **6.18** | **6.16** | **6,809** |
| **Supplies Extracted from Seaside Groundwater Basin ASR System** | | | | | | | | | | | | | |
| Highly Treated Wastewater from MRWPCA Regional WWTP | 0.0 | 0.0 | 0.0 | 0.6 | 4.4 | 6.2 | 6.8 | 6.6 | 6.2 | 3.8 | 2.6 | 0.0 | 3,500 |
| Carmel River | 0.0 | 0.0 | 0.0 | 0.2 | 1.6 | 2.3 | 2.5 | 2.5 | 2.3 | 1.4 | 1.0 | 0.0 | 1,300 |
| Desalinated Supplies | 0.0 | 0.0 | 0.0 | 0.1 | 0.7 | 1.1 | 1.1 | 1.1 | 1.0 | 0.6 | 0.4 | 0.0 | 590 |
| **Total Extraction** | **0.0** | **0.0** | **0.0** | **0.9** | **6.8** | **9.6** | **10.4** | **10.2** | **9.5** | **5.9** | **4.1** | **0.0** | **5,390** |

This total pumping capacity is reduced when one or more ASR sites are unavailable for extraction. One reason an ASR site may be unavailable for extraction is that it may be used for injection, and an ASR site cannot simultaneously inject and extract water. Furthermore, MPWMD's previous experience has shown that ASR wells are required to rest for up to 60 days after injection to reduce the occurrence of disinfection byproducts and meet permit requirements. As a result, we conservatively estimated that an ASR well site is unavailable for extraction during any month that it has injected water, and for two additional months following injection. Information from MPWMD helped determine when ASR wells are unavailable for extraction. MPWMD developed a likely future ASR Well Site injection and extraction schedule based on the hydrology incorporated into the predictive simulation. Appendix A includes the historic and projected ASR Wells Site injection schedule that was developed by MPWMD. The MPWMD injection and extraction schedule identifies months when ASR wells are not available to pump groundwater, either because they are being used for injection or they are resting. For simulated months when the ASR wells were not available for extraction, Cal-Am's pumping capacity was reduced by 4.32 MGD for each unavailable site. The possible pumping capacities are shown in Table 2.

*Table 2: Total Extraction Capacity*

| Number of ASR Sites Available for Extraction | Total Capacity (MGD) | Total Capacity (GPM) | Total Capacity (AF/day) |
|---|---|---|---|
| 3 | 18.2 | 12,653 | 55.8 |
| 2 | 13.9 | 9,653 | 42.6 |
| 1 | 9.6 | 6,653 | 29.4 |
| 0 | 5.3 | 3,653 | 16.1 |

For some years in MPWMD's predicted future pumping schedule, ASR wells must inject Carmel River Water in the spring months, leaving them unavailable for extraction in early summer while they rest. This can result in inadequate extraction capacity to meet the pumping demand specified in Table 1. Due to this capacity constraint, HydroMetrics WRI has identified and accommodated three types of years in setting up the predictive model:

1. Years in which there are no constraints, and the average extraction numbers from Table 1 are used in the model (i.e., no modification)

2. Years in which Carmel River water injection continues into April, and the extraction capacity from existing wells is inadequate to meet Cal-Am's expected demands in June. We refer to this as Modification 1.
3. Years in which Carmel River water injection continues into May and the extraction capacity from existing wells is inadequate to meet Cal-Am's expected demands in June and July. We refer to this as Modification 2.

The pumping constraints identified above are resolved by increasing the amount of water that is assumed to be delivered directly from the Carmel River to the distribution system during June and/or July. The delivery of Carmel River water to the distribution system is then reduced in December to ensure that the annual total use of Carmel River water remains at Cal-Am's right of 3,376 acre-feet per year. This approach to resolving the pumping constraints has the advantages of being easily implemented, not requiring any new wells, and meeting Cal-Am's and MPWMD's water rights and permit restrictions on the Carmel River. Carmel River extractions under the proposed changes would still comply with the impending SWRCB Cease and Desist Order.

Table 3 shows the modifications made to the average monthly supply sources for years when capacity is constrained in June. ~~**Error! Reference source not found.**~~ Table 4 shows the modifications made to the average monthly supply sources for years when pumping capacity is constrained in both June and July. The cells highlighted in red show the changes from Cal-Am's original supply schedule.

## *Table 3: Average Monthly CAW Supply and Demand – Modification 1*

| Modifcation 1 - Carmel Injection through April; Capacity Deficit in June | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPICAL OPERATIONS BASED ON AVERAGE MONTHLY FLOWS – MPWSP VARIANT | | | | | | | | | | | | | |
| | Average Monthly Flow (mgd) | | | | | | | | | | | | TOTAL (AFY) |
| | Jan | Feb | Mar | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec | |
| **Demand** | | | | | | | | | | | | | |
| Average Demand | 10.3 | 10.5 | 11.4 | 12.8 | 15.5 | 16.6 | 17.3 | 17.1 | 16.8 | 13.3 | 11.8 | 10.3 | 15,300 |
| Water Returned to Salinas Valley | 0.0 | 0.0 | 0.0 | 0.0 | 0.9 | 1.2 | 1.1 | 1.1 | 1.1 | 0.4 | 0.0 | 0.0 | 549 |
| **System Supplies** | | | | | | | | | | | | | |
| Carmel River to Distribution System | 5.7 | 5.7 | 5.7 | 5.2 | 2.2 | 2.1 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 4.6 | 3,376 |
| Seaside GW Production Wells to Distribution System | 0.0 | 0.0 | 0.0 | 1.0 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 0.5 | 0.0 | 770 |
| Sand City Desalinated Supplies to Distribution System | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 94 |
| Supplies Extracted from Seaside Groundwater Basin ASR System | 0.0 | 0.0 | 0.0 | 0.9 | 6.8 | 8.5 | 10.4 | 10.2 | 9.5 | 5.9 | 4.1 | 1.1 | 5,390 |
| MPWSP Desalinated Supplies to Distribution System | 4.5 | 4.7 | 5.6 | 5.6 | 5.3 | 4.8 | 4.6 | 4.7 | 5.1 | 5.3 | 6.2 | 4.5 | 5,671 |
| **Total Supplies to Distribution System** | **10.3** | **10.5** | **11.4** | **12.8** | **15.5** | **16.6** | **17.3** | **17.1** | **16.8** | **13.3** | **11.8** | **10.3** | **15,300** |
| **MPWSP Desalination Plant Operations** | | | | | | | | | | | | | |
| Desalinated Supplies for Distribution System | 4.5 | 4.7 | 5.6 | 5.6 | 5.3 | 4.8 | 4.6 | 4.7 | 5.1 | 5.3 | 6.2 | 4.5 | 5,671 |
| Desalinated Supplies for ASR Injection | 1.7 | 1.5 | 0.6 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.0 | 1.7 | 590 |
| Desalinated Supplies for Salinas Valley | 0.0 | 0.0 | 0.0 | 0.0 | 0.9 | 1.2 | 1.1 | 1.1 | 1.1 | 0.4 | 0.0 | 0.0 | 549 |
| **Total Desalinated Supplies** | **6.14** | **6.18** | **6.16** | **6.15** | **6.22** | **5.92** | **5.78** | **5.78** | **6.18** | **6.15** | **6.18** | **6.16** | **6,809** |
| **Supplies Extracted from Seaside Groundwater Basin ASR System** | | | | | | | | | | | | | |
| Highly Treated Wastewater from MRWPCA Regional WWTP | 0.0 | 0.0 | 0.0 | 0.6 | 4.4 | 5.5 | 6.8 | 6.6 | 6.2 | 3.8 | 2.6 | 0.7 | 3,500 |
| Carmel River | 0.0 | 0.0 | 0.0 | 0.2 | 1.6 | 2.0 | 2.5 | 2.5 | 2.3 | 1.4 | 1.0 | 0.3 | 1,300 |
| Desalinated Supplies | 0.0 | 0.0 | 0.0 | 0.1 | 0.7 | 0.9 | 1.1 | 1.1 | 1.0 | 0.6 | 0.4 | 0.1 | 590 |
| **Total Extraction** | **0.0** | **0.0** | **0.0** | **0.9** | **6.8** | **8.5** | **10.4** | **10.2** | **9.5** | **5.9** | **4.1** | **1.1** | **5,390** |

## *Table 4: Average Monthly CAW Supply and Demand – Modification 2*

| Modifcation 1 - Carmel Injection through May; Capacity Deficit in June and July | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| TYPICAL OPERATIONS BASED ON AVERAGE MONTHLY FLOWS – MPWSP VARIANT | | | | | | | | | | | | | |
| | Average Monthly Flow (mgd) | | | | | | | | | | | | TOTAL (AFY) |
| | Jan | Feb | Mar | Apr | May | June | July | Aug | Sept | Oct | Nov | Dec | |
| **Demand** | | | | | | | | | | | | | |
| Average Demand | 10.3 | 10.5 | 11.4 | 12.8 | 15.5 | 16.6 | 17.3 | 17.1 | 16.8 | 13.3 | 11.8 | 10.3 | 15,300 |
| Water Returned to Salinas Valley | 0.0 | 0.0 | 0.0 | 0.0 | 0.9 | 1.2 | 1.1 | 1.1 | 1.1 | 0.4 | 0.0 | 0.0 | 549 |
| **System Supplies** | | | | | | | | | | | | | |
| Carmel River to Distribution System | 5.7 | 5.7 | 5.7 | 5.2 | 2.2 | 2.1 | 3.0 | 1.0 | 1.0 | 1.0 | 1.0 | 2.7 | 3,376 |
| Seaside GW Production Wells to Distribution System | 0.0 | 0.0 | 0.0 | 1.0 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 1.1 | 0.5 | 0.0 | 770 |
| Sand City Desalinated Supplies to Distribution System | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 94 |
| Supplies Extracted from Seaside Groundwater Basin ASR System | 0.0 | 0.0 | 0.0 | 0.9 | 6.8 | 8.5 | 8.5 | 10.2 | 9.5 | 5.9 | 4.1 | 3.0 | 5,390 |
| MPWSP Desalinated Supplies to Distribution System | 4.5 | 4.7 | 5.6 | 5.6 | 5.3 | 4.8 | 4.6 | 4.7 | 5.1 | 5.3 | 6.2 | 4.5 | 5,671 |
| **Total Supplies to Distribution System** | **10.3** | **10.5** | **11.4** | **12.8** | **15.5** | **16.6** | **17.3** | **17.1** | **16.8** | **13.3** | **11.8** | **10.3** | **15,300** |
| **MPWSP Desalination Plant Operations** | | | | | | | | | | | | | |
| Desalinated Supplies for Distribution System | 4.5 | 4.7 | 5.6 | 5.6 | 5.3 | 4.8 | 4.6 | 4.7 | 5.1 | 5.3 | 6.2 | 4.5 | 5,671 |
| Desalinated Supplies for ASR Injection | 1.7 | 1.5 | 0.6 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.0 | 1.7 | 590 |
| Desalinated Supplies for Salinas Valley | 0.0 | 0.0 | 0.0 | 0.0 | 0.9 | 1.2 | 1.1 | 1.1 | 1.1 | 0.4 | 0.0 | 0.0 | 549 |
| **Total Desalinated Supplies** | **6.14** | **6.18** | **6.16** | **6.15** | **6.22** | **5.92** | **5.78** | **5.78** | **6.18** | **6.15** | **6.18** | **6.16** | **6,809** |
| **Supplies Extracted from Seaside Groundwater Basin ASR System** | | | | | | | | | | | | | |
| Highly Treated Wastewater from MRWPCA Regional WWTP | 0.0 | 0.0 | 0.0 | 0.6 | 4.4 | 5.5 | 5.5 | 6.6 | 6.2 | 3.8 | 2.6 | 2.0 | 3,500 |
| Carmel River | 0.0 | 0.0 | 0.0 | 0.2 | 1.6 | 2.0 | 2.0 | 2.5 | 2.3 | 1.4 | 1.0 | 0.7 | 1,300 |
| Desalinated Supplies | 0.0 | 0.0 | 0.0 | 0.1 | 0.7 | 0.9 | 0.9 | 1.1 | 1.0 | 0.6 | 0.4 | 0.3 | 590 |
| **Total Extraction** | **0.0** | **0.0** | **0.0** | **0.9** | **6.8** | **8.5** | **8.5** | **10.2** | **9.5** | **5.9** | **4.1** | **3.0** | **5,390** |

## PREDICTED PUMPING ASSUMPTIONS

HydroMetrics WRI made a number of assumptions for the predictive simulation about future pumping rates by various entities in the Seaside Basin. These assumptions were consistent with assumptions developed for previous modeling exercises in the basin. Pumping assumptions were developed for standard producers, alternative producers, golf courses, and Cal-Am.

### WATER YEAR 2009 THROUGH WATER YEAR 2012 PUMPING

Actual pumping and injection data for all wells from January 2009 through December 2012 are included in the predictive simulation.

### MUNICIPAL PUPMPING FROM WATER YEAR 2013 ONWARDS

Predicted pumping by the City of Seaside and the City of Sand City follows the triennial reductions prescribed in the Amended Decision (California American Water v. City of Seaside et al., 2007). These pumping reductions are designed to reduce basin-wide pumping to the approximate safe yield of 3,000 acre-feet per year by 2021.

### CAL-AM PUMPING FROM WATER 2013 ONWARDS

A number of assumptions were necessary to estimate Cal-Am's monthly pumping rates and pumping distribution.

#### Well Priority Assumptions

HydroMetrics WRI assumed that Cal-Am's monthly pumping from the Seaside Basin is allocated among their available wells with the following order of preference:

1. ASR 5&6
2. ASR 3&4
3. ASR 1&2
4. Ord Grove #2
5. Paralta
6. Luzern
7. Playa #3
8. Plumas #4

The pumping during any month was first allocated to the ASR wells up to their capacity. Pumping was then allocated to the Ord Grove #2 well up to its capacity, and so on.  As discussed above, ASR wells are unavailable for extraction if they are injecting water, or have injected water at any time during the previous 3 months.  Cal-Am agreed that these are reasonable assumptions during coordination meetings in 2014. Using this well priority sequence, Figure 6 shows Cal-Am's monthly pumping by well in the predictive simulation.  Figure 7 shows the monthly distribution of ASR water injection and extraction by well in the predictive simulation.

**Water Available for Cal-Am During Droughts**

The predictive simulation includes a five-year drought between 2030 and 2034.  During this drought, virtually no Carmel River water is injected into the Seaside Basin (Figure 5).  Therefore, Cal-Am will need to draw from ASR water previously stored in the basin during this drought.  Figure 8 shows an analysis of the amount of ASR water stored in the Seaside Basin for the entire simulated period.  This figure shows that, without pumping modifications, Cal-Am will deplete all the water previously stored in the Seaside Basin after the five-year drought, and will run a storage deficit.

To avoid a storage deficit, HydroMetrics WRI assumed that Cal-Am would suspend its groundwater repayment plan during the five-year drought.  This is a reasonable assumption: during a drought, we expect all water purveyors will fully use any available water supplies.  Analysis by HydroMetrics WRI showed that Cal-Am would need to suspend its groundwater repayment plan for only three years of the five year drought to avoid depleting all the water previously stored in the Seaside Basin.  Figure 9 shows that Cal-Am would always retain some amount of stored water in the Seaside Basin by suspending its groundwater repayment plan for only three years.  This suspension of repayment would be in accordance with, and would not undermine, the long-term goal of maintaining the groundwater basin as a water supply source. HydroMetrics WRI assumed that Cal-Am would restart its groundwater repayment schedule after the drought ends, and would continue this plan until the full amount of repayment is achieved.

Using these assumptions, Figure 10 shows were Cal-Am's water comes from during both drought and non-drought years.  The green area on this figure represents the current year's GWR Project water that is extracted by Cal-Am.  The purple area represents the MPWSP desalinated water that was injected during the current year, and subsequently extracted by Cal-Am.  The red area represents native groundwater pumped by Cal-Am.  The blue area represents Carmel River water that was injected during the current year, and subsequently extracted by Cal-Am.  The orange area represents ASR water stored by Cal-Am in previous years.

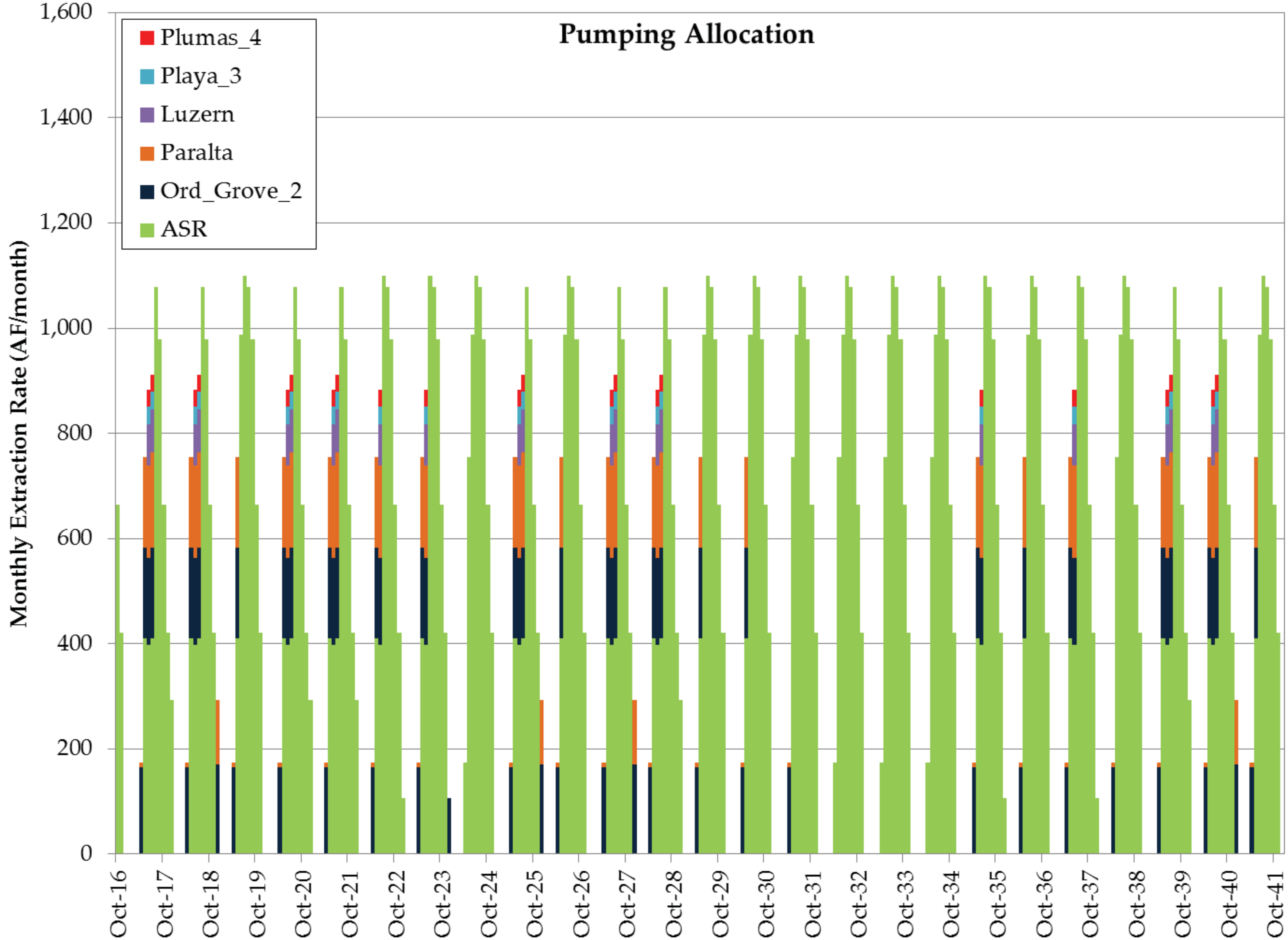


*Figure 6: Monthly Pumping Totals by Well*

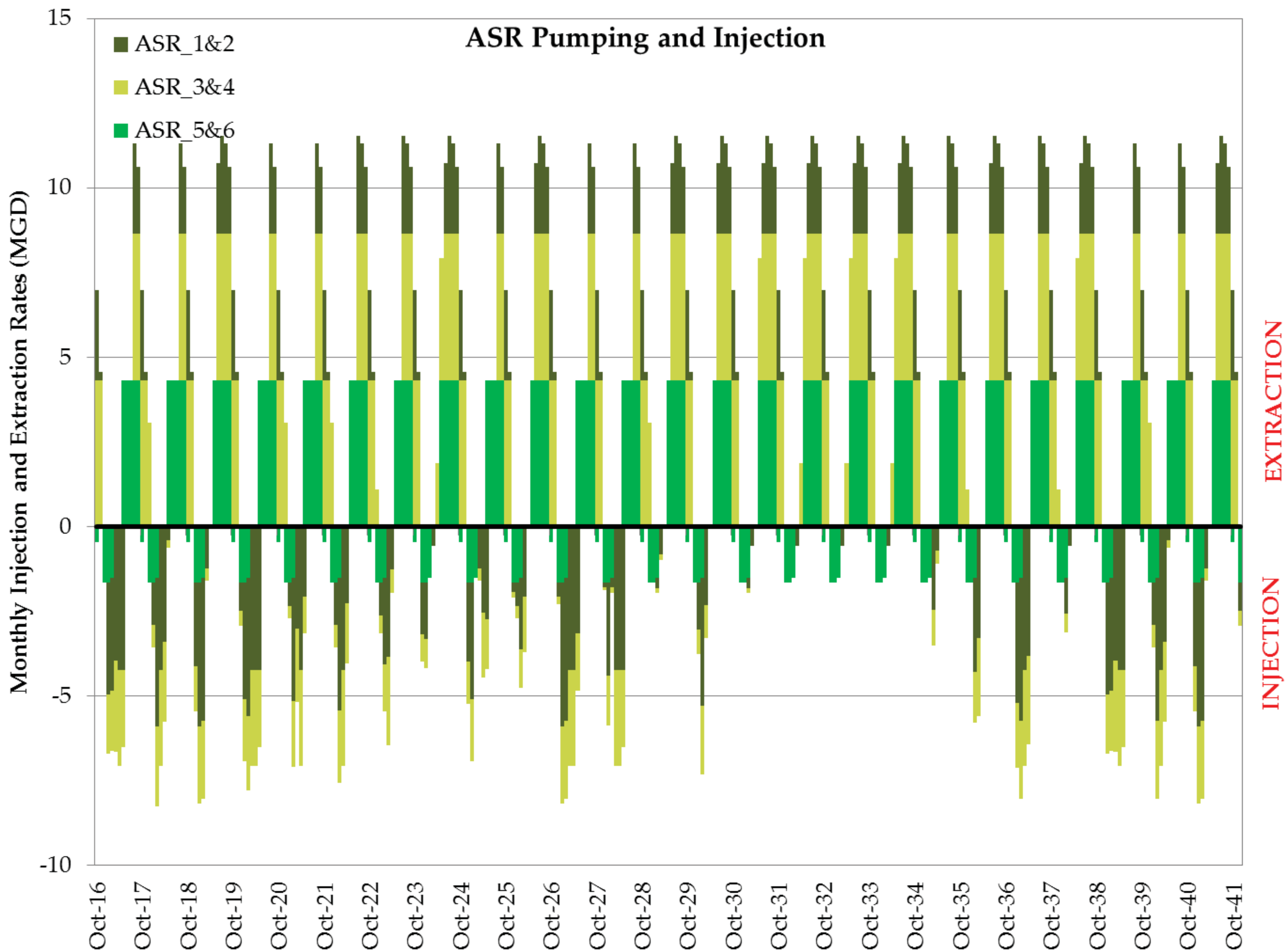


*Figure 7: Monthly ASR Injection and Extraction*


*Figure 8: ASR Water in Storage with no Pumping Modifications*


*Figure 9: ASR Water in Storage with Repayment Suspended in 2034, 2035, and 2038*

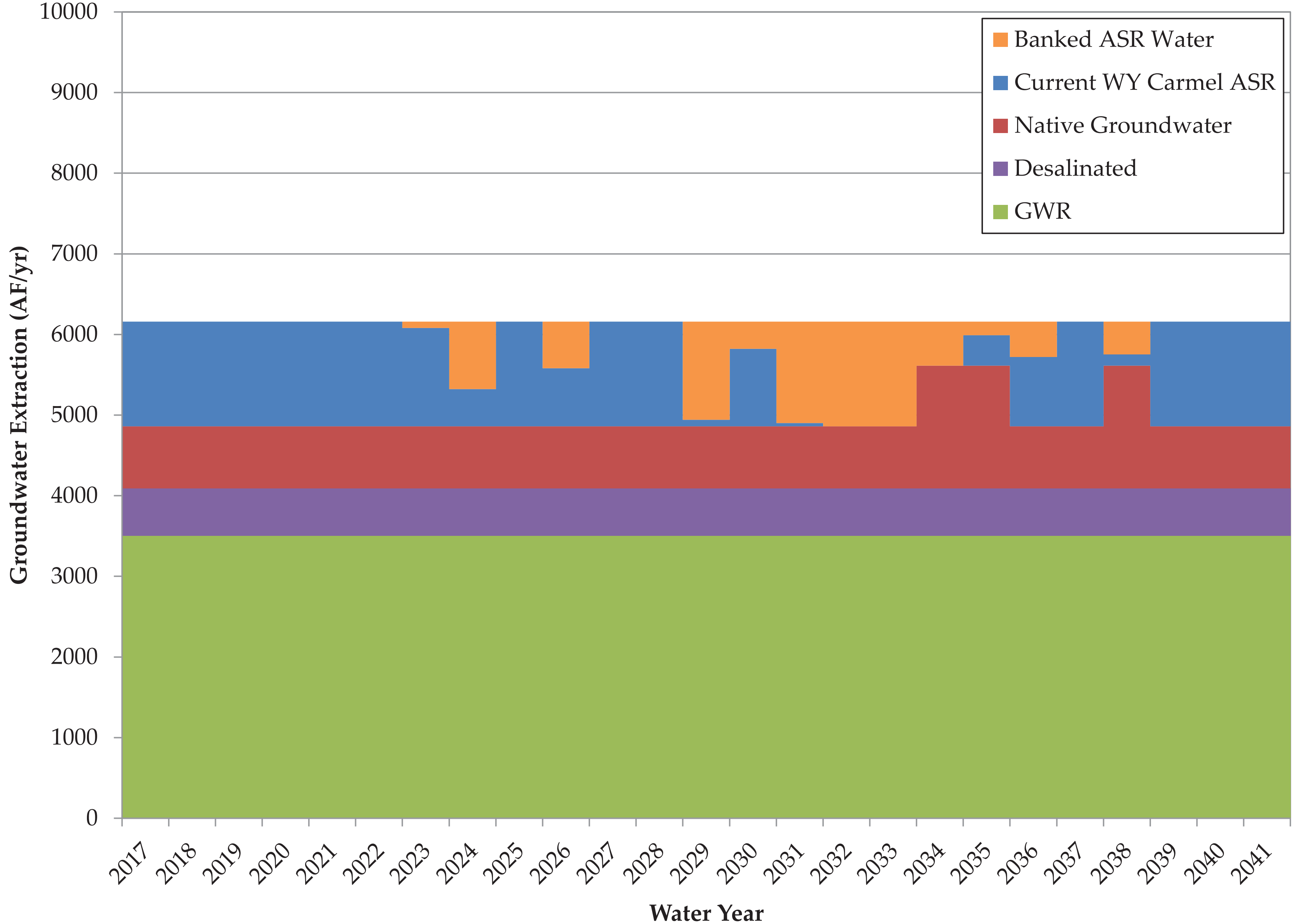


*Figure 10: Annual Cal-Am Water Allocation by Water Right Source*

## GOLF COURSE PUMPING FROM WATER YEAR 2013 ONWARDS

Predicted golf course pumping is based on the hydrologic year. For example, pumping in January 2015 equals the amount pumped in January 1993, because the simulated 2015 hydrology is based on 1993 hydrology. This ensures that the demand corresponds to the hydrology. If the amount pumped by a Producer pre-adjudication exceeds the Producer's adjudicated right, pumping was capped at the Producer's adjudicated amount.

Additional golf course pumping adjustments accounted for in the simulation are:

- The Bayonet and Blackhorse golf courses pump no water until September, 2016. This is based on an in-lieu replenishment program in which Marina Coast Water District provides water in-lieu of the City of Seaside pumping from the Seaside Basin. The City of Seaside expects to start pumping its golf course wells again starting September 2016.

- In 2007, Bayonet and Black Horse golf courses had irrigation upgrades that have reduced irrigation demand by approximately 10% from historical amounts.

- The City of Seaside expects to begin pumping an average of 360 AFY from its wells for golf course supply starting in September 2016. These projected quantities were used rather than basing demand on the hydrology year.

## PREDICTED ALTERNATIVE PRODUCER AND PRIVATE PUMPING

Predicted alternative producer pumping is set at measured Water Year (WY) 2011 volumes from WY 2013 onwards. All other pumpers that are not covered by the Decision, including Cal Water Service and private wells, also pump at WY 2011 volumes from WY 2013 onwards.

Pumping exceptions in the simulation are:

- Water for SNG, which is an Alternative Producer, is supplied from Cal-Am wells under an agreement with Cal-Am. When the SNG site is developed they will be supplied with water by Cal-Am, who will use SNG's water right of 149.7 acre-feet/year. Based on input from the property owner, Ed Ghandour, project construction planned to start in 2013, and use 25 AFY of water; however, construction is now estimated to occur in 2015 or later. Water usage thereafter is estimated to be:

- 2014 - 30 AFY
- 2015 – 50 AFY
- 2016 onwards – 70 AFY

Because the SNG project has been delayed, it is unclear what SNG's future water use might be. Therefore, HydroMetrics WRI adopted the water use estimates listed above to be consistent with previous modeling efforts.

## Particle Tracking Approach

Particle tracking was conducted to estimate the fate and transport of GWR water under the Cumulative Projects. Particles were first introduced around all eight GWR Project injection wells on the simulated period corresponding to October 1, 2016. A new set of particles was released into the model at the beginning of every month until the end of the simulation in 2042. Each month, 40 particles were released from each injection well. Every particle was tracked through the model until it terminated at an extraction well, or until the end of the simulation period in 2042. By introducing the particles continuously, we ensured that there were particles introduced and tracked during times when the travel times would be the fastest.

Particles were placed along the edges of each of the model cells that contained the injection and vadose wells. This strategy is necessary to ensure that the particles are carried outward in all directions in the same manner that water would travel radially from a well. Placing many particles at the exact location of the well results in only a single path taken by all particles. While the approach of placing particles around the edge of the model cell gives a more accurate picture of the dispersal pattern of the water from the injection wells, it also places particles closer to the extraction wells, effectively resulting in faster simulated travel times than actual travel times.

Particles are captured by wells not when they reach the exact location of the extraction wells, but when they reach the edge of the cell that contains an extraction well. This also leads to faster simulated travel times. The results shown below should therefore be considered conservative estimates because actual travel times will be greater than simulated.

# Model Results

## Groundwater Elevation Results

The impact of the Cumulative Projects on groundwater elevations was determined by comparing results from the Cumulative Projects simulation with results from the GWR Project and No-Project scenarios. The No-Project scenario simulates future groundwater conditions without either the GWR or MSPWP projects. The Project scenario simulates future groundwater conditions with the GWR Project but without the MPWSP Project. The assumptions of each of these scenarios are documented in the *Groundwater Replenishment Project Description Development Modeling* (HydroMetrics WRI, October 2, 2013), where they are referred to as the No-Project and Project-High scenarios.

Simulated groundwater elevations from the three scenarios were compared at the following seven wells:

- ASR 1&2 Well Site
- City of Seaside #3
- Ord Grove #2
- Paralta
- Luzern
- PCA-West (Shallow)
- PCA-West (Deep)

Figure 11 shows the location of these seven wells and the GWR injection wells. These seven wells span the area between the GWR injection wells and the coast. Several of the major extraction wells for the GWR Project water are included in this set of wells.

Hydrographs for simulated groundwater elevations under the Cumulative Projects, Project, and No-Project scenarios are shown on Figure 12 through Figure 18. The blue lines represent the simulated static groundwater elevation under the No-Project scenario; the green lines represent the simulated static groundwater elevation under the GWR Project scenario, and the purple lines represent the simulated static groundwater elevation under the Cumulative Projects scenario. The simulated groundwater elevations are generally higher under the Cumulative Projects scenario than under the No-Project and GWR Project scenarios. This is primarily the result of reduced extraction of native groundwater that occurs under the Cumulative Projects scenario. Cal-Am has proposed foregoing extracting 700 acre-feet/year of groundwater from 2017 through 2041 as repayment for past overpumping. The reduced use of native groundwater under the Cumulative Projects scenario translates to a relative increase in storage and rising groundwater elevations. Figure 9 shows the annual use of native groundwater under each scenario. Note that Figure 9 spans the entire simulation period from 2009-2041, while Figure 10 spans the simulation period 2017-2041.

Simulated groundwater elevations around Cal-Am production wells, such as Ord Grove #2, are also higher under the Cumulative Projects scenario because they have lower extraction rates than under the GWR Project and No-Project scenarios. As discussed in the Predicted Pumping Assumptions section above, the Cumulative Project scenario assumes that Cal-Am will use the ASR Well Sites to meet a greater portion of their pumping needs than under the Project and No-Project scenario. This is accompanied by reducing pumping from other Cal-Am well in the coastal subarea, including Ord Grove #2. Figure 20 compares the extraction rates of the Ord Grove #2 well under the No-project, Project, and Cumulative Project scenarios.

The increased use of ASR wells under the Cumulative Projects scenario also leads to increased groundwater elevations in the shallower model layers, where the Ord Grove #2 and Paralta wells draw a portion of their extracted water but the ASR wells do not. This behavior is seen in hydrographs of the Luzern and PCA-West Shallow wells (Figure 16 and Figure 17). Under the GWR Project scenario, drops in groundwater elevations in the Luzern and PCA-West Shallow wells were observed almost immediately with the beginning of GWR Project operation in 2017. This drop was caused by increases in pumping that were not offset immediately by the injection of water that took place in a deeper layer. Under the Cumulative Projects scenario, however, there is an overall reduction in pumping from the shallower layers.

Groundwater elevations in the Cumulative Projects scenario are below those of the GWR Project and No-Project scenarios for some short time periods. This is observed only in wells that penetrate the deep aquifer, including the ASR 1&2 Well Site, the Paralta well, and the PCA-West Deep well. These reductions occur during the summer months of the simulated drought period between 2030 and 2034. For each of these years, winter groundwater levels under the Cumulative Projects scenario are high relative to the No-Project and GWR Project scenarios, drop to a relatively low levels during the summer months, and then quickly recover again to a relatively high level during the next winter. This behavior can be explained by the increased use of use of ASR wells under the Cumulative Projects scenario. Under the Cumulative Project scenario, more water is drawn from the deep aquifer layer, but the effect of the increased pumping is quickly offset by injection in the same layer. During the drought years, however, heavy pumping continues despite four consecutive years without any injection of Carmel River water to help offset the effect of pumping. Furthermore, with no injection of Carmel River water, the ASR wells are rested for fewer months and take an even greater share of the pumping than under a typical year.

Comparing GWR Project and No-Project Hydrographs of the PCA-West Deep and PCA-West Shallow wells allows us to evaluate how the Cumulative Project may impact seawater intrusion in the Seaside Basin. The simulated groundwater elevations at the PCA-West Deep and PCA-West Shallow wells are higher under the Cumulative Projects scenario than under the GWR Project and No-Project scenarios, indicating that the combined GWR and desalination project would not worsen the potential for seawater intrusion at this location. Instead, it appears that the Cumulative Projects would cause this location to become less vulnerable to seawater intrusion.

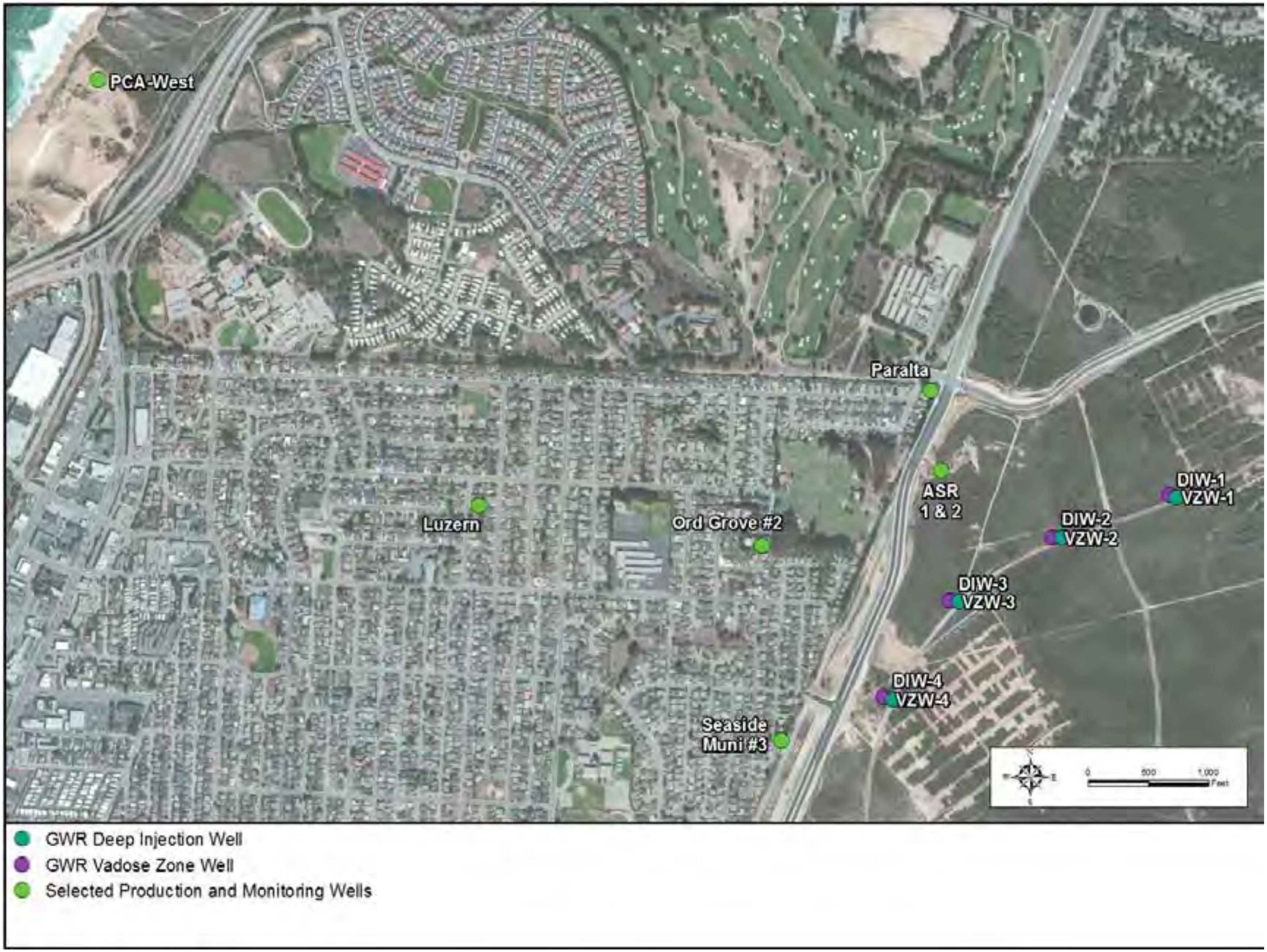


*Figure 11: Locations of Wells with Groundwater Elevation Comparisons*

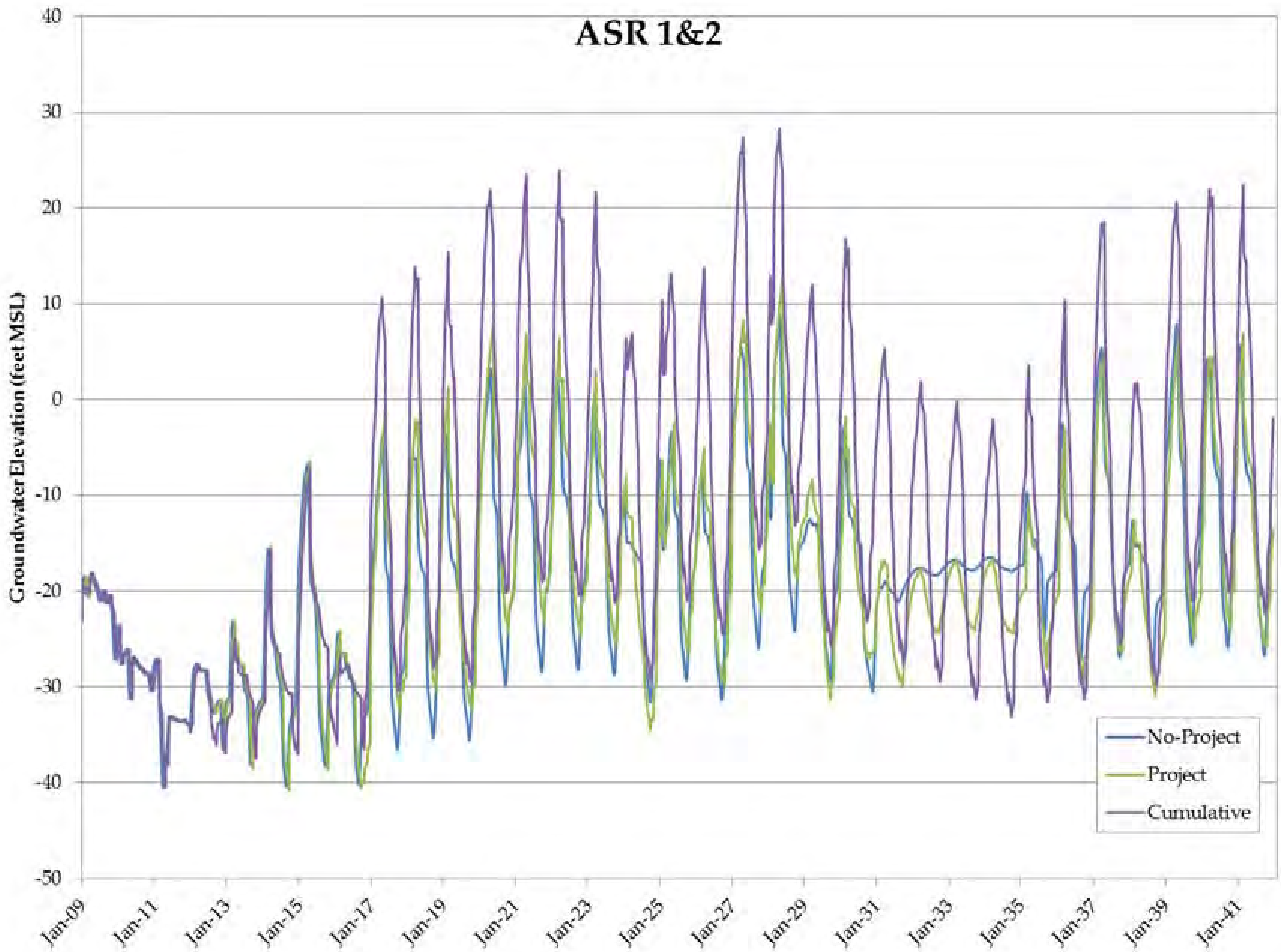


*Figure 12: Predicted Static Groundwater Elevations at ASR 1&2 Wells*

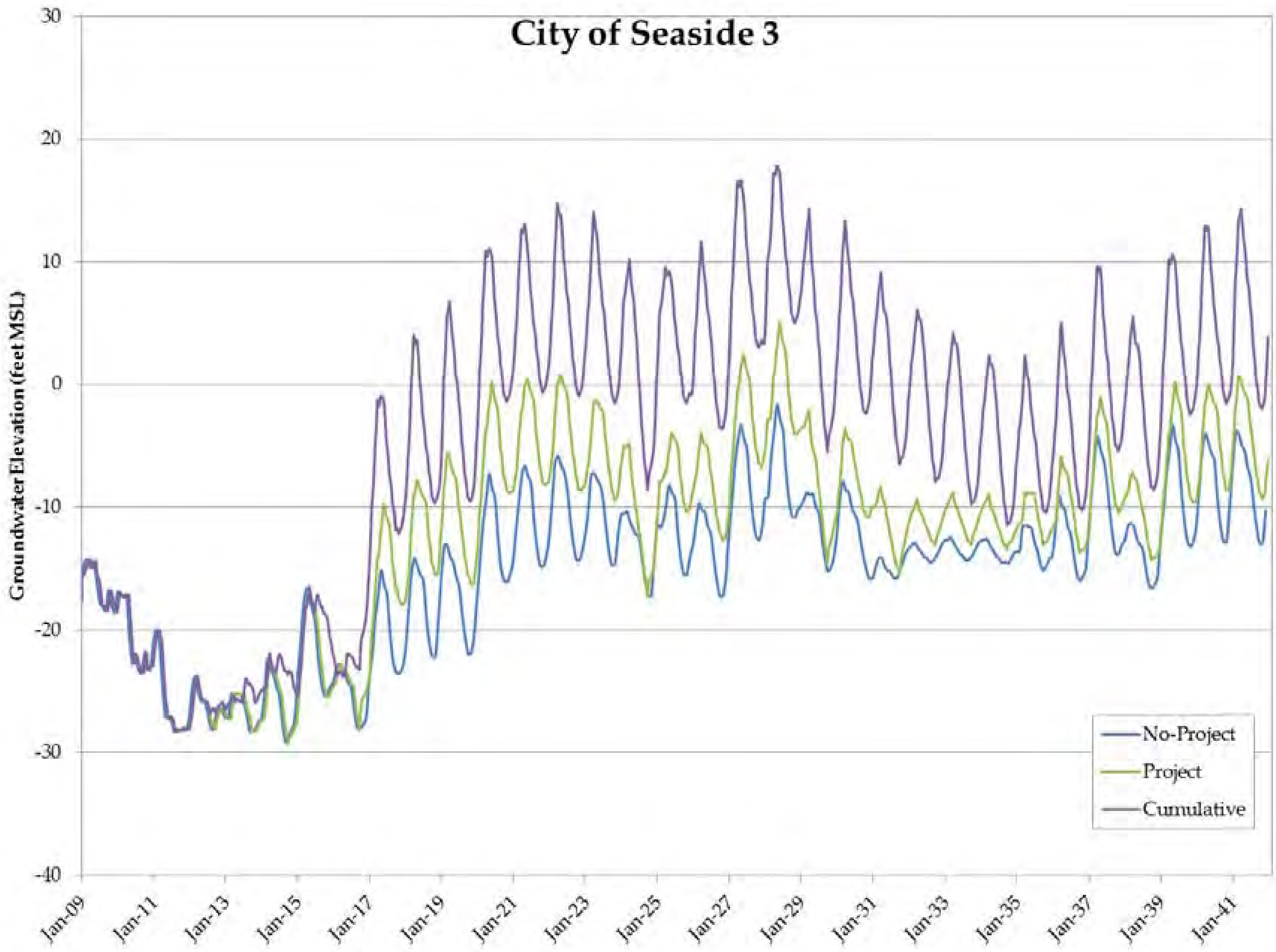


*Figure 13: Predicted Static Groundwater Elevations at City of Seaside 3 Well*

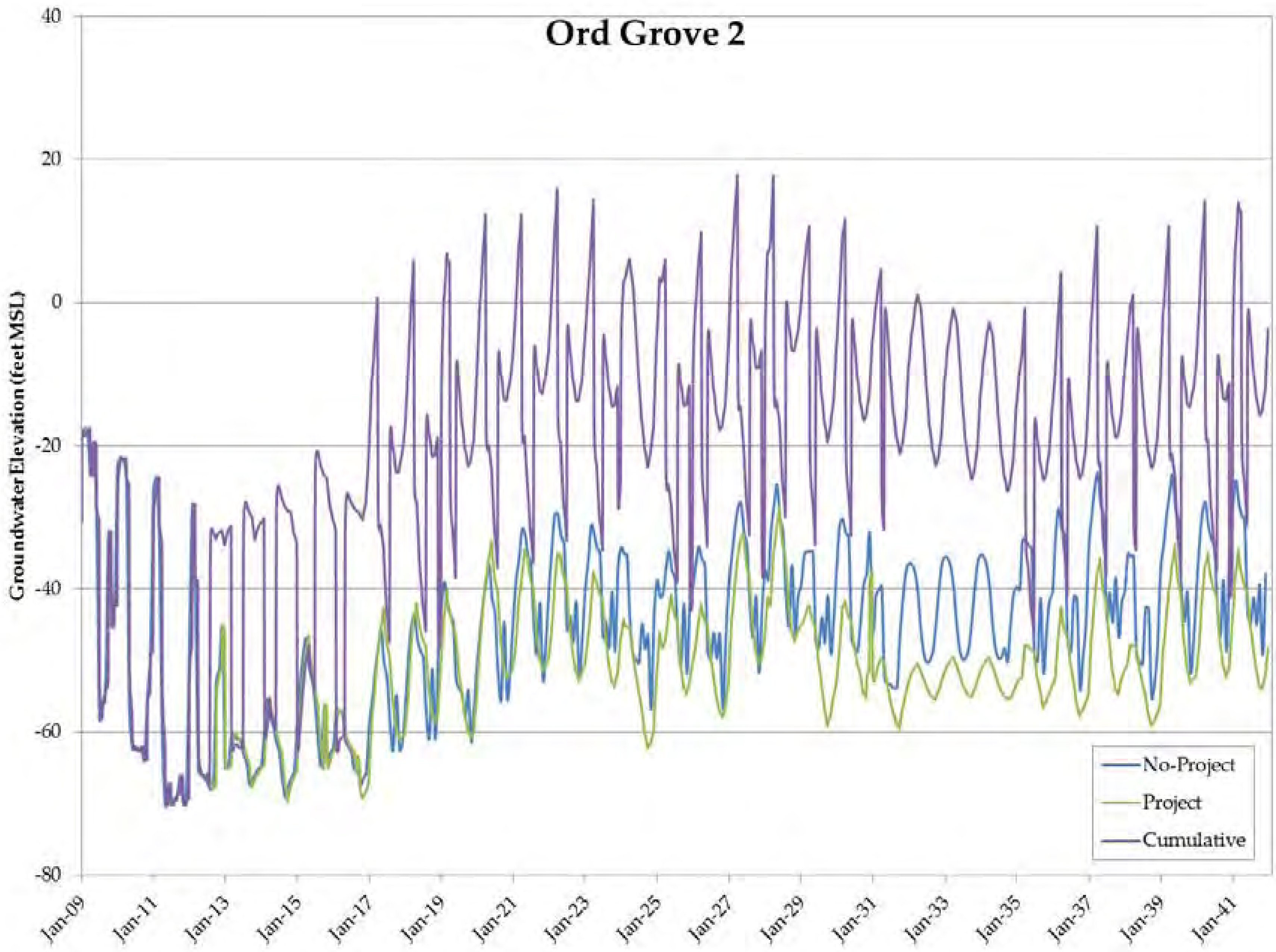


*Figure 14: Predicted Static Groundwater Elevations at Ord Grove 2 Well*

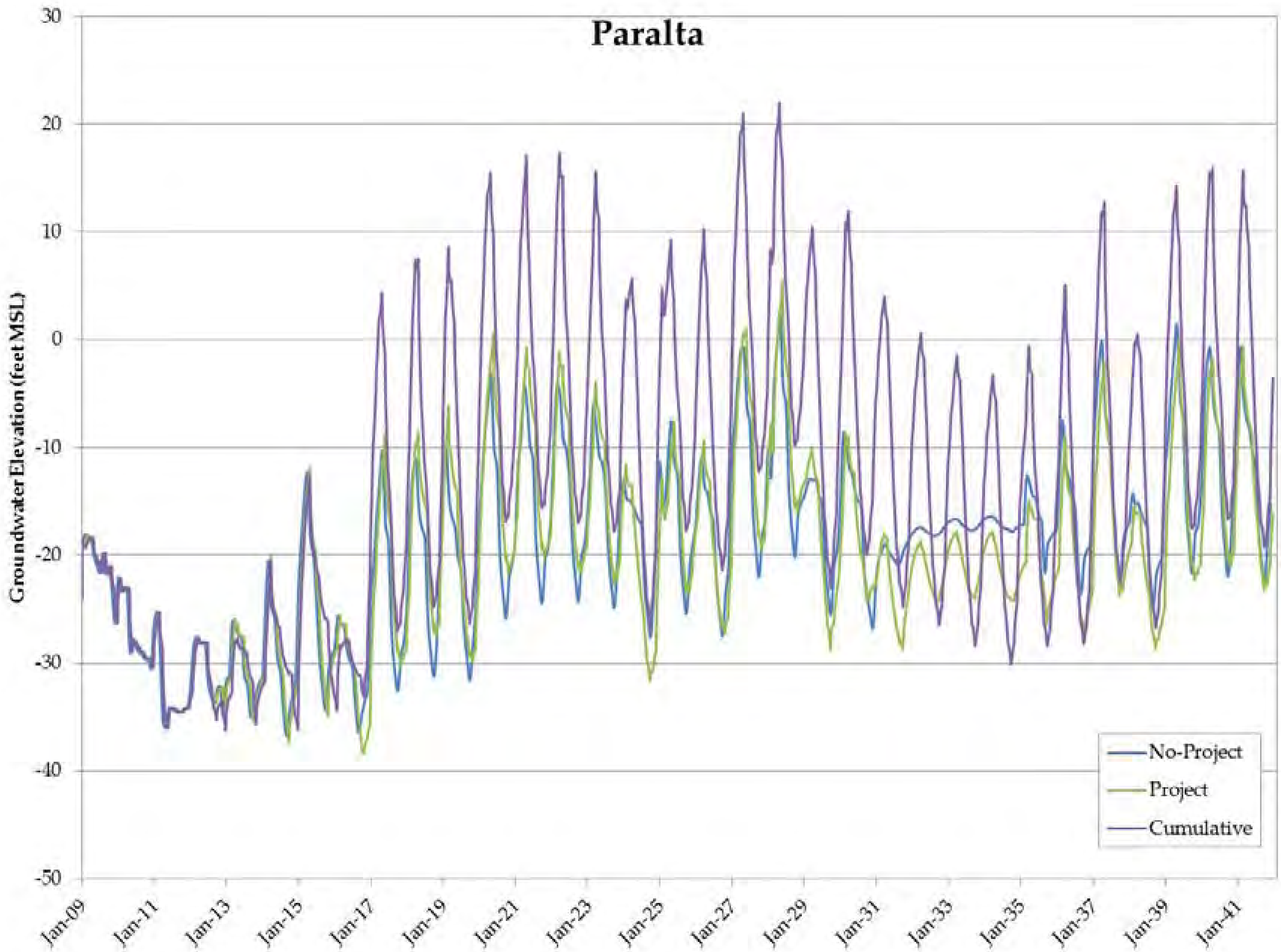


*Figure 15: Predicted Static Groundwater Elevations at Paralta Well*

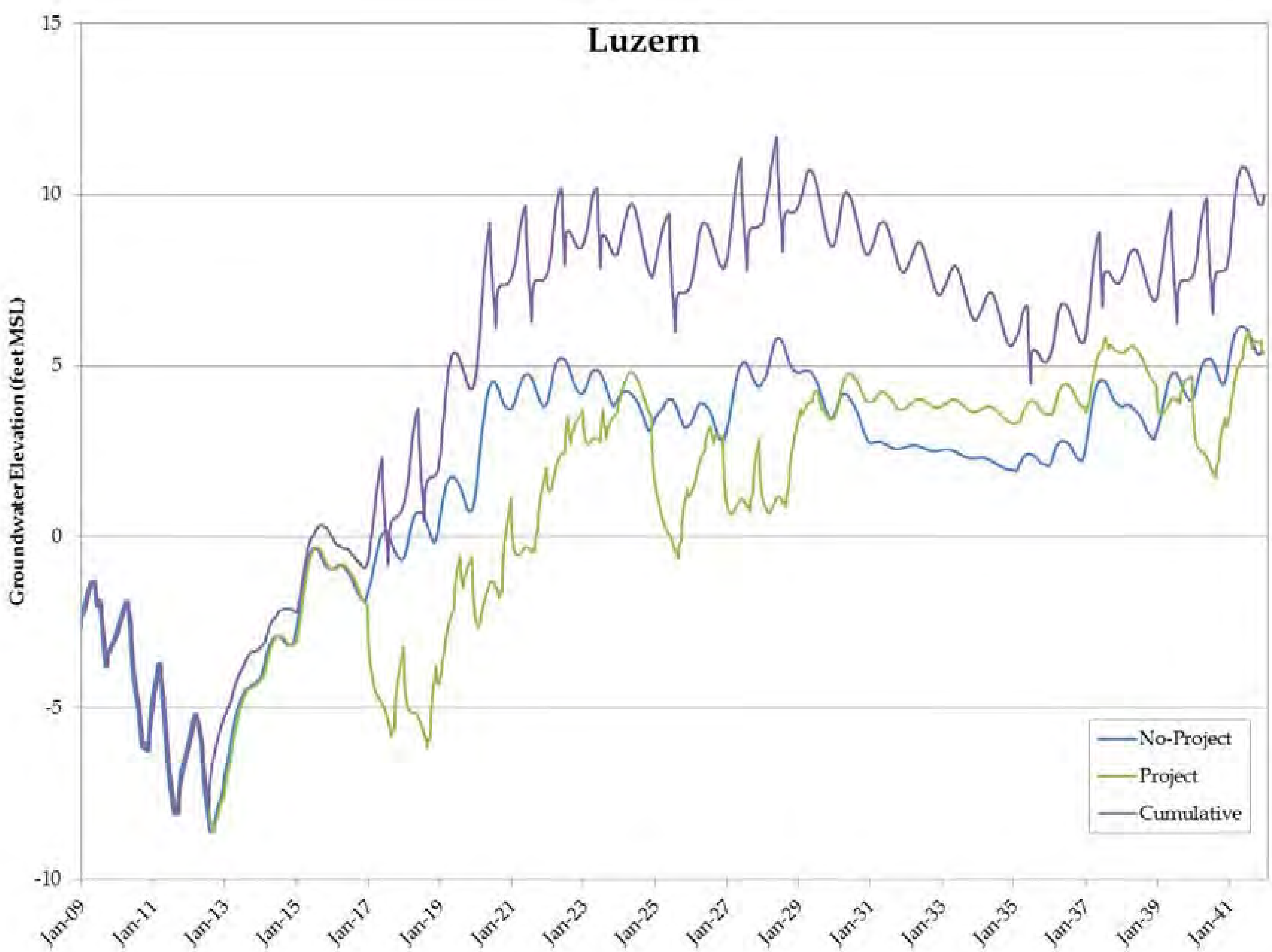


*Figure 16: Predicted Static Groundwater Elevations at Luzern Well*

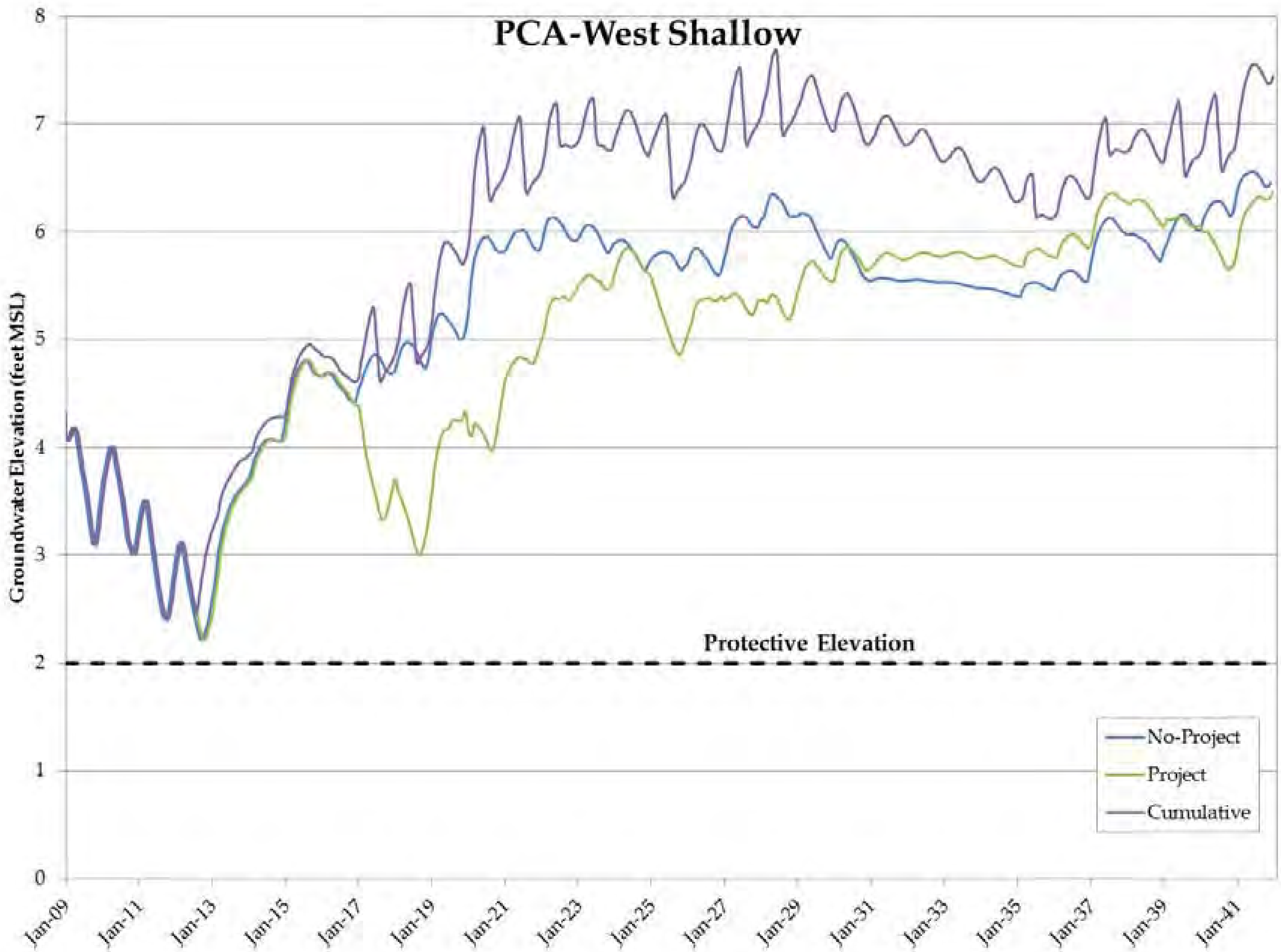


*Figure 17: Predicted Static Groundwater Elevations at PCA-West Shallow Well*

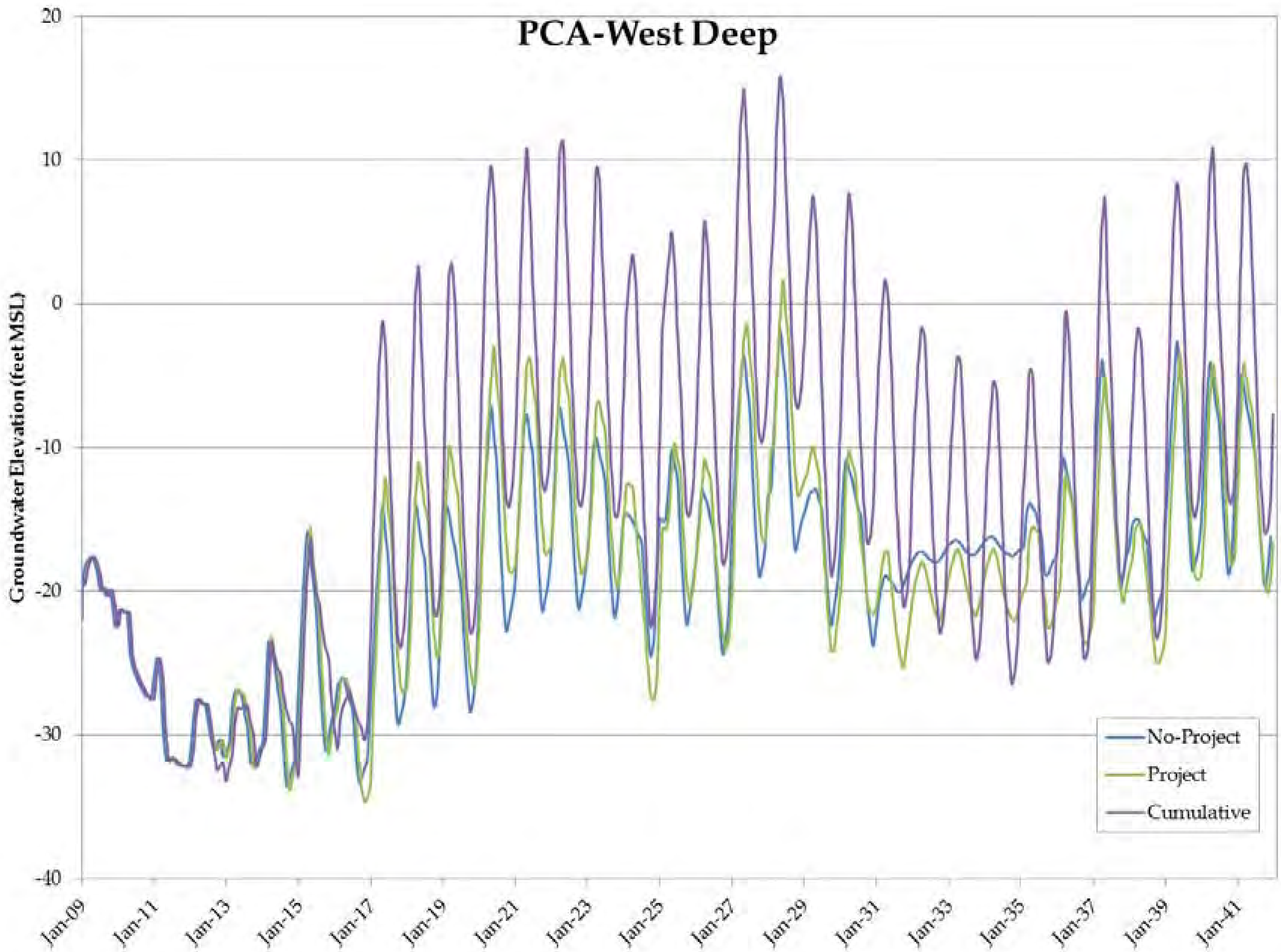


*Figure 18: Predicted Static Groundwater Elevations at PCA-W Deep Well*

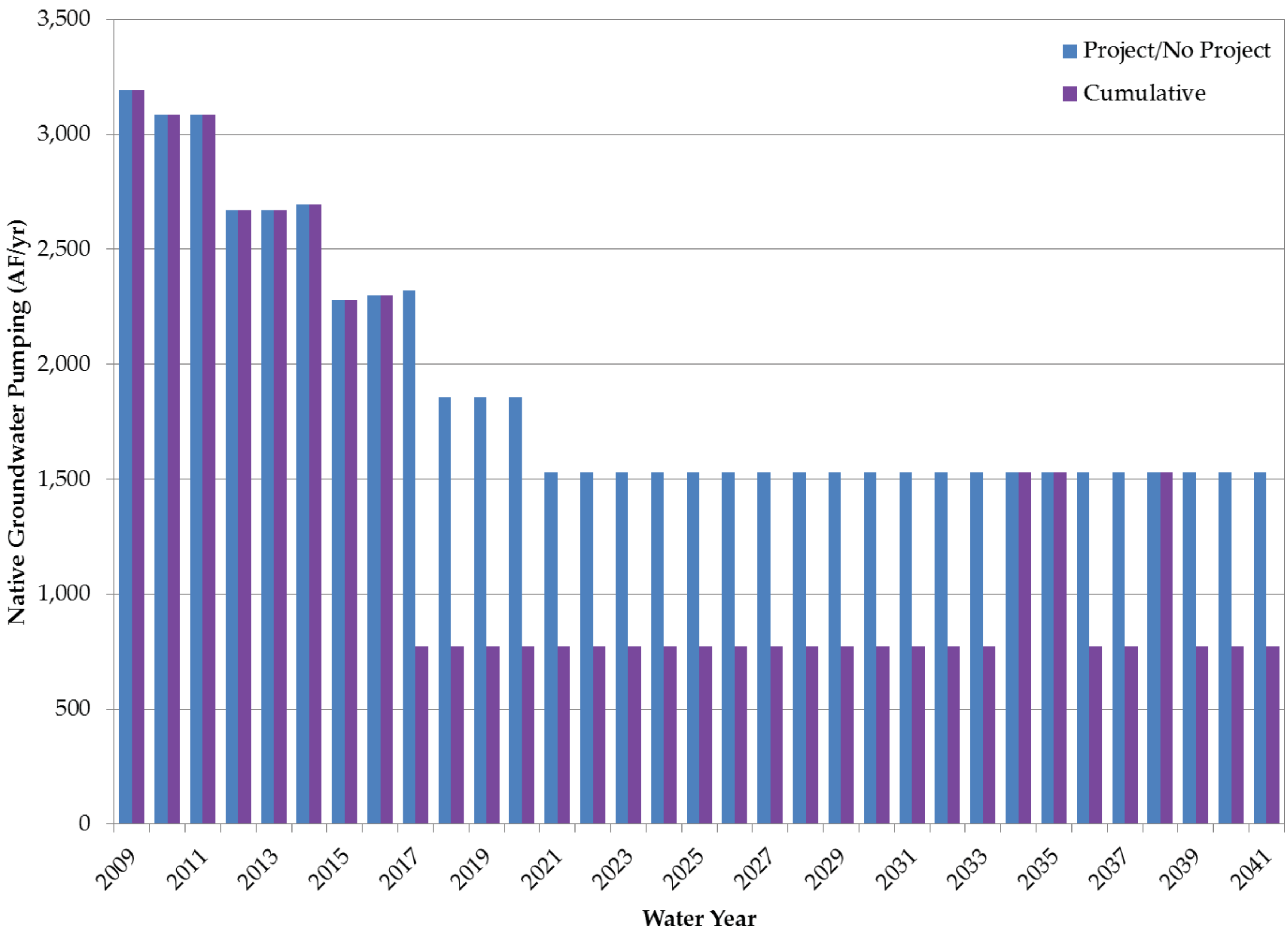


*Figure 19: Annual Use of Native (non-ASR) Groundwater*

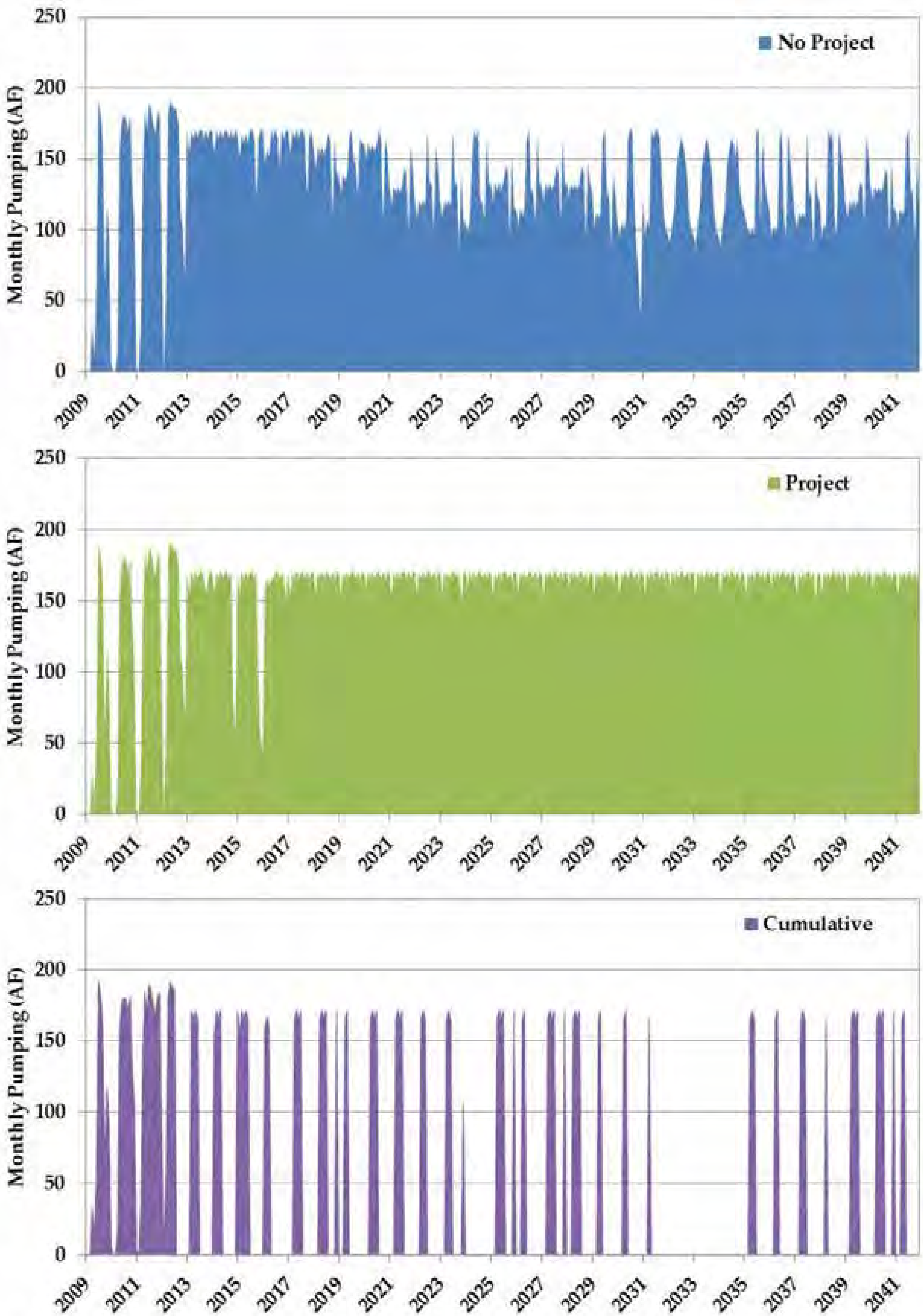


*Figure 20: Pumping Rates for Ord Grove #2 Well*

## Particle Tracking Results

Figure 21 shows how travel times between the GWR Project injection wells and the nearest extraction wells vary depending upon time of release. The horizontal axis represents the time at which groups of particles were released from the injection wells and the vertical axis represents time in days it took for the fastest particle to reach an extraction well. Each dot represents the time travelled by the fastest particle. The light blue, green, red, and dark blue dots show travel times from the locations of the deep injection wells DIW-1, DIW-2, DIW-3, and DIW-4, respectively. The black, yellow, orange, and magenta dots show travel times from the locations of the vadose zone wells VZW-1, VZW-2, VZW-3, and VZW-4, respectively.

The fastest particles are those released from well DIW-3, and captured at the ASR 1&2 Well Site. The fastest time any particle takes to travel from an injection well to a nearby extraction well is approximately 334 days. Travel times from deep injection well DIW-1 are the next fastest; taking approximately 543 days for the fastest particles to reach the ASR 3&4 Well Site. The fastest particles released at the remaining wells take between 2 and 22 years to reach an extraction well, with particles released from vadose zone well VZW-1 never reaching an extraction well after 24 years of simulation.

For most of the wells, there is a notable variation throughout the simulation in the minimum travel time taken by the released particles. For all four deep injection wells, the variations in travel times are strongly influenced by the ASR wells. These ASR wells both inject and extract water throughout the simulation period, thereby impacting groundwater gradients. These ASR wells sometimes draw particles in and sometimes repel them, creating greatly different trajectories depending on when a particle approaches the ASR wells. For example, particles that are released from well DIW-3 in the early winter and captured by wells ASR 1&2 in the late fall experience the fastest travel times. These particles approach the ASR 1&2 wells during the summer pumping season and are captured before any injection begins in the winter. Particles that approach the ASR wells during simulated drought years, experience less seasonal variation in travel times and faster travel times. During these years, particles encounter little to no injection of Carmel River water that would repel them from their path, and at the same time feel a greater a pull from ASR wells that have an extended pumping season under dry conditions.

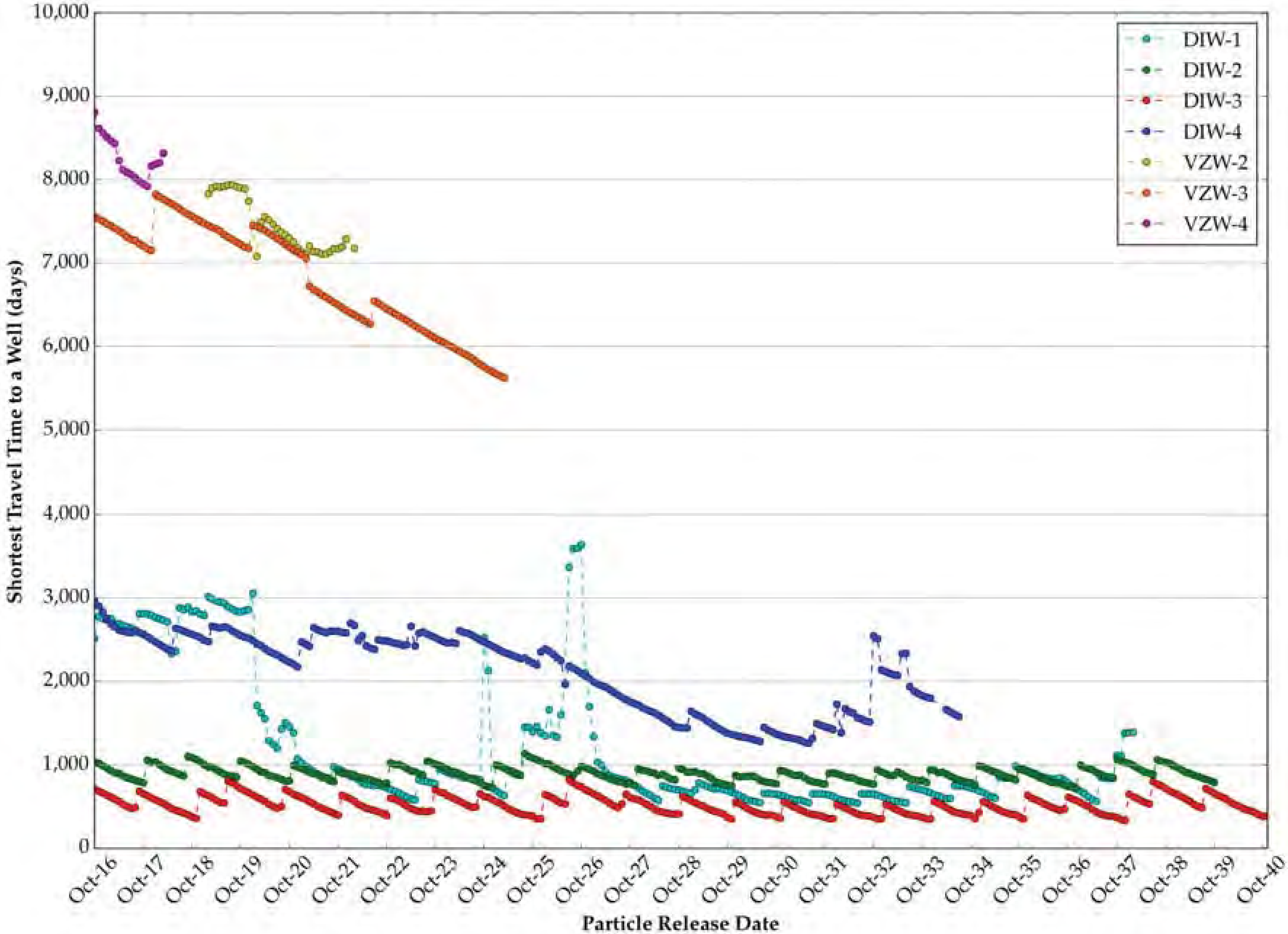


*Figure 21: Fastest Travel Times to a Pumping Well*

The vadose zone wells also display variations in minimum travel times throughout the simulation. These particles are initially released at shallow depths, above the influence of the large-capacity injection and extraction wells. The dynamics of the shallow layers in the model are mostly influenced by fluctuations in natural recharge and by the vadose zone injection itself. Variations in these factors can lead to saturation or desaturation of shallow model cells which in turn cause rapid changes in vertical and horizontal gradients in these cells. This type of behavior is likely to explain the stepped changes in minimum travel times that are seen in vadose zone wells VZW-2, VZW-3, and VZW-4.

The only production wells that capture particles released from the eight injection locations are the three ASR Well Sites, the Ord Grove #2 well; the Paralta well; and the Luzern well. Table 5 and Table 6 summarize how particles from each injection site are captured by nearby wells under the Cumulative Projects scenario.

Table 5 shows the fastest travel times between each injection location and the six groups of extraction wells. A value is not shown if there was no particle travelling between the two wells.

***Table 5: Fastest Travel Times between Injection and Extraction Wells, in Days***

| **Extraction Well** | **Well of Origin** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | DIW-1 | DIW-2 | DIW-3 | DIW-4 | VZW-1 | VZW-2 | VZW-3 | VZW-4 |
| ASR 1&2 | - | 834 | 334 | 1,259 | - | - | - | - |
| ASR 3&4 | 543 | 720 | 1,217 | 2,070 | - | - | - | - |
| ASR 5&6 | 2,515 | 4,068 | 6,116 | 5,828 | - | - | - | - |
| Luzern | - | - | - | - | - | - | 5,626 | - |
| Ord Grove | - | - | 3,788 | 2,583 | - | - | - | 7,924 |
| Paralta | - | 870 | 1,040 | 2,125 | - | 7,081 | - | - |

Note: — = no particle traveling between wells

Table 6 shows the percent of particles injected at each of the injection locations that were captured by each extraction well. This table only shows the fate of the captured particles – not the fate of all particles. As a result, the columns add to 100% for each scenario, even though most of the particles released from the vadose zone wells were not captured by the end of the simulation. The Paralta, Luzern, and Ord Grove 2 wells capture the greatest share of the particles originating from the vadose zone wells; while the ASR 3&4 Well Site and ASR 5&6 Well Site capture the greatest share of particles originating from the deep injection wells.

*Table 6: Percent of Captured Particles that Travel between Injection and Extraction Wells*

| Extraction Well | Well of Origin | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | DIW-1 | DIW-2 | DIW-3 | DIW-4 | VZW-1 | VZW-2 | VZW-3 | VZW-4 |
| ASR 1&2 | - | 2 | 60% | 6% | - | - | - | - |
| ASR 3&4 | 63% | 89% | 32% | 49% | - | - | - | - |
| ASR 5&6 | 37% | 2% | 1% | 5% | - | - | - | - |
| Luzern | - | - | - | - | - | - | 100% | - |
| Ord Grove | - | - | 1% | 38% | - | - | - | 100% |
| Paralta | - | 7% | 6% | 2% | - | 100% | - | - |

Note: — = no particle traveling between wells

Figure 22 and Figure 23 show the path each particle takes from its initial injection location to either an extraction well or its final location when the simulation ends. Separate maps for paths originating from deep injection wells and paths originating from vadose zone wells are included. The particle tracks shown on each figure display the fate of particles that were released in the model period corresponding to December, 2037. This is the release date corresponding to the fastest travel times.

Figure 22 and Figure 23 show that the northwestern-directed groundwater flow field dominates the migration of particles from the vadose zone wells while the local dynamics of the many deep injection and extraction wells dominate the migration of the particles from the deep injection wells. As noted above, there are several particle paths that fluctuate towards and away from the ASR wells before the particles are captured. These fluctuations are the result of the injection and extraction pattern at the ASR wells. The deep particles released in December 2037 that are not captured by the nearby ASR 1&2, ASR 3&4, Ord Grove #2, or Paralta wells flow northward toward the ASR 5&6 wells, but are not captured before the end of the simulation (Figure 22).


*Figure 22: Particle Paths from a Single Release in Deep Injection*

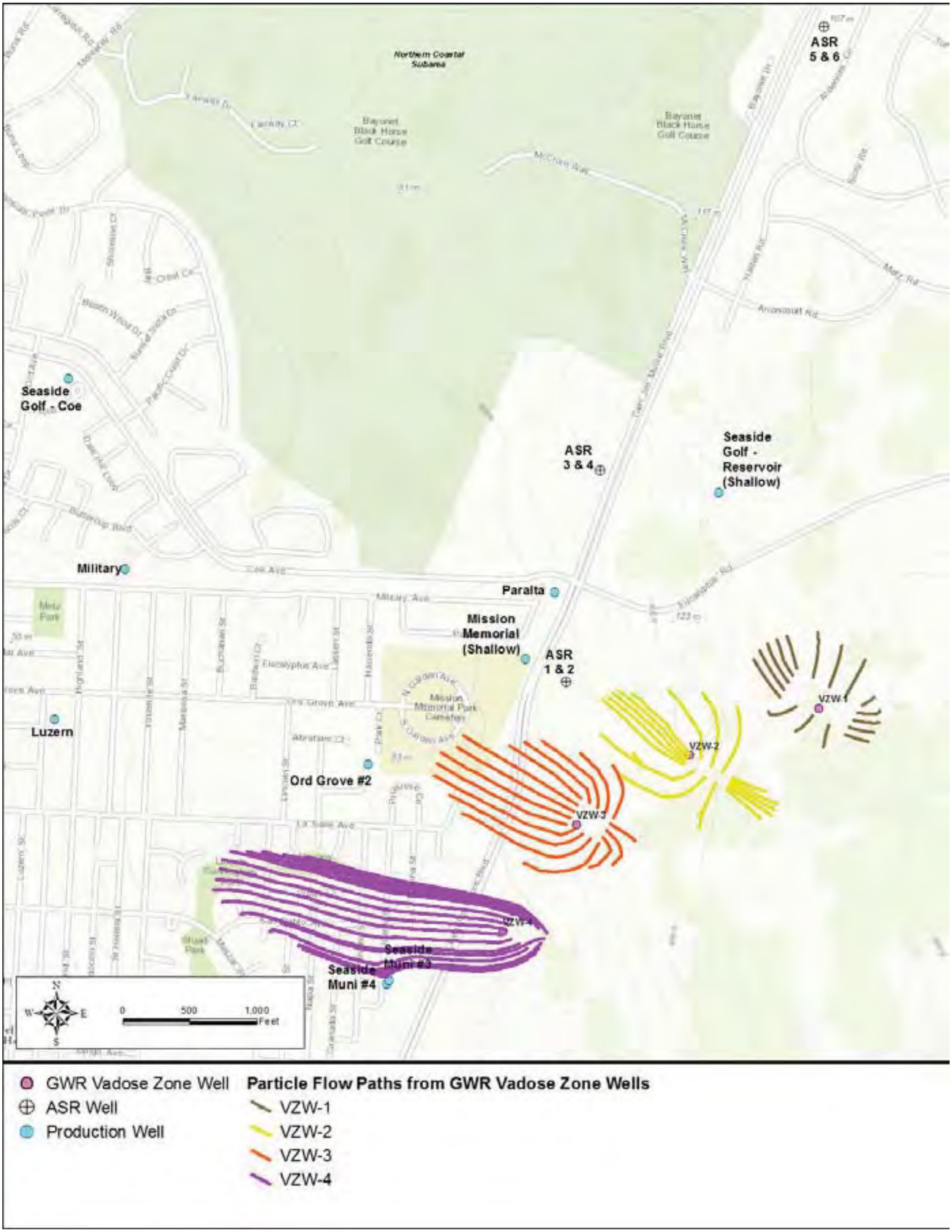


*Figure 23: Particle Paths from a Single Release in Vadose Zone*

Figure 24 and Figure 25 show the greatest particle extent from each injection location at four separate times. Separate maps for paths originating from deep injection wells and paths originating from vadose zone wells are included. Four times are shown: 90 days (yellow), 180 days (orange), 270 days (red), and 360 days (blue). These contours show the same general spatial pattern as Figure 22 and Figure 23 but represent the extent of all particles at any time rather than individual paths.


*Figure 24: Travel Time Extents from Deep Injection Wells*

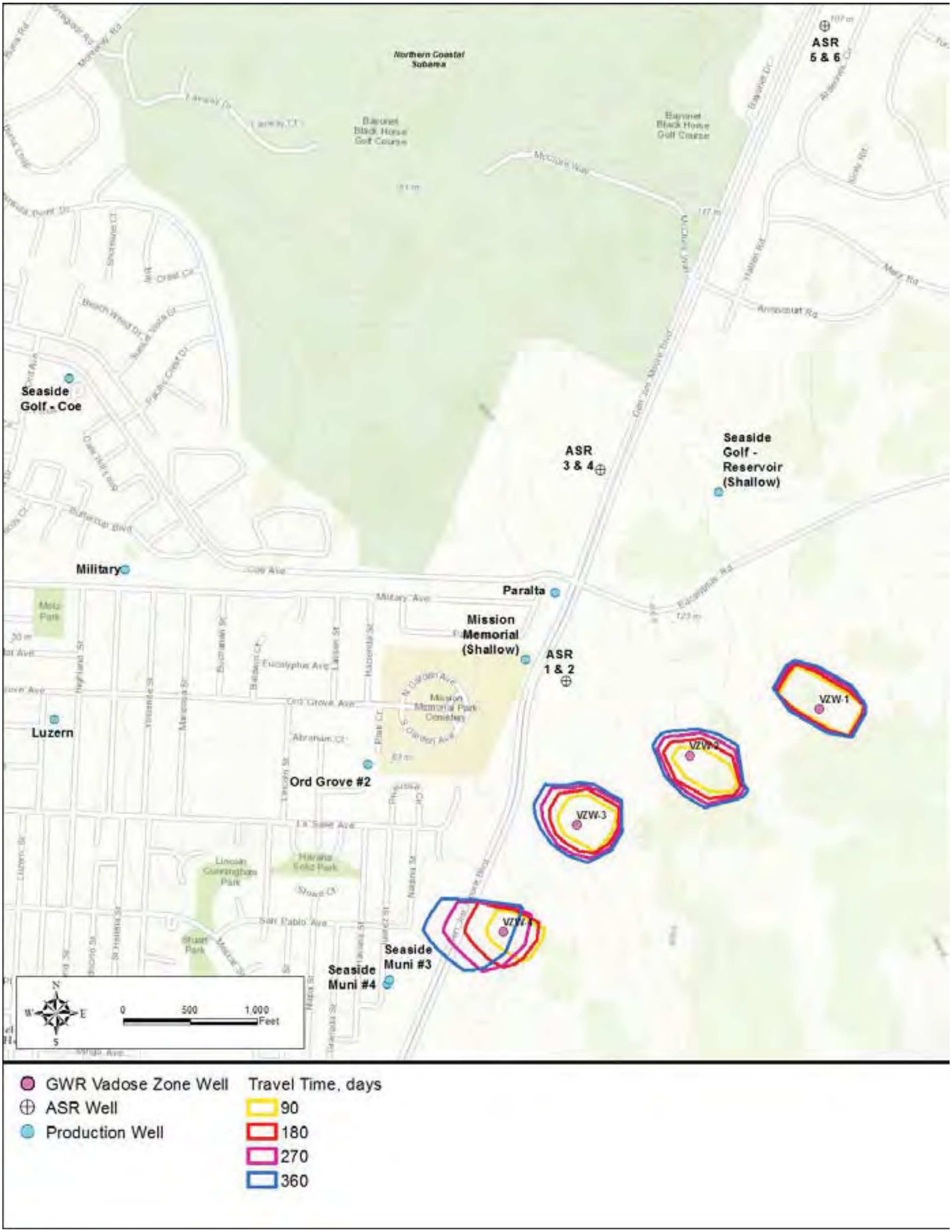


*Figure 25: Travel Time Extents from Vadose Zone Wells*

# References

*California American Water v. City of Seaside et al.* Monterey County Superior Court, Case Number M66343, filed in Monterey County Superior Court on March 27, 2006, amended on February 9, 2007

HydroMetrics Water Resources Inc. 2009. *Seaside groundwater basin modeling and protective groundwater elevations*, prepared for Seaside basin watermaster, November, 151 p.

HydroMetrics Water Resources Inc. 2013. G*roundwater replenishment project description development modeling,* letter to Mr. Bob Holden, Monterey County Water Pollution Control Agency, 12 p.

## Planned Cumulative Projects Water Injection Schedule and CSIP Storage and Delivery Operation

| Water Year | Simulated Historical Climate Water Year | Salinas Station Precip (% of Ave.) | Drought Year Criteria (<75% of Average) | Injection Delivery Schedule | Injection Volume (AF) | Annual Recycled Water to CSIP (AF) | Drought Reserve Change (AF) | Cumulative Drought Reserve (AF) | Injection Delivery Schedule (AFM) Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2017 | 1995 | 131% | | A | 3,700 | - | 200 | 200 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2018 | 1996 | 95% | | A | 3,700 | - | 200 | 400 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2019 | 1997 | 123% | | A | 3,700 | - | 200 | 600 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2020 | 1998 | 240% | | A | 3,700 | - | 200 | 800 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2021 | 1999 | 98% | | A | 3,700 | - | 200 | 1,000 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2022 | 2000 | 114% | | B | 3,500 | - | - | 1,000 | 297 | 288 | 297 | 297 | 268 | 297 | 288 | 297 | 288 | 297 | 297 | 288 | 3,500 |
| 2023 | 2001 | 93% | | B | 3,500 | - | - | 1,000 | 297 | 288 | 297 | 297 | 268 | 297 | 288 | 297 | 288 | 297 | 297 | 288 | 3,500 |
| 2024 | 2002 | 74% | Drought | G | 2,500 | 1,000 | (1,000) | - | 297 | 288 | 297 | 297 | 268 | 297 | 124 | 128 | 124 | 128 | 128 | 124 | 2,500 |
| 2025 | 2003 | 94% | | A | 3,700 | - | 200 | 200 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2026 | 2004 | 82% | | A | 3,700 | - | 200 | 400 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2027 | 2005 | 148% | | A | 3,700 | - | 200 | 600 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2028 | 2006 | 118% | | A | 3,700 | - | 200 | 800 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2029 | 2007 | 73% | Drought | D | 2,700 | 1,000 | (800) | - | 331 | 321 | 331 | 331 | 299 | 331 | 124 | 128 | 124 | 128 | 128 | 124 | 2,700 |
| 2030 | 2008 | 79% | | A | 3,700 | - | 200 | 200 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2031 | 1987 | 60% | Drought | E | 3,300 | 400 | (200) | - | 331 | 321 | 331 | 331 | 299 | 331 | 222 | 229 | 222 | 229 | 229 | 222 | 3,300 |
| 2032 | 1988 | 40% | Drought | F | 3,500 | 200 | - | - | 331 | 321 | 331 | 331 | 299 | 331 | 255 | 263 | 255 | 263 | 263 | 255 | 3,500 |
| 2033 | 1989 | 63% | Drought | F | 3,500 | 200 | - | - | 331 | 321 | 331 | 331 | 299 | 331 | 255 | 263 | 255 | 263 | 263 | 255 | 3,500 |
| 2034 | 1990 | 57% | Drought | F | 3,500 | 200 | - | - | 331 | 321 | 331 | 331 | 299 | 331 | 255 | 263 | 255 | 263 | 263 | 255 | 3,500 |
| 2035 | 1991 | 88% | | A | 3,700 | - | 200 | 200 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2036 | 1992 | 90% | | A | 3,700 | - | 200 | 400 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2037 | 1993 | 140% | | A | 3,700 | - | 200 | 600 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2038 | 1994 | 83% | | A | 3,700 | - | 200 | 800 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2039 | 1995 | 131% | | A | 3,700 | - | 200 | 1,000 | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| 2040 | 1996 | 95% | | B | 3,500 | - | - | 1,000 | 297 | 288 | 297 | 297 | 268 | 297 | 288 | 297 | 288 | 297 | 297 | 288 | 3,500 |
| 2041 | 1997 | 123% | | B | 3,500 | - | - | 1,000 | 297 | 288 | 297 | 297 | 268 | 297 | 288 | 297 | 288 | 297 | 297 | 288 | 3,500 |

| Injection Delivery Schedule (AF/month) | | | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| before drought reserve complete | wet/normal year | A | 331 | 321 | 331 | 331 | 299 | 331 | 288 | 297 | 288 | 297 | 297 | 288 | 3,700 |
| after drought reserve complete | wet/normal year | B | 297 | 288 | 297 | 297 | 268 | 297 | 288 | 297 | 288 | 297 | 297 | 288 | 3,500 |
| before drought reserve complete | drought year (min. AWTF delivery) | C | 331 | 321 | 331 | 331 | 299 | 331 | 107 | 111 | 107 | 111 | 111 | 107 | 2,601 |
| before drought reserve complete | drought year (1,000 AF to CSIP) | D | 331 | 321 | 331 | 331 | 299 | 331 | 124 | 128 | 124 | 128 | 128 | 124 | 2,700 |
| before drought reserve complete | drought year (400 AF to CSIP) | E | 331 | 321 | 331 | 331 | 299 | 331 | 222 | 229 | 222 | 229 | 229 | 222 | 3,300 |
| before drought reserve complete | drought year (200 AF to CSIP) | F | 331 | 321 | 331 | 331 | 299 | 331 | 255 | 263 | 255 | 263 | 263 | 255 | 3,500 |
| after drought reserve complete | drought year (1,000 AF to CSIP) | G | 297 | 288 | 297 | 297 | 268 | 297 | 124 | 128 | 124 | 128 | 128 | 124 | 2,500 |

## *APPENDIX A:*
## *MPWMD HISTORIC AND PROJECTED ASR WELL SITE INJECTION*

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| Before | Oct-86 | 1986/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Nov-86 | 1986/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-86 | 1986/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-87 | 1987/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Feb-87 | 1987/2 | 40 | 26 | 14 | NO | Y | Y | N | N |
| Before | Mar-87 | 1987/3 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Apr-87 | 1987/4 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | May-87 | 1987/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jun-87 | 1987/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jul-87 | 1987/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-87 | 1987/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Sep-87 | 1987/9 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Oct-87 | 1987/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Nov-87 | 1987/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-87 | 1987/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-88 | 1988/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Feb-88 | 1988/2 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Mar-88 | 1988/3 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Apr-88 | 1988/4 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | May-88 | 1988/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jun-88 | 1988/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jul-88 | 1988/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-88 | 1988/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Sep-88 | 1988/9 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Oct-88 | 1988/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Nov-88 | 1988/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-88 | 1988/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-89 | 1989/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Feb-89 | 1989/2 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Mar-89 | 1989/3 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Apr-89 | 1989/4 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | May-89 | 1989/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jun-89 | 1989/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jul-89 | 1989/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-89 | 1989/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Sep-89 | 1989/9 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Oct-89 | 1989/10 | 0 | 0 | 0 | YES | N | N | Y | Y |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| Before | Nov-89 | 1989/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-89 | 1989/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-90 | 1990/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Feb-90 | 1990/2 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Mar-90 | 1990/3 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Apr-90 | 1990/4 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | May-90 | 1990/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jun-90 | 1990/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jul-90 | 1990/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-90 | 1990/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Sep-90 | 1990/9 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Oct-90 | 1990/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Nov-90 | 1990/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-90 | 1990/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-91 | 1991/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Feb-91 | 1991/2 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Mar-91 | 1991/3 | 280 | 182 | 98 | NO | Y | Y | N | N |
| Before | Apr-91 | 1991/4 | 100 | 65 | 35 | NO | Y | Y | N | N |
| Before | May-91 | 1991/5 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jun-91 | 1991/6 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jul-91 | 1991/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-91 | 1991/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Sep-91 | 1991/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-91 | 1991/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Nov-91 | 1991/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-91 | 1991/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-92 | 1992/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Feb-92 | 1992/2 | 380 | 247 | 133 | NO | Y | Y | N | N |
| Before | Mar-92 | 1992/3 | 480 | 312 | 168 | NO | Y | Y | N | N |
| Before | Apr-92 | 1992/4 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | May-92 | 1992/5 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jun-92 | 1992/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jul-92 | 1992/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-92 | 1992/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-92 | 1992/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-92 | 1992/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Nov-92 | 1992/11 | 0 | 0 | 0 | YES | N | N | Y | Y |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| Before | Dec-92 | 1992/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-93 | 1993/1 | 520 | 338 | 182 | NO | Y | Y | N | N |
| Before | Feb-93 | 1993/2 | 560 | 364 | 196 | NO | Y | Y | N | N |
| Before | Mar-93 | 1993/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| Before | Apr-93 | 1993/4 | 540 | 351 | 189 | NO | Y | Y | N | N |
| Before | May-93 | 1993/5 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jun-93 | 1993/6 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jul-93 | 1993/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-93 | 1993/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-93 | 1993/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-93 | 1993/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-93 | 1993/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-93 | 1993/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-94 | 1994/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Feb-94 | 1994/2 | 140 | 91 | 49 | NO | Y | Y | N | N |
| Before | Mar-94 | 1994/3 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Apr-94 | 1994/4 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | May-94 | 1994/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jun-94 | 1994/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jul-94 | 1994/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-94 | 1994/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-94 | 1994/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-94 | 1994/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Nov-94 | 1994/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-94 | 1994/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-95 | 1995/1 | 480 | 312 | 168 | NO | Y | Y | N | N |
| Before | Feb-95 | 1995/2 | 440 | 286 | 154 | NO | Y | Y | N | N |
| Before | Mar-95 | 1995/3 | 580 | 377 | 203 | NO | Y | Y | N | N |
| Before | Apr-95 | 1995/4 | 600 | 390 | 210 | NO | Y | Y | N | N |
| Before | May-95 | 1995/5 | 620 | 403 | 217 | NO | Y | Y | N | N |
| Before | Jun-95 | 1995/6 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jul-95 | 1995/7 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Aug-95 | 1995/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-95 | 1995/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-95 | 1995/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-95 | 1995/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-95 | 1995/12 | 0 | 0 | 0 | YES | N | N | Y | Y |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| Before | Jan-96 | 1996/1 | 180 | 117 | 63 | NO | Y | Y | N | N |
| Before | Feb-96 | 1996/2 | 580 | 377 | 203 | NO | Y | Y | N | N |
| Before | Mar-96 | 1996/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| Before | Apr-96 | 1996/4 | 480 | 312 | 168 | NO | Y | Y | N | N |
| Before | May-96 | 1996/5 | 60 | 39 | 21 | NO | Y | Y | N | N |
| Before | Jun-96 | 1996/6 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jul-96 | 1996/7 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Aug-96 | 1996/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-96 | 1996/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-96 | 1996/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-96 | 1996/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-96 | 1996/12 | 360 | 234 | 126 | NO | Y | Y | N | N |
| Before | Jan-97 | 1997/1 | 620 | 403 | 217 | NO | Y | Y | N | N |
| Before | Feb-97 | 1997/2 | 560 | 364 | 196 | NO | Y | Y | N | N |
| Before | Mar-97 | 1997/3 | 100 | 65 | 35 | NO | Y | Y | N | N |
| Before | Apr-97 | 1997/4 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | May-97 | 1997/5 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jun-97 | 1997/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jul-97 | 1997/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-97 | 1997/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-97 | 1997/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-97 | 1997/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-97 | 1997/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-97 | 1997/12 | 120 | 78 | 42 | NO | Y | Y | N | N |
| Before | Jan-98 | 1998/1 | 500 | 325 | 175 | NO | Y | Y | N | N |
| Before | Feb-98 | 1998/2 | 560 | 364 | 196 | NO | Y | Y | N | N |
| Before | Mar-98 | 1998/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| Before | Apr-98 | 1998/4 | 600 | 390 | 210 | NO | Y | Y | N | N |
| Before | May-98 | 1998/5 | 620 | 403 | 217 | NO | Y | Y | N | N |
| Before | Jun-98 | 1998/6 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jul-98 | 1998/7 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Aug-98 | 1998/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-98 | 1998/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-98 | 1998/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-98 | 1998/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-98 | 1998/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-99 | 1999/1 | 100 | 65 | 35 | NO | Y | Y | N | N |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| Before | Feb-99 | 1999/2 | 480 | 312 | 168 | NO | Y | Y | N | N |
| Before | Mar-99 | 1999/3 | 440 | 286 | 154 | NO | Y | Y | N | N |
| Before | Apr-99 | 1999/4 | 600 | 390 | 210 | NO | Y | Y | N | N |
| Before | May-99 | 1999/5 | 300 | 195 | 105 | NO | Y | Y | N | N |
| Before | Jun-99 | 1999/6 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jul-99 | 1999/7 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Aug-99 | 1999/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-99 | 1999/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-99 | 1999/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-99 | 1999/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-99 | 1999/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-00 | 2000/1 | 180 | 117 | 63 | NO | Y | Y | N | N |
| Before | Feb-00 | 2000/2 | 520 | 338 | 182 | NO | Y | Y | N | N |
| Before | Mar-00 | 2000/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| Before | Apr-00 | 2000/4 | 320 | 208 | 112 | NO | Y | Y | N | N |
| Before | May-00 | 2000/5 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jun-00 | 2000/6 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jul-00 | 2000/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-00 | 2000/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-00 | 2000/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-00 | 2000/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-00 | 2000/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-00 | 2000/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-01 | 2001/1 | 140 | 91 | 49 | NO | Y | Y | N | N |
| Before | Feb-01 | 2001/2 | 340 | 221 | 119 | NO | Y | Y | N | N |
| Before | Mar-01 | 2001/3 | 560 | 364 | 196 | NO | Y | Y | N | N |
| Before | Apr-01 | 2001/4 | 180 | 117 | 63 | NO | Y | Y | N | N |
| Before | May-01 | 2001/5 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jun-01 | 2001/6 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jul-01 | 2001/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-01 | 2001/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-01 | 2001/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-01 | 2001/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-01 | 2001/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-01 | 2001/12 | 220 | 143 | 77 | NO | Y | Y | N | N |
| Before | Jan-02 | 2002/1 | 240 | 156 | 84 | NO | Y | Y | N | N |
| Before | Feb-02 | 2002/2 | 0 | 0 | 0 | NO | N | N | N | N |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| Before | Mar-02 | 2002/3 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Apr-02 | 2002/4 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | May-02 | 2002/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jun-02 | 2002/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jul-02 | 2002/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-02 | 2002/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-02 | 2002/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-02 | 2002/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-02 | 2002/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-02 | 2002/12 | 340 | 221 | 119 | NO | Y | Y | N | N |
| Before | Jan-03 | 2003/1 | 500 | 325 | 175 | NO | Y | Y | N | N |
| Before | Feb-03 | 2003/2 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Mar-03 | 2003/3 | 100 | 65 | 35 | NO | Y | Y | N | N |
| Before | Apr-03 | 2003/4 | 360 | 234 | 126 | NO | Y | Y | N | N |
| Before | May-03 | 2003/5 | 400 | 260 | 140 | NO | Y | Y | N | N |
| Before | Jun-03 | 2003/6 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jul-03 | 2003/7 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Aug-03 | 2003/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-03 | 2003/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-03 | 2003/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-03 | 2003/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-03 | 2003/12 | 40 | 26 | 14 | NO | Y | Y | N | N |
| Before | Jan-04 | 2004/1 | 100 | 65 | 35 | NO | Y | Y | N | N |
| Before | Feb-04 | 2004/2 | 280 | 182 | 98 | NO | Y | Y | N | N |
| Before | Mar-04 | 2004/3 | 300 | 195 | 105 | NO | Y | Y | N | N |
| Before | Apr-04 | 2004/4 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | May-04 | 2004/5 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jun-04 | 2004/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jul-04 | 2004/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-04 | 2004/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-04 | 2004/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-04 | 2004/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-04 | 2004/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-04 | 2004/12 | 60 | 39 | 21 | NO | Y | Y | N | N |
| Before | Jan-05 | 2005/1 | 620 | 403 | 217 | NO | Y | Y | N | N |
| Before | Feb-05 | 2005/2 | 560 | 364 | 196 | NO | Y | Y | N | N |
| Before | Mar-05 | 2005/3 | 620 | 403 | 217 | NO | Y | Y | N | N |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| Before | Apr-05 | 2005/4 | 600 | 390 | 210 | NO | Y | Y | N | N |
| Before | May-05 | 2005/5 | 460 | 299 | 161 | NO | Y | Y | N | N |
| Before | Jun-05 | 2005/6 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jul-05 | 2005/7 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Aug-05 | 2005/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-05 | 2005/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-05 | 2005/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-05 | 2005/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-05 | 2005/12 | 20 | 13 | 7 | NO | Y | Y | N | N |
| Before | Jan-06 | 2006/1 | 400 | 260 | 140 | NO | Y | Y | N | N |
| Before | Feb-06 | 2006/2 | 40 | 26 | 14 | NO | Y | Y | N | N |
| Before | Mar-06 | 2006/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| Before | Apr-06 | 2006/4 | 600 | 390 | 210 | NO | Y | Y | N | N |
| Before | May-06 | 2006/5 | 620 | 403 | 217 | NO | Y | Y | N | N |
| Before | Jun-06 | 2006/6 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jul-06 | 2006/7 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Aug-06 | 2006/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-06 | 2006/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-06 | 2006/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-06 | 2006/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-06 | 2006/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-07 | 2007/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Feb-07 | 2007/2 | 40 | 26 | 14 | NO | Y | Y | N | N |
| Before | Mar-07 | 2007/3 | 40 | 26 | 14 | NO | Y | Y | N | N |
| Before | Apr-07 | 2007/4 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | May-07 | 2007/5 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jun-07 | 2007/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jul-07 | 2007/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-07 | 2007/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Sep-07 | 2007/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-07 | 2007/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-07 | 2007/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Dec-07 | 2007/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jan-08 | 2008/1 | 200 | 130 | 70 | NO | Y | Y | N | N |
| Before | Feb-08 | 2008/2 | 500 | 325 | 175 | NO | Y | Y | N | N |
| Before | Mar-08 | 2008/3 | 260 | 169 | 91 | NO | Y | Y | N | N |
| Before | Apr-08 | 2008/4 | 0 | 0 | 0 | NO | N | N | N | N |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| Before | May-08 | 2008/5 | 0 | 0 | 0 | NO | N | N | N | N |
| Before | Jun-08 | 2008/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Jul-08 | 2008/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Aug-08 | 2008/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| Before | Sep-08 | 2008/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Oct-08 | 2008/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Nov-08 | 2008/11 | 0 | 0 | 0 | NO | N | N | Y | Y |
| Before | Dec-08 | 2008/12 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 1 | Jan-09 | 1987/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 2 | Feb-09 | 1987/2 | 40 | 26 | 14 | NO | Y | Y | N | N |
| 3 | Mar-09 | 1987/3 | 0 | 0 | 0 | NO | N | N | N | N |
| 4 | Apr-09 | 1987/4 | 0 | 0 | 0 | NO | N | N | N | N |
| 5 | May-09 | 1987/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 6 | Jun-09 | 1987/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 7 | Jul-09 | 1987/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 8 | Aug-09 | 1987/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 9 | Sep-09 | 1987/9 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 10 | Oct-09 | 1987/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 11 | Nov-09 | 1987/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 12 | Dec-09 | 1987/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 13 | Jan-10 | 1988/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 14 | Feb-10 | 1988/2 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 15 | Mar-10 | 1988/3 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 16 | Apr-10 | 1988/4 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 17 | May-10 | 1988/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 18 | Jun-10 | 1988/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 19 | Jul-10 | 1988/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 20 | Aug-10 | 1988/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 21 | Sep-10 | 1988/9 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 22 | Oct-10 | 1988/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 23 | Nov-10 | 1988/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 24 | Dec-10 | 1988/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 25 | Jan-11 | 1989/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 26 | Feb-11 | 1989/2 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 27 | Mar-11 | 1989/3 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 28 | Apr-11 | 1989/4 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 29 | May-11 | 1989/5 | 0 | 0 | 0 | YES | N | N | Y | Y |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| 30 | Jun-11 | 1989/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 31 | Jul-11 | 1989/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 32 | Aug-11 | 1989/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 33 | Sep-11 | 1989/9 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 34 | Oct-11 | 1989/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 35 | Nov-11 | 1989/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 36 | Dec-11 | 1989/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 37 | Jan-12 | 1990/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 38 | Feb-12 | 1990/2 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 39 | Mar-12 | 1990/3 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 40 | Apr-12 | 1990/4 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 41 | May-12 | 1990/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 42 | Jun-12 | 1990/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 43 | Jul-12 | 1990/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 44 | Aug-12 | 1990/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 45 | Sep-12 | 1990/9 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 46 | Oct-12 | 1990/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 47 | Nov-12 | 1990/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 48 | Dec-12 | 1990/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 49 | Jan-13 | 1991/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 50 | Feb-13 | 1991/2 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 51 | Mar-13 | 1991/3 | 280 | 182 | 98 | NO | Y | Y | N | N |
| 52 | Apr-13 | 1991/4 | 100 | 65 | 35 | NO | Y | Y | N | N |
| 53 | May-13 | 1991/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 54 | Jun-13 | 1991/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 55 | Jul-13 | 1991/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 56 | Aug-13 | 1991/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 57 | Sep-13 | 1991/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 58 | Oct-13 | 1991/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 59 | Nov-13 | 1991/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 60 | Dec-13 | 1991/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 61 | Jan-14 | 1992/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 62 | Feb-14 | 1992/2 | 380 | 247 | 133 | NO | Y | Y | N | N |
| 63 | Mar-14 | 1992/3 | 480 | 312 | 168 | NO | Y | Y | N | N |
| 64 | Apr-14 | 1992/4 | 0 | 0 | 0 | NO | N | N | N | N |
| 65 | May-14 | 1992/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 66 | Jun-14 | 1992/6 | 0 | 0 | 0 | YES | N | N | Y | Y |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| 67 | Jul-14 | 1992/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 68 | Aug-14 | 1992/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 69 | Sep-14 | 1992/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 70 | Oct-14 | 1992/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 71 | Nov-14 | 1992/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 72 | Dec-14 | 1992/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 73 | Jan-15 | 1993/1 | 520 | 338 | 182 | NO | Y | Y | N | N |
| 74 | Feb-15 | 1993/2 | 560 | 364 | 196 | NO | Y | Y | N | N |
| 75 | Mar-15 | 1993/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 76 | Apr-15 | 1993/4 | 540 | 351 | 189 | NO | Y | Y | N | N |
| 77 | May-15 | 1993/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 78 | Jun-15 | 1993/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 79 | Jul-15 | 1993/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 80 | Aug-15 | 1993/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 81 | Sep-15 | 1993/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 82 | Oct-15 | 1993/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 83 | Nov-15 | 1993/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 84 | Dec-15 | 1993/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 85 | Jan-16 | 1994/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 86 | Feb-16 | 1994/2 | 140 | 91 | 49 | NO | Y | Y | N | N |
| 87 | Mar-16 | 1994/3 | 0 | 0 | 0 | NO | N | N | N | N |
| 88 | Apr-16 | 1994/4 | 0 | 0 | 0 | NO | N | N | N | N |
| 89 | May-16 | 1994/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 90 | Jun-16 | 1994/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 91 | Jul-16 | 1994/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 92 | Aug-16 | 1994/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 93 | Sep-16 | 1994/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 94 | Oct-16 | 1994/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 95 | Nov-16 | 1994/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 96 | Dec-16 | 1994/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 97 | Jan-17 | 1995/1 | 480 | 312 | 168 | NO | Y | Y | N | N |
| 98 | Feb-17 | 1995/2 | 440 | 286 | 154 | NO | Y | Y | N | N |
| 99 | Mar-17 | 1995/3 | 580 | 377 | 203 | NO | Y | Y | N | N |
| 100 | Apr-17 | 1995/4 | 600 | 390 | 210 | NO | Y | Y | N | N |
| 101 | May-17 | 1995/5 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 102 | Jun-17 | 1995/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 103 | Jul-17 | 1995/7 | 0 | 0 | 0 | NO | N | N | N | N |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| 104 | Aug-17 | 1995/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 105 | Sep-17 | 1995/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 106 | Oct-17 | 1995/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 107 | Nov-17 | 1995/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 108 | Dec-17 | 1995/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 109 | Jan-18 | 1996/1 | 180 | 117 | 63 | NO | Y | Y | N | N |
| 110 | Feb-18 | 1996/2 | 580 | 377 | 203 | NO | Y | Y | N | N |
| 111 | Mar-18 | 1996/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 112 | Apr-18 | 1996/4 | 480 | 312 | 168 | NO | Y | Y | N | N |
| 113 | May-18 | 1996/5 | 60 | 39 | 21 | NO | Y | Y | N | N |
| 114 | Jun-18 | 1996/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 115 | Jul-18 | 1996/7 | 0 | 0 | 0 | NO | N | N | N | N |
| 116 | Aug-18 | 1996/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 117 | Sep-18 | 1996/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 118 | Oct-18 | 1996/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 119 | Nov-18 | 1996/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 120 | Dec-18 | 1996/12 | 360 | 234 | 126 | NO | Y | Y | N | N |
| 121 | Jan-19 | 1997/1 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 122 | Feb-19 | 1997/2 | 560 | 364 | 196 | NO | Y | Y | N | N |
| 123 | Mar-19 | 1997/3 | 100 | 65 | 35 | NO | Y | Y | N | N |
| 124 | Apr-19 | 1997/4 | 0 | 0 | 0 | NO | N | N | N | N |
| 125 | May-19 | 1997/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 126 | Jun-19 | 1997/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 127 | Jul-19 | 1997/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 128 | Aug-19 | 1997/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 129 | Sep-19 | 1997/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 130 | Oct-19 | 1997/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 131 | Nov-19 | 1997/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 132 | Dec-19 | 1997/12 | 120 | 78 | 42 | NO | Y | Y | N | N |
| 133 | Jan-20 | 1998/1 | 500 | 325 | 175 | NO | Y | Y | N | N |
| 134 | Feb-20 | 1998/2 | 560 | 364 | 196 | NO | Y | Y | N | N |
| 135 | Mar-20 | 1998/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 136 | Apr-20 | 1998/4 | 600 | 390 | 210 | NO | Y | Y | N | N |
| 137 | May-20 | 1998/5 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 138 | Jun-20 | 1998/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 139 | Jul-20 | 1998/7 | 0 | 0 | 0 | NO | N | N | N | N |
| 140 | Aug-20 | 1998/8 | 0 | 0 | 0 | NO | N | N | Y | Y |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| 141 | Sep-20 | 1998/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 142 | Oct-20 | 1998/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 143 | Nov-20 | 1998/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 144 | Dec-20 | 1998/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 145 | Jan-21 | 1999/1 | 100 | 65 | 35 | NO | Y | Y | N | N |
| 146 | Feb-21 | 1999/2 | 480 | 312 | 168 | NO | Y | Y | N | N |
| 147 | Mar-21 | 1999/3 | 440 | 286 | 154 | NO | Y | Y | N | N |
| 148 | Apr-21 | 1999/4 | 600 | 390 | 210 | NO | Y | Y | N | N |
| 149 | May-21 | 1999/5 | 300 | 195 | 105 | NO | Y | Y | N | N |
| 150 | Jun-21 | 1999/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 151 | Jul-21 | 1999/7 | 0 | 0 | 0 | NO | N | N | N | N |
| 152 | Aug-21 | 1999/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 153 | Sep-21 | 1999/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 154 | Oct-21 | 1999/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 155 | Nov-21 | 1999/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 156 | Dec-21 | 1999/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 157 | Jan-22 | 2000/1 | 180 | 117 | 63 | NO | Y | Y | N | N |
| 158 | Feb-22 | 2000/2 | 520 | 338 | 182 | NO | Y | Y | N | N |
| 159 | Mar-22 | 2000/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 160 | Apr-22 | 2000/4 | 320 | 208 | 112 | NO | Y | Y | N | N |
| 161 | May-22 | 2000/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 162 | Jun-22 | 2000/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 163 | Jul-22 | 2000/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 164 | Aug-22 | 2000/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 165 | Sep-22 | 2000/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 166 | Oct-22 | 2000/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 167 | Nov-22 | 2000/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 168 | Dec-22 | 2000/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 169 | Jan-23 | 2001/1 | 140 | 91 | 49 | NO | Y | Y | N | N |
| 170 | Feb-23 | 2001/2 | 340 | 221 | 119 | NO | Y | Y | N | N |
| 171 | Mar-23 | 2001/3 | 560 | 364 | 196 | NO | Y | Y | N | N |
| 172 | Apr-23 | 2001/4 | 180 | 117 | 63 | NO | Y | Y | N | N |
| 173 | May-23 | 2001/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 174 | Jun-23 | 2001/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 175 | Jul-23 | 2001/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 176 | Aug-23 | 2001/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 177 | Sep-23 | 2001/9 | 0 | 0 | 0 | NO | N | N | Y | Y |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| 178 | Oct-23 | 2001/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 179 | Nov-23 | 2001/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 180 | Dec-23 | 2001/12 | 220 | 143 | 77 | NO | Y | Y | N | N |
| 181 | Jan-24 | 2002/1 | 240 | 156 | 84 | NO | Y | Y | N | N |
| 182 | Feb-24 | 2002/2 | 0 | 0 | 0 | NO | N | N | N | N |
| 183 | Mar-24 | 2002/3 | 0 | 0 | 0 | NO | N | N | N | N |
| 184 | Apr-24 | 2002/4 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 185 | May-24 | 2002/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 186 | Jun-24 | 2002/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 187 | Jul-24 | 2002/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 188 | Aug-24 | 2002/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 189 | Sep-24 | 2002/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 190 | Oct-24 | 2002/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 191 | Nov-24 | 2002/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 192 | Dec-24 | 2002/12 | 340 | 221 | 119 | NO | Y | Y | N | N |
| 193 | Jan-25 | 2003/1 | 500 | 325 | 175 | NO | Y | Y | N | N |
| 194 | Feb-25 | 2003/2 | 0 | 0 | 0 | NO | N | N | N | N |
| 195 | Mar-25 | 2003/3 | 100 | 65 | 35 | NO | Y | Y | N | N |
| 196 | Apr-25 | 2003/4 | 360 | 234 | 126 | NO | Y | Y | N | N |
| 197 | May-25 | 2003/5 | 400 | 260 | 140 | NO | Y | Y | N | N |
| 198 | Jun-25 | 2003/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 199 | Jul-25 | 2003/7 | 0 | 0 | 0 | NO | N | N | N | N |
| 200 | Aug-25 | 2003/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 201 | Sep-25 | 2003/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 202 | Oct-25 | 2003/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 203 | Nov-25 | 2003/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 204 | Dec-25 | 2003/12 | 40 | 26 | 14 | NO | Y | Y | N | N |
| 205 | Jan-26 | 2004/1 | 100 | 65 | 35 | NO | Y | Y | N | N |
| 206 | Feb-26 | 2004/2 | 280 | 182 | 98 | NO | Y | Y | N | N |
| 207 | Mar-26 | 2004/3 | 300 | 195 | 105 | NO | Y | Y | N | N |
| 208 | Apr-26 | 2004/4 | 0 | 0 | 0 | NO | N | N | N | N |
| 209 | May-26 | 2004/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 210 | Jun-26 | 2004/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 211 | Jul-26 | 2004/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 212 | Aug-26 | 2004/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 213 | Sep-26 | 2004/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 214 | Oct-26 | 2004/10 | 0 | 0 | 0 | NO | N | N | Y | Y |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| 215 | Nov-26 | 2004/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 216 | Dec-26 | 2004/12 | 60 | 39 | 21 | NO | Y | Y | N | N |
| 217 | Jan-27 | 2005/1 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 218 | Feb-27 | 2005/2 | 560 | 364 | 196 | NO | Y | Y | N | N |
| 219 | Mar-27 | 2005/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 220 | Apr-27 | 2005/4 | 600 | 390 | 210 | NO | Y | Y | N | N |
| 221 | May-27 | 2005/5 | 460 | 299 | 161 | NO | Y | Y | N | N |
| 222 | Jun-27 | 2005/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 223 | Jul-27 | 2005/7 | 0 | 0 | 0 | NO | N | N | N | N |
| 224 | Aug-27 | 2005/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 225 | Sep-27 | 2005/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 226 | Oct-27 | 2005/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 227 | Nov-27 | 2005/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 228 | Dec-27 | 2005/12 | 20 | 13 | 7 | NO | Y | Y | N | N |
| 229 | Jan-28 | 2006/1 | 400 | 260 | 140 | NO | Y | Y | N | N |
| 230 | Feb-28 | 2006/2 | 40 | 26 | 14 | NO | Y | Y | N | N |
| 231 | Mar-28 | 2006/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 232 | Apr-28 | 2006/4 | 600 | 390 | 210 | NO | Y | Y | N | N |
| 233 | May-28 | 2006/5 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 234 | Jun-28 | 2006/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 235 | Jul-28 | 2006/7 | 0 | 0 | 0 | NO | N | N | N | N |
| 236 | Aug-28 | 2006/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 237 | Sep-28 | 2006/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 238 | Oct-28 | 2006/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 239 | Nov-28 | 2006/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 240 | Dec-28 | 2006/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 241 | Jan-29 | 2007/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 242 | Feb-29 | 2007/2 | 40 | 26 | 14 | NO | Y | Y | N | N |
| 243 | Mar-29 | 2007/3 | 40 | 26 | 14 | NO | Y | Y | N | N |
| 244 | Apr-29 | 2007/4 | 0 | 0 | 0 | NO | N | N | N | N |
| 245 | May-29 | 2007/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 246 | Jun-29 | 2007/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 247 | Jul-29 | 2007/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 248 | Aug-29 | 2007/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 249 | Sep-29 | 2007/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 250 | Oct-29 | 2007/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 251 | Nov-29 | 2007/11 | 0 | 0 | 0 | YES | N | N | Y | Y |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| 252 | Dec-29 | 2007/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 253 | Jan-30 | 2008/1 | 200 | 130 | 70 | NO | Y | Y | N | N |
| 254 | Feb-30 | 2008/2 | 500 | 325 | 175 | NO | Y | Y | N | N |
| 255 | Mar-30 | 2008/3 | 260 | 169 | 91 | NO | Y | Y | N | N |
| 256 | Apr-30 | 2008/4 | 0 | 0 | 0 | NO | N | N | N | N |
| 257 | May-30 | 2008/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 258 | Jun-30 | 2008/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 259 | Jul-30 | 2008/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 260 | Aug-30 | 2008/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 261 | Sep-30 | 2008/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 262 | Oct-30 | 2008/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 263 | Nov-30 | 2008/11 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 264 | Dec-30 | 2008/12 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 265 | Jan-31 | 1987/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 266 | Feb-31 | 1987/2 | 40 | 26 | 14 | NO | Y | Y | N | N |
| 267 | Mar-31 | 1987/3 | 0 | 0 | 0 | NO | N | N | N | N |
| 268 | Apr-31 | 1987/4 | 0 | 0 | 0 | NO | N | N | N | N |
| 269 | May-31 | 1987/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 270 | Jun-31 | 1987/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 271 | Jul-31 | 1987/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 272 | Aug-31 | 1987/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 273 | Sep-31 | 1987/9 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 274 | Oct-31 | 1987/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 275 | Nov-31 | 1987/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 276 | Dec-31 | 1987/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 277 | Jan-32 | 1988/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 278 | Feb-32 | 1988/2 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 279 | Mar-32 | 1988/3 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 280 | Apr-32 | 1988/4 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 281 | May-32 | 1988/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 282 | Jun-32 | 1988/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 283 | Jul-32 | 1988/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 284 | Aug-32 | 1988/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 285 | Sep-32 | 1988/9 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 286 | Oct-32 | 1988/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 287 | Nov-32 | 1988/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 288 | Dec-32 | 1988/12 | 0 | 0 | 0 | YES | N | N | Y | Y |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| 289 | Jan-33 | 1989/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 290 | Feb-33 | 1989/2 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 291 | Mar-33 | 1989/3 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 292 | Apr-33 | 1989/4 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 293 | May-33 | 1989/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 294 | Jun-33 | 1989/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 295 | Jul-33 | 1989/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 296 | Aug-33 | 1989/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 297 | Sep-33 | 1989/9 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 298 | Oct-33 | 1989/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 299 | Nov-33 | 1989/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 300 | Dec-33 | 1989/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 301 | Jan-34 | 1990/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 302 | Feb-34 | 1990/2 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 303 | Mar-34 | 1990/3 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 304 | Apr-34 | 1990/4 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 305 | May-34 | 1990/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 306 | Jun-34 | 1990/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 307 | Jul-34 | 1990/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 308 | Aug-34 | 1990/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 309 | Sep-34 | 1990/9 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 310 | Oct-34 | 1990/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 311 | Nov-34 | 1990/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 312 | Dec-34 | 1990/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 313 | Jan-35 | 1991/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 314 | Feb-35 | 1991/2 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 315 | Mar-35 | 1991/3 | 280 | 182 | 98 | NO | Y | Y | N | N |
| 316 | Apr-35 | 1991/4 | 100 | 65 | 35 | NO | Y | Y | N | N |
| 317 | May-35 | 1991/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 318 | Jun-35 | 1991/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 319 | Jul-35 | 1991/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 320 | Aug-35 | 1991/8 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 321 | Sep-35 | 1991/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 322 | Oct-35 | 1991/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 323 | Nov-35 | 1991/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 324 | Dec-35 | 1991/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 325 | Jan-36 | 1992/1 | 0 | 0 | 0 | YES | N | N | Y | Y |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| 326 | Feb-36 | 1992/2 | 380 | 247 | 133 | NO | Y | Y | N | N |
| 327 | Mar-36 | 1992/3 | 480 | 312 | 168 | NO | Y | Y | N | N |
| 328 | Apr-36 | 1992/4 | 0 | 0 | 0 | NO | N | N | N | N |
| 329 | May-36 | 1992/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 330 | Jun-36 | 1992/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 331 | Jul-36 | 1992/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 332 | Aug-36 | 1992/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 333 | Sep-36 | 1992/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 334 | Oct-36 | 1992/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 335 | Nov-36 | 1992/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 336 | Dec-36 | 1992/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 337 | Jan-37 | 1993/1 | 520 | 338 | 182 | NO | Y | Y | N | N |
| 338 | Feb-37 | 1993/2 | 560 | 364 | 196 | NO | Y | Y | N | N |
| 339 | Mar-37 | 1993/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 340 | Apr-37 | 1993/4 | 540 | 351 | 189 | NO | Y | Y | N | N |
| 341 | May-37 | 1993/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 342 | Jun-37 | 1993/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 343 | Jul-37 | 1993/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 344 | Aug-37 | 1993/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 345 | Sep-37 | 1993/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 346 | Oct-37 | 1993/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 347 | Nov-37 | 1993/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 348 | Dec-37 | 1993/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 349 | Jan-38 | 1994/1 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 350 | Feb-38 | 1994/2 | 140 | 91 | 49 | NO | Y | Y | N | N |
| 351 | Mar-38 | 1994/3 | 0 | 0 | 0 | NO | N | N | N | N |
| 352 | Apr-38 | 1994/4 | 0 | 0 | 0 | NO | N | N | N | N |
| 353 | May-38 | 1994/5 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 354 | Jun-38 | 1994/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 355 | Jul-38 | 1994/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 356 | Aug-38 | 1994/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 357 | Sep-38 | 1994/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 358 | Oct-38 | 1994/10 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 359 | Nov-38 | 1994/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 360 | Dec-38 | 1994/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 361 | Jan-39 | 1995/1 | 480 | 312 | 168 | NO | Y | Y | N | N |
| 362 | Feb-39 | 1995/2 | 440 | 286 | 154 | NO | Y | Y | N | N |

| | | | | | | | Carmel River Water Injection | | ASR sites available for extraction | |
|---|---|---|---|---|---|---|---|---|---|---|
| Model Stress Period | Model Date | Historic Date | Monthly Injection | Santa Margarita Site Injection | Seaside Middle School Site Injection | ASR Wells Available for GWR extraction | Active Injection Santa Margarita | Active Injection Seaside Middle School | Santa Margarita Available for Extraction | Santa Margarita Available for Extraction |
| | | | (AF) | (AF) | (AF) | (Yes/NO) | (Y/N) | (Y/N) | (Y/N) | (Y/N) |
| 363 | Mar-39 | 1995/3 | 580 | 377 | 203 | NO | Y | Y | N | N |
| 364 | Apr-39 | 1995/4 | 600 | 390 | 210 | NO | Y | Y | N | N |
| 365 | May-39 | 1995/5 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 366 | Jun-39 | 1995/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 367 | Jul-39 | 1995/7 | 0 | 0 | 0 | NO | N | N | N | N |
| 368 | Aug-39 | 1995/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 369 | Sep-39 | 1995/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 370 | Oct-39 | 1995/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 371 | Nov-39 | 1995/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 372 | Dec-39 | 1995/12 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 373 | Jan-40 | 1996/1 | 180 | 117 | 63 | NO | Y | Y | N | N |
| 374 | Feb-40 | 1996/2 | 580 | 377 | 203 | NO | Y | Y | N | N |
| 375 | Mar-40 | 1996/3 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 376 | Apr-40 | 1996/4 | 480 | 312 | 168 | NO | Y | Y | N | N |
| 377 | May-40 | 1996/5 | 60 | 39 | 21 | NO | Y | Y | N | N |
| 378 | Jun-40 | 1996/6 | 0 | 0 | 0 | NO | N | N | N | N |
| 379 | Jul-40 | 1996/7 | 0 | 0 | 0 | NO | N | N | N | N |
| 380 | Aug-40 | 1996/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 381 | Sep-40 | 1996/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 382 | Oct-40 | 1996/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 383 | Nov-40 | 1996/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 384 | Dec-40 | 1996/12 | 360 | 234 | 126 | NO | Y | Y | N | N |
| 385 | Jan-41 | 1997/1 | 620 | 403 | 217 | NO | Y | Y | N | N |
| 386 | Feb-41 | 1997/2 | 560 | 364 | 196 | NO | Y | Y | N | N |
| 387 | Mar-41 | 1997/3 | 100 | 65 | 35 | NO | Y | Y | N | N |
| 388 | Apr-41 | 1997/4 | 0 | 0 | 0 | NO | N | N | N | N |
| 389 | May-41 | 1997/5 | 0 | 0 | 0 | NO | N | N | N | N |
| 390 | Jun-41 | 1997/6 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 391 | Jul-41 | 1997/7 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 392 | Aug-41 | 1997/8 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 393 | Sep-41 | 1997/9 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 394 | Oct-41 | 1997/10 | 0 | 0 | 0 | NO | N | N | Y | Y |
| 395 | Nov-41 | 1997/11 | 0 | 0 | 0 | YES | N | N | Y | Y |
| 396 | Dec-41 | 1997/12 | 120 | 78 | 42 | NO | Y | Y | N | N |

# Appendix N

# Memorandum Regarding Pure Water Monterey Groundwater Replenishment Project - Impacts of Changes in Percolation at the Salinas Industrial Wastewater Treatment Facility on Groundwater and the Salinas River

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TODD GROUNDWATER

February 11, 2015

## TECHNICAL MEMORANDUM

**To:** Alison Imamura, Denise Duffy and Associates

**From:** Gus Yates, Senior Hydrologist, Todd Groundwater

**Re:** Pure Water Monterey Groundwater Replenishment Project: Impacts of Changes in Percolation at the Salinas Industrial Wastewater Treatment Facility on Groundwater and the Salinas River

## 1. INTRODUCTION

The Salinas Industrial Wastewater Treatment Facility (Salinas Treatment Facility) is located adjacent to the Salinas River about 3 miles southwest of the City of Salinas. The plant is owned and operated by the City of Salinas to treat and dispose of water primarily used to wash and prepare vegetable crops at industrial food processing facilities in Salinas. The Salinas Treatment Facility consists of an aeration pond for treatment of incoming water and three large percolation ponds that dispose of water by percolation and evaporation. Additional disposal capacity during the high-inflow season (May-October) is provided by drying beds and by temporary Rapid Infiltration Basins (RIBs) located between the main ponds and the Salinas River channel. **Figure 1** shows the locations of the ponds, RIBs, drying beds, Salinas River, shallow monitoring wells at the Salinas Treatment Facility and nearby irrigation wells.

Water that percolates from the ponds either flows a short distance through the subsurface and emerges as seepage into the Salinas River or flows downward to the shallow aquifer that is present in some places at depths of 0-80 feet, above the regionally extensive Salinas Valley Aquitard. The shallow aquifer is not used directly as a source of water supply, but gradual downward percolation from the shallow aquifer is a source of recharge to the 180-Foot aquifer, which is used for water supply in the Salinas region.

Wastewater currently treated at the Salinas Treatment Facility is one of several supplemental sources of water proposed for recycling and reuse for the Pure Water Monterey Groundwater Replenishment Project (GWR Project). Other sources include municipal wastewater, Blanco Drain, the Reclamation Ditch, Tembladero Slough and urban stormwater runoff from parts of Monterey and Salinas. A description and map of the source waters are included in section 2.7.1 of the GWR Project Draft Environmental Impact Report (DEIR). These sources would be diverted to the municipal wastewater system in varying amounts depending on availability, demand, and conditions of the various permits and agreements. The source waters would all be conveyed to the regional wastewater treatment plant (RTP) operated by Monterey Regional Water Pollution Control Agency (MRWPCA), located next to the Salinas River several miles downstream of the Salinas Treatment Facility. Some of the treated water would be delivered to agricultural users in the Castroville Seawater Intrusion Project (CSIP) service area, which encompasses 12,000 acres of coastal cropland north of the Salinas River (see map in Figure 2-2 of the GWR Project DEIR) . The rest of the water would be further purified at an advanced water treatment facility to be built within the RTP site and then conveyed south for injection into the Seaside Groundwater Basin. The injected water would augment the basin yield to replace existing sources of potable water that serve the Monterey Peninsula area.[1]

The GWR Project would alter the operation of the Salinas Treatment Facility. Currently, the only inflow is industrial wastewater produced by vegetable washing and related agricultural processing facilities in Salinas (agricultural wash water). The only outflows are evaporation and percolation. Under the proposed GWR Project, agricultural wash water would only be sent to the Salinas Treatment Facility during November-April, when irrigation demand is low. During May-October, it would be sent directly to the RTP for immediate treatment, and recycling. In addition, water stored in the Salinas Treatment Facility ponds over the winter would be pumped out and sent to the RTP. Finally, stormwater runoff from the southern part of Salinas would be added as a new source of inflow to the Salinas Treatment Facility ponds. Monthly water balances showing inflows and outflows to and from the Salinas Treatment Facility under existing conditions and with the GWR Project are presented in the following sections.

## 2. 2013 Salinas Treatment Facility Operations (Existing Conditions)

The water balance of the Salinas Treatment Facility during 2013 was quantified as the starting point for evaluating potential impacts. A water balance is a detailed tabulation of inflows, outflows and storage changes for a defined hydrologic system. In this case, flows and storage changes were calculated monthly. Extra measurements of flow and quality in the Salinas River near the Salinas Treatment Facility during 2013 supported calculations related to the fate of water that percolated from the ponds. Salinas Treatment Facility operations during 2013 differed from “existing conditions” for CEQA purposes in two respects. First, 2013 was an extremely dry year, which resulted in atypical net pond evaporation. Second, inflows to the Salinas Treatment Facility have been increasing in recent years and the amount of agricultural wash water sent to the Salinas Treatment Facility is projected to continue increasing in the future. Another potentially appropriate definition of baseline conditions for CEQA purposes would include inflows at the time the GWR Project goes on-line (assumed here to be 2017) and average rainfall and evaporation. That condition is described in Section 4, below. Both the existing conditions (represented as the 2013 conditions) and this future baseline are used in the analysis of impacts to thoroughly comply with the requirements of CEQA.

A diagram of flow routing among the Salinas Treatment Facility ponds is shown in **Figure 2** (City of Salinas; Operations and Maintenance Manual, January 30, 2003; recreated by DD&A and Todd

[1] The area proposed for use of the purified water is the Monterey District service area of the California American Water Company.

Groundwater, February 2014). In 2013, all agricultural wash water was sent to the Salinas Treatment Facility, and those flows were metered upon arrival. During the past ten or more years, the percolation ponds have been continuously full or nearly so, which has precluded normal maintenance activities such as drying and disking the pond bottoms. Consequently, percolation rates in Ponds 1-2-3 have declined (Margaretten, 2013). The ponds are approximately flat-bottomed and 6-10 feet deep, which means that pond surface area remains relatively constant over most of the range of storage volumes.

**Table 1** presents a monthly water balance for the ponds and drying beds during 2013. Entries in the table are shown to three or four significant digits for arithmetic consistency. However, estimates of evaporation and percolation are probably accurate to only two significant digits. Accordingly, percolation and evaporation values extracted from the table are rounded in the text to two significant digits or the nearest 10 acre-feet. Agricultural wash water inflow totaled 3,240 acre-feet (AF) during 2013. Monthly rainfall is from the Salinas municipal airport station and is the same data used for urban runoff calculations in the Salinas River Inflow Impacts Report (Schaaf & Wheeler 2015). Annual rainfall during calendar year 2013 was 3.3 inches, or 25 percent of the 1932-2013 average, making it the driest year in the 81-year period of record. The rainfall rate was multiplied by the combined area of all the ponds (118.4 acres) to obtain the volume of rainfall accretion to pond storage. Rainfall added about 50 AF to the ponds in 2013 but would add 200 AF in a year with normal rainfall. Evaporation was similarly estimated from CIMIS reference evapotranspiration data.[2] Pond evaporation totaled 390 AF in 2013 and would be 360 AF in an average year.

The volumes of water spread on the drying beds are not recorded. Due to poor drainage, 13 of the drying bed cells are not used, which corresponds to roughly one-fourth of the 67-acre drying bed complex (Cole, 2014). Due to capacity constraints at the Salinas Treatment Facility, the remaining 75 percent of the drying bed area was more or less continuously wet throughout the year (Cole 2014c), and it was assumed that the per-area evaporation rate equaled the pond evaporation rate. Pond water levels are also not routinely monitored. It was assumed that the net change in storage over the year was zero, given that the facility has been operating near capacity and that excess inflow is handled using the drying beds and RIBs rather than by a long-term increase in pond storage. Finally, the overall percolation volume was obtained as the residual in the water balance and totaled 2,730 AF in 2013. The residual is the amount of percolation that in combination with all other inflows and outflows resulted in a calculated net storage change of zero from December 2012 to December 2013. The percolation rate from the ponds was assumed to be equal in all months.

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[2] Reference evapotranspiration is typically about 75 percent of open-water evaporation from a Class A evaporation pan (Dunne and Leopold, 1979). However, evaporation from lakes is also less than pan evaporation because the larger surface area causes the adjacent air layer to become more saturated with moisture. The pan-to-lake coefficient is also typically about 75 percent, so evaporation from the ponds—which are the size of small lakes—can be approximated by reference evapotranspiration.

**Table 1. Monthly Salinas Treatment Facility Water Balance during 2013**[3]

| Month | Agri-cultural Wash Water Inflow (AF) | Rainfall Rate (in) | Rainfall Volume (AF) | Pond Evaporation Rate (in) | Pond Evaporation Volume (AF) | Drying Bed Evaporation (AF) | Pond + RIB + Drying Bed Percolation (AF) | Pond Storage (AF) |
|---|---|---|---|---|---|---|---|---|
| Dec-12 | | | | | | | | 1,100 |
| Jan-13 | 135 | 1.04 | 16 | 1.90 | 19 | 8 | 227 | 997 |
| Feb-13 | 137 | 0.56 | 9 | 2.16 | 21 | 9 | 227 | 885 |
| Mar-13 | 174 | 0.41 | 6 | 3.16 | 31 | 13 | 227 | 794 |
| Apr-13 | 265 | 0.27 | 4 | 4.30 | 42 | 18 | 227 | 776 |
| May-13 | 272 | 0.01 | 0 | 4.99 | 49 | 21 | 227 | 750 |
| Jun-13 | 338 | 0.04 | 1 | 4.26 | 42 | 18 | 227 | 802 |
| Jul-13 | 376 | 0.00 | 0 | 3.73 | 37 | 16 | 227 | 898 |
| Aug-13 | 383 | 0.02 | 0 | 3.87 | 38 | 16 | 227 | 1,000 |
| Sep-13 | 318 | 0.07 | 1 | 3.93 | 39 | 16 | 227 | 1,036 |
| Oct-13 | 355 | 0.15 | 2 | 3.10 | 31 | 13 | 227 | 1,122 |
| Nov-13 | 284 | 0.47 | 7 | 1.99 | 20 | 8 | 227 | 1,159 |
| Dec-13 | 193 | 0.21 | 3 | 1.95 | 19 | 8 | 227 | 1,100 |
| Total (AF): | 3,231 | 3.26 | 50 | 39.34 | 388 | 165 | 2,729 | |
| Percent of SIWTF outflow: | | | | | 12% | 5% | 83% | |

Notes: AF = acre-feet; RIB = rapid infiltration basin; Ponds 1-2-3 + RIB area = 106 acres; drying bed area = 67 acres; average percolation rate = 0.043 feet per day; aeration pond area = 12.4 acres, which is included in rain and evaporation but not percolation.

A key result of the water balance analysis is that only 17 percent of Salinas Treatment Facility outflow was by evaporation at the ponds and drying beds during 2013. Therefore, it can be concluded that percolation is the primary means of wastewater disposal at this facility.

[3] Volumes in the table are shown in units of acre-feet (AF), which is customary for analysis of groundwater flow. The corresponding rates are acre-feet per month (AF/mo) or per year (AFY). Water and wastewater studies typically express volumes and rates in million gallons (mgal; 1 mgal = 3.069 AF) and million gallons per day (mgd). River flows are usually expressed in cubic feet per second (cfs; 1 cfs = 725 AFY = 0.65 mgd). This memorandum uses whichever units are customary for the topic under discussion.

## 3. FATE OF SALINAS TREATMENT FACILITY PERCOLATION WATER

Water that percolates from the Salinas Treatment Facility ponds travels through the subsurface using two pathways: a short path from beneath the ponds to the Salinas River and a longer flow path into the shallow aquifer away from the river. These pathways are part of a complex three-dimensional groundwater flow system that interacts dynamically with water levels in the river and the Salinas Treatment Facility ponds. This system is portrayed in **Figure 3**, which shows a cross-section through the Salinas Treatment Facility perpendicular to the river (see Figure 1 for cross section location). In addition to water levels in the ponds and river, groundwater levels are shown for two of the eight onsite monitoring wells. These wells monitor the shallow aquifer, which is discontinuously present and overlies the Salinas Valley Aquitard, which is a fine-grained layer that restricts downward flow of water from the shallow aquifer to the 180-Foot aquifer. The 180-Foot aquifer is the shallowest aquifer used for water supply in the Salinas region. As its name implies, it is typically present at depths of approximately 180 feet below ground surface. It is underlain by the 400-Foot and deep aquifers, which are also used for water supply. Intervening fine-grained layers restrict flow between the aquifers. An average water level is shown on the figure for nearby wells that are screened in the 180-Foot aquifer. The water surface elevations of the ponds are higher than the water surface of the river and shallow aquifer, and all three are higher than water levels in the 180-Foot aquifer. Pond percolation creates a water-table mound that sends groundwater in all directions. Because the river is only 200 feet from the ponds along the entire 1.5-mile length of the Salinas Treatment Facility and has a much lower water surface, a substantial percentage of percolated water is likely to flow to the river. Percolated water that disperses into the shallow aquifer is likely to percolate down to the 180-Foot aquifer (see Section 3.2 “Recharge to the Shallow and 180-Foot Aquifers”, below).

These water-level relationships can also be seen in **Figure 4**, which shows hydrographs of daily water levels measured in eight monitoring wells at the Salinas Treatment Facility site during 2009-2012 (see Figure 1 for well locations). The plot also includes a hydrograph of water level in the Salinas River, which was estimated from daily flow recorded at the USGS gage at Spreckels (2.5 miles upstream of the Salinas Treatment Facility) and the flow-stage rating curve for that gage. Stream elevations were projected to the Salinas Treatment Facility location based on the average gradient of the river channel and were consistent with elevations determined from Google Earth. Several high-flow events can be seen in the hydrographs. Water levels in the two wells on the river side of Ponds 1-3 (wells MW-1 and MW-2) track river stage closely. Monitoring wells on the far side of the ponds (wells MW-3, -4, -5 and -6) have relatively stable water levels 12-15 feet higher than the river that show little response to fluctuations in river stage. This pattern confirms that shallow groundwater in close proximity to the river is hydraulically connected to flow in the river. Water can readily flow from the aquifer into the river or vice versa, depending on which is higher, the surface of the river or the water table. The pattern also confirms that pond percolation is the dominant influence on groundwater levels in areas on the far side (northeast) of the ponds. This is expected given that the ponds are 10-15 times wider than the river.

### 3.1 Seepage into the Salinas River

The subsurface flow of pond percolation into the river (seepage) is not routinely measured. However, two sets of measurements were made in October and November, 2013. These used two different methods:

- **Water quality mixing model**. MRWPCA personnel measured water quality in the Salinas Treatment Facility ponds and in the Salinas River at points upstream and downstream of the ponds on October 8, 2013. At that time, pond water was high in chloride (Cl) relative to the river. Chloride is a conservative solute that tends to remain in solution without reacting, adsorbing or precipitating. It is commonly used in mixing model calculations. By comparing the increase in chloride concentration in river water along the Salinas Treatment Facility reach, the amount of seepage from the ponds into the river can be calculated. This approach uses a mixing model represented by the following equation:

$$Q_1C_1 + Q_2C_2 = Q_3C_3$$

where,

$Q_1$ = river flow upstream of Salinas Treatment Facility
$C_1$ = concentration in river upstream of Salinas Treatment Facility
$Q_2$ = percolation from ponds toward the river
$C_2$ = concentration in ponds
$Q_3$ = river flow downstream of Salinas Treatment Facility
$C_3$ = concentration in river downstream of Salinas Treatment Facility

Using the concentrations $C_1$, $C_2$ and $C_3$ measured on October 8, 2013, the value of $Q_1$ measured at the Spreckels stream gage on that date, and noting that $Q_3 = Q_1 + Q_2$, the mixing model can be solved to obtain $Q_2$, which is the rate of subsurface flow from the ponds into the river. The variables are listed in **Table 2**, and the calculated estimate of seepage from the ponds to the river was 3.67 cfs.

Transpiration by riparian vegetation between the ponds and river does not materially affect the calculations. The vegetation transpires essentially pure water, but correcting for this loss only slightly changes the calculations. The strip of riparian vegetation between the RIBs and the river channel averages 175 ft wide and has a total area of 31.5 acres. Multiplying that area by the reference ET rate measured at the CIMIS station in Salinas on October 8, 2013 (0.10 inches) results in an estimated 0.13 cfs of water consumption. In terms of the above system of equations, $Q_3 = Q_1 + Q_2 – Q_{ET}$. Conservatively assuming that all of the evapotranspiration is of pond percolation and none is of river underflow, the resulting estimate of pond percolation becomes 3.72 cfs. The initial and adjusted estimates differ by only 1.3 percent, which is less than the uncertainty in other factors in the equation. For practical purposes, the effect of water loss to evapotranspiration can safely be ignored.

**Table 2. Variables Used for Chloride Mixing Model Calculation of Subsurface Flow of Salinas Treatment Facility Pond Seepage into the Salinas River**

| Parameter | Value | Units |
|---|---|---|
| $Q_1$ = | 15 | cfs |
| $C_1$ = | 26 | mg/L |
| $Q_2$ = | $Q_2$ | cfs |
| $C_2$ = | 292 | mg/L |
| $Q_3$ = | 15 + $Q_2$ | cfs |
| $C_3$ = | 79 | mg/L |

- **Change in river flow**. River flow at Salinas Treatment Facility is usually at its annual minimum in November, after upstream reservoir releases have ceased and before natural rainfall runoff has commenced. Those conditions are optimal for direct measurement of seepage derived from pond percolation, which is only a small percentage of total flow at other times of the year. River flow upstream and downstream of the Salinas Treatment Facility was measured on November 13, 2013. Visual inspection revealed that flow was zero upstream of Davis Road, although pools were still present in the channel. Flow was measured using a propeller-type ("pygmy") flow meter 1,000 ft downstream of Pond 3, which produced a value of 2.4 cfs. The accuracy of the measurement was probably only +/- 20% due to deep, low-velocity conditions. However, this result was similar to the estimate from the mixing model.

For the purposes of the SIWTF percolation analysis in this memorandum, the two estimates of seepage into the river were simply averaged, with a resulting estimate of 3.0 cfs. If this rate were constant throughout the year, it would amount to 2,170 AFY, or 80 percent of total SIWTF pond percolation during 2013. This percentage is expected to remain approximately the same with the higher expected SIWTF inflow in 2017, provided that the RIBs and drying beds continue to be operated in the present manner.

There are several sources of uncertainty in estimating the future effects of SIWTF pond percolation on river flows. First, the operators of the SIWTF have flexibility to modify their operations in ways that might influence the relative proportions of seepage into the river and percolation that flows downward to the 180-Foot aquifer. For example, if percolation is shifted from the RIBs back to Ponds 1, 2 and 3 (assuming percolation rates in one or more of those ponds were restored by drying and disking) or to the drying beds, then the center of percolation would shift slightly away from the river, and the proportion of percolation that goes to the 180-Foot aquifer could increase. Such future changes are outside the control of the GWR Project. Reservoir releases to the Salinas River could also change in the future in response to evolving water demands along the Salinas Valley or changes in seawater intrusion near the coast. Finally, climate change could impact seasonal runoff patterns, average annual rainfall and runoff, and the yield of upstream water supply reservoirs.

### 3.2 Recharge to the Shallow and 180-Foot Aquifers

By ruling out other potential pathways, it can be concluded that percolation from the Salinas Treatment Facility to the shallow aquifer that does not seep to the Salinas River percolates downward and becomes recharge to the 180-Foot aquifer. Other outflow pathways that were considered and rejected included:

- **Evapotranspiration by phreatophytic vegetation.** Phreatophytes are plants such as willow, cottonwood and sycamore with roots that can extract water directly from the water table. They are common along rivers and other shallow water-table areas in California. No phreatophytes are present in the cropland north and east of the Salinas Treatment Facility. A band of phreatophytes is present along both sides of the Salinas River channel downstream of Spreckels. The width, stature and vigor of the riparian vegetation between the Salinas Treatment Facility and the river are no different than on the opposite bank or along upstream and downstream reaches. Therefore, from a water balance standpoint, the riparian vegetation is supplied by shallow groundwater associated from the river, and riparian evapotranspiration does not constitute a separate outflow pathway from the Salinas Treatment Facility.

- **Passive seepage into Blanco Drain.** Blanco Drain is a ditch that conveys agricultural drainage water from a 6,400-acre area to the Salinas River. The Drain approximately parallels the river about 1.2 miles northeast of the Salinas Treatment Facility, which is 37 times farther from the Salinas Treatment Facility than the river channel is. The Drain is also shallower than the river channel. Therefore, it is not hydraulically plausible that recharge at the Salinas Treatment Facility would flow to the Drain instead of the river.

- **Active removal by agricultural tile drains.** Agricultural tile drains are parallel rows of perforated pipe buried several feet beneath the ground surface over the entire area of certain fields to prevent the crop root zone from becoming waterlogged. The pipes drain to a sump, where the water is pumped up into a ditch that carries it away. Tile drains are common in the Blanco Drain watershed—which includes the Salinas Treatment Facility site—and the primary purpose of Blanco Drain is to convey tile drain discharge to the Salinas River. The source of the water that causes the soil saturation problem can be either a shallow water table—such as one receiving excess recharge from Salinas Treatment Facility percolation—or applied irrigation water that cannot percolate downward through the root zone due to restrictive layers in the soil horizon. In the former case, drain discharges would be greatest in spring, following winter rainfall recharge of the shallow aquifer. In the latter case, discharges would be greatest during the peak of the irrigation season. Measured monthly flows in Blanco Drain peak in July at a level two times greater than the minimum monthly flow in November (Schaaf & Wheeler 2015). This seasonal pattern suggests that the primary source of the drainage water is applied irrigation water, not a shallow water table caused by Salinas Treatment Facility percolation.

- **Subsurface flow through the shallow aquifer, parallel to the river with eventual discharge into the Salinas River lagoon or Monterey Bay.** This flow is negligible because the shallow aquifer is patchy and discontinuous (Kennedy/Jenks Consultants, 2004), the distances to those discharge points are large, and the hydraulic gradients are correspondingly low. Groundwater flow is proportional to the water-level gradient, which is the difference in potentiometric head[4] at two points in a groundwater flow system divided by the distance between the points. The gradient from the water table beneath the Salinas Treatment Facility ponds downward to the 180-Foot aquifer is about 0.24 foot per foot (ft/ft). By comparison, the Salinas River lagoon and Monterey Bay are 6-8 miles away, and water-level gradients between the Salinas Treatment Facility and those locations range from 0.0007 ft/ft to 0.0008 ft/ft. These are about 300 times smaller than the downward gradient to the 180-Foot aquifer. The cross-sectional area available for downward flow is also about two orders of magnitude larger than for horizontal flow through the shallow aquifer, assuming the shallow aquifer were continuous to the lagoon and ocean. However, the discontinuous pattern of shallow aquifer deposits overlying the Salinas Valley Aquitard greatly diminish the cross-sectional area available for flow and increase the length of the flow path. These factors favoring downward over horizontal flow very likely outweigh the lower average permeability in the downward direction.

- **Underflow through Salinas River channel deposits.** Permeable sand deposits are present beneath and adjacent to the river channel, at least in places. Anecdotal evidence of these deposits include the high percolation rates of the rapid infiltration basins adjacent to the channel at the Salinas Treatment Facility and the high rate of dewatering pumping that was required during construction of the Salinas River Diversion Facility and a pipeline crossing beneath the river. The underflow through sand deposits can be estimated by applying the Darcy equation using estimates of cross sectional area, hydraulic conductivity and gradient. Assuming a continuous body of sand extending to 15 feet below the water surface and to 100 feet on either side of the channel center line, with a typical hydraulic conductivity for clean sand of 100 feet per day (Freeze and Cherry, 1979), and a gradient along the river of 0.0008 feet per foot, then the subsurface flow would be 240 cubic feet per day, which is equivalent to 0.003 cubic feet per second, or one-thousandth the estimated amount of seepage from the Salinas Treatment Facility ponds to the river. Thus, over long distances, one thousand times more water would travel as surface flow than as underflow. This result does not contradict the anecdotal observations; the key difference is the long flow path and small hydraulic gradient. Over shorter flow paths—such as from the rapid infiltration basins to the river or from the river to nearby dewatering wells—the amount of subsurface flow can be significant.

To reach the 180-Foot aquifer, groundwater in the shallow aquifer must flow downward through the Salinas Valley Aquitard (SVA). The SVA is a shallow fine-grained layer that has traditionally been viewed as an extensive, continuous, impermeable clay cap that restricts direct downward recharge to the 180-Foot aquifer. Water levels in the 180-Foot aquifer are much lower than shallow groundwater levels, which suggests that overall vertical permeability is low but not necessarily zero. In 2011, groundwater elevation in the 180-Foot aquifer near Salinas Treatment Facility was -18 ft (i.e., below sea level), while

[4] Potentiometric head is represented by the water level in a well that is screened at a point within the flow system. In this case, the water level in a well screened at the water table beneath the Salinas Treatment Facility ponds would be about 30 ft above sea level, while the water level in a well at the same location screened in the 180-Foot aquifer would be about 18 ft below sea level.

water levels in shallow wells near the ponds were 12-33 ft above sea level. This substantial downward gradient will induce downward flow if permeable pathways are present.

Evidence that recharge occurs through the SVA comes from detailed stratigraphic analyses and groundwater model calibration. One of the most detailed evaluations of aquifer stratigraphy in the vicinity of the Salinas Treatment Facility focused on the area encompassed by Alisal Slough, Highway 68 and the Salinas River, which includes the Salinas Treatment Facility (Heard, 1992). Texture descriptions from 117 cable-tool driller's logs were classified into coarse and fine categories and mapped at 20-foot depth intervals from the ground surface down to 340 feet. Overlaying these maps reveals vertical continuity of coarse deposits through all but one of the top seven layers (a total vertical interval of 140 feet) in several locations, each covering about 1 square mile:

- Near the Salinas Treatment Facility across South Davis Road
- Near the intersection of Blanco Road and Highway 68, about 2.5 miles east of the Salinas Treatment Facility
- Along Davis Road between Blanco Road and Castroville Road, about 2.5 miles northeast of the Salinas Treatment Facility

A small amount of horizontal flow within the remaining depth interval would allow groundwater flow to link up gaps between clay lenses and continue moving downward.

Heard also evaluated groundwater quality patterns and discovered that groundwater in the 180-Foot aquifer in the study area was slightly enriched in sulfur relative to other dissolved minerals. The only geochemically plausible source of the enrichment was determined to be gypsum, which is commonly applied to heavy soils in the area to maintain soil texture. To arrive at the 180-Foot aquifer, the dissolved gypsum would have had to percolate downward through the SVA. Nitrate is also elevated in some 180-Foot aquifer wells in the area and also derives from fertilizers applied at the land surface.

Another detailed stratigraphic study of the region between Spreckels and the coast included cross sections showing the SVA missing at various locations (Kennedy/Jenks Consultants, 2004). The cross sections were developed from geologic logs prepared by well drillers, and most of the logs were from irrigation wells. Although often close to other wells where the SVA is present, wells that show gaps in the SVA include several near the Salinas Treatment Facility in the region between Salinas and the Salinas River (at wells APN-414021010, 15S/03E-04T50, 15S/03E-17B3, and 15S/03E-17M1). The description of SVA hydrogeology in the Monterey County Groundwater Management Plan reiterates the concept of local discontinuity (MCWRA 2006).

A groundwater flow model of the Salinas Valley, called the Salinas Valley Integrated Surface and Groundwater Model (SVISGM), has been used extensively by Monterey County Water Resources Agency (MCWRA) for water planning studies over nearly 20 years. The calibrated model includes recharge from the ground surface to the 180-Foot aquifer. The 180-Foot aquifer is present only in the Pressure Area, which occupies the southwestern half of Salinas Valley between Gonzales and Monterey Bay. In most parts of the Pressure Area, recharge to the 180-Foot aquifer from the ground surface would have to pass through the SVA (MWH, 1997). The shallow aquifer and SVA are not explicitly represented in the model, but their effects are reflected in the amount of downward recharge that accrues to the 180-Foot aquifer. During the 1970-1994 calibration period, there was an average of 54,000 AFY of recharge to the 180-Foot aquifer in the Pressure Area from deep percolation of rainfall and applied irrigation water and 60,000 AFY of recharge from Salinas River infiltration, some of which must also pass through the SVA. Together, these recharge sources accounted for 79% of total recharge to the 180-Foot aquifer in the Pressure Area. However, much of the downward recharge to the 180-Foot aquifer in the model could have been in the southern part of the Pressure Area (between Gonzales and Chualar), where the SVA is known to be discontinuous or absent.

The above lines of evidence lead to a conclusion that Salinas Treatment Facility percolation that does not seep into the river very likely becomes recharge to the 180-Foot aquifer. During 2013, this recharge amounted to 550 AF, or 20% of total Salinas Treatment Facility percolation.

## 4. FUTURE NO-PROJECT SALINAS TREATMENT FACILITY WATER BALANCE

The 2013 Salinas Treatment Facility water balance described in Section 2 was not representative of existing or no-project conditions for the purpose of evaluating impacts. Rainfall was extremely low that year, and inflows of agricultural wash water were less than the inflows expected at the time the GWR Project is constructed. A more appropriate baseline for evaluating impacts is the Salinas Treatment Facility water balance under normal climatic conditions and with the inflows expected to occur in 2017 (the approximate date of construction). This is consistent with the Salinas River Inflows Impact Report (Schaaf & Wheeler 2015), which evaluated 2017 Salinas Treatment Facility inflows and normal climatic conditions.

The estimated baseline (no-project) Salinas Treatment Facility water balance is shown in **Table 3**. Agricultural wash water inflows are expected to total 3,730 in 2017. Monthly rainfall and evaporation rates are long-term averages for stations in Salinas. As in the 2013 water balance (see Table 1), it was assumed there would be no net increase in pond storage over the year. The assumed percolation rate was increased to achieve zero net storage change, and the relative proportions of seepage to the river and percolation to groundwater are the same as in the 2013 water balance. The resulting estimate of seepage into the river is 2,730 AFY, and the estimate of percolation to the 180-Foot aquifer is 680 AFY.

**Table 3. Monthly Baseline (No-Project) Salinas Treatment Facility Water Balance**

| Month | Agri-cultural Wash Water Inflow (AF) | Rainfall Rate (in) | Rainfall Volume (AF) | Pond Evaporation Rate (in) | Pond Evaporation Volume (AF) | Drying Bed Evaporation (AF) | Pond + RIB + Drying Bed Percolation (AF) | Pond Storage (AF) |
|---|---|---|---|---|---|---|---|---|
| DEC | | | | | | | | 1,100 |
| JAN | 156 | 2.62 | 40 | 1.21 | 12 | 5 | 285 | 995 |
| FEB | 158 | 2.35 | 36 | 1.54 | 15 | 6 | 285 | 883 |
| MAR | 201 | 2.11 | 33 | 2.88 | 28 | 12 | 285 | 791 |
| APR | 307 | 1.10 | 17 | 4.08 | 40 | 17 | 285 | 773 |
| MAY | 311 | 0.30 | 5 | 4.56 | 45 | 19 | 285 | 740 |
| JUN | 391 | 0.08 | 1 | 5.16 | 51 | 22 | 285 | 775 |
| JUL | 435 | 0.02 | 0 | 4.47 | 44 | 19 | 285 | 863 |
| AUG | 444 | 0.04 | 1 | 4.30 | 42 | 18 | 285 | 962 |
| SEP | 367 | 0.17 | 3 | 3.20 | 32 | 13 | 285 | 1,002 |
| OCT | 410 | 0.57 | 9 | 2.75 | 27 | 12 | 285 | 1,098 |
| NOV | 329 | 1.41 | 22 | 1.50 | 15 | 6 | 285 | 1,143 |
| DEC | 223 | 2.35 | 36 | 1.23 | 12 | 5 | 285 | 1,100 |
| Total (AF): | 3,732 | 13.12 | 203 | 36.88 | 364 | 154 | 3,416 | |
| Percent of SIWTF outflow: | | | | | 9% | 4% | 87% | |

Notes: AF = acre-feet; RIB = rapid infiltration basin; Ponds 1-2-3 + RIB area = 106 acres; drying bed area = 67 acres; wash water inflows are the expected amounts in 2017; rainfall and evaporation are long-term averages; percolation rate = 0.054 feet per day; aeration pond area = 12.4 acres, which is included in rain and evaporation but excluded from percolation.

## 5. LOCAL HYDROLOGIC EFFECTS OF THE GWR PROJECT

The GWR Project would alter the operation of the Salinas Treatment Facility in terms of the amounts and types of water stored at the facility. Those changes would locally alter the quantity and quality of percolation, which would affect the quantity and quality of river flow and groundwater recharge. This memorandum focuses on local effects. However, those effects should be considered in a regional context because surface and groundwater throughout the northern Salinas Valley area are intensively managed as a single, interconnected system. Effects on operation and yield of the Salinas Valley Water Project are described in the Salinas River Inflow Impacts Report (Schaaf & Wheeler 2015). The combined effects of all elements of the GWR Project on regional groundwater pumping and seawater intrusion are described in Chapter 4 of the DEIR. Potential local hydrologic impacts evaluated in this memorandum are the following:

- Changes in Salinas River flow
- Decreased groundwater recharge and local well yields
- Changes in river and groundwater quality

All of these impacts stem from changes in the amount of water percolated at the Salinas Treatment Facility. Accordingly, the first step in the impact analysis is to calculate the amount of percolation by month and year type for each potential example scenario of operation of the GWR Project (see Section 5.2 for a description of these scenarios). This depends in part on the distribution of percolation among the various ponds, basins and drying beds at the Salinas Treatment Facility.

### 5.1 Percolation Patterns at the Salinas Treatment Facility

Water percolates from Ponds 1, 2 and 3, the RIBs and the drying beds, but percolation rates vary substantially among those areas. Therefore, percolation under existing and project conditions must be estimated for each area separately to the extent available data support such an analysis. The aeration pond is lined and percolation is assumed to be negligible. Percolation from Ponds 1-2-3 historically declined due to accumulation of fine-grained material and/or biofilms on the pond bottoms. As annual inflows increased, the ponds no longer drained completely at any point during the year, which prevented the normal maintenance procedure of drying and disking the pond bottoms to restore percolation rates (Margaretten, 2013). This led to reliance on the RIBs and drying beds to provide additional disposal capacity during the past decade. The drying beds have actually been operated more like percolation basins in recent years. Low berms divide the drying bed area into 54 cells or beds separated by low berms. Each bed is flooded to a depth of 1.0-1.5 feet then allowed to percolate, which takes anywhere from 5 days to several weeks (Cole, 2014c). The three RIBs are long, narrow basins that occupy a strip along the river side of Ponds 1-2-3. They have consistently provided relatively high rates of percolation but cover only a small area. Unfortunately, available records for Salinas Treatment Facility operations do not document the volumes of water sent to each of the three areas; only the total amount is known. However, soils information and semi-quantitative anecdotal data can be used to estimate the amounts percolated at each area during 2013 and/or 2014, as follows:

- **Percolation at RIBs.** Two methods were used to estimate percolation rate: the rate at which water was pumped into the RIBs and the time required for them to drain. The two diesel-powered pumps that transferred water from Ponds 1, 2 and 3 to the RIBs operated 1,000 hours each at an estimated discharge of 800 gallons per minute (Cole, 2014c). These figures produce an estimate of 300 AF pumped during the year. However, the pump discharge was estimated from its rated capacity under 150 feet of lift, whereas the actual lift was about -10 feet (the pumps were moving water downhill from the ponds to the RIBs). Consequently, the actual discharge rate was probably higher. After drying and disking, each RIB would drain in 2-3 days; however, percolation rates decreased noticeably as the season of use progressed (Cole, 2014c). A decrease in percolation rate due to clogging of the bed with fine-grained material or organic biofilms is a nearly universal occurrence in percolation basins operated for prolonged periods. The long-term average percolation rate assuming periodic disking and drying typically averages about 25 percent of the initial percolation rate (Bouwer, 1985; Schuh and Shaver, 1989; Miele, 2011). Assuming a ponding depth of 2 feet and 10-day average percolation cycle, the combined 1.67 acres of RIBs would percolate 120 AF per year. This estimate is considerably smaller than the pump-operation estimate. The resulting range of plausible RIB percolation volume during 2013 is roughly 100-400 AF.

- **Percolation at drying beds.** Percolation rates are highly variable among the drying bed cells and appear to be influenced by soil variability, season, and depth to the underlying water table (Cole, 2014c). Individual beds are flooded to a depth of 1.0-1.5 feet then allowed to completely infiltrate, which takes anywhere from 5 days to many weeks. About 18 of the beds percolate only once per season or not at all. Thus, the long-term average percolation rate is about 1.25 foot over 20-100 days. Assuming year-round operation over the 67-acre drying bed area, annual percolation is roughly 200-1,400 AFY (after subtracting 130 AFY of normal-year net evaporation).

- **Percolation from Ponds 1, 2 and 3.** The percolation rate from Ponds 1-2-3 can estimated from the observed change in storage during spring 2014, when all inflows to the Salinas Treatment Facility were diverted to the Regional Treatment Plant. Based on manual readings of staff gages in the three ponds, water levels declined 4.5-5.5 feet during April and May, 2014. Water was being pumped from those ponds to the drying beds and RIBs throughout that period, so percolation at Ponds 1-2-3 equaled the change in storage minus percolation at the other two facilities and minus net evaporation from all of the facilities. Net evaporation over 173 acres of wetted area was 150 AF, which leaves 380 AF of the total storage change attributable to percolation. To be consistent with the annual percolation rate estimated for 2013, this 2-month estimate of percolation during April-May, 2014 was increased 20 percent to 460 AF. Percolation at the RIBs during the two months probably equaled one-sixth of the annual percolation during 2013, or 17-67 AF. Percolation from the drying beds can similarly be estimated as one-sixth of the 2013 annual percolation volume, or 33-230 AF. Subtracting the minimums and maximums of these percolation ranges from the total percolation volume produces an estimated range of Pond 1-2-3 percolation of 160-400 AF. Using the midpoint of that range as an estimate of the average results in 280 AF of estimated percolation during April-May, which is equivalent to an annual rate of 1,680 AFY or 140 AF per month. Based on the above information regarding percolation at the individual facilities, Ponds 1-2-3 account for 62% of total percolation when all three facilities are in operation, the RIBs account for 9%, and the drying beds account for 29%.

  A lower estimate of the percolation rate for Ponds 1-2-3 is obtained if the 2014 results are not adjusted to be consistent with the 2013 results. In that case, the percolation rate is 103 AF per month.

### 5.2 Decreased Groundwater Recharge and Local Well Yields

A spreadsheet operations model was developed to estimate which source waters would be selected for the GWR Project under six operating scenarios: two phases of diversion rate for surface water sources and three types of years related to the status of the drought reserve (See the Draft EIR Project Description Section 2.7.1 for a description of the source water availability and assumed diversion scenarios). The model indicated the amount of water sent to or pumped from the Salinas Treatment Facility for each month of the year. The model was based on two unique sets of monthly inflows and outflows: in normal/wet years and in drought years. Simulated Salinas Treatment Facility operations were not affected by the maximum surface water diversion rate or the current storage level of the drought reserve.

Some of the water that percolates from the Salinas Treatment Facility flows downward through gaps in the Salinas Valley Aquitard and becomes recharge to the 180-Foot aquifer, which is one of several aquifers tapped by water supply wells in the northern Salinas Valley. A decrease in percolation would decrease recharge and tend to lower groundwater levels in wells near the Salinas Treatment Facility that pump from the 180-Foot aquifer. If the decline in water levels were large, it could impact groundwater availability to well owners by physically damaging wells or by decreasing their pumping rates. Quantifying that impact begins with estimating the decrease in percolation from the Salinas Treatment Facility that would result from the GWR Project.

#### 5.2.1 Change in Percolation Volumes

Operation of the Salinas Treatment Facility would change substantially under the GWR Project. In spite of new inflows of urban storm runoff, total annual inflow would decrease substantially because agricultural wash water inflows would be diverted to the Regional Treatment Plant during half the year for recycling and use by the CSIP irrigators and for advanced treatment and injection into the Seaside Groundwater Basin. The drying beds and RIBs would no longer be needed. The primary purpose of the Salinas Treatment Facility would switch from disposal to storage; any water that does not percolate or evaporate during the November-April storage season would be pumped back out to supply the GWR Project. Only Ponds 1, 2 and/or 3 would be used for storage. The effect of reoperation under the GWR Project depends on the amount of percolation that continues to occur during the storage and pump-out seasons. This can be determined from monthly water balance calculations for the ponds, given the percolation rates estimated above.

**Table 4** shows the monthly pond water balance in normal/wet years, and **Table 5** shows the balance during drought years. Inflows of agricultural wash water and Salinas urban storm runoff were obtained from the Salinas River Inflows Impact Report (Schaaf & Wheeler 2015). The rainfall and evaporation rates in Table 4 are average annual rates, and the rates in Table 5 are the 2013 rates. The percolation rate from Ponds 1-2-3 equals the rate of 140 AF per month estimated from 2014 data adjusted to be consistent with 2013 percolation.

In both tables, the amount of stored water that can be pumped out of the ponds during April-October is limited by percolation losses. Although percolation rates have declined over the past decade, the ponds still retain substantial percolation capacity and hence are not optimal for storage. In the tables, all of the water was assumed to be pumped out during May and June to avoid additional percolation losses that would occur if the stored water were pumped out over a longer period. The amount of water pumped out to supply the GWR Project during May-June would be approximately 380 AF in normal or wet years and 120 AF in dry years. Annual percolation from all Salinas Treatment Facility facilities would be approximately 1,110 AFY in normal and wet years (Table 4), which is 2,300 AFY less than under baseline conditions (Table 3). The proportion of percolated water that seeps into the Salinas River (80 percent) would remain about the same as under baseline conditions because the center of percolation volume would remain under Ponds 1-2-3. That is, the two percolation facilities that would be discontinued (RIBs and drying beds) are closer and farther from the river, respectively, than Ponds 1-2-3. Therefore, seepage into the river would be approximately 890 AFY (1.2 cfs), and recharge to the 180-Foot aquifer would be approximately 220 AFY.

## Table 4. GWR Project Salinas Treatment Facility Water Balance in Normal/Wet Years

| Month | Agricultural Wash Water (AF) Total Available | Agricultural Wash Water (AF) Sent to STF | Salinas Urban Storm Water Inflow (AF) | Rainfall Rate (in) | Rainfall Volume (AF) | Pond Evaporation Rate (in) | Pond Evaporation Volume (AF) | Pumped Outflow to RTP (AF) | Ponds 1-2-3 Percolation (AF) | Pond Storage (AF) |
|---|---|---|---|---|---|---|---|---|---|---|
| DEC | | | | | | | | | | 353 |
| JAN | 156 | 156 | 52 | 2.62 | 25 | 1.21 | 12 | 0 | 140 | 435 |
| FEB | 158 | 158 | 41 | 2.35 | 23 | 1.54 | 15 | 0 | 140 | 502 |
| MAR | 201 | 201 | 34 | 2.11 | 20 | 2.88 | 28 | 0 | 140 | 590 |
| APR | 307 | 307 | 16 | 1.10 | 11 | 4.08 | 40 | 0 | 140 | 745 |
| MAY | 311 | 0 | 2 | 0.30 | 3 | 4.56 | 44 | 190 | 140 | 376 |
| JUN | 391 | 0 | 0 | 0.08 | 1 | 5.16 | 50 | 190 | 136 | 0 |
| JUL | 435 | 0 | 0 | 0.02 | 0 | 4.47 | 0 | 0 | 0 | 0 |
| AUG | 444 | 0 | 0 | 0.04 | 0 | 4.30 | 0 | 0 | 0 | 0 |
| SEP | 367 | 0 | 2 | 0.17 | 2 | 3.20 | 4 | 0 | 0 | 0 |
| OCT | 410 | 0 | 8 | 0.57 | 6 | 2.75 | 14 | 0 | 0 | 0 |
| NOV | 329 | 329 | 23 | 1.41 | 14 | 1.50 | 15 | 0 | 140 | 212 |
| DEC | 223 | 223 | 47 | 2.35 | 23 | 1.23 | 12 | 0 | 140 | 353 |
| Total (AF): | 3,732 | 1,374 | 225 | 13.12 | 128 | 36.88 | 233 | 380 | 1,113 | |
| Percent of SIWTF outflow: | | | | | | | 14% | 22% | 64% | |

Notes: AF = acre-feet; RIB = rapid infiltration basin; ponds 1-2-3 area = 104.3 acres; drying beds and RIBs inactive; wash water inflows are the expected amounts in 2017; rainfall and evaporation are long-term averages; ponds 1-2-3 percolation rate = 0.044 feet per day; aeration pond area = 12.4 acres, which is included in rain and evaporation but not percolation.

## Table 5. GWR Project Salinas Treatment Facility Water Balance in Drought Years

| Month | Agricultural Wash Water (AF) Total Available | Agricultural Wash Water (AF) Sent to STF | Salinas Urban Storm Water Inflow (AF) | Rainfall Rate (in) | Rainfall Volume (AF) | Pond Evaporation Rate (in) | Pond Evaporation Volume (AF) | Pumped Outflow to RTP (AF) | Ponds 1-2-3 Percolation (AF) | Pond Storage (AF) |
|---|---|---|---|---|---|---|---|---|---|---|
| DEC | | | | | | | | | | 264 |
| JAN | 156 | 156 | 17 | 1.04 | 10 | 1.90 | 18 | 0 | 140 | 289 |
| FEB | 158 | 158 | 14 | 0.56 | 5 | 2.16 | 21 | 0 | 140 | 306 |
| MAR | 201 | 201 | 11 | 0.41 | 4 | 3.16 | 31 | 0 | 140 | 352 |
| APR | 307 | 307 | 5 | 0.27 | 3 | 4.30 | 42 | 0 | 140 | 485 |
| MAY | 311 | 0 | 1 | 0.01 | 0 | 4.99 | 49 | 60 | 140 | 238 |
| JUN | 391 | 0 | 0 | 0.04 | 0 | 4.26 | 41 | 60 | 137 | 0 |
| JUL | 435 | 0 | 0 | 0.00 | 0 | 3.73 | 0 | 0 | 0 | 0 |
| AUG | 444 | 0 | 0 | 0.02 | 0 | 3.87 | 0 | 0 | 0 | 0 |
| SEP | 367 | 0 | 1 | 0.07 | 1 | 3.93 | 1 | 0 | 0 | 0 |
| OCT | 410 | 0 | 3 | 0.15 | 1 | 3.10 | 4 | 0 | 0 | 0 |
| NOV | 329 | 329 | 8 | 0.47 | 5 | 1.99 | 19 | 0 | 140 | 182 |
| DEC | 223 | 223 | 16 | 0.21 | 2 | 1.95 | 19 | 0 | 140 | 264 |
| Total (AF): | 3,732 | 1,374 | 75 | 3.26 | 32 | 39.34 | 246 | 120 | 1,114 | |
| Percent of SIWTF outflow: | | | | | | | 17% | 8% | 75% | |

Notes: AF = acre-feet; RIB = rapid infiltration basin; ponds 1-2-3 area = 104.3 acres; drying beds and RIBs inactive; wash water inflows are the expected amounts in 2017; rainfall and evaporation are 2013 values; ponds 1-2-3 percolation rate = 0.044 feet per day; aeration pond area = 12.4 acres, which is included in rain and evaporation but not percolation.

Percolation from the Salinas Treatment Facility would be more seasonally variable than under baseline conditions. The maximum change in percolation would occur during July-October, when percolation would be zero. Seepage into the Salinas River follows a short subsurface flow path that would respond quickly to changes in percolation. Thus, during July-October, seepage into the river would decrease by 3 cfs. During November-June, seepage into the river would be about 1.9 cfs, or about 1.1 cfs less than under baseline conditions. In drought years, annual percolation would decrease by about 2,230 AFY. Monthly river flow would decrease by 1.1-3.0 cfs depending on the month (same as in normal/wet years), and the annualized average decrease would be 2.5 cfs.

Recharge to the 180-Foot aquifer might also vary somewhat seasonally, but by less than the variations in pond percolation. This is because the relatively low average permeability along the downward flow path would tend to smooth out short-term fluctuations in pond percolation. For the purpose of evaluating water supply and well impacts, the change in average annual percolation is a reasonable basis for comparison with baseline conditions.

It would be possible to line the ponds to reduce percolation and maximize the amount of stored water that could be pumped out to supply the GWR Project. This option could theoretically reduce percolation to near zero year-round. Thus, depending on whether Ponds 1-2-3 are modified or left as is, percolation could range from essentially zero to the amounts shown in Tables 4 and 5. The evaluation of impacts on river flow assumes a year-round decrease of 3 cfs, which represents a worst-case scenario as described in the Salinas River Inflows Impact Report (Schaaf & Wheeler 2015).

#### 5.2.2 Uncertainty of Change in Percolation Volumes

The above estimates of percolation from Ponds 1-2-3 under GWR Project operation are subject to substantial uncertainty. The ranges of uncertainty for RIB and drying bed percolation are quite large, and the midpoints of those ranges were used in calculating the “best” estimate of the percolation rate from Ponds 1-2-3. In addition, the resulting percolation rate was increased by 20 percent to make it consistent with annual percolation volumes observed during 2013. The recoverable yield of water stored in Ponds 1-2-3 is quite sensitive to the percolation rate, because percolation occurs throughout the storage and pump-out periods (November to June). To illustrate this sensitivity, plausible alternative estimates of percolation and yield were calculated using the 2014 percolation rate without the 20 percent adjustment. The 2014 estimated percolation rate from Ponds 1-2-3 is 103 AF per month, and the water balance results for GWR Project operation under normal/wet years can be summarized as follows: recoverable storage pumped for GWR Project use during May-June = 620 AF; total percolation = 830 AFY, of which 660 AFY seeps to the Salinas River and 170 AFY recharges the 180-Foot aquifer. During drought years, total annual percolation is only slightly less than during wet/normal years because the duration of pond inundation would be about the same. Recoverable storage would be only about 400 AF, however, due largely to decreased rainfall and stormwater inflows.

### 5.2.3 Change in Groundwater Levels

Compared with baseline conditions (Table 3) annual pond percolation under GWR Project conditions (Table 4) would decrease by 2,300 AFY, of which 460 AFY would be a decrease in recharge to the 180-Foot aquifer. Recharge from Salinas Treatment Facility pond percolation to the 180-Foot aquifer occurs over a broad area due to the low permeability of the SVA. The ponds are 1.5 miles long, and if 460 AFY of recharge is assumed to be distributed uniformly over a circular area with a radius of 1.5 miles, it would raise water levels in the 180-Foot aquifer by approximately 1.3 feet. Conversely, a decrease in percolation by that amount would tend to lower water levels by 1.3 feet.

The median elevation of the top of the screen in the 23 wells used to monitor water levels in the 180-Foot aquifer is 160 feet below sea level (Feeney, 2014). The water level in wells screened in the 180-Foot aquifer near the Salinas Treatment Facility is approximately 18 feet below sea level, or 142 feet above the top of the screen in a typical well. A decline of 1.3 feet would not lower the water level to below the top of the screen. Therefore, the potential impact of interrupted water supply due to screen corrosion or pump failure would not occur.

Performance curves for typical deep-well turbine pumps indicate that a change in water level of 1.3 feet would in most cases decrease the pump output by 3-4 percent (Driscoll, 1986; Goulds Water Technology, 2014). This small decrease in pump output can typically be accommodated by increased pumping duration.

The change in recharge to the 180-Foot aquifer during drought years would be about 420 AFY less than under baseline conditions, which is a slightly smaller impact than during normal and wet years. Impacts on wells would therefore also be less than significant during drought years.

## 5.3 Changes in Salinas River and Groundwater Quality

The effect of Salinas Treatment Facility percolation on water quality in the Salinas River and 180-Foot aquifer depends on the concentrations of individual chemical constituents in the Salinas Treatment Facility ponds compared to existing concentrations and water quality objectives for those receiving waters. **Table 6** compares median concentrations of chloride, nitrate, total dissolved solids (TDS) and phosphorus for each water body. These constituents are present in pond water at concentrations that pose a risk of contamination. Data for the Blanco Drain are used as a surrogate for shallow groundwater, because most of the flow in Blanco Drain derives from soil water at the base of the root zone in agricultural fields, which is pumped into Blanco Drain from agricultural drainage tile systems. The data shown in the table were compiled from various monitoring programs with differing suites of constituents and periods of record. Aquifer-specific data for groundwater quality were not available, and data in the table probably reflect a combination of 180-Foot and 400-Foot aquifer groundwater. In spite of these limitations in available data, the table reveals several large contrasts in water quality conditions that can be used to infer impacts of Salinas Treatment Facility percolation on water quality.

Median concentrations were used because average concentrations are often influenced by skewed distributions (for example, high outliers for nitrate).

## Table 6. Comparison of Water Quality in Salinas Treatment Facility Ponds, Salinas River and Groundwater

| Water Source | Chloride (mg/L) | Nitrate (mg/L as $NO_3$) | Total Dissolved Solids (mg/L) | Phosphorus (mg/L as P) | Notes |
|---|---|---|---|---|---|
| SIWTF Ponds 1-3 | 301 | 20 | 1,090 | -- | Medians of 12 monthly samples during 2013. Total nitrogen converted to nitrate. |
| SIWTF Ponds | 237 | 26 | 1,228 | 27 | Median of six samples collected during July 2013 to February 2014 |
| Salinas River at South Davis Road (upstream of SIWTF) | 70 | 31 | 618 | 0.1 | CCAMP data. Medians of 92-100 samples during 1998-2011. Primarily low-flow data. |
| Blanco Drain[a] | 274 | 292 | 2,003 | <0.1 | Median of monthly samples collected during July 2013-June 2014 for GWR Project source water investigation (Nellor Environmental Associates, 2015). |
| Groundwater | 100 | 9 | 800 | 0.012 | Chloride, nitrate and TDS from GeoTracker GAMA database. Medians of samples from 15-23 well locations between Salinas and the Salinas River. Dates vary. Combination of 180-Foot and 400-Foot aquifers. Phosphorus is the median of 8 samples from the Pressure Area (Kulongoski and Belitz, 2011). |
| Water Quality Objectives | | | | | |
| Salinas River below Spreckels | 250[b] | 6.2-28[c] | 500-1,000[d] | 0.07-0.13[c] | Basin Plan for the Central Coast Region, and CCRWQCB Resolution R3-2013-2008 |
| 180-Foot Aquifer | 250 | 4 | 1,500 | no objective | |

Notes:

CCAMP = Central Coast Ambient Monitoring Program CCRWQCB = Central Coast Regional Water Quality Control Board

GAMA = groundwater ambient monitoring and assessment SIWTF = Salinas Industrial Wastewater Treatment Facility

[a] Blanco Drain data used as a surrogate for shallow groundwater quality, for which direct measurements are not available.

[b] The drinking water standard for municipal use is shown. Agricultural crops can experience "increasing problems" at concentrations ranging from 142 to 355 mg/L.

[c] Dry-season Total Maximum Daily Load objectives for the lower Salinas River.

[d] The lower and upper secondary drinking water standards are shown. Agricultural crops can experience "increasing problems" at electrical conductivity values that correspond to approximately 500-2,000 mg/L of TDS.

Median concentrations of TDS, chloride and phosphorus are higher in the Salinas Treatment Facility ponds than in the Salinas River and all of those constituents plus nitrate exceed the water quality objectives for the river at least occasionally. During periods when essentially all flow downstream of the Salinas Treatment Facility derives from pond seepage—such as was observed in November 2013—there would be little dilution of pond seepage, and water quality objectives in the river would probably not be met. Mixing model calculations can be applied to estimate the amount of river flow needed to dilute the inflow from pond seepage sufficiently to meet the objectives, as follows:

- In the case of chloride, a flow of only 0.85 cfs would be needed, which is exceeded 92 percent of the time when the river is flowing[5].
- For nitrate, the water quality objective cannot be met by dilution because pond water and river water both already exceed the objective. Concentrations in the ponds and river are similar, and they are 0.7-4.2 times greater than the objective.
- The lower objective for TDS is similarly not achievable by dilution, but the upper objective (1,000 mg/L) would be achieved by dilution with a river flow of 1.8 cfs, which is exceeded 79 percent of the time when the river is flowing.
- The phosphorus concentration in the ponds is 210-390 times greater than the water quality objective for the river. The objective would be achieved by dilution only when river flow exceeds 2,700 cfs, which occurs only 5 percent of the time when the river is flowing. However, phosphorus is not a conservative solute during subsurface transport. It is removed from soil water and groundwater by adsorption and chemical precipitation, which are influenced by pH, dissolved oxygen and the presence of iron, aluminum and calcium. Also, the capacity to remove phosphorus typically diminishes over time under conditions of prolonged high loading rates (such as occur beneath the ponds) due to saturation of the sorption sites on soil minerals. Consequently, results of field studies have been highly variable, ranging from nearly complete removal of phosphorus within a few inches of a field soil surface to high concentrations extending over 2,500 feet from a municipal wastewater percolation pond on Cape Cod (Pitt and others, 1996; Walter and others, 1996; Pettygrove and Asano, 1985). In the case of the Salinas Treatment Facility, the distance from the ponds to the river is only a few hundred feet and loading has been continuous for decades. It is therefore likely that the phosphorus concentration in pond water that reaches the river exceeds the water quality objective.

Thus, seepage into the Salinas River derived from existing Salinas Treatment Facility pond percolation consistently exceeds the water quality objective for nitrate, occasionally degrades Salinas River water quality with respect to TDS and chloride, and probably continually degrades river quality with respect to phosphorus. Because the GWR Project would decrease the annual volume of water percolated at the Salinas Treatment Facility, it would decrease the input of those contaminants to the river and have a beneficial impact on river water quality.

The impact of decreased Salinas Treatment Facility pond percolation on beneficial uses of groundwater in the 180-Foot aquifer depends on the existing groundwater concentration, the concentration in the ponds and the significance threshold for each constituent that affects beneficial use. Those relationships are different for chloride, nitrate, TDS and phosphorus, as explained below.

Groundwater quality impacts would be greatest near the Salinas Treatment Facility, and for this analysis the impact area previously described for water level impacts was also used for water quality impacts: a circle with a 1.5-mile radius surrounding the Salinas Treatment Facility. The Pressure Area water balance in the SVIGSM groundwater model indicates that groundwater recharge from rainfall and irrigation

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[5] Based on a frequency analysis of daily flows at the Spreckels gage for 1967-2013, there was flow 78 percent of the time.

return flow averages 0.76 ft/yr, which is 38 percent of total groundwater recharge (MWH, 1997). Groundwater recharge from Salinas Treatment Facility percolation averages 0.12 ft/yr when distributed over the circular analysis area. Recharge from Salinas Treatment Facility percolation therefore amounts to approximately 6 percent of total recharge. This means that water quality impacts of changes in Salinas Treatment Facility percolation would be substantially diluted by mixing with other sources of recharge.

Chloride is a relatively conservative solute, which means its concentration does not gradually decrease due to adsorption, degradation or mineral precipitation as it moves through the subsurface. The concentration in the Salinas Treatment Facility ponds is up to three times greater than the existing groundwater concentration, but only 0.9-1.2 times the water quality objective (see Table 4). This means that pond percolation tends to degrade existing groundwater quality and could at most cause groundwater quality to slightly exceed the water quality objective. Therefore, a decrease in Salinas Treatment Facility pond percolation and associated groundwater recharge would probably have a small but beneficial impact on chloride concentration.

Nitrate is usually also a conservative solute in groundwater under typical aerobic conditions. The nitrate concentration in pond water is 2-3 times greater than the existing ambient groundwater concentration and 5-7 times greater than the water quality objective. However, existing nitrate concentrations in the 180-Foot aquifer already exceed the water quality objective by a factor of two. Recharge from pond percolation presently tends to exacerbate an existing degraded condition. Therefore, a decrease in pond percolation would probably have a small but beneficial impact on nitrate concentration.

TDS tends also to be fairly conservative during subsurface transport. The TDS concentration in pond water is 1.5-1.6 times greater than the ambient groundwater concentration. It is greater than the upper secondary MCL for drinking water but less than the Basin Plan water quality objective. Recharge from pond percolation presently tends to degrade groundwater quality with respect to TDS and could impact potable use but does not contribute to an exceedance of water quality objectives. Therefore, a decrease in pond percolation resulting from the GWR Project would tend to improve groundwater quality and maintain beneficial uses.

Finally, the Central Coast Regional Water Quality Control Board has not issued a water quality objective for phosphorus in groundwater. It is not a constituent regulated by drinking water standards or addressed in irrigation water quality guidelines. Therefore, changes in phosphorus concentrations in the 180-Foot aquifer caused by decreased Salinas Treatment Facility pond percolation would not affect beneficial uses.

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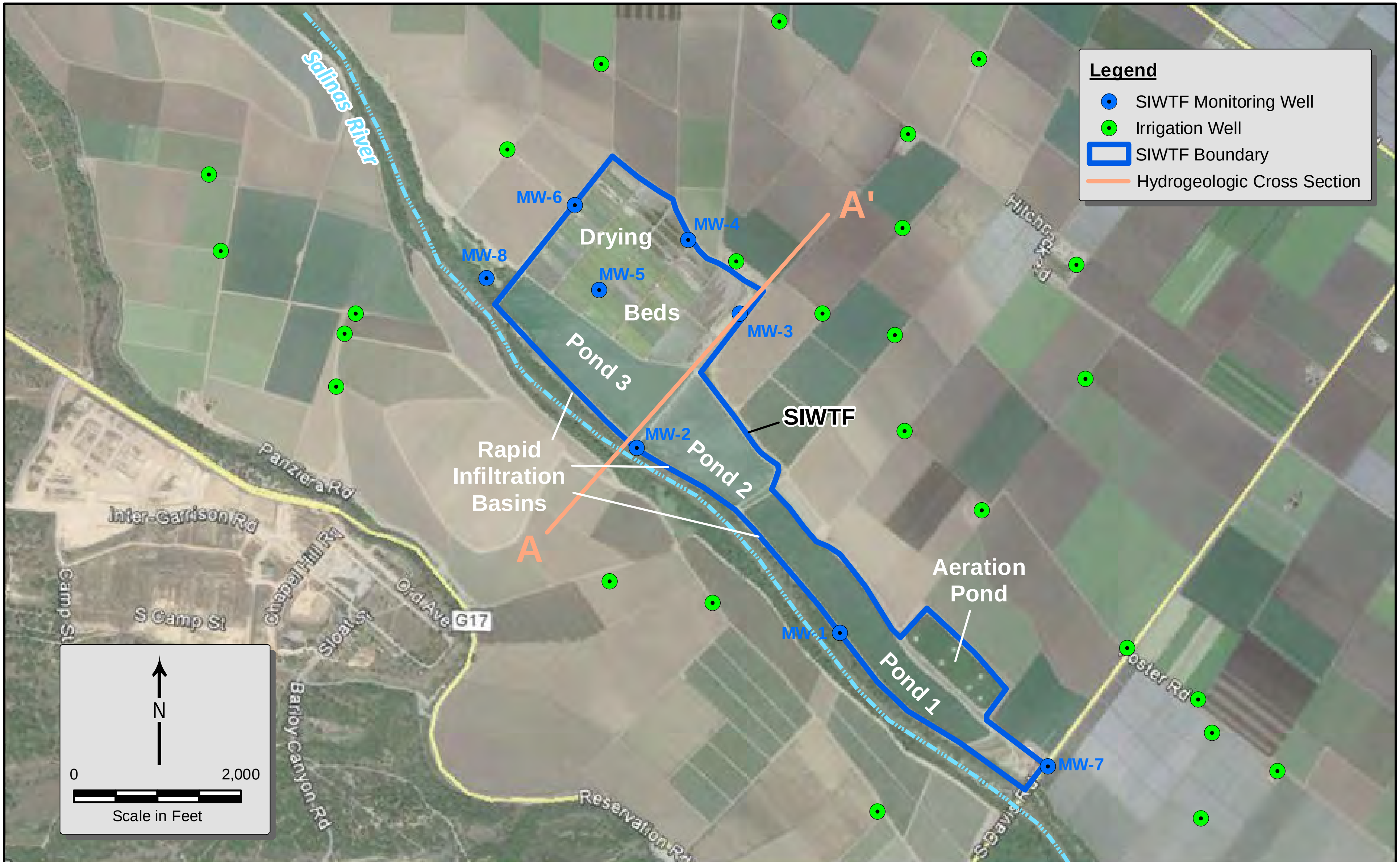


February 2015

TODD GROUNDWATER

**Figure 1**
**Salinas Industrial Wastewater Treatment Facility (SIWTF)**

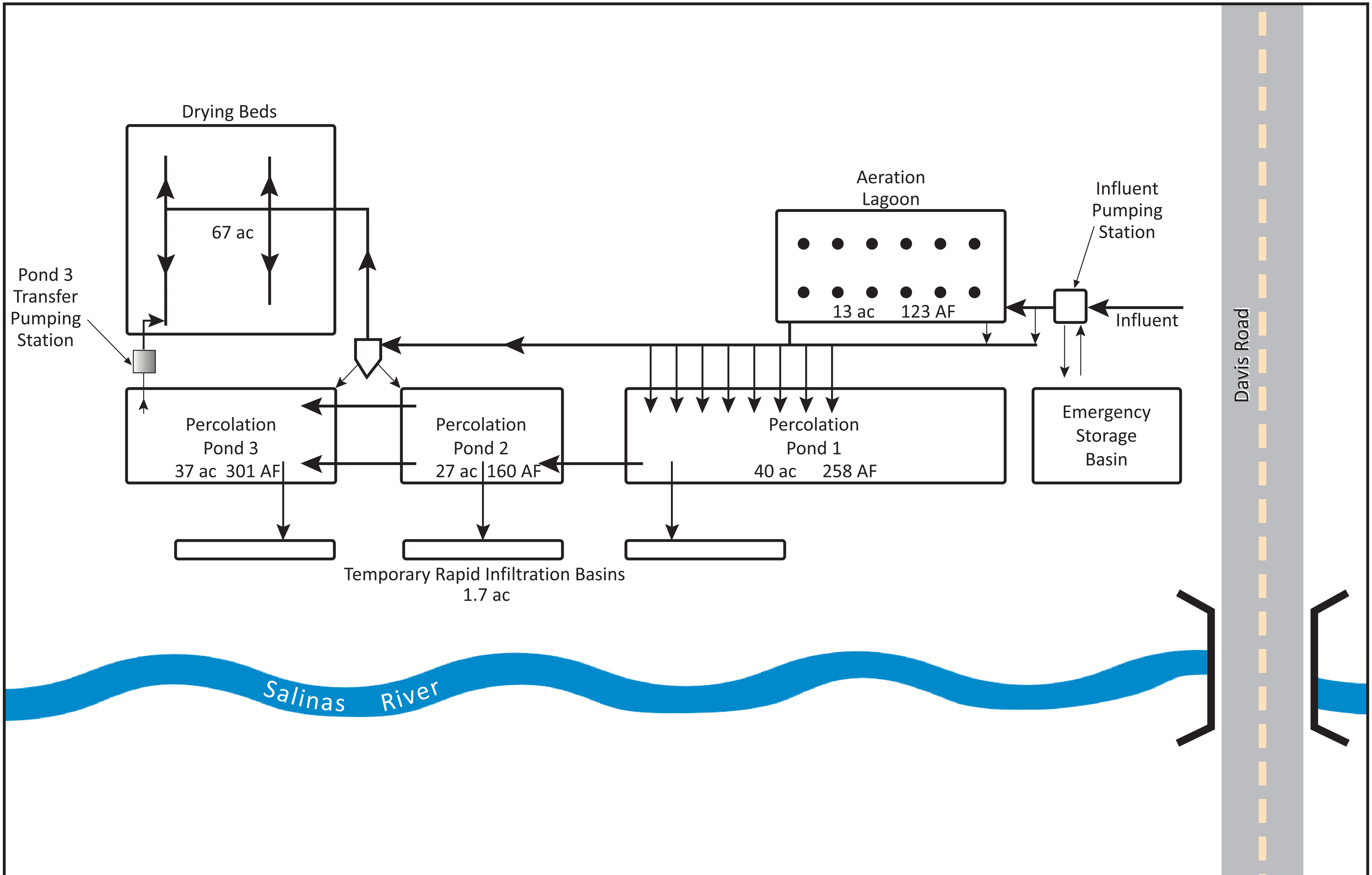


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**Figure 2**
**Diagram of SIWTF Ponds and Flows**

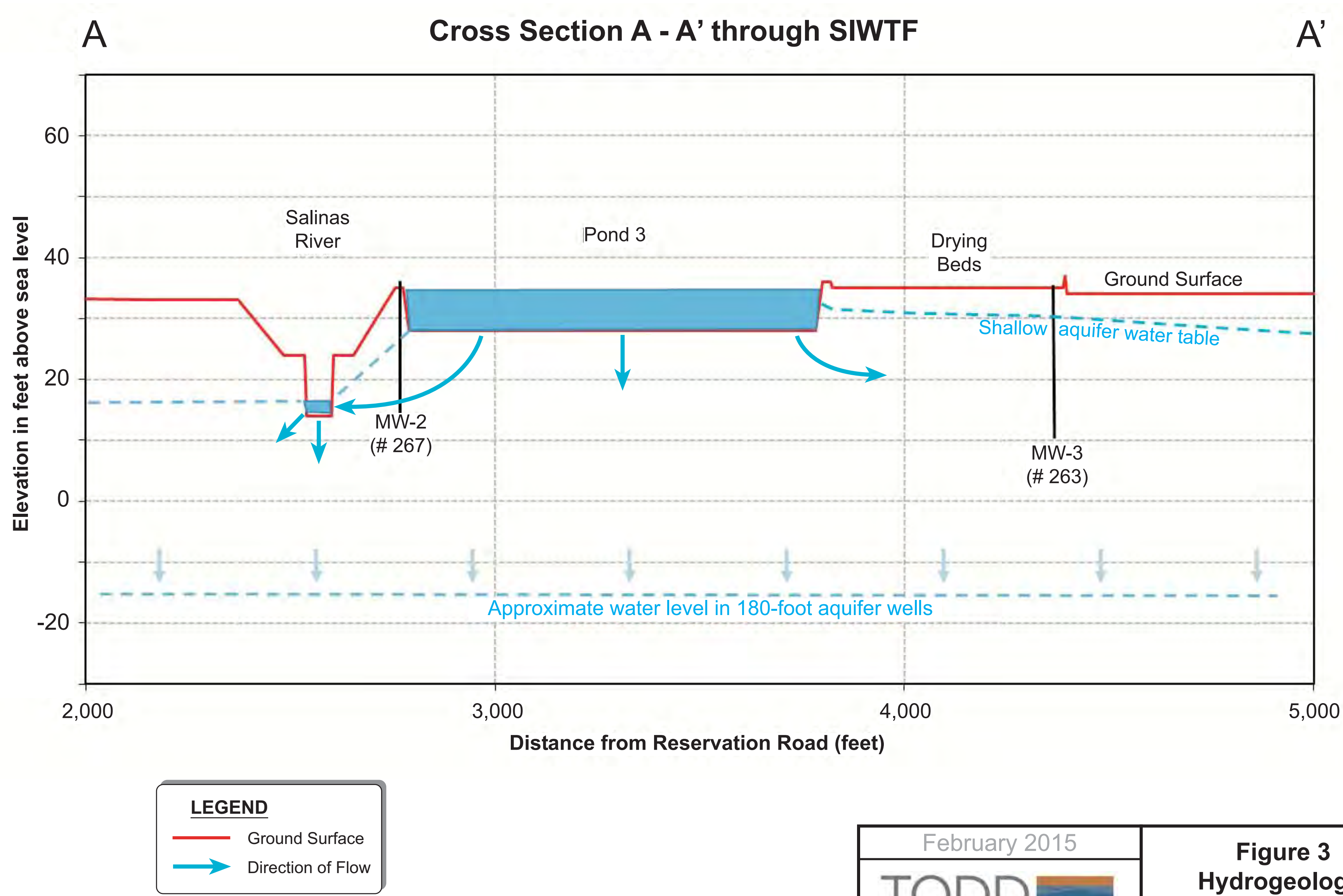


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**Figure 3**
**Hydrogeologic Cross Section A - A'**

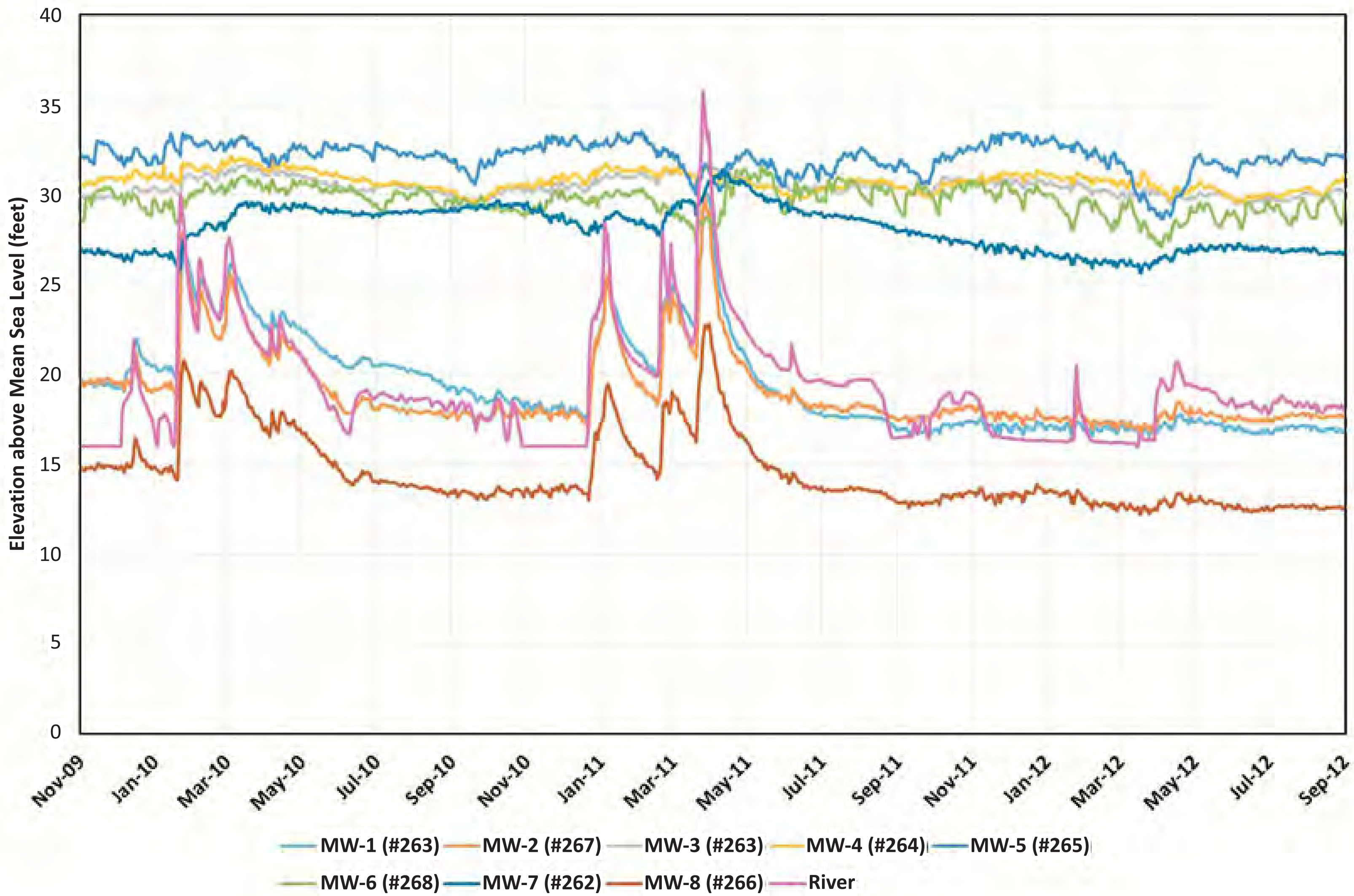


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**Figure 4**
**Water Levels in SIWTF Monitoring Wells and the Salinas River**

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# Appendix O rev

# Salinas River Inflow Impacts Report

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# GROUNDWATER REPLENISHMENT PROJECT

# SALINAS RIVER INFLOW IMPACTS

**Prepared for**

## DENISE DUFFY & ASSOCIATES


**Prepared by**

Schaaf & Wheeler
CONSULTING CIVIL ENGINEERS
3 QUAIL RUN CIRCLE, SUITE 101
SALINAS, CA 93907

**February 2015**

**Revised August 2015**

**Revision Note**: Text updates were made to Section 2.4 in response to comments received. The revisions did not affect the yield or impacts analysis results.

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**Table i. Acronyms Used in this Report**

| Acronym | Description |
|---|---|
| AFY, ac-ft/yr | Acre-feet/year |
| cfs | Cubic foot per second |
| gpd | Gallons per day |
| mgd | Million gallons per day |
| mg/L | Milligrams per liter |
| µg/L | Micrograms per liter |
| MPN | Most Probable Number |
| ppb | Parts per billion |
| ppm | Parts per million |
| | |
| ASBS | Areas of Special Biological Significance |
| ASR | Aquifer Storage and Recovery |
| BMP | Best management practice |
| CAW, CalAm | California American Water Company |
| CCAMP | Central Coast Ambient Monitoring Program |
| CCR | California Code of Regulations |
| CCRWQCB | Central Coast Regional Water Quality Control Board |
| CDPH | California Department of Public Health |
| CEQA | California Environmental Quality Act |
| CSIP | Castroville Seawater Intrusion Project |
| CWC | California Water Code |
| DWR | California Department of Water Resources |
| GWR | Groundwater Replenishment |
| MCWRA | Monterey County Water Resources Agency |
| MPWMD | Monterey Peninsula Water Management District |
| MRSWMP | Monterey Regional Stormwater Management Program |
| MRWPCA | Monterey Regional Water Pollution Control Agency |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic and Atmospheric Administration |
| NRCS | USDA Natural Resources Conservation Service |
| RTP | Regional Treatment Plant |
| SB | California Senate Bill |
| SIWTF | Salinas Industrial Wastewater Treatment Facility |
| SRDF | Salinas River Diversion Facility |
| SRDP | Salinas River Diversion Project |
| SVRP | Salinas Valley Reclamation Plant |
| SVWP | Salinas Valley Water Project |
| SVGB | Salinas Valley Groundwater Basin |
| SWRCB | California State Water Resources Control Board |
| USACE | U.S. Army Corps of Engineers |
| USBR | U.S. Bureau of Reclamation |
| USGS | U.S. Geologic Survey |

**Table ii. Units of Measure Used in this Report**

| Unit | Equals |
|---|---|
| 1 acre-foot | = 43,560 cubic feet<br>= 325,851 gallons |
| 1 cubic foot | = 7.48 gallons |
| 1 cfs | = 448.8 gallons per minute<br>= 724 acre-feet/year |
| 1 MGD | = 1,000,000 gallons/day<br>= 1,120 acre-feet / year |
| 1 mg/L | = 1 ppm<br>= $1 / 10^6$ |
| 1 µg/L | = 1 ppb<br>=$1 / 10^9$ |

## Summary of Salinas River Flow Impacts Study

The Monterey Peninsula Water Management District (MPWMD) and the Monterey Regional Water Pollution Control Agency (MRWPCA) are jointly sponsoring the proposed Pure Water Monterey Groundwater Replenishment Project (Proposed Project), a water supply project that will serve northern Monterey County. The project will provide purified water for recharge of the Seaside Groundwater Basin that serves as drinking water supply, and recycled water to augment the existing Castroville Seawater Intrusion Project agricultural irrigation supply. Three of the proposed sources of water supply to be developed for this project are urban runoff from the City of Salinas, agricultural wash water from the Salinas Industrial Wastewater Collection System, and tile drainage and stormwater runoff from the Blanco Drain, all of which currently contribute flow to the Salinas River. The purpose of this study was to (1) analyze the availability of stormwater runoff from the City of Salinas for this project, (2) provide an engineering analysis of the flow reductions in the Salinas River due to diverting City of Salinas stormwater runoff, agricultural wash water and Blanco Drain flows to the Proposed Project, and (3) assess the potential project impacts on hydrology and water quality in the Salinas River.

The southwest portion of the City of Salinas (approximately 2.55 square miles) is tributary to the Salinas River. Runoff from this portion of the City is collected and pumped to the Salinas River, discharging above Davis Road. Average annual runoff to the Salinas River was estimated to be 246 acre-feet per year (AFY). Of this, an average of 225 AFY may be diverted to the Proposed Project using existing capacity in the MRWPCA regional wastewater collection system.

The Salinas Industrial Wastewater Treatment Facility and Collection System serves 25 agricultural processing and related businesses located in the southeast corner of the City. Industrial wastewater is collected and conveyed separately from municipal wastewater, and treated at a facility located along the Salinas River northwest of Davis Road. Treated wastewater is disposed of using evaporation/percolation ponds along the river, with some flows seeping into and contributing to the river. An estimated 3,733 AFY of industrial wastewater may be diverted to the Proposed Project using existing capacity in the MRWPCA regional wastewater collection system. This diversion may reduce inflows to the Salinas River by up to 2,170 AFY[1].

The Blanco Drain is a man-made reclamation ditch draining approximately 6,400 acres of agricultural lands near Salinas, CA. It discharges to the Salinas River at river mile 5, downstream of the Salinas Industrial Wastewater Treatment Facility. Estimated flow in the Blanco Drain is 2,620 AFY. Some or all of this flow may be diverted to the Proposed Project, depending upon the availability of other source waters and the final permitted diversion rate.

[1] Estimate of current percolation to the river prepared by Todd Groundwater, February 2015.

The water quality of the Blanco Drain is poor, and the diversion would require costly facilities, so the use of other sources is preferred.

Flows in the Salinas River below these facilities were estimated using a mass balance model, and a statistical analysis was performed on the results. Diverting agricultural wash water and City of Salinas stormwater to the Proposed Project would reduce average annual flows in the river by less than 1%. If water is also diverted from the Blanco Drain, the average annual flow in the Salinas River decreases by 1.7%. If diversions are made year-round, they will reduce the number of days that minimum flows for fish passage are achieved. Under the current conditions, the target flows for fish passage are met between 24.7% and 27.5% of the time[2], depending upon the target. With the diversions, the target flows are met between 24.1% and 26.5% of the time.

[2] Percentages are calculated as the number of days meeting the minimum passage flow divided by the total number of days modeled. The model covered the river gage period of record, 1932 to 2013.

# Section 1 - Introduction

## 1.1 Project Description

The Monterey Peninsula Water Management District (MPWMD) and the Monterey Regional Water Pollution Control Agency (MRWPCA) are jointly sponsoring the proposed Pure Water Monterey Groundwater Replenishment Project (Proposed Project), a water supply project that will serve northern Monterey County. The project will provide purified water for recharge of the Seaside Groundwater Basin that serves as drinking water supply, and recycled water to augment the existing Castroville Seawater Intrusion Project agricultural irrigation supply.

Source water for the project would include agricultural wash water from the City of Salinas Industrial Wastewater Collection System, stormwater from MRWPCA member cities, secondary-treated effluent from the MRWPCA Regional Treatment Plant, and surface water diverted from the Reclamation Ditch, Tembladero Slough and Blanco Drain. Water supplied to the Proposed Project would undergo primary and secondary treatment at the existing Regional Treatment Plant. The portion used for groundwater recharge would then undergo advanced treatment at a new facility to be located at the MRWPCA site, and then be conveyed to the Seaside Groundwater Basin for injection. The portion used for agricultural irrigation would undergo tertiary treatment at the existing Salinas Valley Reclamation Plant, and distribution through the Castroville Seawater Intrusion Project system.

The MRWPCA provides wastewater treatment for municipalities along the Monterey Bay from Pacific Grove north to Moss Landing, and inland to the City of Salinas. Wastewater is collected in an interceptor pipeline system and conveyed to the Regional Treatment Plant (RTP), located two miles north of the City of Marina. A large portion of this incoming flow is tertiary treated and used for unrestricted agricultural irrigation within the Castroville Seawater Intrusion Project system in the northern Salinas Valley. Flow that is not sent to the tertiary treatment system is discharged through an outfall to Monterey Bay after receiving secondary treatment. The RTP has an average dry weather design capacity of 29.6 million gallons per day (mgd) and a peak wet weather design capacity of 75.6 mgd. It currently receives and treats approximately 17 to 18 mgd of average dry weather flow and therefore has capacity to treat additional flows. The interceptor pipeline system also has currently unused or excess conveyance capacity. Most of the new source waters would be conveyed to the RTP using the existing wastewater collection system; water from Blanco Drain would be conveyed in a new pipeline directly to the RTP.

The purpose of this study is to analyze the availability of urban stormwater runoff from the City of Salinas that currently flows into the Salinas River and to provide an engineering analysis of the potential yields which may be captured and conveyed to the RTP. This study also estimates the Proposed Project's impacts on Salinas River flows, which will include (1) diverting agricultural wash water from the Salinas Industrial Wastewater collection system, (2) capturing stormwater runoff from the City of Salinas, and (3) diverting Blanco Drain flows. The other proposed water sources for the Proposed Project do not affect flow in the Salinas River, and are therefore not included in this analysis. The modeled Salinas River flows from this analysis will be used for the Project's fisheries impacts analysis (by others). Finally, this report provides a summary of the available water quality for the Salinas River and the proposed water sources.

This report builds upon preliminary analysis presented in other reports, including: (1) Technical Memorandum, Salinas Sewage Conveyance Study, prepared by Carollo Engineers; (2) Draft Memorandum, Pure Water Monterey Groundwater Replenishment Project: Impacts of Changes in Percolation at the Salinas Industrial Wastewater Treatment Facility on Groundwater and the Salinas River, prepared by Todd Groundwater; and (3) Revised Draft, Blanco Drain Yield Study, prepared by Schaaf & Wheeler. References are cited as they appear and are listed in Appendix D.

## 1.2 Water Source Descriptions

The City of Salinas is located in the northern part of the Salinas Valley in Monterey County, approximately ten miles east of the Pacific Ocean and adjacent to the Salinas River. Two sources of untreated water for the Proposed Project originate within the City, agricultural wash water and urban stormwater runoff, as discussed below.

### 1.2.1 Salinas Industrial Wastewater Collection and Treatment Systems (Agricultural Wash Water)

The City of Salinas operates an industrial wastewater collection and treatment system that serves approximately 25 agricultural processing and related businesses located in the southeast corner of the City. This water is referred to as agricultural wash water because the majority of it is used to rinse table crops before packaging. This wastewater collection system is separate from the Salinas municipal sewage collection system. Wastewater is conveyed in a network of gravity pipelines to the Salinas Industrial Wastewater Treatment Facility (SIWTF), which is located on the north bank of the Salinas River, downstream of the Davis Road crossing (see Figure A-1). The plant has been in operation since 1944. The SIWTF consists of an influent pump station, an aeration lagoon, percolation ponds, drying beds and rapid infiltration basins to treat, percolate and evaporate the water.

The SIWTF is designed and permitted for an average daily flow of 4.0 million gallons per day (MGD) with a peak flow of 6.8 MGD. The SIWTF operates year-round, with a current peak monthly inflow during summer months of approximately 3.5 to 4.0 mgd. This summer peak corresponds with the peak agricultural harvesting season in the Salinas Valley. In recent years, substantial flows to the SIWTF have continued during the winter months due to the importation of agricultural products from Arizona for processing. Flows in all seasons are expected to increase as additional customers are added to the SIWTF system.

The SIWTF collection system trunk sewer passes through the City's former municipal wastewater treatment plant, known as Treatment Plant No. 1 (TP1), located on Hitchcock Road (see Figure A-2). TP1 is also the location of the MRWPCA Salinas Pump Station, which conveys municipal wastewater to the Regional Treatment Plant via the Salinas Interceptor pipeline. One of the proposed sources of supply for the Proposed Project is agricultural wash water, which may be diverted at TP1 from the industrial collection system to the municipal collection system. The industrial wastewater pipeline is shallower than the municipal wastewater pipeline, so a gravity connection is feasible.

### 1.2.2 Salinas Stormwater

The City of Salinas receives an average of 13.1 inches of rain each year[3]. Four major creeks and several minor tributaries pass through the Salinas area and receive stormwater discharges from the City northeast and adjacent to Highway 101. These creeks are all tributary to the Tembladero Slough and thence to the Old Salinas River channel. Stormwater from the southernmost portion of the City is collected in a storm drain system that flows south toward the Salinas River (Figure A-3). This stormwater system terminates at a lift station on the TP1 property, which discharges to the Salinas River upstream of Davis Road via a 66-inch pipeline (Figure A-4). The pump station has a peak flow capacity of 110 cubic feet per second (cfs). Excess stormwater (peak flows exceeding the pump capacity) overflows to the on-site Blanco Detention Pond. The portion of the City that drains to the Salinas River is approximately 1,631 acres, or 2.55 square miles.

Another of the proposed sources of supply for the Proposed Project is diversion of urban stormwater runoff from the City into the municipal and/or the industrial wastewater collection systems at TP1. The stormwater collection pipelines are shallower than the municipal wastewater pipeline, so a gravity connection to the municipal system is feasible. Connection to the industrial wastewater system would require a gated structure to impound water up to the level of the industrial wastewater collection system pipeline, or a pumped connection may be used. Stormwater flows are highly variable, and occur primarily in the winter months. Peak flows which cannot be captured for the Proposed Project may still be discharged to the Salinas River.

The storm drainage system currently discharges to the Salinas River. During the summer months, the Salinas River flows into the Old Salinas River Channel through a gated culvert on the northern side of the Salinas Lagoon (see Figure A-5 in Appendix A and Figure 1.1, below). Direct discharge to the ocean is blocked by a seasonal sand bar which forms across the mouth of the Salinas Lagoon due to wave and tidal action in the Monterey Bay. The Old Salinas River channel is controlled by tide gates at Potrero Road in Moss Landing. River flow combines with

[3] NWS Gage USW00023233, Salinas Municipal Airport, period 1932-2013

Tembladero Slough flow approximately 1.2 miles above the tide gates. During high winter flows in the Salinas River, the sand bar breaches and the river flows directly to the Bay. When this occurs, the Monterey County Water Resources Agency (MCWRA) closes the slide gate to the Old Salinas River.

**Figure 1.1: Salinas River Lagoon**

Lagoon closed to the ocean (left) and open (right). Arrow indicates gated outlet to Old Salinas River.

The Central Coast Regional Water Quality Control Board (CCRWQCB) has listed the Salinas River below Spreckels on the impaired water body listing pursuant to Section 303(d) of the Clean Water Act for pesticides, nitrate, chloride and other parameters. A summary matrix of 303(d) listed streams is provided as Table B-1. Water quality is discussed in greater detail in Section 3.2 of this report.

### 1.2.3 Blanco Drain

The Blanco Drain is a man-made reclamation ditch draining approximately 6,400 acres of agricultural lands near Salinas, CA. The watershed is between the Salinas River and Alisal Slough, and discharges to the Salinas River at river mile 5 (see Figure A-6). A headwall and flap gate at the lower end of the ditch system prevents seasonal high flows in the Salinas River from migrating up the Blanco Drain channel. Summer flows in the Blanco Drain are generally tile drainage and runoff from irrigated agriculture. Winter flows also include stormwater runoff, but many fields remain in production and are irrigated year-round.

The Central Coast Regional Water Quality Control Board (CCRWQCB) has listed Blanco Drain as an impaired water body pursuant to Section 303(d) of the Clean Water Act for pesticides, nitrate and low dissolved oxygen. Aquatic habitats within the Blanco Drain system are poor. In addition to the poor water quality, the system is generally maintained as a drainage canal without vegetation or tree canopy, and the flap gate prevents fish passage during periods of high flow in the Salinas River.

In 2009-2010, the Monterey County Water Resources Agency's (MCWRA) Salinas River Diversion Facility (SRDF) was constructed downstream of the Blanco Drain. The SRDF includes an inflatable rubber dam that impounds water during the summer months to supply the diversion pump station. To prevent accumulated water in the Blanco Drain channel from submerging the agricultural drains, the Blanco Drain channels were regraded and a new slide gate and pump station were installed at the lower end of the Drain, several hundred feet above the confluence with the Salinas River. The pump station lifts Blanco Drain flows past the slide gate and into the gravity portion of the channel.

The Proposed Project would divert flows from the Blanco Drain at a new pump station, located next to the existing MCWRA pump station, and convey it directly to the RTP via a new pipeline.

# Section 2 - Yield Estimation

## 2.1 Salinas Agricultural Wash Water Capture

Annual yields from the SIWTF were estimated by MRWPCA Staff based upon operational records for the years 2007 through 2013. Total estimated yield of agricultural wash water is 3,733 AFY, based on the projected flows for year 2017 (the year the Proposed Project will commence operation). The Proposed Project is estimated to use 73% to 100% of the available SIWTF influent as source water supply for the Project. Projected monthly inflows to the SIWTF are shown in Table 2-1.

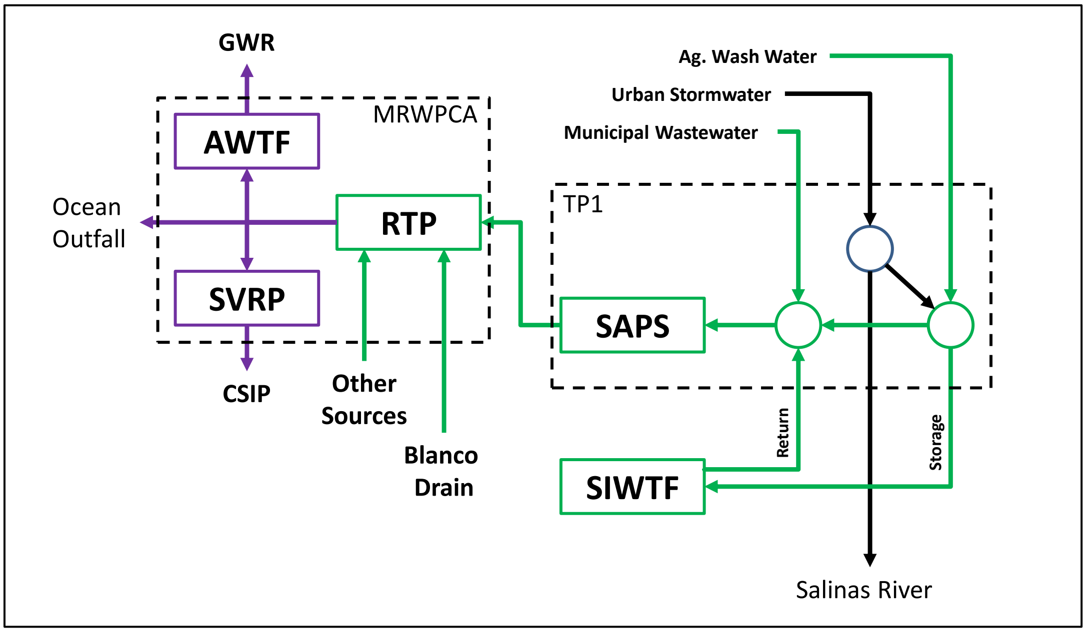
**Table 2-1: Estimated Monthly SIWTF Flows, 2017 Projection[4]**

| Month | Ac-Ft |
|---|---|
| January | 156 |
| February | 158 |
| March | 201 |
| April | 307 |
| May | 311 |
| June | 391 |
| July | 435 |
| August | 444 |
| September | 367 |
| October | 410 |
| November | 329 |
| December | 223 |
| **Total** | **3,733** |

Agricultural wash water would be diverted at the TP1 site into the municipal wastewater collection system. The MRWPCA Salinas Pump Station (SAPS) has a maximum day capacity of 35.4 MGD, but the current peak flow is only 15.6 MGD[5], leaving almost 20 MGD of unused capacity. A valved gravity connection is proposed to transfer agricultural wash water flows into the municipal collection system, retaining the ability to send flows to the existing SIWTF (see Figure 2.1, below, and TP1 piping schematic in Appendix A, Figure A-2). A temporary transfer of agricultural wash water to the municipal wastewater system occurred in the spring and summer of 2014, in response to the prolonged drought conditions. The agricultural wash water was routed backward through the existing municipal-to-industrial emergency overflow pipeline. This increased the amount of secondary-treated effluent available for conversion to recycled water at the Salinas Valley Reclamation Plant.

[4] Projection by Bob Holden, MRWPCA Staff, 2014
[5] MRWPCA Operating Records, 1999-2013

**Figure 2.1: Project Flow Schematic (partial)**




The SIWTF has a design peak flow rate of 6.8 MGD. Water treatment at the SIWTF consists of screening for trash removal, aeration and then percolation/evaporation. Wastewater is treated in a 13-acre aeration lagoon and then discharged by gravity to a series of three percolation/evaporation ponds that have a total surface area of 110 acres[6]. Remaining wastewater is disposed of in 54 shallow drying beds and rapid infiltration beds that are alternately loaded with treated effluent for disposal by percolation and evaporation. Water from the SIWTF percolates into the shallow A-Aquifer above the Salinas Valley Aquitard, which overlies the 180-foot aquifer of the Salinas Groundwater Basin. A large portion of the percolated flow has historically seeped into the Salinas River. Todd Groundwater estimates that in 2013, 20% of the water that was percolated from the SIWTF became recharge to the A-aquifer and 80% seeped to and became surface flow in the Salinas River.

The percolation rate of water in the ponds between 2011 and 2013 declined substantially. The 2013 Annual Report for the SIWTF[7] opines that higher than normal groundwater levels, possibly due to operation of the Salinas River Diversion Facility, may be contributing to this condition. In 2014, the agricultural wash water was diverted to the Regional Treatment Plant between April 1 and October 31 and the water was pumped to the rapid infiltration beds to completely empty the main percolation/evaporation ponds. Prior to this year, the ponds had not been emptied for maintenance of the pond bottoms for more than twelve years (i.e., since emergency repairs were

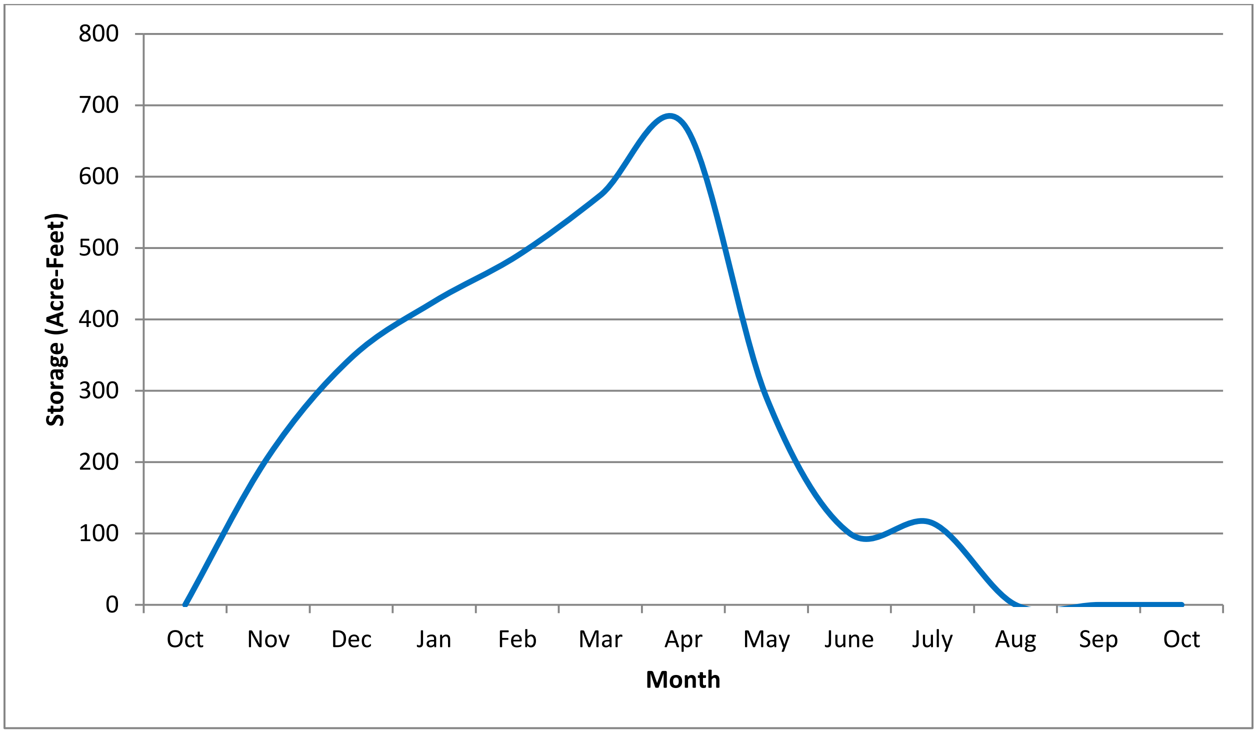
[6] City of Salinas, *Industrial Wastewater Treatment Facility, 2013 Annual Report*, January 2014
[7] City of Salinas, *Industrial Wastewater Treatment Facility, 2013 Annual Report*, January 2014

completed in early 2002). As evidenced by the survey of the empty ponds in 2014, the ponds have accumulated silts (see Figure 2.2).

**Figure 2.2: SIWTF Pond 1 (September 2014)**

The Proposed Project would maximize the use of agricultural wash water by sending flows to the SIWTF ponds from November through April when other sources of water supply are available. From April through October, incoming agricultural wash water would be diverted to the Salinas Pump Station, and stored water from the SIWTF ponds would be pumped back to the Salinas Pump Station. This will allow the production of additional tertiary treated water during the peak irrigation season. The SIWTF ponds can hold approximately 1,250 acre-feet of water. Operating the ponds in this manner, the use of the drying beds and rapid infiltration basins will be eliminated in all but wet years. Assuming the ponds are empty at the start of the filling cycle in November, they will be half full by the end of the filling cycle in April and empty again by mid-August (see Figure 2.3). Increased storage may be achieved by lining one or more ponds to decrease the percolation losses. Stormwater runoff from the City of Salinas that passes through the TP1 site during the filling cycle would also be stored in the SIWTF ponds, if storage capacity exists.

**Figure 2.3: Projected SIWTF Pond Storage (typical year)**[8]




## 2.2 Salinas Stormwater Capture

Estimates of stormwater runoff into the Salinas River from the City of Salinas were made based on daily rainfall gage data, National Resource Conservation Service[9] mapped hydrologic soil group information, and land use as shown on aerial photographs. Calculations were made for each day using the methods in SCS Manual TR-55, Urban Hydrology for Small Watersheds. Runoff curve numbers (CN) were determined based on soil group and cover. Curve numbers appropriate for scrub cover were used for areas of natural vegetation, and curve numbers appropriate for irrigated pasture were used for lawns and other irrigated ground cover. A curve number of 98 for antecedent moisture condition (AMC) II was used for all impervious areas. The runoff curve numbers used to calculate runoff varied between AMC I (with 1.4 inches or less during previous five days) and AMC III (with 2.1 inches or more during the previous five days) depending on the precipitation during the previous five days. Results were aggregated by month and water year (October 1 through September 30).

[8] Storage reflects operational analysis by Larry Hampson, MPWMD, 10/17/2014, with updated percolation rates by Todd Groundwater, 2015.
[9] Formerly the USDA Soil Conservation Service

For each land use and soil group combination, runoff was determined for each day during the period of record. The following equations are used in the NRCS model:

$$R = \frac{(P - 0.2S)^2}{(P + 0.8S)}$$

Where P is the precipitation in inches, R is the runoff in inches, and S is the storage in inches:

$$S = \frac{1000}{CN} - 10$$

Rainfall data for Salinas were obtained from NOAA gage USW00023233, Salinas Airport, Salinas, CA, for the period 10/1/1932 to 12/31/2013. The Salinas Airport Gage has several data gaps (listed below). Data from NOAA gage Salinas #2 (USC00047668) was substituted as indicated below. The average annual precipitation is 13.1 inches/year. Total precipitation by month is shown in Table B-2.

| Date Gap Period | Replaced With |
|---|---|
| 8/6/1941 | None |
| 11/15/1944 – 11/16-1944 | None |
| 6/4/1946 – 7/31/1946 | None |
| 2/1/1948 – 2/29/1948 | None |
| 5/1/1959 – 12/31/1959 | Salinas #2 |
| 7/20/1995 – 7/31/1995 | Salinas #2 |

The portion of the City that drains to the Salinas River is 1,631 acres, or approximately 2.55 square miles (see Figure A-3). The land use and soil types are shown in Table 2-2. Using the method described above, the total estimated runoff into the Salinas River from the City averages 246 acre-feet per year (see Appendix B, Table B-3).

**Table 2-2: Land Use, Areas and Curve Numbers**

| Land Use | Soil Group | Curve Number | Total Area | Percent Impervious | Impervious Area | Pervious Area |
|---|---|---|---|---|---|---|
| | | (AMC II) | (acres) | | (acres) | (acres) |
| Single Family Residential | C | 83 | 1,108 | 40% | 443.4 | 665.0 |
| Commercial | C | 94 | 51 | 90% | 46.0 | 5.1 |
| Open Space | C | 79 | 184 | 10% | 18.4 | 165.9 |
| Single Family Residential | D | 87 | 261 | 40% | 104.5 | 156.8 |
| Commercial | D | 95 | 16 | 90% | 14.2 | 1.6 |
| Open Space | D | 84 | 10 | 10% | 1.0 | 9.4 |
| **Totals** | | | **1,631** | | **628** | **1,004** |
| Net Impervious Area | | 98 | | | **628** | |

Stormwater from the City of Salinas flows to the City's Salinas River Pump Station, located adjacent to the TP1 site and the MRWPCA Salinas Pump Station (Figure A-2). The site elevation at TP1 is approximately 36-ft. The gravity stormwater mains enter the Salinas River Pump Station at invert elevation 23-ft (+/-)[10], or about 13-ft below ground surface. The sanitary sewer mains entering the MRWPCA pump station have an invert elevation of 16-ft (+/-), or about 20-ft below ground surface. The sanitary sewer main is deeper, therefore it is possible to connect the stormwater system to the sanitary system using a gravity pipeline and check valve.

The MRWPCA operates three wastewater interceptor systems that convey flows to the Regional Treatment Plant: the Moss Landing-Castroville Interceptor from the north, the Monterey-Seaside-Fort Ord-Marina Interceptor from the south, and the Salinas Interceptor from the east (Figure A-7). As discussed above, the MRWPCA Salinas Pump Station has a maximum day capacity of 35.4 MGD, a current peak flow of 15.6 MGD[11], and approximately 20 MGD of unused capacity. Runoff capture from Salinas was calculated based on an upper diversion limit of 61 acre-feet/day (= 20 MGD). No lower limit was needed because this system may be configured to capture all stormwater below the daily limit. If the combined stormwater and agricultural wash water flows exceed 20 MGD, the excess stormwater would bypass to the existing Salinas River Pump Station, or may be routed to the SIWTF for storage using the existing Industrial Wastewater collection system. The estimated average annual runoff capture was 225 AFY (see Tables B-4 and B-5 for monthly model results). The estimated runoff capture varied based on the annual rainfall pattern, from a minimum of 19 AFY to a maximum of 654 AFY.

### 2.3 Blanco Drain Flow Capture

Annual yields from the Blanco Drain were estimated by Schaaf & Wheeler[12] based on operational records for the existing Blanco Drain pump station. Monthly pump station flows, rainfall data and Castroville Seawater Intrusion Project delivery records were used to determine the relationship between Blanco Drain flows and rainfall and applied irrigation across the 6,000 acre drainage basin. An average 17% of the total precipitation and applied irrigation returns as flow in the Blanco Drain. The estimated average monthly flows in the Blanco Drain are shown in Table 2-3. A full discussion of the estimating methodology and the underlying data are available in the Blanco Drain Yield Study report.

[10] Using the City of Salinas IWTF Ponds for Stormwater Storage, Kimley-Horn and Associates, 2013

[11] MRWPCA Operating Records, 1999-2013

[12] Revised Draft Blanco Drain Yield Study, Schaaf & Wheeler, 2014

**Table 2-3: Estimated Monthly Flows in Blanco Drain**

| Month | Applied Irrig + Precip | 17% return | Avg Return Flow Rate |
|---|---|---|---|
| | AF | AF | CFS |
| January | 1,229 | 209 | 3.4 |
| February | 1,314 | 223 | 4.0 |
| March | 1,446 | 246 | 4.0 |
| April | 1,481 | 252 | 4.2 |
| May | 1,323 | 225 | 3.7 |
| June | 1,613 | 274 | 4.6 |
| July | 1,629 | 277 | 4.5 |
| August | 1,436 | 244 | 4.0 |
| September | 1,080 | 184 | 3.1 |
| October | 989 | 168 | 2.7 |
| November | 782 | 133 | 2.2 |
| December | 1,088 | 185 | 3.0 |
| **Totals** | **15,410** | **2,620** | |

Flow capture from the Blanco Drain was estimated based on two diversion rates. The permitting process for a water right diversion under 3 cfs is shorter than for a larger water right, so the Proposed Project assumes an initial water right diversion at 2.99 cfs, and an ultimate water right allowing diversions at up to 6 cfs. Because the water quality and in-stream habitat in the Blanco Drain is poor, it was assumed that all of the available flows may be diverted (that is, no minimum flow into the Salinas River would be required). The estimated monthly diversions are shown in Table 2-4, below. The Proposed Project would develop multiple sources of water supply. Water from the Blanco Drain is only projected for use between March and September, although diversions in other months may occur depending upon the availability of supply from other sources. For this analysis, year-round diversions under the proposed water rights were considered.

**Table 2-4: Estimated Monthly Diversions from Blanco Drain**

| Month | Diverting at 2.99 cfs | Diverting at 6.0 cfs |
|---|---|---|
| | AF | AF |
| January | 184 | 209 |
| February | 166 | 223 |
| March | 184 | 246 |
| April | 178 | 252 |
| May | 184 | 225 |
| June | 178 | 274 |
| July | 184 | 277 |
| August | 184 | 244 |
| September | 178 | 184 |
| October | 168 | 168 |
| November | 133 | 133 |
| December | 184 | 185 |
| **Totals** | **2,104** | **2,620** |

## 2.4 Salinas River Flows

The Salinas River is the largest river of the Central Coast of California, running 170 miles and draining 4,160 square miles (Figure A-8). It originates near the town of Santa Margarita in San Luis Obispo County and flows north-northwest through Monterey County and into the Monterey Bay. The Salinas River watershed is bounded by the Gabilan Range to the east and the Sierra de Salinas and Santa Lucia Range on the west. The combination of steep terrain on the sides of the watershed and intense farming of the valley floor leads to high sediment loads within the river. The Salinas River has three main tributaries, the Nacimiento, San Antonio and Arroyo Seco Rivers. Historically, the River was dry during summer months and prone to flooding during extreme winter and spring storm events. Levees were constructed to prevent flooding and restrict channel migration on the historic floodplain and adjacent lands[13]. Modifications to the natural hydrologic condition occurred with the construction of reservoirs for flood control and water supply.

**Table 2-5: Reservoirs in the Salinas Basin**

| Reservoir Name | Storage Capacity<br>Drainage Area | Constructed | Owner |
|---|---|---|---|
| Lake Nacimiento | 377,900 ac-ft<br>362 sq-mi | 1957 | Monterey County Water Resources Agency |
| Lake San Antonio | 335,000 ac-ft<br>344 sq-mi | 1967 | Monterey County Water Resources Agency |
| Santa Margarita Lake | 23,843 ac-ft<br>112 sq-mi | 1941 | City of San Luis Obispo |

The Salinas Valley Groundwater Basin extends along the river valley floor from Bradley north to the Monterey Bay. It provides approximately 500,000 acre-feet per year of water supply for municipal, industrial and agricultural use. The groundwater basin has four designated subareas, the Upper Valley, Forebay, East Side and Pressure (Figure A-9). The groundwater basin is recharged in all but the Pressure Subarea, which has a clay layer above the major water bearing layers[14]. Monterey County Water Resources Agency (MCWRA) releases flows from Lakes Nacimiento and San Antonio through the spring and summer months to recharge the groundwater basin. Santa Margarita Lake is used for municipal water supply in San Luis Obispo County and is not released to the river. In 2009, the MCWRA constructed the Salinas River Diversion Facility (SRDF) near the Salinas Valley Reclamation Plant (Figure A-10). Water released from San Antonio and Nacimiento Reservoirs which has not percolated into the Salinas Valley Groundwater Basin may be rediverted at the SRDF. The facility includes an inflatable

[13] Salinas River Stream Maintenance Program EIR, Executive Summary, Cardno ENTRIX, 2013
[14] DWR Bulletin 118, description of Subbasin 3-4.01

rubber dam that creates a seasonal intake pool for the diversion pump station, a metered release weir for maintenance of downstream flows and a fish ladder (Figure 2.4).

**Figure 2.4: Salinas River Diversion Facility[15]**

The U.S. Geologic Survey operates a stream flow gage on the Salinas River below Spreckels, approximately 3-miles upstream of Davis Road and the SIWTF. Daily flow readings are available from October 1, 1929 to present. Data were analyzed for the period 10/1/1931-12/31/2013, to be consistent with the period of precipitation data used for runoff analysis. The stream gage data allow a review of the river conditions before the construction of the two major reservoirs (1932-1956), regulated flows for groundwater recharge (1957-2009) and increased flows for rediversion at the SRDF (2010-2013) (see Table 2-6, below, and Tables B-6, B-7 and B-8 in Appendix B). The decline in average annual flows during the regulated period was approximately 90,000 AFY, due to a combination of increased groundwater recharge, increased evaporative losses (from the reservoirs), lower average rainfall than the previous period and likely increases in riparian water use due to year-round availability. Summer flows (July-September) averaged less than 5 cfs under natural conditions, but increased to over 20 cfs once the reservoirs were operated to maintain year-round flow in the river. Similarly, average winter flows (January-March) decreased by 25% due to the capture of peak flows in the reservoirs.

[15] AMBAG aerial imagery

**Table 2-6: Annual Flow, Salinas River near Spreckels**

| Water Years (Oct to Sep) | Average Flow (AFY) | Median Flow (AFY) | Period Description |
|---|---|---|---|
| 1932-2013 | 297,070 | 121,392 | All years of record |
| 1932-1956 | 362,407 | 224,798 | Prior to reservoirs |
| 1957-2009 | 276,431 | 88,450 | Regulated Flows |
| 2010-2013 | 162,187 | 112,900 | Increased releases for SRDF |

As a condition of operating the SRDF, MCWRA must maintain certain in-stream flows in the Salinas River. When San Antonio and Nacimiento Reservoirs have a combined storage of 220,000 acre-feet, the SRDF has a requirement to release (1) a minimum of 15 cfs downstream from April 1 to June 30, and (2) a minimum of 2 cfs downstream from July 1 to the end of the SRDF operating season for maintenance of the Salinas River Lagoon habitat. Higher flow releases are triggered during steelhead migration season if the Salinas Lagoon is open to the ocean. When the combined storage in the two reservoirs is under 220,000 ac-ft and/or the water year type is Dry, the minimum bypass requirement for Salinas River Lagoon habitat maintenance is 2 cfs while the SRDF is in operation. In Table 2-7, the recorded daily by-passed flows at the SRDF during years 2012 and 2013 are provided (fish ladder plus regulating weir, as shown in Figure 2.5). Unmetered flows also occurred across the 144-ft wide dam face. The table includes the number of days the average water level behind the dam was higher than the dam crest. Water year 2012 was classified as a dry year, so the trigger for fish passage releases was not met. Water year 2013 was classified as a dry-normal year, so increased releases for Salinas Lagoon habitat maintenance were made. The required minimum releases are included in the table.

The proposed project will reduce inflows above the SRDF by capturing flows from the Blanco Drain and reducing percolation from the SIWTF into the river. Those reductions are tabulated by month in Table 2-8. Urban stormwater will also be captured, but rain events are typically single-day occurrences, so they were omitted from the table. The project will reduce inflows by 3 cfs up to 8.6 cfs during the SRDF operating season. In a dry year, this should not affect the achievement of minimum releases, but it will reduce the frequency of unmetered releases over the dam crest. During years where passage flow releases are required, full diversion under the proposed project will reduce the frequency of unmetered releases over the dam crest, and may affect the achievement of minimum releases. The MCWRA releases between 350 cfs and 550 cfs from Nacimiento and San Antonio Reservoirs when the SRDF is operating, but less than 50 cfs (about 10%) remains in-stream at the Spreckels gage[16]. The majority of the released flow goes to groundwater recharge and riparian evapotranspiration above Spreckels. The SRDF diversion rate is an average 20 cfs. Due to the significant losses and travel time between the

[16] Salinas Valley Water Project, Annual Flow Monitoring Report, Water Year 2013, and USGS Gage 11152500, Salinas River near Spreckels

reservoirs and the SRDF, flows reductions affecting the by-pass releases would likely be addressed by temporarily reducing SRDF pumping before adjusting the reservoir release schedule. A portion of the diversions made for the proposed project will be used to augment the CSIP supply, off-setting the effect of any temporary SRDF reduction.

The SRDF was not operated during 2014 due to the extended drought. Minimum fish releases were made from San Antonio and Nacimiento Reservoirs, but no additional conservation releases. Measurable flow at the Spreckels gage was recorded only on December 11-12 of that year. Agricultural wash water was diverted from the SIWTF to the municipal wastewater system starting in April 2014 to provide additional source water to the Salinas Valley Reclamation Plant, and by late July the SIWTF ponds had been drained for maintenance. The mean water level for the Salinas River Lagoon[17] was 10.42 feet in August 2013 and 10.50 feet in August 2014. The water level in the lagoon is controlled by a slide gate to maintain habitat, so the effect of diverting agricultural wash water could not be observed.

**Figure 2.5: SRDF Release Weir**

[17] California Data Exchange Center, data for Station SLG. Station datum is unknown.

**Table 2-7: SRDF By-Passed Flows**

| Month | Year | Average Daily Metered By-Passed Flow[18] | No. of Days with Unmetered Excess Releases | Required Minimum By-Pass[19] |
|---|---|---|---|---|
| | | (cfs) | Count | cfs |
| 4 | 2012 | 22.5 | 28 | 2.0 |
| 5 | 2012 | 18.6 | 18 | 2.0 |
| 6 | 2012 | 9.1 | 12 | 2.0 |
| 7 | 2012 | 10.1 | 17 | 2.0 |
| 8 | 2012 | 11.3 | 7 | 2.0 |
| 9 | 2012 | 18.3 | 20 | 2.0 |
| 10 | 2012 | 15.0 | 28 | 2.0 |
| 11 | 2012 | 57.3 | 19 | 2.0 |
| | | | | |
| 4 | 2013 | 15.6 | 2 | 15.0 |
| 5 | 2013 | 17.0 | 22 | 15.0 |
| 6 | 2013 | 16.4 | 18 | 15.0 |
| 7 | 2013 | 12.3 | 25 | 2.0* |
| 8 | 2013 | 11.8 | 20 | 2.0* |
| 9 | 2013 | 13.9 | 29 | 2.0* |
| 10 | 2013 | 10.1 | 22 | 2.0* |
| 11 | 2013 | 11.5 | 0 | 2.0* |

* Due to calibration limits, when releasing only through the fish ladder, MCWRA uses a target of 7 cfs to ensure a minimum 2 cfs is achieved

**Table 2-8: Projected Daily Project Diversions**

| Month | SIWTF Seepage (Loss assumption) | Blanco Drain Diversion at 6 cfs (100% capture) | Total Potential Flow Reduction |
|---|---|---|---|
| | cfs | cfs | cfs |
| 4 | 3.0 | 5.6 | 8.6 |
| 5 | 3.0 | 5.0 | 8.0 |
| 6 | 3.0 | 5.6 | 8.6 |
| 7 | 3.0 | 5.3 | 8.3 |
| 8 | 3.0 | 4.8 | 7.8 |
| 9 | 3.0 | 3.6 | 6.6 |
| 10 | 3.0 | 2.4 | 5.4 |
| 11 | 3.0 | 1.1 | 4.1 |

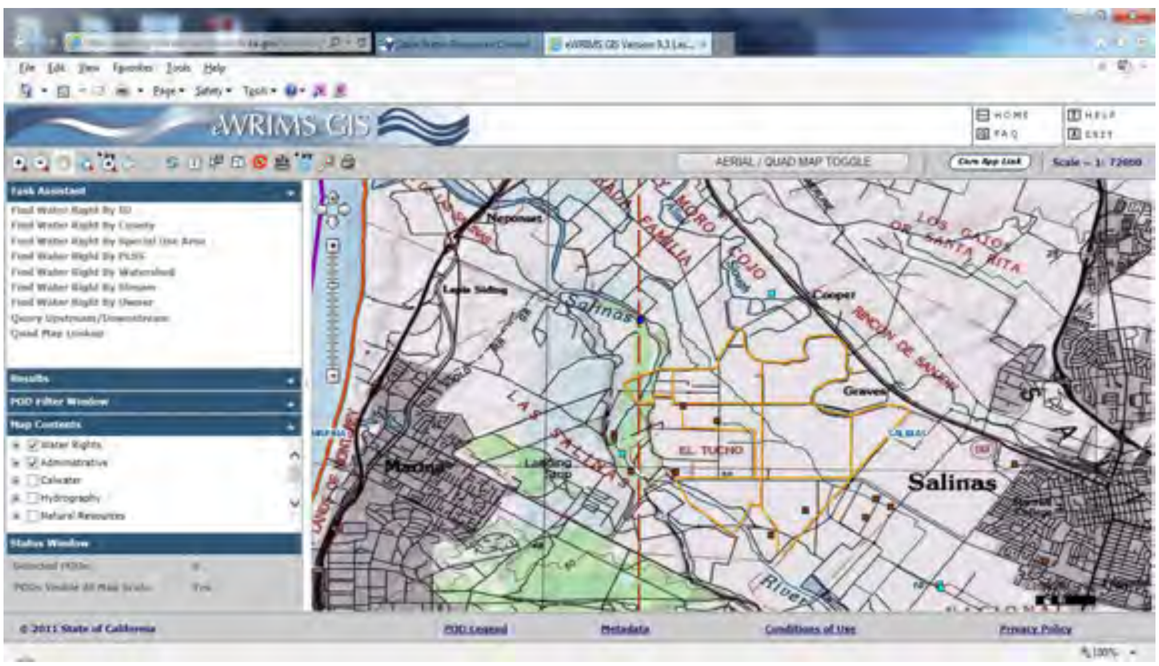
[18] Salinas Valley Water Project, Annual Flow Monitoring Report, Water Year 2012 and 2013
[19] Salinas Valley Water Project, Annual Flow Monitoring Report, Water Year 2012 and 2013

## 2.5 Water Rights Database Review

Water that enters surface streams and rivers is considered water of the state. A water rights permit is required to impound or divert waters of the state, except for certain riparian uses. Stormwater runoff from the City of Salinas does not become water of the state until it is discharged to the river. Agricultural wash water originates as groundwater supply, and does not become water of the state until it percolates into the river. Stormwater and agricultural return flows in the Blanco Drain would be subject to water rights permitting rules. Existing surface water rights were researched to assess potential impacts to current water right holders or challenges to the proposed diversions.

The State Water Resources Control Board Electronic Water Rights Information Management System (eWRIMS) was queried to identify existing water rights in the Lower Salinas Watershed. A listing of all current water rights for Monterey County was obtained using a database query. The Points of Diversion (PODs) within the Lower Salinas watershed and vicinity were identified using the on-line GIS mapping tool. The POD listing was used to create a tailored list of water rights within the area of interest (see Tables B-9 and B-10).

**Figure 2.6: SWRCB eWRIMS Interface**




The SWRCB Water Rights Order 98-08, Declaration of Fully Appropriated Stream Systems in California, identifies those stream segments which cannot support additional authorizations for diversion. The Lower Salinas River was not listed in that decision, so there is no regulatory prohibition on requesting a water right on the river or its tributary streams.

The water rights listing includes several water right types:

- Appropriative, for the diversion and use of surface water.
- Stockpond, for the on-stream impoundment and use of water.
- Statements of Diversion and Use, for reporting riparian use of surface water and for the use of groundwater. Statements of Diversion and Use are also used for claims of pre-1914 appropriative water rights. The limitation of the eWRIMS database is that most Claimed water rights do not appear with a Face Amount the way Appropriative Rights are listed.

The majority of the existing points of diversion downstream of Davis Road are for groundwater use. The sources for these are variously listed as "Salinas River Underflow", "Salinas Valley Basin" and "Groundwater Use." The shallow "A-Aquifer" groundwater in this area is not used due to poor water quality. Wells in this area tap the 180-ft and 400-ft aquifers of the Salinas Valley Groundwater Basin (SVGB), which are recharged from the Forebay and Upper Valley subareas and are separated from the overlying A-Aquifer by the Salinas Valley Aquitard[20]. Reducing surface water discharges to the river for this project should not affect groundwater yields from the SVGB.

The MCWRA has three water rights (Permits 10137, 21089 and 12261) for water diversion and storage in San Antonio and Nacimiento Reservoirs, with authorized points of rediversion at the Salinas River Diversion Facility (SRDF) (small blue square on the map above). The MCWRA must release flows from the upstream reservoirs in order to redivert them at the SRDF. There are no other surface water rights with points of diversion below the SRDF. MCWRA has a fourth water right, Permit 11043, for run-of-river flows with two authorized points of diversion upstream of Davis Road (one near Spreckels and one near Soledad). This fourth water right has not been used but has a priority date of July 11, 1949.

[20] California Groundwater Bulletin 118, Subbasin 3-4.01, Salinas Valley Groundwater Basin, 180/400 Foot Aquifer Subbasin

# Section 3 - Impacts Analysis

## 3.1 In-Stream Flow Analysis

A quantitative analysis of the Project's effects on the Salinas River was performed by modeling the daily river flows under the current condition and under several project conditions. The change in river flows can then analyzed for effects on (1) downstream water rights diversions, and (2) in-stream habitat. There are no run-of-river water rights downstream of the Proposed Project's source water diversions; therefore the assessment of river flow changes only looks at flow levels required to maintain habitat. In the Steelhead Habitat and Passage Effects Assessment Technical Memorandum, the fisheries biologist identified the South-Central California Steelhead as a Federally Threatened species with Critical Habitat occurring in the Salinas River. The biologist further identified four target flow rates for the Salinas River, as required for juvenile and smolt migration downstream and adult migration upstream (Table 3-1).

**Table 3-1: Target Flows for Maintenance of Steelhead Critical Habitat[21]**

| Case | Required Flow Depth | Channel Width | Target Flow |
|---|---|---|---|
| Adult Immigration | 0.6 feet | 25% of channel | 72 cfs |
| Adult immigration | 0.6 feet | 8 feet (min) | 60 cfs |
| Juvenile and Smolt Emigration | 0.4 feet | 25% of channel | 56 cfs |
| Juvenile and Smolt Emigration | 0.4 feet | 8 feet (min) | 50 cfs |

The three proposed sources of supply for the Proposed Project contribute flow to the Salinas River above the SRDF. Impacts on river flows due to removing or reducing these sources were assessed using a mass-balance analysis at a point below the SRDF rubber dam (see Figure 3.1, below). Table 3-2 provides the relative locations of the facilities shown in Figure 3.1.

**Table 3-2: Relative Locations of Facilities in this Analysis**

| Description | River Mile (Salinas River) |
|---|---|
| USGS Gage 11152500, Spreckels | 13.2 |
| Salinas Stormwater Outfall | 11.2 |
| Davis Road | 10.9 |
| SIWTF Ponds | 9.2 – 10.7 |
| Blanco Road | 7.5 |
| Blanco Drain | 5.1 |
| SRDF | 4.8 |
| Analysis Point | 4.7 |

[21] Pure Water Monterey Groundwater Replenishment Project, Steelhead Habitat and Passage Effects Assessment Technical Memorandum, HDR Engineering, 2015

Flows in the Salinas River were calculated using a daily time step model and aggregated on a monthly basis, using the following equations:

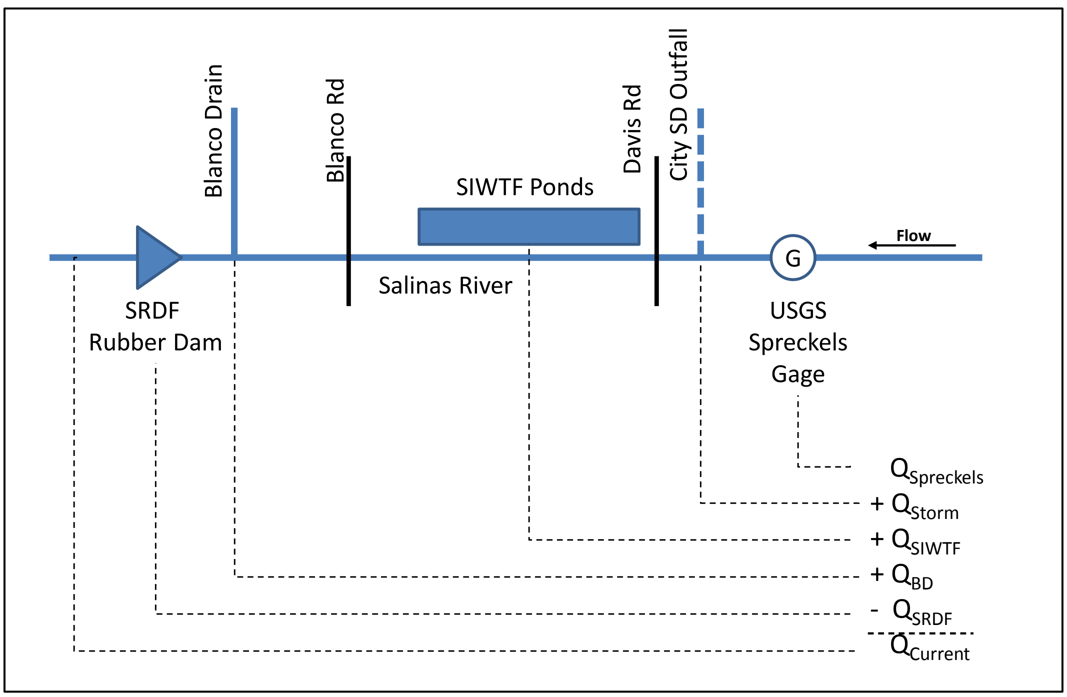
Current Condition: $Q_{Current} = Q_{Spreckels} + Q_{Storm} + Q_{SIWTF} + Q_{BD} - Q_{SRDF}$

Project Condition: $Q_{Project} = Q_{Current} - Q_{StormCapture} - Q_{SIWTF} - Q_{BD\_Capture}$

Where:

| | |
|---|---|
| $Q_{Current}$ | is the estimated river flow below the Salinas River Diversion Facility (SRDF) |
| $Q_{Spreckels}$ | is the USGS gaged flow in the Salinas River at Spreckels |
| $Q_{Storm}$ | is the stormwater discharge from Salinas (estimated by S&W) |
| $Q_{SIWTF}$ | is the seepage from the SIWTF ponds to the Salinas River (estimate by Todd) |
| $Q_{BD}$ | is the Blanco Drain discharge to the Salinas River (estimated by S&W) |
| $Q_{SRDF}$ | is the recorded diversions at the SRDF (2010-2013 only) |
| $Q_{StormCapture}$ | is the estimated stormwater capture at TP1 |
| $Q_{BD\_Capture}$ | is the estimated diversion from the Blanco Drain |
| $Q_{Project}$ | is the estimated river flow below the SRDF under project conditions |

**Figure 3.1: Salinas River In-Flow and Out-Flow Schematic**




Monthly water balances for the various percolation facilities at the SIWTF were estimated for baseline and GWR Project conditions by Todd Groundwater (2015). The calculations accounted for rainfall, evaporation and percolation at the aeration pond, Ponds 1, 2 and 3, the drying beds and the rapid infiltration basins. Measurements of river flow and quality in fall 2013 indicated that about 3.0 cfs of pond percolation was flowing via subsurface flow paths into the river. Under GWR Project operation, Ponds 1, 2 and 3 would be mostly full in winter and spring and be dry in summer and fall. The change in monthly seepage into the river would therefore probably range from 0 to 3 cfs. The impact analysis here assumes a worst-case change of 3.0 cfs year-round, which would require lining the ponds to prevent percolation or diverting flows to the RTP year-round.

Daily calculations were performed for the period 10/1/1931 to 12/31/2013 for four conditions:

Case 0: Current condition (no diversions)

Case 1: Divert Ag. Wash Water and Stormwater at TP1, no diversion at Blanco Drain

Case 2: Divert Ag. Wash Water and Stormwater at TP1, and 2.99 cfs at Blanco Drain

Case 3: Divert Ag. Wash Water and Stormwater at TP1, and 6.0 cfs at Blanco Drain

This methodology does not consider other inflows (agricultural tile drainage and seepage from other wastewater treatment facilities) and losses (evaporation and seepage into the shallow aquifer) between the Spreckels gage and the SRDF. However, these other inflows and losses are not affected by the proposed project, so their omission does not affect the comparison of the current condition model to the project condition models.

The modeled average annual flow totals are provided in Table 3-3, below. As can be seen, the proposed diversions account for less than 2% of the average annual flow downstream of the SRDF. Assuming that pond percolation would continue for more than six months per year, the reduction in average annual flow downstream of the SRDF would be less than 1%.

**Table 3-3: Modeled Average Annual Flows**

| Case | Reduction | Net Flow below SRDF | Percent of Case 0 |
|---|---|---|---|
| | (AFY) | (AFY) | |
| 0, Base Condition | | 301,916 | |
| 1, Divert at TP1 only | 2,397 | 299,519 | 99.21% |
| 2, Divert at TP1 plus 2.99 cfs at Blanco Drain | 4,501 | 297,415 | 98.51% |
| 3, Divert at TP1 plus 6.0 cfs at Blanco Drain | 5,017 | 296,899 | 98.34% |

Seepage flows converted using 1 cfs = 724 AFY
Modeled period is 10/1/1931 to 12/31/2013

A comparison of the total number of days meeting the four flow targets is presented in Table 3-4. The detailed modeling results are presented in Appendix C as (1) statistical counts of days per month that the modeled flow equaled or exceeded the target flow, under the four conditions listed above, (2) monthly percentile tables of the modeled flow rates under the four conditions, and (3) graphs of the monthly flow exceedance curves. An assessment of the impacts on fish passage was prepared separately, based upon the monthly results.

**Table 3-4: Model Results, Number of Days meeting Flow Targets**

| Flow | Case 0 | | Case 1 | | Case 2 | | Case 3 | |
|---|---|---|---|---|---|---|---|---|
| (cfs) | No. Days | Percent | No. Days | Percent | No. Days | Percent | No. Days | Percent |
| 72 | 7,428 | 24.72% | 7,325 | 24.38% | 7,242 | 24.11% | 7,239 | 24.10% |
| 60 | 7,814 | 26.01% | 7,701 | 25.63% | 7,604 | 25.31% | 7,596 | 25.28% |
| 56 | 7,984 | 26.58% | 7,841 | 26.10% | 7,755 | 25.81% | 7,743 | 25.77% |
| 50 | 8,252 | 27.47% | 8,083 | 26.90% | 7,971 | 26.53% | 7,960 | 26.50% |

Percentage calculated out of 30,043 total days modeled.

When the Salinas River Lagoon is closed to the ocean, the water level is maintained at 3-feet above mean sea level by use of a slide gate controlling outflow into the Old Salinas River channel. This management method creates a backwater effect that extends 3 to 4 miles upstream, nearly reaching to the SRDF site[22]. Reducing the excess flows passing the SRDF during the summer months may reduce the upstream extent of the backwater effect, exposing more of the seasonal sand bars in the channel bottom. The minimum by-pass flows under the SRDF and agricultural return flows along this reach of the river will prevent the channel from completely dewatering.

The outflow from the Salinas River Lagoon into the Old Salinas River Channel through the slide gate is limited to 120 cfs[23]. During the winter-spring wet season, peak flows due to rain events breach the coastal dune and open the lagoon to the ocean. Once the lagoon is open to the ocean, the slide gate to the Old Salinas River is closed. Capturing urban stormwater during lagoon opening rain events may delay the opening by a few hours, because the urban runoff from Salinas reaches the Salinas River earlier than runoff from other portions of the watershed. If the season is wet enough to maintain the open mouth of the lagoon into the spring irrigation season, the Project will not need to divert flows from the Blanco Drain, so urban runoff capture would be the only project diversion affecting river flows.

[22] Historic imagery and topographic maps

[23] Coastal Commission Permit No. 3-95-58

### 3.2 Water Quality Considerations

The Central Coast Regional Water Quality Control Board (CCRWQCB) Water Quality Control Plan for the Central Coast Basin (Basin Plan) designates beneficial uses of the Salinas River below Spreckels as including municipal and domestic supply, agricultural supply, non-contact water recreation, wildlife habitat, warm and cold water fish habitat, freshwater replenishment (of the Salinas Lagoon) and commercial or sport fishing.

The Salinas River is listed as an impaired water body pursuant to Section 303(d) of the Clean Water Act for chlorides, pesticides, Escherichia coli, fecal coliform, nitrate, total dissolved solids, turbidity and other factors. Water quality has been sampled and monitored for the past 15 years under various programs, including the Central Coast Ambient Monitoring Program (CCAMP) under the RWQCB, the Central Coast Watershed Studies (CCoWS) program of the Watershed Institute at California State University Monterey Bay, and the Cooperative Monitoring Program under the Conditional Waiver of Waste Discharges from Irrigated Lands (Ag Waiver). The results of these programs have been consolidated in Table B-11, Stream Water Quality, for the Salinas River, Salinas Lagoon and the Old Salinas River. Figure A-8 shows the primary sampling locations.

The Central Coast RWQCB adopted order R3-2013-0008 to establish Total Maximum Daily Loads (TMDL) for pollutants in the lower Salinas River Basin in 2013. These and other applicable water quality standards are consolidated in Table B-12, Total Maximum Daily Loads. A summary of the key parameters for the Salinas River are shown in Table 3-5, below.

**Table 3-5: Water Quality Parameters, Salinas River below Spreckels**

| Parameter | Units | Mean[1] | Max[1] | Standard[2] |
|---|---|---|---|---|
| Ammonia as N, Unionized | mg/L | 0.02 | 0.13 | 0.025 |
| Ammonia as NH3 | mg/L | 0.12 | 0.98 | 0.025 Note 3 |
| Chlorophyll a, water column | mg/L | 0.0033 | 0.023 | 0.015 |
| Chlorpyrifos | mg/L | 0.0011 | 0.029 | 0.00025 |
| Diazinon | mg/L | 0.008 | 0.22 | 0.00016 |
| Dissolved Solids, Total | mg/L | 369.60 | 610.00 | 1000 Note 3 |
| Nitrate as N | mg/L | 5.08 | 78.00 | 1.4 (May-Oct)<br>8.0 (Nov-Apr) |
| OrthoPhosphate as P | mg/L | 0.23 | 2.60 | 0.07 (May-Oct)<br>0.3 (Nov-Apr) |
| Oxygen, Dissolved | mg/L | 0.36 | 2.66 | > 7.0 |
| Turbidity | NTU | 118.66 | 2,584.00 | 10 Note 3 |

1. Max and Mean values reflect all results in the CCAMP/CCoWS database
2. Listed Total Maximum Daily Load (TMDL) established by CC RWQCB, except where noted
3. Proposed TMDL from CCAMP program

The City of Salinas operates the SIWTF under Waste Discharge Requirement Order R3-2003-0008. The City also has an NPDES permit (number CA0049981, order R3-2012-0005) for municipal stormwater discharges. Both of these permits require water quality monitoring and reporting. For the SIWTF, influent and effluent water quality is monitored at the plant. For stormwater, the City monitors stormwater outfalls and receiving streams at various locations (see Figures A-11 and A-12). Table 3-6, below, shows the most recent sampling results for those parameters included in Table 3-5.

**Table 3-6: City of Salinas, Water Quality Sampling**

| Analyte Name | Units | Stormwater at 309U19 | SIWTF Effluent[1] | Standard |
|---|---|---|---|---|
| Ammonia as N, Unionized | mg/L | 0.00022 | NR | 0.025 |
| Chloride | Mg/L | NR | 318 | 150 |
| Dissolved Solids, Total | mg/L | 50.8 | 1011 | 1000 |
| Nitrate as N | mg/L | ND | 0.12 | 1.4 (May-Oct)<br>8.0 (Nov-Apr) |
| OrthoPhosphate as P | mg/L | 0.2 | NR | 0.07 (May-Oct)<br>0.3 (Nov-Apr) |
| Oxygen, Dissolved | mg/L | 5.54 | >4.5 | >7 |
| Turbidity | NTU | 44.7 | NR | 10 |

Stormwater results from 2012-2013 season, SIWTF results from 2013
ND = not detected, NR = testing not required
Note 1: Effluent sampling conducted on flows from ponds to disposal beds

The results above are typical of those in previous annual reports. The stormwater runoff is generally of equal or better quality than the Salinas River that receives it. It meets the Central Coast RWQCB Basin Plan objectives in some categories. In the categories of turbidity and orthophosphate, it exceeds the basin plan objectives but is below the average concentration in the receiving stream. Although the stormwater runoff may slightly improve the quality of the water in the river, the Salinas River basin is so large that diverting urban stormwater runoff to the Proposed Project should have no appreciable effect on water quality within the Salinas River.

Effluent from the SIWTF is not tested for ammonia or orthophosphate, so a general water quality comparison with the Salinas River cannot be made. The effluent exceeds the Basin Plan objective for Chloride and Total Dissolved Solids (TDS). Diverting Industrial Wastewater to the Proposed Project may result in reduced TDS levels in the river, particularly in summer months when percolation from the SIWTF makes up a significant portion of the river flow. Under natural conditions, the impact of removing inflows to downstream riparian habitats during the summer months may have a greater impact than the benefit of reducing the TDS might justify. However, under the current condition with increased flows released to the SRDF during the summer months, the SIWTF inflows represent a smaller percentage of the total streamflow and the impact of their removal would be reduced.

### 3.3 Hydrology Considerations

The California Environmental Quality Act (CEQA) requires that effects of the Proposed Project on surface water hydrology be analyzed to identify impacts in the following areas:

a. Would the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on- or off-site?

The Project components addressed in this report, diversions of agricultural wash water, Salinas urban runoff and flows from the Blanco Drain, would capture some stormwater which currently flows to the Salinas River. Reducing urban runoff into the Salinas River, particularly the first flush as storms begin, would reduce the amount of suspended solids conveyed to the river and may reduce peak flows being discharged into the river. The change in operation at the SIWTF to facilitate the diversion of agricultural wash water would have no effect on erosion and siltation, because that water is currently disposed of using evaporation and percolation. The diversion of Blanco Drain flows would reduce the amount of sediment carried from the Blanco Drain into the main stem of the Salinas River, and the channel around the inlet structure for the diversion pump station would be lined with concrete to prevent local scour and erosion. The Blanco Drain diversion may not be required to operate during wet winter months when storm runoff typically occurs. In that case, the conveyance of sediment from the Blanco Drain into the River will be no greater than under the current condition.

The construction of the Blanco Drain diversion structure and pipeline will require open-cut excavation, which will require the use of erosion and sediment controls to prevent the migration of sediments into the river. The pipeline crossing of the river will be installed using trenchless methods to avoid impacts to the channel. The pipeline trench will be restored to prevent erosion, either by reseeding (if outside a roadway) or by resurfacing if in a trafficked area.

b. Would the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site?

The Project would not make physical changes to the Salinas River, and the operation of the Project would reduce the amount of surface runoff entering the river. The proposed project components would increase impervious areas by a small amount including less than 1000 square feet each at the TP1site, the SIWTF and the Blanco Drain. The Project would not substantially alter the existing drainage patterns of any of the proposed project sites.

c. Would the project create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?

The Project components discussed in this report would add structures at various locations, including (1) new diversion structures at TP1, (2) two new pump stations at the SIWTF, and (3) a new pump station at the Blanco Drain. Up to 1,000 sq-ft of impervious surface may be added at each site, and runoff from the new hardscape would be directed to existing drainage structures or channels. The soils at these sites are Type C (runoff coefficient >80), so the increase in runoff will be small and within the available existing drainage system conveyance capacity. Runoff from the SIWTF TP1 site and Blanco Drain would be diverted to the Project. No impact is expected under this criterion.

d. Would the project place within a 100-year flood hazard area structures that would impede or redirect flood flows?

The Project would not make physical changes to the Salinas River, but it would add a diversion pump station on the Blanco Drain adjacent to an existing pump station and new pump stations at the SIWTF. All of these would be located within 100-year flood hazard areas. The proposed Blanco Drain pump station intake would be located at the channel bottom, and would be configured to not alter the conveyance capacity of the Blanco Drain. The pump stations within flood hazard areas would be configured with submersible pumps and elevated electrical controls so that they are not affected by occasional inundation. They should not require padded sites requiring revisions to the flood hazard maps.

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## Appendix A: Figures

Figure A-1: SIWTF Project Area
Figure A-2: Treatment Plant 1 (TP1 Site)
Figure A-3: Salinas Stormwater Drainage Basins
Figure A-4: Salinas Stormwater Pump Station and Outfall
Figure A-5: Old Salinas River and tributaries
Figure A-6: Storm Drain Maintenance District Number 2, Blanco Drain
Figure A-7: MRWPCA Interceptor System Schematic
Figure A-8: Salinas River Watershed
Figure A-9: Salinas Valley Groundwater Basin, Hydrologic Subareas
Figure A-10: MRWPCA and MCWRA Facilities
Figure A-11: City of Salinas Water Sampling Sites
Figure A-12: CCAMP/CMP Water Sampling Sites

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**Figure A-1: Salinas Industrial Wastewater Treatment Facility Project Area**

Source: GWR Project Description, Denise Duffy & Associates, 2014


**Figure A-2: Treatment Plant 1 (TP1 site)**

Source: Monterey Peninsula Groundwater replenishment Project, Source Water Alternatives Report, Kimley-Horn and Associates, 2013


**Figure A-3: Salinas Stormwater Drainage Basins**

Source: City of Salinas Storm Water Master Plan, CDM, 2004

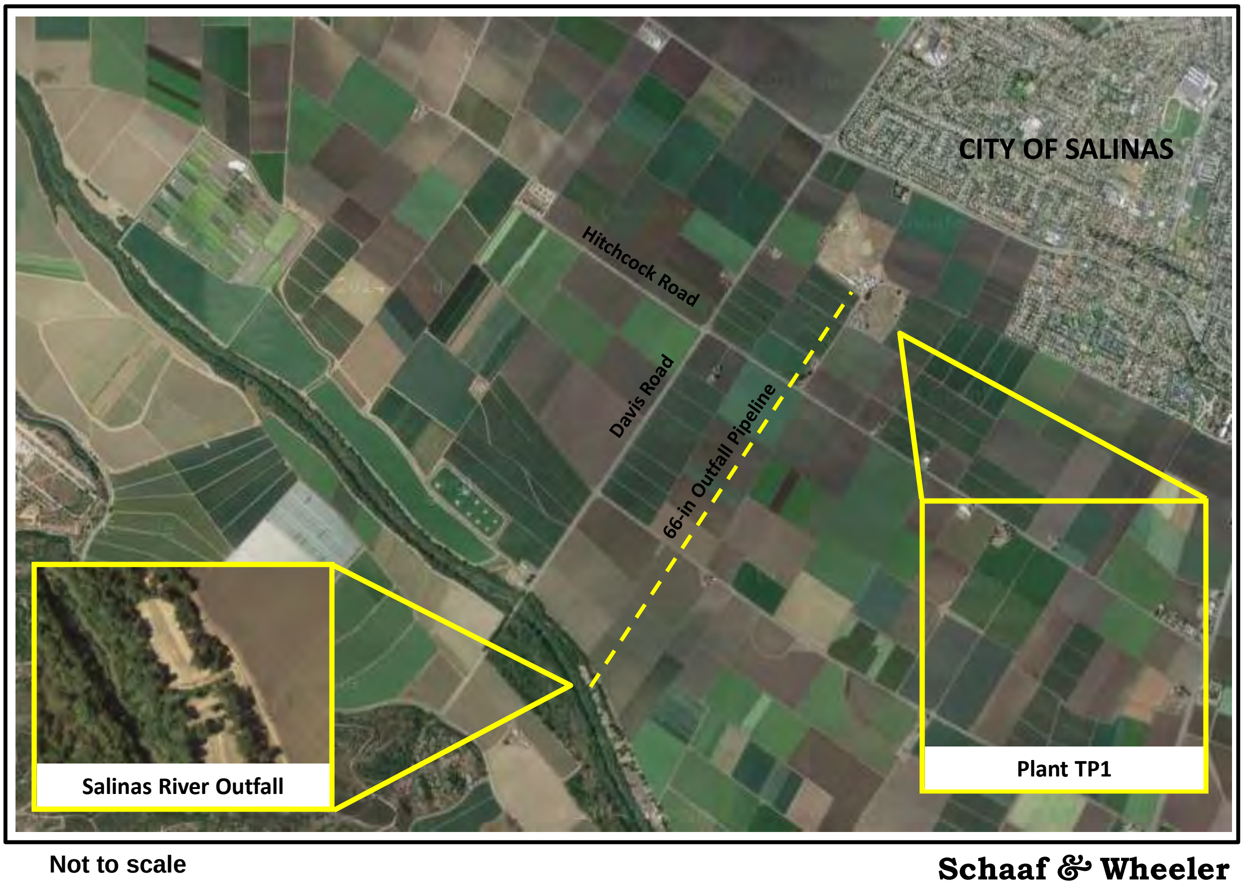



**Figure A-4: Salinas Stormwater Pump Station and Outfall**


**Figure A-5: Old Salinas River and Tributaries**

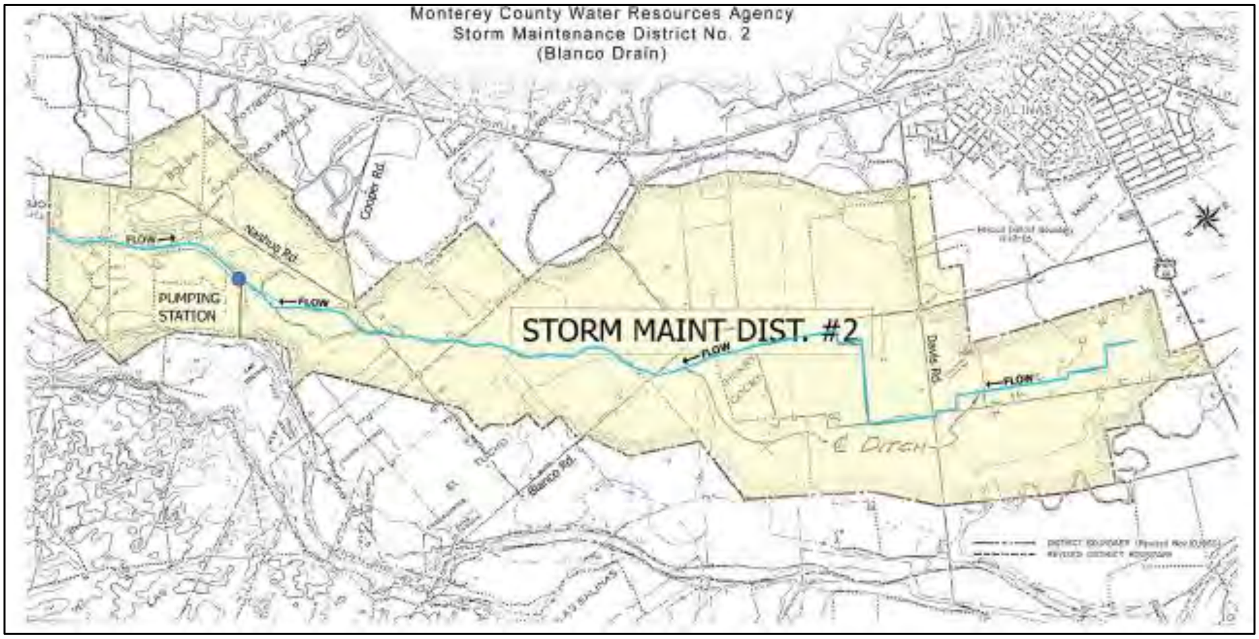
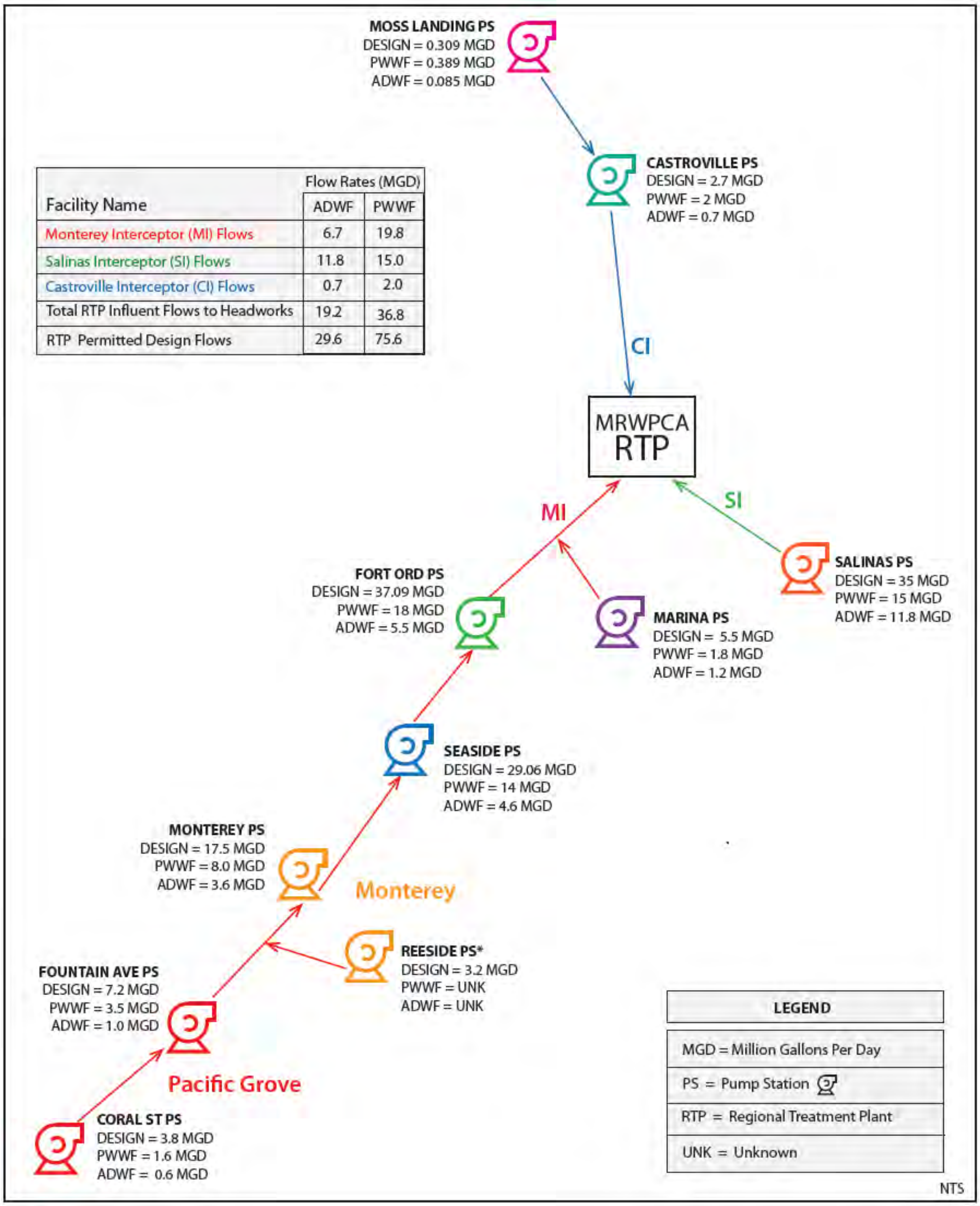



**Figure A-6: Storm Drain Maintenance District No. 2, Blanco Drain**

Source: Monterey County Water Resources Agency




| Facility Name | Flow Rates (MGD) ADWF | PWWF |
|---|---|---|
| Monterey Interceptor (MI) Flows | 6.7 | 19.8 |
| Salinas Interceptor (SI) Flows | 11.8 | 15.0 |
| Castroville Interceptor (CI) Flows | 0.7 | 2.0 |
| Total RTP Influent Flows to Headworks | 19.2 | 36.8 |
| RTP Permitted Design Flows | 29.6 | 75.6 |

**Figure A-7: MRWPCA Interceptor System Schematic**

Source: Brezack and Associates Planners, September 2013


**Figure A-8: Salinas River Watershed**

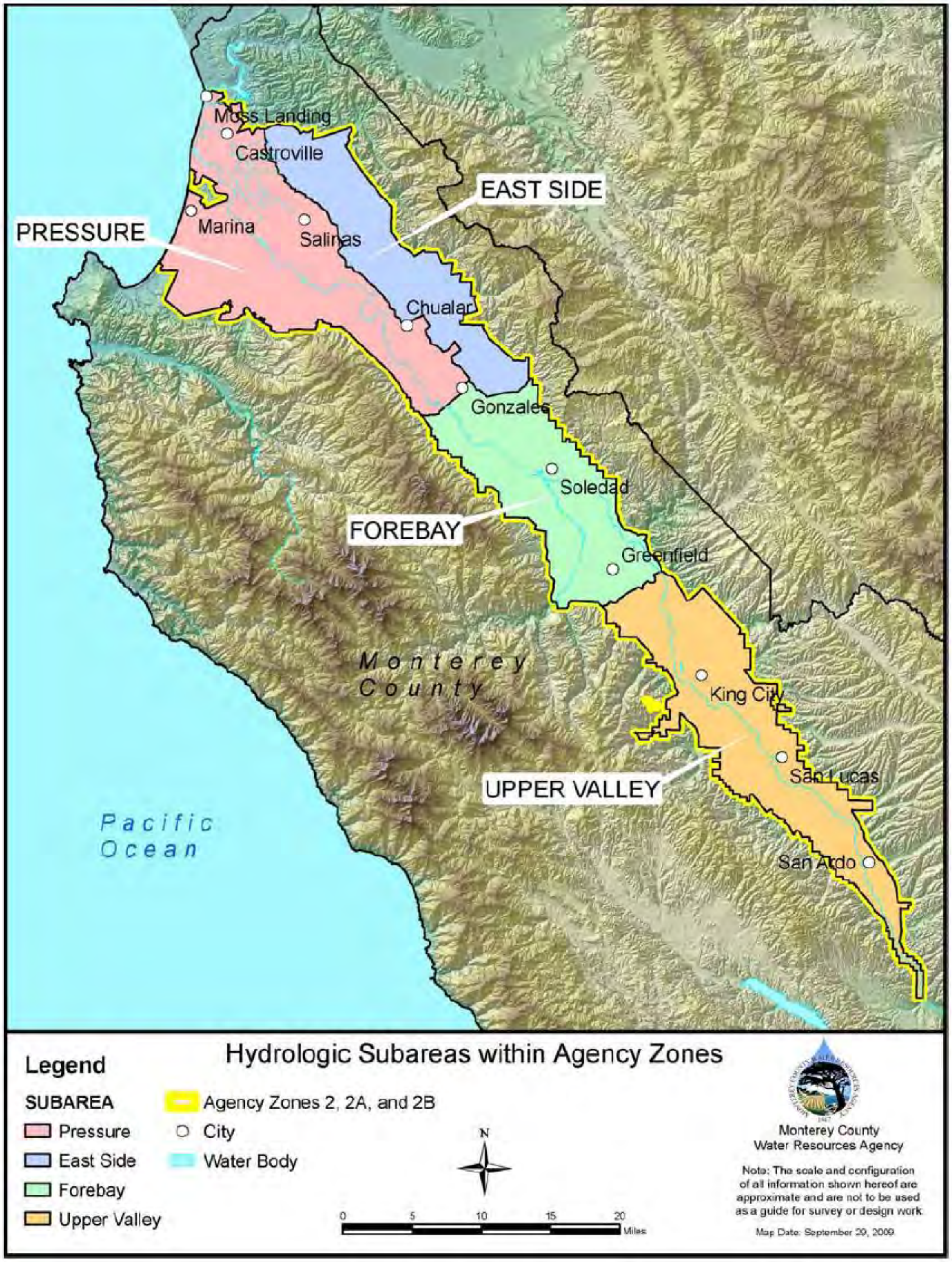



**Figure A-9: Salinas Valley Groundwater Basin, Hydrologic Subareas**

Source: MCWRA Annual Groundwater Report

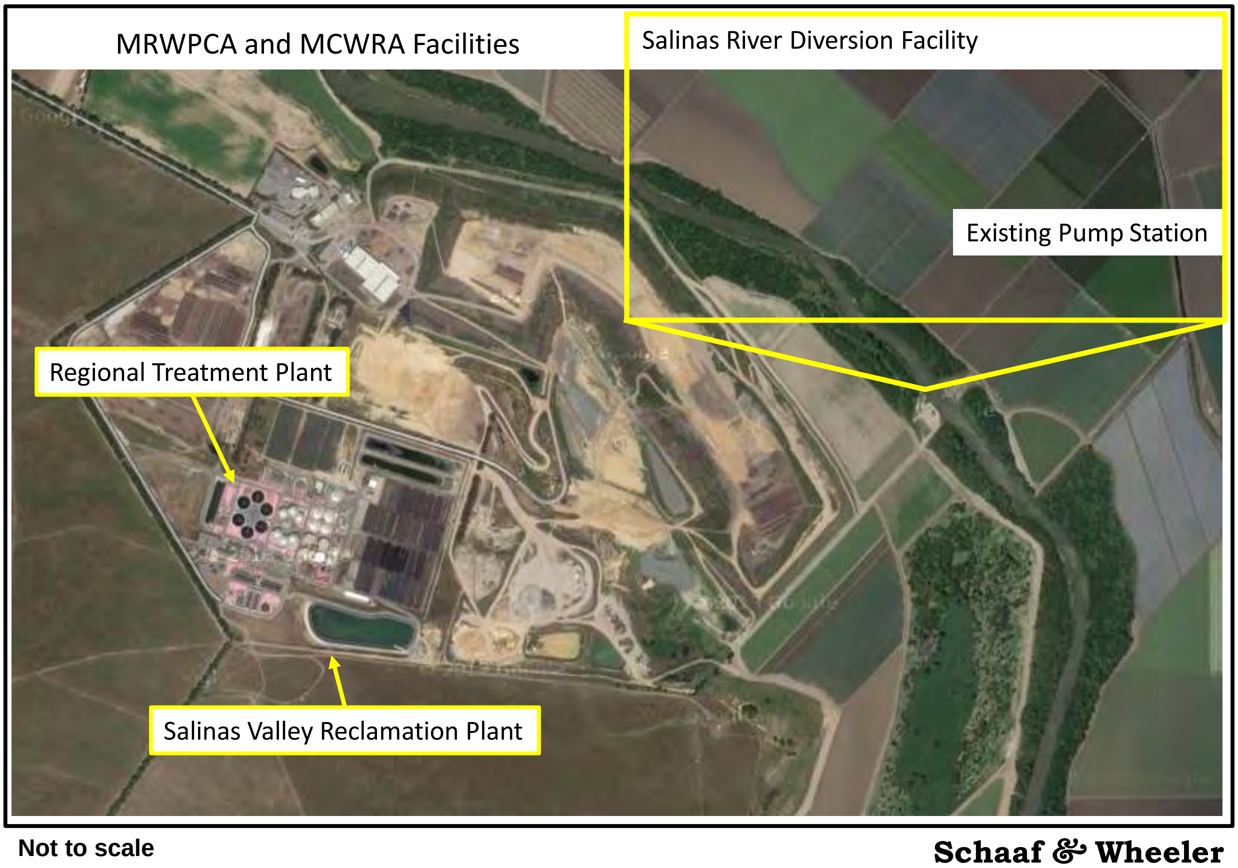



**Figure A-10: MRWPCA and MCWRA Facilities**


| # | Site ID | Site Name |
|---|---|---|
| 1 | 306MOR | Moro Cojo Slough @ Highway 1 |
| 2 | 309OLD | Old Salinas River @ Monterey Dunes Way |
| 3 | 309TEH | Tembladero Slough @ Haro |
| 4 | 309MER | Merrit Ditch u/s of 183 |
| 5 | 309ESP | Espinosa Slough u/s of Alisal Slough |
| 6 | 309ASB | Alisal Slough @ White Barn |
| 7 | 309BLA | Lower Salinas River/Blanco? |
| 8 | 309JON | Lower Salinas River |
| 9 | 309GAB | Gabilan Creek @ Independence Road and East Boranda Road |
| 10 | 309NAT | Natividad Creek? |
| 11 | 309ALG | Alisal Creek? |
| 12 | 309SSP | Salinas River @ El Toro Creek |
| 13 | 309QUI | Quail Creek |
| 14 | 309SAC | Salinas River @ Chualar bridge on River Road |
| 15 | 309CRR | Chualar Creek |
| 36 | 309GRN | Salinas River @ Elm Rd in Greenfield |
| 37 | 309SAG | Salinas River @ Gonzales River Rd Bridge |

**Figure A-11: CCAMP/CMP Water Sampling Sites**

Source: Central Coast Region Conditional Waiver Cooperative Monitoring Program, 5 Year Evaluation Report, Larry Walker & Associates, 2010

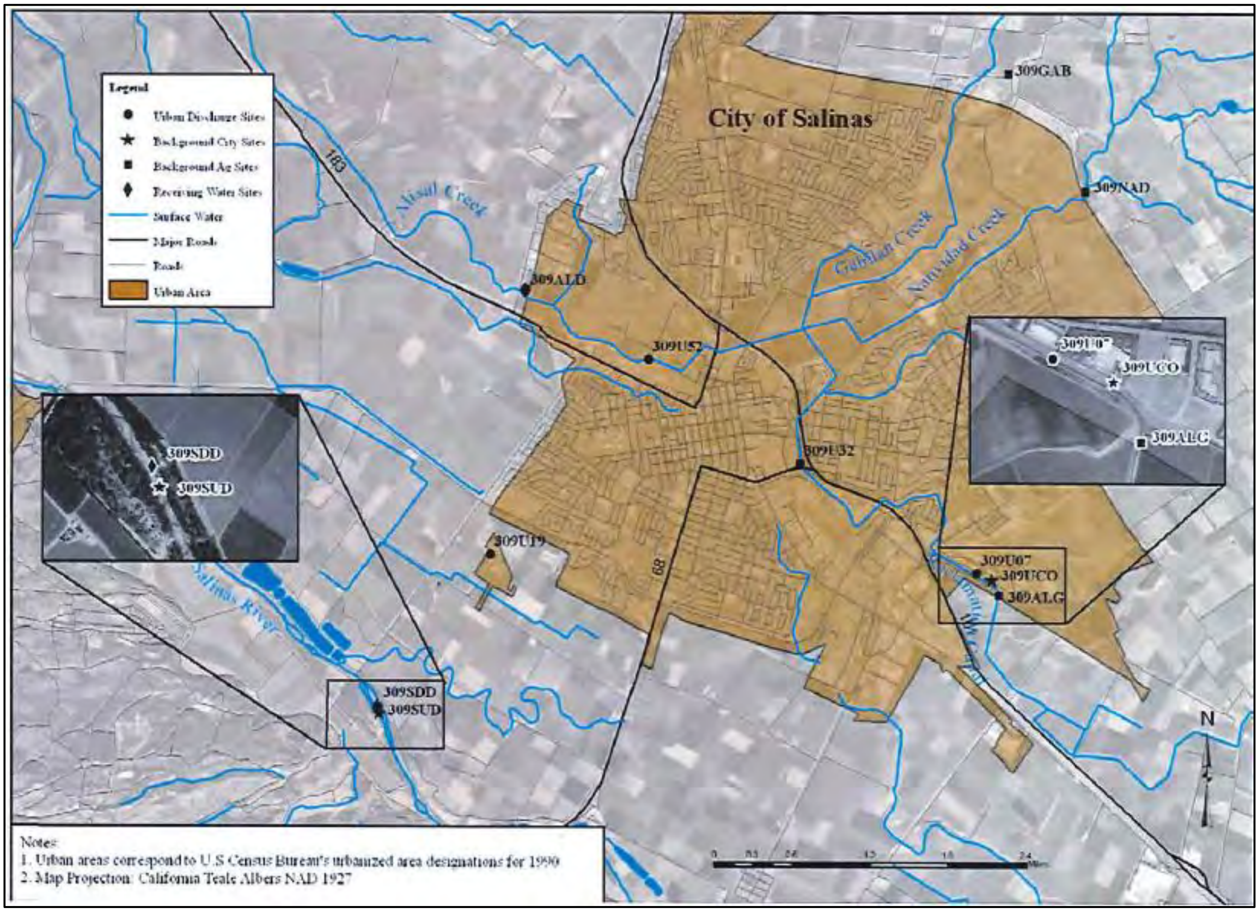



**Figure A-12: City of Salinas Water Sampling Sites**

Source: City of Salinas Stormwater Management Program, Quality Assurance Project Plan, Pacific EcoRisk, 2007

## Appendix B: Tables

Table B-1: 2010 California 303(d) Listing
Table B-2: Recorded Precipitation in Salinas, CA
Table B-3: Estimated Runoff to the Salinas River from Salinas, CA
Table B-4: Estimate of Runoff Captured in Salinas, CA
Table B-5: Estimate of Uncaptured Runoff to the Salinas River from Salinas, CA
Table B-6: Average Monthly Flow, Salinas River near Spreckels, CA (cfs)
Table B-7: Minimum Monthly Flow, Salinas River near Spreckels, CA (cfs)
Table B-8: Average Monthly Flow, Salinas River near Spreckels, CA (AFY)
Table B-9: Water Rights Database GIS Capture, PODs near Salinas
Table B-10: Surface Water Rights and Claims in the Salinas River below Spreckels
Table B-11: Stream Water Quality, Salinas River at Spreckels to Potrero Road
Table B-12: Total Maximum Daily Loads

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**Table B-1: 2010 California 303(d) Listing**

| Listed for: | Ammonia (Unionized) | Chlordane | Chloride | Chlorophyll-a | Chlorpyrifos | Copper | DDD (Dichlorodiphenyldichloroethane) | Diazinon | Dieldrin | Electrical Conductivity | Enterococcus | Escherichia coli (E. coli) | Fecal Coliform | Low Dissolved Oxygen | Metals | Nickel | Nitrate | Nutrients | Pathogens | PCBs (Polychlorinated biphenyls) | Pesticides | pH | Priority Organics | Sediment Toxicity | Sedimentation/Siltation | Sodium | Temperature, water | Total Coliform | Total Dissolved Solids | Toxaphene | Turbidity | Unknown Toxicity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Water Body** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Alisal Creek (Monterey County) | | | | X | | | | | | | | | X | | | | X | | | | | | | | | X | | | | | | |
| Alisal Slough (Monterey County) | | | | | | | | | | | | | | X | | | X | | | | | | | X | | | | | | | | X |
| Blanco Drain | | | | | X | | | X | | | | | | X | | | X | | | | X | | | | | | | | | | X | |
| Espinosa Lake | | | | | X | | | X | | | | | | | | | | | | | | | | | | | | | | | | |
| Espinosa Slough | X | | | | | | | X | | | | | | | | | X | | | | X | X | X | X | | | | | | | X | X |
| Gabilan Creek | X | | | | | | | | | | | | X | | | | X | | | | | X | | X | | | | | | | X | X |
| Majors Creek (Monterey County) | | | | | | X | | | | | | X | | | | | | | | | | | | | | | | | | | | |
| Merrit Ditch | X | | | | | | | | | | | | | X | | | X | | | | | | | X | | | | | | | X | X |
| Monterey Harbor | | | | | | | | | | | | | | | X | | | | | | | | | X | | | | | | | | |
| Moss Landing Harbor | | | | | X | | | X | | | | | | X | | X | | | X | | X | X | | X | X | | | | | | | |
| Natividad Creek | X | | | | | | | | | | | X | | X | | | X | | | | | X | | X | | | X | | | | X | X |
| Old Salinas River | | | | X | X | | | X | | | | X | X | X | | | X | | | | | X | | X | | | | | | | X | X |
| Old Salinas River Estuary | | | | | | | | | | | | | | | | | | X | | | X | | | | | | | | | | | |
| Salinas Reclamation Canal | X | | | | X | X | | X | | | | X | X | X | | | X | | | | X | X | X | X | | | | | | | X | X |
| **Salinas River (lower, estuary to near Gonzales Rd crossing, watersheds 30910 and 30920)** | | **X** | **X** | | **X** | | **X** | **X** | **X** | **X** | **X** | **X** | **X** | | | | **X** | | | **X** | **X** | **X** | | | | **X** | | | **X** | **X** | **X** | **X** |
| Salinas River Lagoon (North) | | | | | | | | | | | | | | | | | | X | | | X | | | | | | | | | | | |
| Santa Rita Creek (Monterey County) | X | | | | | | | | | | | X | X | X | | | X | | | | | | | | | X | | | | | X | |

**Groundwater Recharge Project**

**Table B-2: Recorded Precipitation in Salinas, CA (inches)**

| Water Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total | Type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1932 | 0.0 | 2.0 | 7.6 | 3.7 | 2.6 | 0.6 | 0.4 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 17.5 | Wet |
| 1933 | 0.1 | 0.0 | 2.1 | 5.0 | 0.4 | 1.2 | 0.2 | 0.5 | 0.0 | 0.0 | 0.0 | 0.1 | 9.6 | Normal |
| 1934 | 0.2 | 0.0 | 2.8 | 0.7 | 2.7 | 0.0 | 0.1 | 0.3 | 0.7 | 0.0 | 0.0 | 0.2 | 7.7 | Dry |
| 1935 | 0.6 | 1.9 | 2.4 | 4.5 | 0.3 | 3.6 | 3.9 | 0.0 | 0.0 | 0.0 | 0.9 | 0.0 | 18.0 | Wet |
| 1936 | 0.4 | 0.4 | 1.0 | 2.3 | 5.8 | 1.4 | 0.9 | 0.4 | 0.4 | 0.4 | 0.0 | 0.0 | 13.5 | Normal |
| 1937 | 0.7 | 0.0 | 3.7 | 3.8 | 4.8 | 5.1 | 0.5 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 18.8 | Wet |
| 1938 | 0.3 | 1.1 | 4.2 | 2.4 | 4.8 | 4.0 | 1.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 18.7 | Wet |
| 1939 | 1.1 | 0.6 | 1.5 | 2.3 | 2.1 | 2.4 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 0.3 | 11.0 | Normal |
| 1940 | 0.6 | 0.3 | 0.7 | 7.5 | 6.0 | 2.7 | 0.4 | 0.2 | 0.0 | 0.0 | 0.0 | 0.2 | 18.5 | Wet |
| 1941 | 0.3 | 0.7 | 3.9 | 4.2 | 7.1 | 4.4 | 4.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 24.9 | Wet |
| 1942 | 1.2 | 0.3 | 6.7 | 2.3 | 1.9 | 2.1 | 2.6 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 18.1 | Wet |
| 1943 | 0.9 | 1.5 | 2.2 | 3.1 | 1.9 | 3.6 | 1.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 14.6 | Normal |
| 1944 | 0.4 | 0.2 | 2.5 | 2.5 | 5.9 | 0.2 | 1.3 | 0.5 | 0.1 | 0.1 | 0.0 | 0.0 | 13.7 | Normal |
| 1945 | 1.2 | 3.7 | 1.8 | 0.4 | 2.7 | 2.7 | 0.3 | 0.1 | 0.0 | 0.0 | 0.3 | 0.1 | 13.3 | Normal |
| 1946 | 0.6 | 1.8 | 4.1 | 1.0 | 2.8 | 2.4 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 13.2 | Normal |
| 1947 | 0.1 | 3.9 | 1.7 | 0.5 | 1.3 | 1.2 | 0.6 | 0.3 | 0.1 | 0.0 | 0.0 | 0.0 | 9.7 | Normal |
| 1948 | 1.7 | 0.7 | 1.2 | 0.1 | 0.0 | 3.8 | 3.1 | 0.4 | 0.0 | 0.1 | 0.0 | 0.0 | 11.2 | Normal |
| 1949 | 0.9 | 0.4 | 3.3 | 1.3 | 1.8 | 3.2 | 0.0 | 0.2 | 0.0 | 0.1 | 0.0 | 0.0 | 11.2 | Normal |
| 1950 | 0.1 | 0.7 | 1.1 | 6.6 | 1.3 | 2.2 | 1.3 | 0.3 | 0.1 | 0.0 | 0.0 | 0.0 | 13.7 | Normal |
| 1951 | 1.8 | 2.9 | 2.5 | 1.4 | 1.8 | 0.6 | 0.9 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 12.1 | Normal |
| 1952 | 0.6 | 2.7 | 6.1 | 5.5 | 1.5 | 2.5 | 0.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 19.9 | Wet |
| 1953 | 0.0 | 1.4 | 4.7 | 1.0 | 0.0 | 0.8 | 1.6 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 9.8 | Normal |
| 1954 | 0.4 | 1.3 | 0.3 | 2.5 | 1.1 | 3.7 | 0.7 | 0.1 | 0.2 | 0.0 | 0.0 | 0.0 | 10.3 | Normal |
| 1955 | 0.0 | 0.8 | 2.1 | 5.7 | 1.3 | 0.1 | 2.4 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 13.1 | Normal |
| 1956 | 0.0 | 1.6 | 9.0 | 4.6 | 1.4 | 0.1 | 0.7 | 0.4 | 0.0 | 0.0 | 0.0 | 0.1 | 17.9 | Wet |
| 1957 | 0.7 | 0.0 | 0.8 | 2.7 | 2.3 | 1.0 | 0.8 | 2.3 | 0.1 | 0.0 | 0.0 | 0.1 | 10.9 | Normal |
| 1958 | 1.0 | 0.5 | 3.0 | 2.9 | 3.2 | 4.7 | 3.9 | 0.5 | 0.1 | 0.0 | 0.0 | 0.5 | 20.2 | Wet |
| 1959 | 0.0 | 0.2 | 0.2 | 2.6 | 3.9 | 0.3 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 4.5 | 12.1 | Normal |
| 1960 | 0.0 | 0.0 | 0.4 | 2.8 | 3.2 | 0.4 | 1.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 8.1 | Dry |
| 1961 | 0.0 | 2.4 | 0.5 | 1.5 | 0.9 | 1.6 | 0.7 | 0.2 | 0.2 | 0.0 | 0.0 | 0.0 | 8.0 | Dry |
| 1962 | 0.0 | 1.5 | 0.5 | 0.2 | 3.9 | 0.0 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 6.4 | Dry |
| 1963 | 0.6 | 0.4 | 1.7 | 2.8 | 1.9 | 3.0 | 2.9 | 0.2 | 0.0 | 0.0 | 0.0 | 0.3 | 14.0 | Normal |
| 1964 | 1.5 | 2.4 | 0.3 | 2.0 | 0.1 | 2.4 | 0.2 | 0.7 | 0.4 | 0.0 | 0.2 | 0.0 | 10.3 | Normal |
| 1965 | 0.7 | 2.2 | 5.1 | 0.8 | 0.4 | 1.7 | 1.3 | 0.0 | 0.0 | 0.0 | 0.3 | 0.0 | 12.7 | Normal |
| 1966 | 0.1 | 4.1 | 4.1 | 1.0 | 1.1 | 0.1 | 0.2 | 0.0 | 0.0 | 0.2 | 0.0 | 0.2 | 11.2 | Normal |
| 1967 | 0.0 | 2.0 | 3.6 | 3.9 | 0.3 | 2.4 | 5.7 | 0.1 | 0.5 | 0.0 | 0.0 | 0.1 | 18.7 | Wet |
| 1968 | 0.1 | 1.4 | 1.4 | 1.8 | 0.9 | 2.0 | 0.3 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 8.0 | Dry |
| 1969 | 0.3 | 1.8 | 2.7 | 7.9 | 5.8 | 1.1 | 1.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 21.1 | Wet |
| 1970 | 0.7 | 0.7 | 2.7 | 5.0 | 1.8 | 1.7 | 0.1 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 13.0 | Normal |
| 1971 | 0.3 | 3.9 | 4.0 | 1.0 | 0.5 | 1.1 | 1.4 | 0.5 | 0.0 | 0.0 | 0.0 | 0.1 | 12.8 | Normal |
| 1972 | 0.0 | 1.5 | 2.9 | 0.9 | 0.7 | 0.0 | 0.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.4 | Dry |
| 1973 | 1.5 | 4.1 | 1.8 | 4.2 | 4.9 | 3.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 20.4 | Wet |
| 1974 | 1.9 | 3.9 | 5.0 | 2.9 | 1.0 | 3.8 | 2.9 | 0.0 | 0.4 | 0.3 | 0.0 | 0.0 | 22.1 | Wet |
| 1975 | 1.3 | 0.3 | 1.6 | 1.3 | 3.5 | 3.3 | 1.0 | 0.0 | 0.0 | 0.1 | 0.3 | 0.0 | 12.6 | Normal |
| 1976 | 1.6 | 0.4 | 0.2 | 0.3 | 1.5 | 1.3 | 1.1 | 0.0 | 0.0 | 0.0 | 0.7 | 1.2 | 8.3 | Dry |
| 1977 | 0.3 | 0.6 | 1.8 | 0.9 | 0.3 | 1.0 | 0.3 | 0.8 | 0.1 | 0.0 | 0.0 | 0.1 | 6.2 | Dry |
| 1978 | 0.0 | 0.5 | 3.9 | 4.6 | 4.0 | 3.5 | 3.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 20.1 | Wet |
| 1979 | 0.0 | 1.9 | 0.8 | 3.3 | 2.7 | 1.5 | 0.3 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 10.6 | Normal |
| 1980 | 1.1 | 1.2 | 2.0 | 3.0 | 2.8 | 1.1 | 0.5 | 0.1 | 0.0 | 0.6 | 0.0 | 0.0 | 12.3 | Normal |
| 1981 | 0.0 | 0.0 | 0.9 | 0.7 | 1.3 | 2.7 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.4 | Dry |
| 1982 | 0.8 | 3.3 | 1.8 | 3.8 | 1.6 | 4.5 | 1.4 | 0.0 | 0.3 | 0.0 | 0.0 | 1.1 | 18.9 | Wet |
| 1983 | 1.5 | 4.8 | 1.6 | 3.2 | 3.9 | 5.0 | 1.6 | 0.1 | 0.0 | 0.0 | 0.1 | 1.1 | 22.9 | Wet |
| 1984 | 0.0 | 3.0 | 1.9 | 0.1 | 1.6 | 0.9 | 0.5 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 8.0 | Dry |
| 1985 | 1.1 | 2.4 | 1.0 | 0.6 | 0.9 | 2.5 | 0.3 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 9.0 | Dry |
| 1986 | 0.0 | 1.5 | 0.4 | 0.9 | 2.5 | 4.4 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.9 | 11.3 | Normal |
| 1987 | 0.0 | 0.1 | 0.6 | 2.3 | 3.5 | 2.1 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 8.8 | Dry |
| 1988 | 0.6 | 1.3 | 2.1 | 0.6 | 0.4 | 0.0 | 1.2 | 0.4 | 0.1 | 0.0 | 0.0 | 0.0 | 6.7 | Dry |
| 1989 | 0.0 | 1.3 | 2.4 | 0.7 | 1.0 | 2.2 | 0.4 | 0.1 | 0.0 | 0.0 | 0.0 | 0.9 | 9.0 | Dry |
| 1990 | 0.9 | 1.0 | 0.1 | 1.6 | 1.4 | 1.2 | 0.5 | 1.4 | 0.0 | 0.0 | 0.0 | 0.1 | 8.2 | Dry |
| 1991 | 0.2 | 0.2 | 1.5 | 0.3 | 1.5 | 6.0 | 0.2 | 0.1 | 0.0 | 0.0 | 0.2 | 0.0 | 10.1 | Normal |
| 1992 | 0.8 | 0.2 | 2.1 | 1.5 | 4.5 | 2.5 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 11.6 | Normal |
| 1993 | 0.5 | 0.0 | 2.6 | 6.1 | 3.5 | 2.3 | 0.2 | 0.8 | 0.3 | 0.0 | 0.0 | 0.0 | 16.3 | Normal |
| 1994 | 0.1 | 0.7 | 1.2 | 1.8 | 2.5 | 0.6 | 1.1 | 1.2 | 0.0 | 0.0 | 0.0 | 0.1 | 9.3 | Dry |
| 1995 | 0.3 | 2.6 | 1.7 | 7.8 | 0.7 | 5.3 | 1.6 | 0.3 | 0.6 | 0.0 | 0.0 | 0.0 | 20.9 | Wet |
| 1996 | 0.0 | 0.0 | 2.1 | 2.7 | 4.3 | 2.1 | 0.7 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12.9 | Normal |
| 1997 | 0.6 | 3.1 | 5.0 | 6.7 | 0.1 | 0.1 | 0.3 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 16.0 | Normal |
| 1998 | 0.1 | 4.2 | 2.5 | 5.4 | 10.0 | 2.9 | 2.0 | 1.9 | 0.1 | 0.0 | 0.0 | 0.1 | 29.1 | Wet |
| 1999 | 0.5 | 2.3 | 0.9 | 2.6 | 3.1 | 1.8 | 1.4 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 12.8 | Normal |
| 2000 | 0.1 | 1.1 | 0.1 | 4.9 | 4.2 | 1.7 | 0.4 | 0.6 | 0.0 | 0.0 | 0.1 | 0.1 | 13.5 | Normal |
| 2001 | 2.5 | 0.2 | 0.7 | 2.9 | 3.0 | 1.6 | 1.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 12.7 | Normal |
| 2002 | 0.0 | 0.9 | 1.6 | 0.2 | 0.3 | 0.4 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.6 | Dry |
| 2003 | 0.0 | 0.9 | 2.8 | 0.7 | 0.7 | 0.6 | 1.2 | 0.2 | 0.0 | 0.0 | 0.1 | 0.0 | 7.1 | Dry |
| 2004 | 0.2 | 0.8 | 3.9 | 1.5 | 3.1 | 0.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 10.0 | Normal |
| 2005 | 2.8 | 0.4 | 3.8 | 2.7 | 3.4 | 4.3 | 1.3 | 0.8 | 0.2 | 0.0 | 0.0 | 0.0 | 19.7 | Wet |
| 2006 | 0.1 | 0.4 | 3.3 | 2.0 | 0.9 | 5.0 | 2.9 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 15.3 | Normal |
| 2007 | 0.0 | 1.3 | 2.3 | 0.7 | 2.4 | 0.5 | 1.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.4 | 8.9 | Dry |
| 2008 | 1.1 | 0.4 | 1.2 | 4.8 | 0.9 | 0.3 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 8.9 | Dry |
| 2009 | 0.2 | 1.3 | 2.3 | 1.3 | 3.5 | 1.8 | 0.2 | 0.3 | 0.1 | 0.0 | 0.3 | 0.1 | 11.4 | Normal |
| 2010 | 1.7 | 0.1 | 1.6 | 4.0 | 3.1 | 2.4 | 3.4 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 16.9 | Wet |
| 2011 | 0.6 | 2.0 | 3.0 | 1.7 | 2.9 | 4.2 | 0.1 | 0.7 | 0.3 | 0.0 | 0.0 | 0.0 | 15.6 | Normal |
| 2012 | 1.5 | 1.8 | 0.0 | 1.6 | 0.8 | 2.6 | 1.9 | 0.1 | 0.2 | 0.0 | 0.0 | 0.0 | 10.4 | Normal |
| 2013 | 0.2 | 3.1 | 3.3 | 1.0 | 0.6 | 0.4 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 | 9.0 | Dry |
| **Average** | 0.6 | 1.4 | 2.3 | 2.6 | 2.4 | 2.1 | 1.1 | 0.3 | 0.1 | 0.0 | 0.0 | 0.2 | 13.1 | |
| **Minimum** | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3.6 | |
| **Maximum** | 2.8 | 4.8 | 9.0 | 7.9 | 10.0 | 6.0 | 5.7 | 2.3 | 0.7 | 0.6 | 0.9 | 4.5 | 29.1 | |

Data from SALINAS MUNICIPAL AIRPORT CA US, Gage USW00023233

Data gaps filled from SALINAS CA, Gage USC00047668

| | Percentiles | |
|---|---|---|
| Median | 0.5 | 12.5 |
| Dry | 0.25 | 9.4 |
| Wet | 0.75 | 16.8 |

## Groundwater Recharge Project

### Table B-3: Estimated Runoff to the Salinas River from Salinas, CA (acre-feet)

| Water Year | *Oct* | *Nov* | *Dec* | *Jan* | *Feb* | *Mar* | *Apr* | *May* | *Jun* | *Jul* | *Aug* | *Sep* | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *1932* | - | 31 | 382 | 104 | 31 | 3 | 0 | 6 | - | - | - | - | 557 |
| *1933* | - | - | 34 | 113 | 2 | 10 | 0 | 2 | - | - | - | - | 160 |
| *1934* | 0 | - | 28 | 8 | 25 | - | 0 | 1 | 10 | - | - | 0 | 72 |
| *1935* | 5 | 32 | 39 | 88 | - | 66 | 131 | - | - | - | 22 | - | 382 |
| *1936* | 0 | 2 | 9 | 21 | 113 | 19 | 13 | 2 | 1 | 1 | - | - | 181 |
| *1937* | 5 | - | 139 | 44 | 131 | 147 | 1 | - | 0 | - | - | - | 467 |
| *1938* | - | 6 | 224 | 19 | 103 | 50 | 14 | - | - | - | - | 0 | 417 |
| *1939* | 10 | 2 | 21 | 37 | 30 | 72 | 1 | 1 | - | - | - | 1 | 175 |
| *1940* | 1 | 2 | 7 | 226 | 164 | 71 | 2 | 0 | - | - | - | 0 | 473 |
| *1941* | 1 | 4 | 107 | 53 | 195 | 109 | 182 | 0 | - | - | - | - | 651 |
| *1942* | 13 | 0 | 190 | 44 | 16 | 32 | 47 | 6 | - | - | - | - | 348 |
| *1943* | 12 | 13 | 39 | 78 | 20 | 54 | 14 | - | - | - | - | - | 230 |
| *1944* | 0 | - | 37 | 34 | 129 | 0 | 14 | 6 | - | - | - | - | 219 |
| *1945* | 35 | 87 | 16 | 3 | 62 | 23 | 3 | - | - | - | 2 | - | 230 |
| *1946* | 2 | 15 | 87 | 9 | 47 | 26 | - | 3 | - | - | - | - | 190 |
| *1947* | - | 229 | 22 | 4 | 10 | 10 | 5 | 2 | - | - | - | - | 283 |
| *1948* | 23 | 6 | 12 | - | - | 81 | 31 | 0 | - | - | - | - | 152 |
| *1949* | 9 | 2 | 40 | 15 | 7 | 38 | - | - | - | 0 | - | - | 111 |
| *1950* | - | 8 | 7 | 153 | 19 | 69 | 30 | 0 | - | - | - | - | 286 |
| *1951* | 28 | 53 | 36 | 7 | 11 | 4 | 11 | - | - | - | - | - | 150 |
| *1952* | 6 | 63 | 216 | 129 | 8 | 28 | 9 | - | - | - | - | - | 458 |
| *1953* | - | 24 | 81 | 5 | - | 5 | 22 | - | - | - | - | - | 136 |
| *1954* | 3 | 20 | 1 | 41 | 12 | 77 | 11 | - | 0 | - | - | - | 166 |
| *1955* | - | 6 | 35 | 148 | 15 | - | 35 | 5 | - | - | - | - | 244 |
| *1956* | - | 29 | 390 | 52 | 16 | - | 3 | 0 | - | - | - | - | 491 |
| *1957* | 1 | - | 7 | 35 | 25 | 2 | 6 | 31 | - | - | - | - | 108 |
| *1958* | 13 | 2 | 40 | 48 | 52 | 74 | 189 | 6 | - | - | - | 3 | 427 |
| *1959* | - | - | - | 51 | 54 | 0 | 0 | - | - | - | - | 340 | 446 |
| *1960* | - | - | 1 | 48 | 43 | 0 | 10 | 0 | - | - | - | - | 102 |
| *1961* | - | 32 | 3 | 19 | 11 | 6 | 4 | - | 0 | - | - | - | 75 |
| *1962* | - | 14 | 2 | 1 | 189 | - | - | - | - | - | - | - | 206 |
| *1963* | 11 | 3 | 38 | 102 | 26 | 70 | 29 | - | - | - | - | 0 | 280 |
| *1964* | 21 | 25 | 0 | 23 | - | 35 | 0 | 1 | 3 | - | 0 | - | 110 |
| *1965* | 14 | 24 | 188 | 2 | 0 | 10 | 15 | - | - | - | 2 | - | 255 |
| *1966* | - | 88 | 123 | 18 | 4 | - | - | - | - | 1 | - | 0 | 234 |
| *1967* | - | 17 | 162 | 90 | 1 | 23 | 70 | - | 6 | - | - | 0 | 369 |
| *1968* | - | 20 | 17 | 14 | 1 | 34 | 3 | - | - | - | - | - | 89 |
| *1969* | 0 | 17 | 24 | 414 | 146 | 18 | 21 | - | - | - | - | - | 641 |
| *1970* | 6 | 15 | 61 | 157 | 30 | 36 | - | - | 0 | - | - | - | 304 |
| *1971* | 1 | 126 | 70 | 6 | 1 | 11 | 11 | 1 | - | - | - | - | 227 |
| *1972* | - | 16 | 26 | 4 | 8 | - | 0 | - | - | - | - | - | 55 |
| *1973* | 22 | 125 | 12 | 63 | 135 | 71 | - | - | - | - | - | - | 428 |
| *1974* | 31 | 58 | 193 | 84 | 7 | 85 | 238 | - | 3 | 2 | - | - | 700 |
| *1975* | 9 | - | 24 | 14 | 48 | 57 | 1 | - | - | - | 3 | - | 155 |
| *1976* | 32 | 1 | - | 1 | 16 | 26 | 5 | - | - | - | 3 | 14 | 97 |
| *1977* | 2 | 3 | 54 | 38 | 0 | 7 | 1 | 4 | - | - | - | - | 110 |
| *1978* | - | 1 | 174 | 89 | 157 | 45 | 59 | - | - | - | - | 1 | 526 |
| *1979* | - | 33 | 11 | 55 | 24 | 15 | 1 | - | - | - | - | - | 140 |
| *1980* | 11 | 10 | 33 | 48 | 30 | 9 | - | - | - | 8 | - | - | 148 |
| *1981* | - | - | 7 | 3 | 12 | 19 | 15 | - | - | - | - | - | 55 |
| *1982* | 8 | 62 | 25 | 67 | 21 | 54 | 22 | - | 1 | - | - | 13 | 273 |
| *1983* | 17 | 157 | 26 | 49 | 48 | 69 | 11 | - | - | - | - | 18 | 394 |
| *1984* | - | 41 | 8 | - | 11 | 3 | 0 | - | - | - | - | - | 63 |
| *1985* | 15 | 18 | 6 | 4 | 16 | 29 | 1 | - | - | - | - | - | 90 |
| *1986* | - | 10 | 0 | 2 | 31 | 125 | 1 | - | - | - | - | 9 | 179 |
| *1987* | - | - | 0 | 34 | 101 | 34 | 0 | - | - | - | - | - | 170 |
| *1988* | 6 | 16 | 18 | 1 | 1 | - | 8 | 0 | - | - | - | - | 50 |
| *1989* | - | 6 | 27 | 6 | 9 | 34 | 1 | - | - | - | - | 8 | 91 |
| *1990* | 14 | 25 | - | 17 | 14 | 7 | 5 | 14 | - | - | - | - | 96 |
| *1991* | 0 | 0 | 21 | 1 | 14 | 109 | - | - | - | - | - | - | 146 |
| *1992* | 9 | 0 | 46 | 13 | 127 | 41 | - | - | - | - | - | - | 236 |
| *1993* | 2 | - | 20 | 176 | 37 | 31 | 0 | 4 | 0 | - | - | - | 271 |
| *1994* | - | 4 | 22 | 22 | 30 | 3 | 10 | 22 | - | - | - | - | 112 |
| *1995* | 2 | 37 | 20 | 209 | 6 | 128 | 12 | - | 5 | - | - | - | 420 |
| *1996* | - | - | 19 | 40 | 78 | 39 | 8 | 17 | - | - | - | - | 201 |
| *1997* | 4 | 111 | 135 | 143 | - | - | 0 | - | - | - | - | - | 393 |
| *1998* | - | 105 | 57 | 97 | 530 | 34 | 19 | 15 | - | - | - | - | 857 |
| *1999* | 7 | 23 | 4 | 33 | 38 | 6 | 19 | - | - | - | - | - | 130 |
| *2000* | - | 7 | - | 208 | 59 | 33 | 1 | 3 | - | - | - | - | 310 |
| *2001* | 65 | - | 7 | 45 | 28 | 17 | 19 | - | - | - | - | - | 180 |
| *2002* | - | 7 | 11 | - | 0 | 1 | - | - | - | - | - | - | 19 |
| *2003* | - | 11 | 31 | 10 | 3 | 5 | 3 | 0 | - | - | - | - | 64 |
| *2004* | 0 | 1 | 85 | 24 | 41 | 2 | - | - | - | - | - | - | 154 |
| *2005* | 57 | 0 | 86 | 31 | 50 | 92 | 8 | 3 | 0 | - | - | - | 327 |
| *2006* | - | 1 | 42 | 18 | 2 | 47 | 34 | 11 | - | - | - | - | 154 |
| *2007* | - | 20 | 30 | 3 | 19 | 2 | 6 | - | - | - | - | 3 | 83 |
| *2008* | 10 | 2 | 12 | 74 | 11 | 0 | - | - | - | - | - | - | 110 |
| *2009* | 0 | 16 | 19 | 19 | 38 | 20 | - | 1 | - | - | 1 | - | 114 |
| *2010* | 64 | - | 12 | 89 | 42 | 42 | 69 | 2 | - | - | - | - | 320 |
| *2011* | 1 | 23 | 31 | 39 | 71 | 127 | - | 0 | 0 | - | - | - | 292 |
| *2012* | 27 | 19 | - | 19 | 4 | 42 | 24 | - | 0 | - | - | - | 135 |
| *2013* | - | 108 | 78 | 12 | 3 | 0 | - | - | - | - | - | - | 201 |
| **Average** | 8 | 26 | 53 | 53 | 45 | 34 | 19 | 2 | 0 | 0 | 0 | 5 | 246 |
| **Minimum** | - | - | - | - | - | - | - | - | - | - | - | - | 19 |
| **Maximum** | 65 | 229 | 390 | 414 | 530 | 147 | 238 | 31 | 10 | 8 | 22 | 340 | 857 |

Data from SALINAS MUNICIPAL AIRPORT CA US, Gage USW00023233
Data gaps filled from SALINAS CA, Gage USC00047668
Drainage area of 1631 acres

## Groundwater Recharge Project
### Table B-4: Estimate of Runoff Captured in Salinas (acre-feet)

| **Water Year** | *Oct* | *Nov* | *Dec* | *Jan* | *Feb* | *Mar* | *Apr* | *May* | *Jun* | *Jul* | *Aug* | *Sep* | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *1932* | 0 | 31 | 310 | 104 | 31 | 3 | 0 | 6 | 0 | 0 | 0 | 0 | 485 |
| *1933* | 0 | 0 | 34 | 113 | 2 | 10 | 0 | 2 | 0 | 0 | 0 | 0 | 160 |
| *1934* | 0 | 0 | 28 | 8 | 25 | 0 | 0 | 1 | 10 | 0 | 0 | 0 | 72 |
| *1935* | 5 | 32 | 39 | 88 | 0 | 66 | 120 | 0 | 0 | 0 | 22 | 0 | 371 |
| *1936* | 0 | 2 | 9 | 21 | 113 | 19 | 13 | 2 | 1 | 1 | 0 | 0 | 181 |
| *1937* | 5 | 0 | 137 | 44 | 100 | 147 | 1 | 0 | 0 | 0 | 0 | 0 | 434 |
| *1938* | 0 | 6 | 154 | 19 | 103 | 50 | 14 | 0 | 0 | 0 | 0 | 0 | 346 |
| *1939* | 10 | 2 | 21 | 37 | 30 | 67 | 1 | 1 | 0 | 0 | 0 | 1 | 170 |
| *1940* | 1 | 2 | 7 | 221 | 164 | 71 | 2 | 0 | 0 | 0 | 0 | 0 | 467 |
| *1941* | 1 | 4 | 107 | 53 | 174 | 109 | 119 | 0 | 0 | 0 | 0 | 0 | 567 |
| *1942* | 13 | 0 | 190 | 44 | 16 | 32 | 47 | 6 | 0 | 0 | 0 | 0 | 348 |
| *1943* | 12 | 13 | 39 | 78 | 20 | 54 | 14 | 0 | 0 | 0 | 0 | 0 | 230 |
| *1944* | 0 | 0 | 37 | 34 | 129 | 0 | 14 | 6 | 0 | 0 | 0 | 0 | 219 |
| *1945* | 35 | 87 | 16 | 3 | 62 | 23 | 3 | 0 | 0 | 0 | 2 | 0 | 230 |
| *1946* | 2 | 15 | 87 | 9 | 47 | 26 | 0 | 3 | 0 | 0 | 0 | 0 | 190 |
| *1947* | 0 | 126 | 22 | 4 | 10 | 10 | 5 | 2 | 0 | 0 | 0 | 0 | 179 |
| *1948* | 23 | 6 | 12 | 0 | 0 | 81 | 31 | 0 | 0 | 0 | 0 | 0 | 152 |
| *1949* | 9 | 2 | 40 | 15 | 7 | 38 | 0 | 0 | 0 | 0 | 0 | 0 | 111 |
| *1950* | 0 | 8 | 7 | 145 | 19 | 62 | 30 | 0 | 0 | 0 | 0 | 0 | 272 |
| *1951* | 28 | 53 | 36 | 7 | 11 | 4 | 11 | 0 | 0 | 0 | 0 | 0 | 150 |
| *1952* | 6 | 63 | 195 | 129 | 8 | 28 | 9 | 0 | 0 | 0 | 0 | 0 | 436 |
| *1953* | 0 | 24 | 81 | 5 | 0 | 5 | 22 | 0 | 0 | 0 | 0 | 0 | 136 |
| *1954* | 3 | 20 | 1 | 41 | 12 | 77 | 11 | 0 | 0 | 0 | 0 | 0 | 166 |
| *1955* | 0 | 6 | 35 | 148 | 15 | 0 | 35 | 5 | 0 | 0 | 0 | 0 | 244 |
| *1956* | 0 | 29 | 255 | 52 | 16 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 356 |
| *1957* | 1 | 0 | 7 | 35 | 25 | 2 | 6 | 31 | 0 | 0 | 0 | 0 | 108 |
| *1958* | 13 | 2 | 40 | 48 | 52 | 74 | 182 | 6 | 0 | 0 | 0 | 3 | 419 |
| *1959* | 0 | 0 | 0 | 51 | 54 | 0 | 0 | 0 | 0 | 0 | 0 | 122 | 227 |
| *1960* | 0 | 0 | 1 | 48 | 43 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 102 |
| *1961* | 0 | 32 | 3 | 19 | 11 | 6 | 4 | 0 | 0 | 0 | 0 | 0 | 75 |
| *1962* | 0 | 14 | 2 | 1 | 126 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 143 |
| *1963* | 11 | 3 | 38 | 102 | 26 | 70 | 29 | 0 | 0 | 0 | 0 | 0 | 280 |
| *1964* | 21 | 25 | 0 | 23 | 0 | 35 | 0 | 1 | 3 | 0 | 0 | 0 | 110 |
| *1965* | 14 | 24 | 188 | 2 | 0 | 10 | 15 | 0 | 0 | 0 | 2 | 0 | 255 |
| *1966* | 0 | 88 | 123 | 18 | 4 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 234 |
| *1967* | 0 | 17 | 100 | 90 | 1 | 23 | 70 | 0 | 6 | 0 | 0 | 0 | 307 |
| *1968* | 0 | 20 | 17 | 14 | 1 | 34 | 3 | 0 | 0 | 0 | 0 | 0 | 89 |
| *1969* | 0 | 17 | 24 | 410 | 146 | 18 | 21 | 0 | 0 | 0 | 0 | 0 | 637 |
| *1970* | 6 | 15 | 61 | 145 | 30 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 292 |
| *1971* | 1 | 119 | 70 | 6 | 1 | 11 | 11 | 1 | 0 | 0 | 0 | 0 | 220 |
| *1972* | 0 | 16 | 26 | 4 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 55 |
| *1973* | 22 | 125 | 12 | 63 | 135 | 71 | 0 | 0 | 0 | 0 | 0 | 0 | 428 |
| *1974* | 31 | 58 | 107 | 84 | 7 | 85 | 64 | 0 | 3 | 2 | 0 | 0 | 440 |
| *1975* | 9 | 0 | 24 | 14 | 48 | 57 | 1 | 0 | 0 | 0 | 3 | 0 | 155 |
| *1976* | 32 | 1 | 0 | 1 | 16 | 26 | 5 | 0 | 0 | 0 | 3 | 14 | 97 |
| *1977* | 2 | 3 | 54 | 38 | 0 | 7 | 1 | 4 | 0 | 0 | 0 | 0 | 110 |
| *1978* | 0 | 1 | 94 | 89 | 151 | 45 | 59 | 0 | 0 | 0 | 0 | 1 | 440 |
| *1979* | 0 | 33 | 11 | 55 | 24 | 15 | 1 | 0 | 0 | 0 | 0 | 0 | 140 |
| *1980* | 11 | 10 | 33 | 48 | 30 | 9 | 0 | 0 | 0 | 8 | 0 | 0 | 148 |
| *1981* | 0 | 0 | 7 | 3 | 12 | 19 | 15 | 0 | 0 | 0 | 0 | 0 | 55 |
| *1982* | 8 | 62 | 25 | 67 | 21 | 54 | 22 | 0 | 1 | 0 | 0 | 13 | 273 |
| *1983* | 17 | 126 | 26 | 49 | 48 | 69 | 11 | 0 | 0 | 0 | 0 | 18 | 363 |
| *1984* | 0 | 41 | 8 | 0 | 11 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 63 |
| *1985* | 15 | 18 | 6 | 4 | 16 | 29 | 1 | 0 | 0 | 0 | 0 | 0 | 90 |
| *1986* | 0 | 10 | 0 | 2 | 31 | 125 | 1 | 0 | 0 | 0 | 0 | 9 | 179 |
| *1987* | 0 | 0 | 0 | 34 | 93 | 34 | 0 | 0 | 0 | 0 | 0 | 0 | 161 |
| *1988* | 6 | 16 | 18 | 1 | 1 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 50 |
| *1989* | 0 | 6 | 27 | 6 | 9 | 34 | 1 | 0 | 0 | 0 | 0 | 8 | 91 |
| *1990* | 14 | 25 | 0 | 17 | 14 | 7 | 5 | 14 | 0 | 0 | 0 | 0 | 96 |
| *1991* | 0 | 0 | 21 | 1 | 14 | 109 | 0 | 0 | 0 | 0 | 0 | 0 | 146 |
| *1992* | 9 | 0 | 46 | 13 | 116 | 41 | 0 | 0 | 0 | 0 | 0 | 0 | 225 |
| *1993* | 2 | 0 | 20 | 161 | 37 | 31 | 0 | 4 | 0 | 0 | 0 | 0 | 255 |
| *1994* | 0 | 4 | 22 | 22 | 30 | 3 | 10 | 22 | 0 | 0 | 0 | 0 | 112 |
| *1995* | 2 | 37 | 20 | 209 | 6 | 109 | 12 | 0 | 5 | 0 | 0 | 0 | 401 |
| *1996* | 0 | 0 | 19 | 40 | 78 | 39 | 8 | 17 | 0 | 0 | 0 | 0 | 201 |
| *1997* | 4 | 111 | 131 | 143 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 389 |
| *1998* | 0 | 92 | 57 | 97 | 340 | 34 | 19 | 15 | 0 | 0 | 0 | 0 | 654 |
| *1999* | 7 | 23 | 4 | 33 | 38 | 6 | 19 | 0 | 0 | 0 | 0 | 0 | 130 |
| *2000* | 0 | 7 | 0 | 124 | 59 | 33 | 1 | 3 | 0 | 0 | 0 | 0 | 225 |
| *2001* | 65 | 0 | 7 | 45 | 28 | 17 | 19 | 0 | 0 | 0 | 0 | 0 | 180 |
| *2002* | 0 | 7 | 11 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 19 |
| *2003* | 0 | 11 | 31 | 10 | 3 | 5 | 3 | 0 | 0 | 0 | 0 | 0 | 64 |
| *2004* | 0 | 1 | 85 | 24 | 41 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 154 |
| *2005* | 57 | 0 | 86 | 31 | 50 | 92 | 8 | 3 | 0 | 0 | 0 | 0 | 327 |
| *2006* | 0 | 1 | 42 | 18 | 2 | 47 | 34 | 11 | 0 | 0 | 0 | 0 | 154 |
| *2007* | 0 | 20 | 30 | 3 | 19 | 2 | 6 | 0 | 0 | 0 | 0 | 3 | 83 |
| *2008* | 10 | 2 | 12 | 74 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 110 |
| *2009* | 0 | 16 | 19 | 19 | 38 | 20 | 0 | 1 | 0 | 0 | 1 | 0 | 114 |
| *2010* | 61 | 0 | 12 | 89 | 42 | 42 | 69 | 2 | 0 | 0 | 0 | 0 | 317 |
| *2011* | 1 | 23 | 31 | 39 | 71 | 127 | 0 | 0 | 0 | 0 | 0 | 0 | 292 |
| *2012* | 27 | 19 | 0 | 19 | 4 | 42 | 24 | 0 | 0 | 0 | 0 | 0 | 135 |
| *2013* | 0 | 62 | 78 | 12 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 155 |
| **Average** | 8 | 23 | 47 | 52 | 41 | 34 | 16 | 2 | 0 | 0 | 0 | 2 | 225 |
| **Minimum** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 |
| **Maximum** | 65 | 126 | 310 | 410 | 340 | 147 | 182 | 31 | 10 | 8 | 22 | 122 | 654 |

Assumes gravity main captures up to 20 mgd = 61 AF/day
Overflow bypasses to Salinas Pump Station

## Groundwater Recharge Project

### Table B-5: Estimate of Uncaptured Runoff to the Salinas River from Salinas, CA (acre-feet)

| Water Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1932 | 0 | 0 | 72 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 72 |
| 1933 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1934 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1935 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 10 |
| 1936 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1937 | 0 | 0 | 2 | 0 | 31 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 |
| 1938 | 0 | 0 | 70 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 70 |
| 1939 | 0 | 0 | 0 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 1940 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 1941 | 0 | 0 | 0 | 0 | 21 | 0 | 63 | 0 | 0 | 0 | 0 | 0 | 84 |
| 1942 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1943 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1944 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1945 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1946 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1947 | 0 | 103 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 103 |
| 1948 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1949 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1950 | 0 | 0 | 0 | 8 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 1951 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1952 | 0 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 |
| 1953 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1954 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1955 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1956 | 0 | 0 | 135 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 135 |
| 1957 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1958 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 8 |
| 1959 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 218 | 218 |
| 1960 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1961 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1962 | 0 | 0 | 0 | 0 | 63 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 63 |
| 1963 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1964 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1965 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1966 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1967 | 0 | 0 | 62 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 62 |
| 1968 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1969 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 1970 | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 1971 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 7 |
| 1972 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1973 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1974 | 0 | 0 | 86 | 0 | 0 | 0 | 174 | 0 | 0 | 0 | 0 | 0 | 260 |
| 1975 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1976 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1977 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1978 | 0 | 0 | 80 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 86 |
| 1979 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1980 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1981 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1982 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1983 | 0 | 31 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 |
| 1984 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1985 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1986 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1987 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| 1988 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1989 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1992 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| 1993 | 0 | 0 | 0 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 |
| 1994 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1995 | 0 | 0 | 0 | 0 | 0 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 19 |
| 1996 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1997 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| 1998 | 0 | 13 | 0 | 0 | 189 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 202 |
| 1999 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2000 | 0 | 0 | 0 | 84 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 84 |
| 2001 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2002 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2003 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2004 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2006 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2007 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2008 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2009 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2010 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 2011 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2012 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2013 | 0 | 46 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 46 |
| **Average** | 0 | 2 | 7 | 2 | 4 | 0 | 3 | 0 | 0 | 0 | 0 | 3 | 21 |
| **Minimum** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Maximum** | 3 | 103 | 135 | 84 | 189 | 19 | 174 | 0 | 0 | 0 | 0 | 218 | 260 |

Assumes gravity main captures up to 20 mgd = 61 AF/day
Overflow bypasses to Salinas Pump Station
Values = Table B3 (Estimated Runoff) minus Table B4 (Estimated Capture)

## Groundwater Recharge Project
### Table B-6: Average Monthly Flow, Salinas River nr Spreckels, CA (cfs)

| Water Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1932 | 0.2 | 2.0 | 3215.2 | 1576.2 | 5468.0 | 414.8 | 71.2 | 8.6 | 3.1 | 1.2 | 1.4 | 6.1 |
| 1933 | 7.5 | 10.3 | 11.8 | 85.1 | 205.3 | 7.0 | 3.9 | 1.8 | 1.2 | 0.1 | 0.0 | 1.5 |
| 1934 | 2.4 | 7.4 | 16.1 | 625.3 | 391.6 | 426.2 | 4.9 | 0.8 | 0.6 | 0.0 | 0.0 | 0.0 |
| 1935 | 3.4 | 5.7 | 3.6 | 1044.1 | 96.6 | 383.8 | 2019.1 | 168.3 | 5.1 | 0.4 | 0.1 | 0.5 |
| 1936 | 1.5 | 2.5 | 2.5 | 38.7 | 5110.2 | 813.7 | 584.8 | 43.4 | 2.9 | 0.4 | 0.2 | 0.1 |
| 1937 | 2.1 | 4.9 | 4.8 | 88.8 | 5760.0 | 3441.6 | 1100.7 | 167.1 | 12.7 | 1.8 | 0.2 | 0.1 |
| 1938 | 1.5 | 3.4 | 877.1 | 177.6 | 11940.0 | 9543.2 | 970.4 | 340.3 | 49.3 | 9.0 | 5.0 | 6.0 |
| 1939 | 12.0 | 12.0 | 13.0 | 10.0 | 10.0 | 160.2 | 21.0 | 4.5 | 1.1 | 0.0 | 0.0 | 0.0 |
| 1940 | 0.0 | 0.0 | 0.0 | 1742.3 | 3782.0 | 2516.0 | 911.1 | 95.4 | 7.7 | 2.9 | 1.0 | 3.7 |
| 1941 | 8.0 | 12.0 | 869.0 | 2881.6 | 9310.7 | 8371.9 | 7181.7 | 943.2 | 226.6 | 44.5 | 7.2 | 4.6 |
| 1942 | 10.2 | 16.9 | 1154.8 | 2351.3 | 1676.4 | 1272.4 | 1865.0 | 473.5 | 67.1 | 7.8 | 4.5 | 6.9 |
| 1943 | 11.7 | 16.0 | 103.7 | 3872.5 | 1941.9 | 5326.1 | 880.9 | 152.4 | 15.1 | 5.3 | 1.4 | 2.8 |
| 1944 | 8.1 | 12.9 | 8.2 | 8.0 | 1632.6 | 2849.3 | 222.6 | 76.9 | 8.0 | 2.0 | 1.0 | 1.0 |
| 1945 | 7.0 | 14.3 | 12.0 | 10.3 | 3485.8 | 1067.3 | 483.3 | 29.5 | 3.0 | 1.0 | 1.0 | 4.0 |
| 1946 | 10.5 | 14.0 | 1114.1 | 301.2 | 181.2 | 68.7 | 484.5 | 5.8 | 1.1 | 0.9 | 1.0 | 2.0 |
| 1947 | 10.6 | 19.1 | 9.3 | 4.0 | 47.2 | 17.4 | 2.8 | 1.0 | 0.8 | 0.5 | 1.0 | 5.2 |
| 1948 | 13.7 | 17.8 | 11.5 | 3.1 | 1.5 | 1.7 | 1.7 | 0.6 | 0.5 | 0.5 | 0.5 | 0.7 |
| 1949 | 2.4 | 7.9 | 6.0 | 2.6 | 2.2 | 786.2 | 11.4 | 1.4 | 0.7 | 0.7 | 0.9 | 1.0 |
| 1950 | 2.5 | 7.5 | 6.0 | 3.0 | 494.8 | 3.5 | 2.0 | 1.5 | 1.8 | 1.5 | 1.5 | 1.5 |
| 1951 | 3.5 | 124.0 | 140.5 | 197.4 | 58.0 | 54.5 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 3.0 |
| 1952 | 5.8 | 9.1 | 227.0 | 5609.7 | 996.9 | 3335.6 | 702.4 | 63.6 | 2.5 | 1.6 | 1.4 | 1.4 |
| 1953 | 1.2 | 1.0 | 117.9 | 1549.1 | 124.1 | 60.4 | 5.9 | 12.8 | 1.0 | 1.0 | 1.0 | 1.0 |
| 1954 | 1.0 | 5.3 | 6.7 | 3.6 | 331.8 | 484.7 | 362.1 | 1.8 | 1.2 | 1.0 | 1.0 | 1.5 |
| 1955 | 1.5 | 2.0 | 2.0 | 3.0 | 3.0 | 10.0 | 2.5 | 2.5 | 2.0 | 1.5 | 1.2 | 1.0 |
| 1956 | 1.0 | 1.5 | 2028.4 | 2733.1 | 1292.7 | 381.8 | 33.5 | 14.0 | 2.0 | 1.5 | 1.0 | 1.0 |
| 1957 | 1.5 | 2.0 | 8.0 | 4.0 | 3.0 | 2.0 | 1.0 | 0.5 | 1.0 | 2.0 | 2.0 | 1.0 |
| 1958 | 1.0 | 1.0 | 3.0 | 3.0 | 979.9 | 2824.0 | 6714.3 | 182.0 | 17.1 | 130.5 | 175.6 | 158.6 |
| 1959 | 70.4 | 24.0 | 26.6 | 102.6 | 1095.3 | 725.0 | 12.7 | 35.0 | 9.2 | 1.0 | 1.0 | 9.2 |
| 1960 | 8.0 | 4.7 | 7.4 | 9.0 | 348.4 | 38.6 | 4.6 | 2.6 | 1.3 | 1.7 | 1.2 | 1.0 |
| 1961 | 1.1 | 3.0 | 3.0 | 1.3 | 1.1 | 1.0 | 0.8 | 1.3 | 1.2 | 1.0 | 0.8 | 0.8 |
| 1962 | 0.7 | 0.9 | 2.1 | 1.9 | 1667.9 | 449.2 | 6.1 | 1.9 | 1.5 | 1.5 | 1.2 | 1.2 |
| 1963 | 2.7 | 4.2 | 5.6 | 45.2 | 1793.0 | 289.3 | 722.9 | 186.9 | 2.9 | 1.5 | 2.7 | 5.6 |
| 1964 | 17.9 | 46.2 | 50.8 | 123.8 | 189.3 | 6.3 | 6.1 | 4.1 | 1.2 | 1.2 | 1.0 | 2.2 |
| 1965 | 4.5 | 7.3 | 17.6 | 636.4 | 77.7 | 4.5 | 148.9 | 9.0 | 5.9 | 2.4 | 1.6 | 4.6 |
| 1966 | 3.5 | 86.2 | 35.5 | 187.9 | 131.7 | 16.5 | 7.1 | 11.2 | 2.9 | 0.9 | 1.5 | 2.3 |
| 1967 | 2.3 | 1.9 | 1591.5 | 891.8 | 2173.4 | 1219.0 | 1803.1 | 674.6 | 280.8 | 122.7 | 252.5 | 284.3 |
| 1968 | 22.0 | 71.5 | 51.4 | 5.0 | 3.2 | 16.8 | 2.4 | 1.4 | 3.9 | 5.0 | 2.2 | 1.8 |
| 1969 | 5.8 | 4.0 | 3.2 | 5959.2 | 9862.1 | 5560.6 | 1858.0 | 587.1 | 419.3 | 280.3 | 182.3 | 335.4 |
| 1970 | 402.5 | 287.0 | 76.3 | 809.3 | 282.8 | 747.9 | 25.1 | 15.9 | 20.6 | 1.3 | 12.2 | 3.0 |
| 1971 | 19.2 | 52.5 | 220.5 | 156.5 | 55.9 | 64.5 | 7.2 | 8.5 | 17.5 | 2.3 | 2.0 | 2.4 |
| 1972 | 15.4 | 5.4 | 59.3 | 11.5 | 4.4 | 2.9 | 20.6 | 1.2 | 1.8 | 3.4 | 2.2 | 3.3 |
| 1973 | 12.7 | 84.7 | 3.1 | 644.7 | 3571.1 | 2499.9 | 409.1 | 46.5 | 2.8 | 1.7 | 2.2 | 10.3 |
| 1974 | 68.7 | 80.4 | 212.6 | 2982.8 | 356.5 | 1023.2 | 715.6 | 46.6 | 10.1 | 2.7 | 17.4 | 77.3 |
| 1975 | 197.4 | 129.0 | 169.8 | 96.8 | 2123.3 | 1244.6 | 363.6 | 38.6 | 8.2 | 5.4 | 10.6 | 95.9 |
| 1976 | 70.5 | 26.8 | 38.1 | 4.3 | 5.4 | 3.9 | 7.8 | 1.6 | 1.3 | 1.9 | 2.1 | 2.8 |
| 1977 | 7.0 | 1.0 | 1.4 | 6.3 | 1.2 | 1.3 | 1.3 | 1.8 | 1.4 | 1.2 | 1.1 | 1.4 |
| 1978 | 1.3 | 1.3 | 261.9 | 2223.9 | 7947.3 | 5238.1 | 1198.1 | 214.7 | 2.3 | 1.9 | 16.2 | 108.2 |
| 1979 | 5.9 | 9.1 | 32.5 | 124.0 | 963.4 | 735.9 | 313.4 | 1.5 | 1.8 | 1.2 | 0.9 | 1.5 |
| 1980 | 1.4 | 1.1 | 69.8 | 3019.6 | 7539.4 | 3492.3 | 370.0 | 50.0 | 1.8 | 1.6 | 21.3 | 36.1 |
| 1981 | 1.1 | 1.1 | 1.3 | 161.1 | 383.4 | 410.7 | 98.9 | 1.7 | 1.7 | 1.3 | 1.4 | 2.0 |
| 1982 | 2.6 | 41.3 | 2.1 | 368.0 | 164.7 | 330.2 | 2824.6 | 352.0 | 72.1 | 7.2 | 20.1 | 113.4 |
| 1983 | 231.3 | 388.8 | 2511.1 | 5594.9 | 7547.5 | 12636.8 | 2482.7 | 2839.0 | 767.0 | 403.4 | 353.7 | 394.5 |
| 1984 | 118.7 | 111.0 | 1113.1 | 1732.1 | 500.1 | 114.7 | 7.9 | 1.4 | 1.2 | 1.4 | 2.6 | 2.3 |
| 1985 | 20.9 | 11.2 | 12.3 | 5.3 | 34.4 | 2.5 | 2.2 | 1.6 | 0.7 | 1.6 | 3.6 | 0.5 |
| 1986 | 18.4 | 12.2 | 35.2 | 3.6 | 2601.2 | 3525.5 | 545.6 | 55.9 | 6.2 | 13.5 | 3.1 | 3.9 |
| 1987 | 2.3 | 18.2 | 51.6 | 66.5 | 156.9 | 48.3 | 1.3 | 0.9 | 1.1 | 1.3 | 2.5 | 3.2 |
| 1988 | 2.9 | 2.1 | 1.9 | 16.6 | 3.4 | 3.3 | 1.9 | 2.1 | 2.2 | 2.3 | 2.2 | 2.3 |
| 1989 | 2.3 | 2.3 | 2.8 | 2.2 | 2.1 | 2.0 | 2.1 | 2.1 | 2.1 | 2.0 | 1.9 | 2.1 |
| 1990 | 2.3 | 2.7 | 2.3 | 2.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1991 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 507.6 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1992 | 0.0 | 0.0 | 0.0 | 0.0 | 434.0 | 9.2 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1993 | 0.0 | 0.0 | 0.0 | 1930.4 | 3224.2 | 1228.8 | 335.5 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |

## Groundwater Recharge Project
### Table B-6: Average Monthly Flow, Salinas River nr Spreckels, CA (cfs)

| Water Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1994 | 0.0 | 0.0 | 0.0 | 0.0 | 100.8 | 3.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 1995 | 0.0 | 0.0 | 0.0 | 2493.8 | 787.9 | 8817.2 | 1302.0 | 310.8 | 5.5 | 5.4 | 0.0 | 9.2 |
| 1996 | 47.0 | 83.7 | 38.9 | 8.1 | 3071.7 | 1586.4 | 159.2 | 0.1 | 9.2 | 0.0 | 0.0 | 0.0 |
| 1997 | 15.4 | 38.8 | 1067.6 | 6992.9 | 2415.9 | 144.4 | 0.0 | 0.0 | 1.7 | 0.1 | 0.0 | 0.0 |
| 1998 | 0.0 | 0.0 | 1.2 | 430.8 | 16261.8 | 2335.5 | 1875.2 | 953.6 | 209.6 | 185.7 | 36.8 | 14.3 |
| 1999 | 0.0 | 152.4 | 225.5 | 173.8 | 489.6 | 191.7 | 208.0 | 5.5 | 30.3 | 0.0 | 7.4 | 14.7 |
| 2000 | 0.0 | 16.2 | 44.5 | 185.0 | 2355.9 | 1149.3 | 82.6 | 27.0 | 2.6 | 9.2 | 8.8 | 18.2 |
| 2001 | 0.0 | 0.0 | 7.1 | 81.1 | 294.0 | 1788.7 | 95.5 | 20.8 | 8.5 | 4.9 | 0.0 | 5.4 |
| 2002 | 0.0 | 0.0 | 112.5 | 118.4 | 5.3 | 10.3 | 7.7 | 15.2 | 1.2 | 14.0 | 3.3 | 15.2 |
| 2003 | 2.5 | 0.0 | 161.0 | 159.5 | 1.0 | 26.1 | 0.2 | 68.4 | 0.1 | 3.3 | 0.9 | 0.1 |
| 2004 | 0.0 | 0.0 | 30.9 | 31.6 | 150.9 | 103.4 | 0.4 | 16.1 | 0.5 | 11.9 | 44.2 | 0.0 |
| 2005 | 0.0 | 0.0 | 0.3 | 2863.5 | 2579.4 | 2160.0 | 540.1 | 154.6 | 15.7 | 30.2 | 8.6 | 0.0 |
| 2006 | 0.0 | 22.8 | 39.0 | 773.3 | 119.2 | 734.0 | 3726.1 | 441.1 | 84.0 | 1.8 | 12.5 | 0.2 |
| 2007 | 0.0 | 15.2 | 10.7 | 83.1 | 11.6 | 8.4 | 5.2 | 8.4 | 5.3 | 1.2 | 2.7 | 0.0 |
| 2008 | 0.0 | 0.0 | 18.1 | 374.0 | 572.5 | 311.4 | 25.7 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2009 | 0.0 | 0.0 | 0.0 | 0.0 | 21.6 | 137.7 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 2010 | 3.1 | 0.0 | 60.0 | 882.0 | 976.0 | 912.2 | 347.6 | 85.3 | 28.9 | 40.4 | 29.6 | 17.0 |
| 2011 | 13.0 | 0.0 | 190.2 | 808.4 | 677.8 | 3059.8 | 1419.2 | 253.8 | 128.4 | 82.9 | 52.3 | 3.3 |
| 2012 | 37.6 | 11.7 | 0.1 | 12.9 | 0.3 | 2.4 | 95.6 | 48.7 | 22.4 | 28.3 | 20.9 | 29.5 |
| 2013 | 32.8 | 0.6 | 121.9 | 42.2 | 1.1 | 4.2 | 27.0 | 34.6 | 38.3 | 33.8 | 31.4 | 32.7 |
| **Average** | 19.8 | 26.8 | 229.0 | 846.0 | 1725.2 | 1345.3 | 596.0 | 127.3 | 32.7 | 18.9 | 17.1 | 23.1 |
| **Median** | 2.7 | 5.7 | 16.1 | 118.4 | 356.5 | 381.8 | 33.5 | 11.2 | 2.3 | 1.6 | 1.5 | 2.2 |
| **Minimum** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Maximum** | 402.5 | 388.8 | 3215.2 | 6992.9 | 16261.8 | 12636.8 | 7181.7 | 2839.0 | 767.0 | 403.4 | 353.7 | 394.5 |

Data from USGS Gage 11152500

| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AVG 1932-1956** | 5.2 | 13.2 | 398.5 | 996.9 | 2173.8 | 1671.9 | 717.2 | 104.5 | 16.7 | 3.5 | 1.4 | 2.3 |
| **AVG 1957-2009** | 26.6 | 35.0 | 159.3 | 805.7 | 1612.6 | 1217.6 | 548.1 | 139.7 | 38.6 | 24.1 | 23.2 | 33.1 |
| **AVG 2010-2013** | 21.6 | 3.1 | 93.1 | 436.4 | 413.8 | 994.6 | 472.3 | 105.6 | 54.5 | 46.3 | 33.6 | 20.6 |
| | | | | | | | | | | | | |
| **MED 1932-1956** | 3.4 | 7.9 | 12.0 | 177.6 | 494.8 | 426.2 | 222.6 | 12.8 | 2.0 | 1.0 | 1.0 | 1.5 |
| **MED 1957-2009** | 2.3 | 4.2 | 18.1 | 118.4 | 348.4 | 289.3 | 20.6 | 8.4 | 2.2 | 1.7 | 2.2 | 2.3 |
| **MED 2010-2013** | 22.9 | 0.3 | 91.0 | 425.3 | 339.5 | 458.2 | 221.6 | 67.0 | 33.6 | 37.1 | 30.5 | 23.3 |

Data from USGS Gage 11152500
Period 1932-1956 predates the addition of San Antonio Reservoir (1967) and Nacimiento Reservoir (1957)
Period 1957-2009: Reservoir releases made to recharge Salians Valley Groundwater Basin
Period 2010-2013: Operating period of the Salinas River Diversion Facility

## Groundwater Recharge Project

### Table B-7: Minimum Daily Flow, Salinas River nr Spreckels, CA (cfs)

| Water Year | *Oct* | *Nov* | *Dec* | *Jan* | *Feb* | *Mar* | *Apr* | *May* | *Jun* | *Jul* | *Aug* | *Sep* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *1932* | 0.0 | 2.0 | 3.0 | 432.0 | 892.0 | 209.0 | 8.5 | 5.5 | 1.8 | 0.6 | 0.3 | 5.0 |
| *1933* | 6.0 | 9.0 | 11.0 | 9.0 | 8.5 | 5.5 | 2.4 | 1.4 | 1.0 | 0.0 | 0.0 | 0.0 |
| *1934* | 1.2 | 4.7 | 11.0 | 12.0 | 5.5 | 23.0 | 1.8 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 |
| *1935* | 0.0 | 4.6 | 3.0 | 4.0 | 17.0 | 12.0 | 248.0 | 17.0 | 1.7 | 0.2 | 0.1 | 0.1 |
| *1936* | 1.0 | 2.5 | 2.5 | 2.5 | 4.8 | 285.0 | 162.0 | 4.3 | 1.1 | 0.1 | 0.1 | 0.1 |
| *1937* | 0.2 | 4.0 | 3.1 | 3.6 | 1800.0 | 715.0 | 368.0 | 39.0 | 5.0 | 0.2 | 0.2 | 0.1 |
| *1938* | 0.2 | 2.5 | 3.3 | 20.0 | 1480.0 | 1800.0 | 512.0 | 128.0 | 12.0 | 9.0 | 5.0 | 6.0 |
| *1939* | 12.0 | 12.0 | 13.0 | 10.0 | 10.0 | 7.5 | 6.0 | 4.0 | 1.0 | 0.0 | 0.0 | 0.0 |
| *1940* | 0.0 | 0.0 | 0.0 | 0.0 | 958.0 | 586.0 | 240.0 | 20.0 | 4.4 | 1.2 | 1.0 | 3.7 |
| *1941* | 8.0 | 12.0 | 13.0 | 570.0 | 1360.0 | 2210.0 | 1880.0 | 426.0 | 97.0 | 14.0 | 5.0 | 4.0 |
| *1942* | 6.0 | 13.0 | 18.0 | 325.0 | 753.0 | 490.0 | 846.0 | 172.0 | 14.0 | 5.0 | 3.8 | 5.5 |
| *1943* | 7.5 | 12.0 | 16.0 | 60.0 | 776.0 | 1460.0 | 341.0 | 46.0 | 5.0 | 1.7 | 1.2 | 1.0 |
| *1944* | 5.0 | 9.5 | 6.0 | 6.0 | 7.5 | 522.0 | 94.0 | 13.0 | 8.0 | 2.0 | 1.0 | 1.0 |
| *1945* | 7.0 | 11.0 | 10.0 | 7.2 | 15.0 | 200.0 | 99.0 | 15.0 | 3.0 | 1.0 | 1.0 | 4.0 |
| *1946* | 9.0 | 14.0 | 16.0 | 85.0 | 72.0 | 32.0 | 20.0 | 1.3 | 0.8 | 0.8 | 1.0 | 2.0 |
| *1947* | 3.5 | 12.0 | 5.3 | 1.5 | 1.0 | 1.0 | 0.6 | 1.0 | 0.8 | 0.5 | 0.5 | 2.2 |
| *1948* | 8.3 | 16.0 | 6.9 | 1.5 | 1.0 | 1.0 | 1.2 | 0.5 | 0.5 | 0.5 | 0.5 | 0.5 |
| *1949* | 0.3 | 5.9 | 3.7 | 2.0 | 1.7 | 1.6 | 2.0 | 1.0 | 0.3 | 0.4 | 0.7 | 0.8 |
| *1950* | 2.5 | 7.5 | 6.0 | 3.0 | 3.0 | 1.6 | 2.0 | 1.5 | 1.8 | 1.5 | 1.5 | 1.5 |
| *1951* | 3.5 | 4.7 | 11.0 | 7.2 | 6.8 | 2.4 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 3.0 |
| *1952* | 4.3 | 7.7 | 5.1 | 575.0 | 450.0 | 381.0 | 241.0 | 3.2 | 2.5 | 1.6 | 1.4 | 1.4 |
| *1953* | 1.0 | 1.0 | 1.0 | 355.0 | 7.8 | 1.1 | 3.2 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| *1954* | 1.0 | 2.0 | 3.5 | 2.5 | 2.0 | 2.0 | 2.5 | 1.4 | 1.2 | 1.0 | 1.0 | 1.5 |
| *1955* | 1.5 | 2.0 | 2.0 | 3.0 | 3.0 | 10.0 | 2.5 | 2.5 | 2.0 | 1.5 | 1.2 | 1.0 |
| *1956* | 1.0 | 1.5 | 2.0 | 385.0 | 372.0 | 110.0 | 3.4 | 2.2 | 2.0 | 1.5 | 1.0 | 1.0 |
| *1957* | 1.5 | 2.0 | 8.0 | 4.0 | 3.0 | 2.0 | 1.0 | 0.5 | 1.0 | 2.0 | 2.0 | 1.0 |
| *1958* | 1.0 | 1.0 | 3.0 | 3.0 | 2.0 | 158.0 | 242.0 | 70.0 | 4.0 | 27.0 | 157.0 | 104.0 |
| *1959* | 38.0 | 14.0 | 20.0 | 33.0 | 50.0 | 61.0 | 2.0 | 2.0 | 0.7 | 1.0 | 1.0 | 1.0 |
| *1960* | 2.6 | 3.9 | 4.4 | 4.4 | 4.4 | 5.8 | 4.2 | 1.1 | 1.0 | 1.5 | 1.0 | 1.0 |
| *1961* | 1.1 | 3.0 | 3.0 | 1.3 | 1.1 | 1.0 | 0.8 | 1.3 | 1.2 | 1.0 | 0.8 | 0.6 |
| *1962* | 0.7 | 0.7 | 1.8 | 1.3 | 1.2 | 40.0 | 2.6 | 1.5 | 1.3 | 1.4 | 0.8 | 1.1 |
| *1963* | 1.2 | 3.0 | 5.2 | 2.7 | 351.0 | 130.0 | 371.0 | 4.2 | 1.8 | 1.4 | 1.5 | 1.8 |
| *1964* | 2.6 | 3.4 | 45.0 | 32.0 | 6.9 | 5.6 | 5.1 | 1.7 | 0.9 | 1.1 | 0.7 | 0.9 |
| *1965* | 3.2 | 4.5 | 4.9 | 97.0 | 15.0 | 3.6 | 4.3 | 5.8 | 4.5 | 1.8 | 0.1 | 3.0 |
| *1966* | 2.3 | 2.8 | 2.3 | 56.0 | 54.0 | 3.5 | 4.2 | 7.4 | 0.6 | 0.7 | 1.0 | 1.8 |
| *1967* | 1.7 | 1.4 | 2.1 | 106.0 | 653.0 | 283.0 | 770.0 | 242.0 | 160.0 | 61.0 | 197.0 | 45.0 |
| *1968* | 8.5 | 12.0 | 11.0 | 2.5 | 2.7 | 2.1 | 2.1 | 0.9 | 2.2 | 1.0 | 0.5 | 0.6 |
| *1969* | 0.6 | 0.6 | 2.2 | 1.0 | 3620.0 | 2100.0 | 520.0 | 440.0 | 391.0 | 203.0 | 176.0 | 183.0 |
| *1970* | 283.0 | 180.0 | 18.0 | 29.0 | 58.0 | 103.0 | 3.8 | 3.7 | 1.3 | 1.3 | 1.3 | 2.1 |
| *1971* | 2.1 | 9.0 | 2.0 | 96.0 | 20.0 | 8.0 | 6.5 | 6.5 | 1.5 | 1.4 | 1.5 | 1.6 |
| *1972* | 2.2 | 2.8 | 6.1 | 5.5 | 3.3 | 0.8 | 0.5 | 0.5 | 1.2 | 1.4 | 1.0 | 2.5 |
| *1973* | 3.0 | 2.7 | 2.5 | 2.5 | 390.0 | 896.0 | 135.0 | 2.8 | 1.9 | 1.4 | 0.6 | 1.3 |
| *1974* | 22.0 | 45.0 | 40.0 | 33.0 | 194.0 | 196.0 | 136.0 | 4.7 | 4.4 | 1.4 | 1.4 | 33.0 |
| *1975* | 142.0 | 40.0 | 38.0 | 55.0 | 64.0 | 312.0 | 147.0 | 4.8 | 1.1 | 1.7 | 1.7 | 20.0 |
| *1976* | 3.7 | 18.0 | 9.3 | 3.2 | 3.2 | 2.4 | 2.2 | 1.3 | 1.0 | 1.4 | 1.5 | 2.0 |
| *1977* | 0.3 | 0.8 | 0.8 | 1.1 | 0.9 | 1.0 | 1.0 | 1.6 | 1.0 | 1.1 | 0.8 | 0.9 |
| *1978* | 1.2 | 1.2 | 1.4 | 237.0 | 340.0 | 1640.0 | 730.0 | 3.8 | 1.8 | 1.5 | 8.1 | 34.0 |
| *1979* | 1.1 | 0.9 | 15.0 | 4.5 | 13.0 | 95.0 | 5.0 | 0.7 | 1.3 | 1.1 | 0.6 | 1.1 |
| *1980* | 1.0 | 0.9 | 1.2 | 9.6 | 472.0 | 664.0 | 156.0 | 3.2 | 1.2 | 0.5 | 0.7 | 1.2 |
| *1981* | 0.8 | 0.9 | 1.0 | 1.5 | 75.0 | 30.0 | 2.8 | 1.1 | 1.1 | 1.0 | 1.0 | 1.0 |
| *1982* | 2.0 | 2.5 | 0.9 | 1.3 | 75.0 | 94.0 | 969.0 | 102.0 | 10.0 | 1.6 | 0.9 | 74.0 |
| *1983* | 190.0 | 297.0 | 181.0 | 526.0 | 2460.0 | 4210.0 | 1670.0 | 1900.0 | 340.0 | 340.0 | 267.0 | 358.0 |
| *1984* | 22.0 | 13.0 | 205.0 | 589.0 | 312.0 | 24.0 | 2.9 | 1.0 | 1.0 | 1.1 | 0.6 | 1.2 |
| *1985* | 2.1 | 1.7 | 3.2 | 1.7 | 1.7 | 1.6 | 1.5 | 0.7 | 0.5 | 0.4 | 1.0 | 0.2 |
| *1986* | 0.5 | 0.2 | 0.1 | 0.1 | 0.5 | 658.0 | 199.0 | 2.7 | 2.0 | 1.4 | 2.1 | 3.2 |
| *1987* | 0.5 | 0.7 | 12.0 | 45.0 | 32.0 | 5.3 | 0.3 | 0.7 | 0.6 | 0.3 | 1.0 | 1.9 |
| *1988* | 2.3 | 1.6 | 1.4 | 1.6 | 1.6 | 1.7 | 1.7 | 1.4 | 1.8 | 1.9 | 1.9 | 1.9 |
| *1989* | 1.6 | 2.0 | 1.6 | 1.6 | 1.7 | 1.5 | 1.8 | 1.7 | 1.8 | 1.9 | 1.9 | 1.9 |
| *1990* | 2.0 | 2.3 | 2.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *1991* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *1992* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *1993* | 0.0 | 0.0 | 0.0 | 0.0 | 346.0 | 286.0 | 0.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

## Groundwater Recharge Project
### Table B-7: Minimum Daily Flow, Salinas River nr Spreckels, CA (cfs)

| Water Year | *Oct* | *Nov* | *Dec* | *Jan* | *Feb* | *Mar* | *Apr* | *May* | *Jun* | *Jul* | *Aug* | *Sep* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *1994* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *1995* | 0.0 | 0.0 | 0.0 | 0.0 | 424.0 | 385.0 | 618.0 | 48.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *1996* | 26.0 | 39.0 | 11.0 | 0.0 | 1060.0 | 386.0 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *1997* | 0.0 | 0.0 | 0.0 | 2440.0 | 914.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *1998* | 0.0 | 0.0 | 0.0 | 0.0 | 679.0 | 1200.0 | 709.0 | 408.0 | 103.0 | 92.0 | 8.0 | 0.0 |
| *1999* | 0.0 | 0.0 | 180.0 | 120.0 | 150.0 | 53.0 | 7.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *2000* | 0.0 | 0.0 | 10.0 | 1.7 | 17.0 | 218.0 | 14.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *2001* | 0.0 | 0.0 | 0.0 | 14.0 | 0.0 | 239.0 | 17.0 | 1.7 | 0.0 | 0.0 | 0.0 | 0.0 |
| *2002* | 0.0 | 0.0 | 0.0 | 5.3 | 0.2 | 3.5 | 0.0 | 0.1 | 0.0 | 0.2 | 0.0 | 2.7 |
| *2003* | 0.0 | 0.0 | 0.0 | 7.6 | 0.1 | 0.1 | 0.0 | 0.9 | 0.0 | 0.0 | 0.0 | 0.0 |
| *2004* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 0.0 | 0.5 | 0.0 | 0.0 | 0.2 | 0.0 |
| *2005* | 0.0 | 0.0 | 0.0 | 1010.0 | 665.0 | 1030.0 | 209.0 | 52.0 | 0.2 | 0.3 | 0.1 | 0.0 |
| *2006* | 0.0 | 0.0 | 9.3 | 226.0 | 43.0 | 458.0 | 804.0 | 226.0 | 0.7 | 0.1 | 0.1 | 0.0 |
| *2007* | 0.0 | 0.0 | 0.0 | 34.0 | 0.9 | 0.0 | 0.0 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 |
| *2008* | 0.0 | 0.0 | 0.0 | 0.1 | 223.0 | 104.0 | 0.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *2009* | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| *2010* | 0.0 | 0.0 | 0.0 | 0.0 | 455.0 | 274.0 | 232.0 | 9.4 | 0.7 | 28.0 | 16.0 | 1.5 |
| *2011* | 0.0 | 0.0 | 0.0 | 177.0 | 109.0 | 329.0 | 461.0 | 143.0 | 86.0 | 74.0 | 0.2 | 0.2 |
| *2012* | 16.0 | 0.3 | 0.1 | 0.0 | 0.0 | 0.0 | 57.0 | 24.0 | 13.0 | 12.0 | 13.0 | 15.0 |
| *2013* | 0.0 | 0.0 | 0.2 | 5.7 | 0.2 | 0.2 | 9.5 | 25.0 | 27.0 | 16.0 | 25.0 | 23.0 |
| **Average** | 10.8 | 10.8 | 12.7 | 108.7 | 285.1 | 314.3 | 174.7 | 57.0 | 16.4 | 11.4 | 11.3 | 11.9 |
| **Median** | 1.2 | 2.0 | 3.0 | 4.4 | 15.0 | 30.0 | 4.2 | 1.7 | 1.1 | 1.0 | 1.0 | 1.0 |
| **Minimum** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| **Maximum** | 283.0 | 297.0 | 205.0 | 2440.0 | 3620.0 | 4210.0 | 1880.0 | 1900.0 | 391.0 | 340.0 | 267.0 | 358.0 |

Data from USGS Gage 11152500

| | *Oct* | *Nov* | *Dec* | *Jan* | *Feb* | *Mar* | *Apr* | *May* | *Jun* | *Jul* | *Aug* | *Sep* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AVG 1932-1956** | 3.6 | 6.9 | 7.0 | 115.3 | 360.3 | 362.7 | 203.5 | 36.3 | 6.8 | 1.9 | 1.2 | 1.9 |
| **AVG 1957-2009** | 14.7 | 13.5 | 16.3 | 110.3 | 260.5 | 303.8 | 160.0 | 67.2 | 19.8 | 14.3 | 15.9 | 16.8 |
| **AVG 2010-2013** | 4.0 | 0.1 | 0.1 | 45.7 | 141.0 | 150.8 | 189.9 | 50.4 | 31.7 | 32.5 | 13.6 | 9.9 |
| | | | | | | | | | | | | |
| **MED 1932-1956** | 2.5 | 5.9 | 5.3 | 7.2 | 10.0 | 32.0 | 8.5 | 3.2 | 1.8 | 1.0 | 1.0 | 1.0 |
| **MED 1957-2009** | 1.1 | 1.0 | 2.1 | 3.2 | 17.0 | 30.0 | 2.9 | 1.4 | 1.0 | 1.0 | 0.8 | 1.0 |
| **MED 2010-2013** | 0.0 | 0.0 | 0.0 | 2.9 | 54.6 | 137.1 | 144.5 | 24.5 | 20.0 | 22.0 | 14.5 | 8.3 |

Data from USGS Gage 11152500

Period 1932-1956 predates the addition of San Antonio Reservoir (1967) and Nacimiento Reservoir (1957)

Period 1957-2009: Reservoir releases made to recharge Salians Valley Groundwater Basin

Period 2010-2013: Operating period of the Salinas River Diversion Facility

Groundwater Recharge Project

Table B-8: Calculated Monthly Flow, Salinas River nr Spreckels, CA (acre-feet)

| **Water Year** | *Oct* | *Nov* | *Dec* | *Jan* | *Feb* | *Mar* | *Apr* | *May* | *Jun* | *Jul* | *Aug* | *Sep* | *Total* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *1932* | 14 | 119 | 197,697 | 96,918 | 314,523 | 25,505 | 4,236 | 527 | 184 | 72 | 83 | 363 | 640,241 |
| *1933* | 463 | 610 | 724 | 5,233 | 11,399 | 430 | 232 | 111 | 72 | 8 | 0 | 89 | 19,372 |
| *1934* | 148 | 441 | 988 | 38,450 | 21,751 | 26,204 | 293 | 50 | 36 | 0 | 0 | 0 | 88,360 |
| *1935* | 206 | 339 | 223 | 64,200 | 5,363 | 23,601 | 120,147 | 10,348 | 304 | 27 | 9 | 31 | 224,798 |
| *1936* | 95 | 149 | 154 | 2,379 | 293,942 | 50,033 | 34,798 | 2,671 | 170 | 22 | 12 | 9 | 384,433 |
| *1937* | 131 | 294 | 295 | 5,462 | 319,894 | 211,617 | 65,498 | 10,274 | 755 | 108 | 12 | 6 | 614,346 |
| *1938* | 89 | 201 | 53,933 | 10,921 | 663,114 | 586,790 | 57,743 | 20,922 | 2,936 | 553 | 307 | 357 | 1,397,866 |
| *1939* | 738 | 714 | 799 | 615 | 555 | 9,850 | 1,250 | 278 | 65 | 0 | 0 | 0 | 14,864 |
| *1940* | 0 | 0 | 0 | 107,129 | 217,543 | 154,705 | 54,216 | 5,867 | 457 | 181 | 61 | 220 | 540,380 |
| *1941* | 492 | 714 | 53,433 | 177,185 | 517,091 | 514,770 | 427,339 | 57,997 | 13,484 | 2,739 | 444 | 273 | 1,765,961 |
| *1942* | 626 | 1,008 | 71,006 | 144,577 | 93,102 | 78,238 | 110,975 | 29,111 | 3,993 | 479 | 274 | 412 | 533,801 |
| *1943* | 718 | 952 | 6,377 | 238,108 | 107,845 | 327,491 | 52,417 | 9,368 | 896 | 324 | 85 | 164 | 744,745 |
| *1944* | 498 | 770 | 507 | 491 | 93,909 | 175,196 | 13,244 | 4,727 | 476 | 123 | 61 | 60 | 290,061 |
| *1945* | 430 | 849 | 738 | 631 | 193,591 | 65,623 | 28,756 | 1,815 | 179 | 61 | 61 | 238 | 292,973 |
| *1946* | 649 | 833 | 68,501 | 18,522 | 10,064 | 4,227 | 28,830 | 356 | 63 | 56 | 61 | 119 | 132,281 |
| *1947* | 651 | 1,137 | 571 | 247 | 2,619 | 1,067 | 168 | 61 | 48 | 31 | 60 | 308 | 6,966 |
| *1948* | 845 | 1,057 | 710 | 189 | 86 | 106 | 101 | 36 | 30 | 31 | 31 | 40 | 3,262 |
| *1949* | 148 | 468 | 368 | 160 | 120 | 48,344 | 681 | 88 | 44 | 42 | 57 | 59 | 50,577 |
| *1950* | 154 | 446 | 369 | 184 | 27,479 | 215 | 119 | 92 | 107 | 92 | 92 | 89 | 29,439 |
| *1951* | 215 | 7,380 | 8,642 | 12,135 | 3,221 | 3,352 | 60 | 61 | 60 | 61 | 61 | 179 | 35,427 |
| *1952* | 360 | 543 | 13,957 | 344,928 | 57,342 | 205,097 | 41,794 | 3,908 | 149 | 98 | 86 | 83 | 668,344 |
| *1953* | 76 | 60 | 7,250 | 95,252 | 6,892 | 3,713 | 352 | 787 | 60 | 61 | 61 | 60 | 114,625 |
| *1954* | 61 | 316 | 413 | 222 | 18,427 | 29,803 | 21,545 | 110 | 71 | 61 | 61 | 89 | 71,181 |
| *1955* | 92 | 119 | 123 | 184 | 167 | 615 | 149 | 154 | 119 | 92 | 74 | 60 | 1,947 |
| *1956* | 61 | 89 | 124,719 | 168,050 | 74,354 | 23,476 | 1,991 | 859 | 119 | 92 | 61 | 60 | 393,932 |
| *1957* | 92 | 119 | 492 | 246 | 167 | 123 | 60 | 31 | 60 | 123 | 123 | 60 | 1,694 |
| *1958* | 61 | 60 | 184 | 184 | 54,420 | 173,643 | 399,531 | 11,191 | 1,019 | 8,027 | 10,798 | 9,439 | 668,558 |
| *1959* | 4,330 | 1,426 | 1,634 | 6,307 | 60,827 | 44,580 | 757 | 2,154 | 549 | 61 | 61 | 549 | 123,238 |
| *1960* | 490 | 282 | 452 | 555 | 20,042 | 2,376 | 276 | 157 | 74 | 107 | 76 | 60 | 24,947 |
| *1961* | 68 | 179 | 184 | 80 | 61 | 61 | 48 | 80 | 71 | 61 | 49 | 48 | 991 |
| *1962* | 44 | 54 | 129 | 114 | 92,629 | 27,618 | 366 | 115 | 87 | 93 | 71 | 73 | 121,392 |
| *1963* | 164 | 247 | 346 | 2,778 | 99,578 | 17,788 | 43,016 | 11,494 | 173 | 95 | 168 | 334 | 176,180 |
| *1964* | 1,102 | 2,751 | 3,124 | 7,613 | 10,890 | 388 | 362 | 254 | 70 | 75 | 60 | 133 | 26,823 |
| *1965* | 275 | 435 | 1,081 | 39,132 | 4,314 | 278 | 8,858 | 555 | 350 | 151 | 97 | 275 | 55,801 |
| *1966* | 215 | 5,130 | 2,180 | 11,556 | 7,315 | 1,013 | 425 | 687 | 170 | 55 | 90 | 136 | 28,971 |
| *1967* | 141 | 113 | 97,858 | 54,833 | 120,706 | 74,951 | 107,290 | 41,480 | 16,707 | 7,547 | 15,529 | 16,919 | 554,074 |
| *1968* | 1,353 | 4,257 | 3,162 | 308 | 183 | 1,030 | 140 | 87 | 234 | 308 | 136 | 107 | 11,306 |
| *1969* | 357 | 241 | 198 | 366,416 | 547,716 | 341,911 | 110,559 | 36,099 | 24,948 | 17,236 | 11,209 | 19,958 | 1,476,846 |
| *1970* | 24,748 | 17,080 | 4,691 | 49,759 | 15,707 | 45,987 | 1,493 | 975 | 1,225 | 80 | 751 | 179 | 162,675 |
| *1971* | 1,178 | 3,121 | 13,557 | 9,626 | 3,106 | 3,969 | 430 | 522 | 1,041 | 141 | 121 | 142 | 36,953 |
| *1972* | 944 | 324 | 3,644 | 709 | 255 | 178 | 1,224 | 73 | 109 | 209 | 137 | 199 | 8,005 |
| *1973* | 783 | 5,039 | 193 | 39,644 | 198,327 | 153,715 | 24,345 | 2,861 | 166 | 103 | 136 | 615 | 425,928 |
| *1974* | 4,225 | 4,782 | 13,073 | 183,408 | 19,799 | 62,916 | 42,583 | 2,863 | 599 | 165 | 1,068 | 4,598 | 340,078 |
| *1975* | 12,139 | 7,678 | 10,441 | 5,954 | 117,923 | 76,530 | 21,634 | 2,373 | 491 | 330 | 651 | 5,706 | 261,851 |
| *1976* | 4,338 | 1,595 | 2,343 | 261 | 309 | 239 | 461 | 100 | 78 | 115 | 131 | 165 | 10,135 |
| *1977* | 430 | 62 | 88 | 390 | 67 | 78 | 76 | 111 | 82 | 74 | 65 | 81 | 1,604 |
| *1978* | 83 | 75 | 16,107 | 136,740 | 441,372 | 322,076 | 71,290 | 13,200 | 134 | 116 | 998 | 6,438 | 1,008,629 |
| *1979* | 364 | 543 | 1,997 | 7,627 | 53,502 | 45,251 | 18,651 | 90 | 107 | 74 | 55 | 91 | 128,352 |
| *1980* | 87 | 67 | 4,293 | 185,670 | 433,674 | 214,731 | 22,017 | 3,077 | 110 | 99 | 1,310 | 2,150 | 867,284 |
| *1981* | 69 | 65 | 80 | 9,908 | 21,293 | 25,254 | 5,885 | 103 | 99 | 82 | 84 | 119 | 63,041 |
| *1982* | 158 | 2,460 | 129 | 22,626 | 9,146 | 20,301 | 168,077 | 21,646 | 4,290 | 443 | 1,234 | 6,746 | 257,255 |
| *1983* | 14,220 | 23,137 | 154,401 | 344,015 | 419,167 | 777,005 | 147,729 | 174,565 | 45,640 | 24,805 | 21,747 | 23,472 | 2,169,903 |
| *1984* | 7,297 | 6,607 | 68,442 | 106,502 | 28,766 | 7,055 | 470 | 86 | 73 | 85 | 159 | 137 | 225,681 |
| *1985* | 1,284 | 668 | 758 | 326 | 1,909 | 151 | 131 | 101 | 44 | 97 | 223 | 31 | 5,725 |
| *1986* | 1,134 | 725 | 2,165 | 223 | 144,466 | 216,776 | 32,463 | 3,440 | 367 | 827 | 193 | 232 | 403,011 |
| *1987* | 144 | 1,082 | 3,174 | 4,088 | 8,711 | 2,968 | 75 | 54 | 64 | 81 | 152 | 189 | 20,781 |
| *1988* | 176 | 123 | 119 | 1,021 | 197 | 202 | 113 | 131 | 132 | 140 | 138 | 136 | 2,629 |
| *1989* | 140 | 135 | 170 | 135 | 117 | 120 | 123 | 129 | 123 | 120 | 120 | 125 | 1,558 |
| *1990* | 143 | 160 | 144 | 137 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 584 |
| *1991* | 0 | 0 | 0 | 0 | 0 | 31,214 | 14 | 1 | 0 | 0 | 0 | 0 | 31,229 |
| *1992* | 0 | 0 | 0 | 0 | 24,963 | 564 | 4 | 0 | 0 | 0 | 0 | 0 | 25,531 |
| *1993* | 0 | 0 | 0 | 118,693 | 179,062 | 75,554 | 19,961 | 7 | 0 | 0 | 0 | 0 | 393,277 |
| *1994* | 0 | 0 | 0 | 0 | 5,595 | 212 | 0 | 0 | 0 | 0 | 0 | 0 | 5,807 |
| *1995* | 0 | 0 | 0 | 153,340 | 43,755 | 542,150 | 77,474 | 19,111 | 325 | 333 | 0 | 547 | 837,037 |
| *1996* | 2,892 | 4,979 | 2,390 | 500 | 176,688 | 97,541 | 9,473 | 5 | 545 | 0 | 0 | 0 | 295,012 |
| *1997* | 950 | 2,311 | 65,643 | 429,977 | 134,170 | 8,880 | 0 | 0 | 103 | 4 | 0 | 0 | 642,038 |
| *1998* | 0 | 0 | 71 | 26,491 | 903,132 | 143,603 | 111,582 | 58,633 | 12,472 | 11,417 | 2,265 | 852 | 1,270,520 |
| *1999* | 0 | 9,070 | 13,862 | 10,685 | 27,193 | 11,788 | 12,375 | 340 | 1,805 | 0 | 457 | 875 | 88,450 |
| *2000* | 0 | 962 | 2,739 | 11,378 | 135,511 | 70,667 | 4,917 | 1,663 | 154 | 566 | 542 | 1,081 | 230,180 |
| *2001* | 0 | 0 | 439 | 4,984 | 16,327 | 109,985 | 5,681 | 1,278 | 507 | 299 | 0 | 324 | 139,825 |
| *2002* | 0 | 0 | 6,916 | 7,283 | 297 | 633 | 456 | 937 | 71 | 858 | 204 | 905 | 18,560 |

## Groundwater Recharge Project
### Table B-8: Calculated Monthly Flow, Salinas River nr Spreckels, CA (acre-feet)

| Water Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2003 | 156 | 1 | 9,897 | 9,805 | 54 | 1,604 | 10 | 4,208 | 4 | 200 | 53 | 7 | 26,000 |
| 2004 | 0 | 0 | 1,900 | 1,943 | 8,681 | 6,359 | 23 | 991 | 30 | 733 | 2,718 | 0 | 23,378 |
| 2005 | 0 | 0 | 21 | 176,073 | 143,252 | 132,813 | 32,136 | 9,507 | 934 | 1,855 | 530 | 1 | 497,123 |
| 2006 | 0 | 1,355 | 2,399 | 47,550 | 6,621 | 45,134 | 221,720 | 27,120 | 4,996 | 113 | 766 | 13 | 357,786 |
| 2007 | 0 | 902 | 660 | 5,107 | 647 | 517 | 308 | 515 | 316 | 76 | 166 | 1 | 9,214 |
| 2008 | 0 | 0 | 1,115 | 22,996 | 32,932 | 19,144 | 1,530 | 6 | 0 | 0 | 0 | 0 | 77,723 |
| 2009 | 0 | 0 | 0 | 0 | 1,202 | 8,468 | 0 | 0 | 0 | 0 | 0 | 0 | 9,670 |
| 2010 | 189 | 0 | 3,692 | 54,234 | 54,202 | 56,087 | 20,682 | 5,245 | 1,717 | 2,483 | 1,823 | 1,014 | 201,367 |
| 2011 | 798 | 0 | 11,693 | 49,708 | 37,644 | 188,140 | 84,448 | 15,604 | 7,638 | 5,100 | 3,214 | 195 | 404,182 |
| 2012 | 2,311 | 694 | 8 | 792 | 19 | 145 | 5,687 | 2,997 | 1,335 | 1,738 | 1,283 | 1,757 | 18,765 |
| 2013 | 2,016 | 38 | 7,495 | 2,595 | 61 | 258 | 1,609 | 2,128 | 2,277 | 2,079 | 1,932 | 1,946 | 24,433 |
| **Average** | 1,220 | 1,594 | 14,079 | 52,017 | 96,623 | 82,717 | 35,463 | 7,826 | 1,946 | 1,163 | 1,049 | 1,372 | 297,070 |
| **Median** | 164 | 339 | 988 | 7,283 | 20,042 | 23,476 | 1,991 | 687 | 134 | 98 | 90 | 133 | 121,392 |
| **Minimum** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 584 |
| **Maximum** | 24,748 | 23,137 | 197,697 | 429,977 | 903,132 | 777,005 | 427,339 | 174,565 | 45,640 | 24,805 | 21,747 | 23,472 | 2,169,903 |

Data from USGS Gage 11152500

| | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **AVG 1932-1956** | 318 | 784 | 24,500 | 61,295 | 122,176 | 102,803 | 42,677 | 6,423 | 995 | 217 | 85 | 135 | 362,407 |
| **AVG 1957-2009** | 1,637 | 2,083 | 9,794 | 49,541 | 90,127 | 74,870 | 32,615 | 8,589 | 2,297 | 1,483 | 1,427 | 1,967 | 276,431 |
| **AVG 2010-2013** | 1,328 | 183 | 5,722 | 26,832 | 22,982 | 61,158 | 28,106 | 6,494 | 3,242 | 2,850 | 2,063 | 1,228 | 162,187 |
| | | | | | | | | | | | | | |
| **MED 1932-1956** | 206 | 468 | 738 | 10,921 | 27,479 | 26,204 | 13,244 | 787 | 119 | 61 | 61 | 89 | 224,798 |
| **MED 1957-2009** | 144 | 247 | 1,115 | 7,283 | 19,799 | 17,788 | 1,224 | 515 | 132 | 107 | 136 | 136 | 88,450 |
| **MED 2010-2013** | 1,407 | 19 | 5,593 | 26,151 | 18,853 | 28,172 | 13,184 | 4,121 | 1,997 | 2,281 | 1,877 | 1,386 | 112,900 |

Data from USGS Gage 11152500

Period 1932-1956 predates the addition of San Antonio Reservoir (1967) and Nacimiento Reservoir (1957)

Period 1957-2009: Reservoir releases made to recharge Salians Valley Groundwater Basin

Period 2010-2013: Operating period of the Salinas River Diversion Facility

**Table B-9: Water Rights Database GIS Capture, PODs near Salinas**

| Application ID | No. | Permit ID | License ID | DB ID | Water Right Type | Water Right Type ID | Status | Holder Name | Date | Face Amt | County | Watershed | Source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A013225 | 1 | 11043 | 0 | 3413 | Appropriative | 84 | Permitted | MONTEREY COUNTY WATER RESOURCES AGENCY | 7/11/1949 | 168,538.0 | Monterey | SALINAS,<br>SALINA | SALINAS RIVER |
| A016124 | 2 | 10137 | 7543 | 4833 | Appropriative | 84 | Licensed | MONTEREY COUNTY WATER RESOURCES AGENCY | 11/4/1954 | 350,000.0 | Monterey, San L | SALINAS,<br>SALINA | NACIMIENTO RIVER, Salinas River |
| A016761 | 2 | 12261 | 12624 | 5163 | Appropriative | 84 | Licensed | MONTEREY COUNTY WATER RESOURCES AGENCY | 12/2/1955 | 220,000.0 | Monterey | SALINAS,<br>SALINA | SAN ANTONIO RIVER, Salinas River |
| A030532 | 2 | 21089 | 0 | 14037 | Appropriative | 84 | Permitted | MONTEREY COUNTY WATER RESOURCES AGENCY | 3/25/1996 | 27,900.0 | Monterey, San L | SALINAS,<br>SALINA | NACIMIENTO RIVER, Salinas River |
| S014817 | 1 | 0 | 0 | 37657 | Statement of Div and Use | 92 | Inactive | STEPHEN JENSEN | 7/5/2000 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014826 | 1 | 0 | 0 | 37666 | Statement of Div and Use | 92 | Claimed | ELMER N JENSEN & ELSIE R JENSEN LIVING TRUST | 5/28/1997 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014867 | 1 | 0 | 0 | 37707 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014868 | 1 | 0 | 0 | 37708 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014869 | 1 | 0 | 0 | 37709 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014870 | 1 | 0 | 0 | 37710 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014872 | 1 | 0 | 0 | 37712 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014873 | 1 | 0 | 0 | 37713 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014874 | 1 | 0 | 0 | 37714 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014875 | 1 | 0 | 0 | 37715 | Statement of Div and Use | 92 | Inactive | TANIMURA & ANTLE INC | 6/28/2013 | - | Monterey | SALINAS | GROUNDWATER USE |
| S014876 | 1 | 0 | 0 | 37716 | Statement of Div and Use | 92 | Inactive | TANIMURA & ANTLE INC | 6/28/2013 | - | Monterey | SALINAS | GROUNDWATER USE |
| S014877 | 1 | 0 | 0 | 37717 | Statement of Div and Use | 92 | Inactive | TANIMURA & ANTLE INC | 6/28/2013 | - | Monterey | SALINAS | GROUNDWATER USE |
| S014878 | 1 | 0 | 0 | 37718 | Statement of Div and Use | 92 | Claimed | T. Yuki Farms, LPII | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014879 | 1 | 0 | 0 | 37719 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014880 | 1 | 0 | 0 | 37720 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014881 | 1 | 0 | 0 | 37721 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014882 | 1 | 0 | 0 | 37722 | Statement of Div and Use | 92 | Claimed | Robert Tanimura 1980 IrrevocableTrust; et al | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014883 | 1 | 0 | 0 | 37723 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014884 | 1 | 0 | 0 | 37724 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 5/30/2013 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014885 | 1 | 0 | 0 | 37725 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014886 | 1 | 0 | 0 | 37726 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014887 | 1 | 0 | 0 | 37727 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014888 | 1 | 0 | 0 | 37728 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014889 | 1 | 0 | 0 | 37729 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014890 | 1 | 0 | 0 | 37730 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014892 | 1 | 0 | 0 | 37732 | Statement of Div and Use | 92 | Claimed | Tanimura & Antle Partnership; et al | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014893 | 1 | 0 | 0 | 37733 | Statement of Div and Use | 92 | Claimed | Tanimura & Antle Partnership; et al | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014894 | 1 | 0 | 0 | 37734 | Statement of Div and Use | 92 | Claimed | Tanimura & Antle Partnership; et al | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014895 | 1 | 0 | 0 | 37735 | Statement of Div and Use | 92 | Claimed | Tanimura & Antle Partnership; et al | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014896 | 1 | 0 | 0 | 37736 | Statement of Div and Use | 92 | Claimed | Tanimura & Antle Partnership; et al | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S016592 | 1 | 0 | 0 | 51867 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 7/6/2010 | 192.4 | Monterey | SALINAS | Salinas River Underflow |
| S021637 | 1 | 0 | 0 | 53889 | Statement of Div and Use | 92 | Claimed | PORTER FAMILY PARTNERSHIP, LP | 7/6/2010 | 136,339.0 | Monterey | SALINAS | Salinas River Underflow |
| S021638 | 1 | 0 | 0 | 53890 | Statement of Div and Use | 92 | Claimed | PORTER FAMILY PARTNERSHIP, LP | 7/6/2010 | 107,448.0 | Monterey | SALINAS | Salinas River Underflow |
| S021639 | 1 | 0 | 0 | 53891 | Statement of Div and Use | 92 | Claimed | M.B.T. FAMILY PARTNERSHIP | 7/6/2010 | 202,417.0 | Monterey | SALINAS | Salinas River Underflow |
| S021641 | 1 | 0 | 0 | 53893 | Statement of Div and Use | 92 | Claimed | THE HARDY FAMILY TRUST, ET AL. | 7/6/2010 | 262.5 | Monterey | SALINAS | Salinas River Underflow |
| S021642 | 1 | 0 | 0 | 53900 | Statement of Div and Use | 92 | Claimed | THE HARDY FAMILY TRUST, ET AL. | 7/6/2010 | 333.8 | Monterey | SALINAS | Salinas River Underflow |
| S023945 | 1 | 0 | 0 | | Statement of Div and Use | 92 | Claimed | TANIMURA & ANTLE | 7/2/2013 | - | Monterey | SALINAS | Salinas Valley Basin |
| S023947 | 1 | 0 | 0 | | Statement of Div and Use | 92 | Claimed | TANIMURA & ANTLE | 7/2/2013 | - | Monterey | SALINAS | Salinas Valley Basin |

**Table B-10: Surface Water Rights and Claims in the Salinas River below Spreckels**

| Water Right ID | Source | Direct Diversion Rate (cfs) | Direct Diversion Season | Face Value Direct Diversion Amount Oct. 1- Mar. 31 (af) | Face Value Storage Amount (af) | Storage Season | Reported Use 2011 (Used) | Reported Use 2012 (Used) | Purpose of Use Code** |
|---|---|---|---|---|---|---|---|---|---|
| A016124, Permit 10137 | Nacimento River, Salinas River | | | 350,000 | 377,900 | Oct 1 - July 1 | 197,000 | 158,633 | M, D, I, J, R |
| A016761, Permit 12261 | San Antonio River, Salinas River | | | 220,000 | 335,000 | Oct 1 - July 1 | 26,410 | 72,175 | M, D, I, J, R |
| A030532, Permit 21089 | Nacimento River, Salinas River | | | 27,900 | | Oct 1 - July 1 | - | - | M, D, I, J, R |
| A013225, Permit 11043 | Salinas River | 400 | Jan 1 - Dec 31 | 135,000 | | | 84,270 | - | I, M |
| | | | | | | | | | |
| Totals | | | | 732,900 | 712,900 | | 307,680 | 230,808 | |

Blank fields indicate no data/ no report

****B-Mining, C-Milling, D-Domestic, E-Fire Protection, G-Dust Control, H-Fish Culture, I-Irrigation, J-Industrial, K-Incidental Power, L-Heat Protection, M-Municipal, N-Frost Protection, P-Power, R-Recreational, S-Stockwatering, T-Snow Making, W-Fish and Wildlife Protection and/or Enhancement, Z-Other.

**Table B-11: Stream Water Quality, Salinas River below Spreckels to Potrero Road**
Note: Location above or below indicates multiple sampling locations

| Stream | Location | Analyte Name | No. Samples | Units | Mean | Min | Max |
|---|---|---|---|---|---|---|---|
| Salinas River | below Spreckels | Ammonia as N, Unionized | 37 | mg/L | 0.02 | 0.0007 | 0.13 |
| Salinas River | below Spreckels | Ammonia as NH3 | 38 | mg/L | 0.12 | 0.00 | 0.98 |
| Salinas River | below Spreckels | Chlorophyll a, water column | 36 | mg/L | 0.0033 | 0.0003 | 0.023 |
| Salinas River | below Spreckels | Chlorpyrifos | 32 | mg/L | 0.0011 | 0.00 | 0.029 |
| Salinas River | below Spreckels | Diazinon | 32 | mg/L | 0.008 | 0.00 | 0.22 |
| Salinas River | below Spreckels | Dissolved Solids, Total | 38 | mg/L | 369.60 | 230.00 | 610.00 |
| Salinas River | below Spreckels | Nitrate as N | 76 | mg/L | 5.08 | 0.002 | 78.00 |
| Salinas River | below Spreckels | OrthoPhosphate as P | 75 | mg/L | 0.23 | 0.0075 | 2.60 |
| Salinas River | below Spreckels | Oxygen, Dissolved | 37 | mg/L | 0.36 | 0.00 | 2.66 |
| Salinas River | below Spreckels | Turbidity | 58 | NTU | 118.66 | 1.40 | 2,584.00 |
| | | | | | | | |
| Salinas Lagoon | Salinas Lagoon | Ammonia as NH3 | 32 | mg/L | 0.05 | 0.00 | 0.52 |
| Salinas Lagoon | Salinas Lagoon | Chlorpyrifos | 28 | mg/L | 0.000064 | 0.00 | 0.00021 |
| Salinas Lagoon | Salinas Lagoon | Diazinon | 24 | mg/L | 0.000036 | 0.00 | 0.00020 |
| Salinas Lagoon | Salinas Lagoon | Nitrate as N | 32 | mg/L | 11.31 | 0.06 | 67.00 |
| Salinas Lagoon | Salinas Lagoon | OrthoPhosphate as P | 33 | mg/L | 0.31 | 0.00 | 1.09 |
| Salinas Lagoon | Salinas Lagoon | Turbidity | 18 | NTU | 29.77 | 3.76 | 76.70 |
| | | | | | | | |
| Old Salinas River | above Potrero Rd | Ammonia as N, Unionized | 96 | mg/L | 0.0075 | 0.0002 | 0.027 |
| Old Salinas River | above Potrero Rd | Ammonia as NH3 | 22 | mg/L | 0.24 | 0.00 | 1.17 |
| Old Salinas River | above Potrero Rd | Chloride | 109 | mg/L | 2,504.48 | 79.00 | 17,000.00 |
| Old Salinas River | above Potrero Rd | Chlorophyll a, water column | 134 | mg/L | 0.029 | 0.00045 | 0.24 |
| Old Salinas River | above Potrero Rd | Chlorpyrifos | 33 | mg/L | 0.00022 | 0.000044 | 0.0010 |
| Old Salinas River | above Potrero Rd | Coliform, Fecal | 106 | MPN/100 ml | 3,222.87 | 23.00 | 92,000.00 |
| Old Salinas River | above Potrero Rd | Coliform, Total | 106 | MPN/100 ml | 19,573.45 | 260.00 | 240,000.00 |
| Old Salinas River | above Potrero Rd | Diazinon | 31 | mg/L | 0.011 | 0.00 | 0.21 |
| Old Salinas River | above Potrero Rd | Dissolved Solids, Total | 116 | mg/L | 5,964.12 | 193.00 | 59,000.00 |
| Old Salinas River | above Potrero Rd | Nitrate as N | 138 | mg/L | 19.50 | 0.00 | 64.00 |
| Old Salinas River | above Potrero Rd | OrthoPhosphate as P | 138 | mg/L | 0.42 | 0.00 | 2.40 |
| Old Salinas River | above Potrero Rd | Oxygen, Dissolved | 138 | mg/L | 1.02 | 0.00 | 18.03 |
| Old Salinas River | above Potrero Rd | Suspended Solids, Total | 114 | mg/L | 113.33 | 5.00 | 578.00 |
| Old Salinas River | above Potrero Rd | Turbidity | 158 | NTU | 183.41 | 0.10 | 4,869.00 |

Highlighted cells exceed TMDL / standards. See table B-7.
Min value of 0.00 = Not Detected.

**Table B-12: Total Maximum Daily Loads**

| Analyte Name | Units | Standard | Reference |
|---|---|---|---|
| Ammonia as N, Unionized | mg/L | 0.025 | Board Order R3-2013-0008 |
| Ammonia as NH3 | mg/L | 0.025 | CCAMP Proposed |
| Chloride | mg/L | 150 | Basin Plan |
| Chlorophyll a, water column | mg/L | 0.015 | Board Order R3-2013-0008 |
| Chlorpyrifos | mg/L | CMC 0.00025<br>CCC 0.00015 | Board Decision 2011 |
| Coliform, Fecal | MPN/100 ml | 400 | Basin Plan, Water Body Contact |
| Coliform, Total | MPN/100 ml | 10,000 | US EPA |
| Diazinon | mg/L | CMC 0.00016<br>CCC 0.00010 | CC RWQCB Decision 2011 |
| Dissolved Solids, Total | mg/L | 1000 | CCAMP Proposed |
| Nitrate as N (all streams with MUN use) | mg/L | 10 | Board Order R3-2013-0008 |
| Nitrate as N (Salinas River) | mg/L | 1.4 (dry season)<br>8.0 (wet season) | Board Order R3-2013-0008 |
| Nitrate as N (Rec. Ditch, Tembladero, Blanco Drain, Alisal Slough, Espinosa Slough, Merritt Ditch, Santa Rita Creek) | mg/L | 6.4 (dry season)<br>8.0 (wet season) | Board Order R3-2013-0008 |
| Nitrate as N (OSR) | mg/L | 3.1 (dry season)<br>8.0 (wet season) | Board Order R3-2013-0008 |
| OrthoPhosphate as P (Salinas River) | mg/L | 0.07 (dry season)<br>0.30 (wet season) | Board Order R3-2013-0008 |
| Orthophosphate as P (Rec. Ditch, Tembladero, Blanco Drain, Alisal Slough, Espinosa Slough, Merritt Ditch, Santa Rita Creek) | mg/L | 0.13 (dry season)<br>0.30 (wet season) | Board Order R3-2013-0008 |
| Oxygen, Dissolved | mg/L | >7.0 and <13.0 (Cold)<br>>5.0 and <13.0 (Warm) | Board Order R3-2013-0008 |
| Suspended Solids, Total | mg/L | 500 | CCAMP Proposed |
| Turbidity | NTU | 10 | CCAMP Proposed |

CMC = Criterion Maximum Concentration (1-hr average)
CCC = Criterion Continuous Concentration (96-hour average)
Order R3-2013-0008: Lower Salinas River Watershed Nutrient TMDL
Seasonal targets for nitrate and orthophosphate

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## Appendix C: Analysis Statistical Outputs

Salinas River below SIWTF, Estimated Number of Days at or above Target Flows

Salinas River below SIWTF, Percentile Flows by Month

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**Groundwater Recharge Project**

**Estimated No. Days with Flow of 72 cfs or Higher, Salinas River below SRDF, Current Condition**

| Water Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1932 | 0 | 0 | 7 | 31 | 29 | 31 | 13 | 0 | 0 | 0 | 0 | 0 | 111 |
| 1933 | 0 | 0 | 0 | 4 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| 1934 | 0 | 0 | 0 | 14 | 7 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 46 |
| 1935 | 0 | 0 | 0 | 24 | 16 | 24 | 30 | 21 | 0 | 0 | 0 | 0 | 115 |
| 1936 | 0 | 0 | 0 | 4 | 26 | 31 | 30 | 9 | 0 | 0 | 0 | 0 | 100 |
| 1937 | 0 | 0 | 0 | 10 | 28 | 31 | 30 | 26 | 0 | 0 | 0 | 0 | 125 |
| 1938 | 0 | 0 | 21 | 15 | 28 | 31 | 30 | 31 | 9 | 0 | 0 | 0 | 165 |
| 1939 | 0 | 0 | 0 | 0 | 0 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 19 |
| 1940 | 0 | 0 | 0 | 21 | 29 | 31 | 30 | 16 | 0 | 0 | 0 | 0 | 127 |
| 1941 | 0 | 0 | 8 | 31 | 28 | 31 | 30 | 31 | 30 | 7 | 0 | 0 | 196 |
| 1942 | 0 | 0 | 16 | 31 | 28 | 31 | 30 | 31 | 13 | 0 | 0 | 0 | 180 |
| 1943 | 0 | 0 | 5 | 29 | 28 | 31 | 30 | 26 | 0 | 0 | 0 | 0 | 149 |
| 1944 | 0 | 0 | 0 | 0 | 24 | 31 | 30 | 10 | 0 | 0 | 0 | 0 | 95 |
| 1945 | 0 | 0 | 0 | 0 | 27 | 31 | 30 | 4 | 0 | 0 | 0 | 0 | 92 |
| 1946 | 0 | 0 | 10 | 31 | 28 | 10 | 24 | 0 | 0 | 0 | 0 | 0 | 103 |
| 1947 | 0 | 1 | 0 | 0 | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 1948 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1949 | 0 | 0 | 0 | 0 | 0 | 28 | 1 | 0 | 0 | 0 | 0 | 0 | 29 |
| 1950 | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| 1951 | 0 | 5 | 15 | 12 | 9 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 52 |
| 1952 | 0 | 0 | 2 | 31 | 29 | 31 | 30 | 11 | 0 | 0 | 0 | 0 | 134 |
| 1953 | 0 | 0 | 8 | 31 | 18 | 8 | 0 | 3 | 0 | 0 | 0 | 0 | 68 |
| 1954 | 0 | 0 | 0 | 0 | 12 | 12 | 19 | 0 | 0 | 0 | 0 | 0 | 43 |
| 1955 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1956 | 0 | 0 | 9 | 31 | 29 | 31 | 4 | 0 | 0 | 0 | 0 | 0 | 104 |
| 1957 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1958 | 0 | 0 | 0 | 0 | 25 | 31 | 30 | 31 | 0 | 26 | 31 | 30 | 204 |
| 1959 | 13 | 1 | 0 | 11 | 19 | 30 | 0 | 6 | 0 | 0 | 0 | 1 | 81 |
| 1960 | 0 | 0 | 0 | 0 | 26 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 35 |
| 1961 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1962 | 0 | 0 | 0 | 0 | 19 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 48 |
| 1963 | 0 | 0 | 0 | 1 | 28 | 31 | 30 | 19 | 0 | 0 | 0 | 0 | 109 |
| 1964 | 0 | 10 | 0 | 10 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 38 |
| 1965 | 0 | 0 | 3 | 31 | 18 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 69 |
| 1966 | 0 | 14 | 4 | 27 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 70 |
| 1967 | 0 | 0 | 26 | 31 | 28 | 31 | 30 | 31 | 30 | 29 | 31 | 27 | 294 |
| 1968 | 0 | 17 | 13 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 32 |
| 1969 | 0 | 0 | 0 | 14 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 256 |
| 1970 | 31 | 30 | 15 | 22 | 26 | 31 | 4 | 0 | 0 | 0 | 0 | 0 | 159 |
| 1971 | 0 | 1 | 17 | 31 | 10 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 66 |
| 1972 | 0 | 0 | 5 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 8 |
| 1973 | 0 | 7 | 0 | 15 | 28 | 31 | 30 | 11 | 0 | 0 | 0 | 0 | 122 |
| 1974 | 16 | 9 | 24 | 29 | 28 | 31 | 30 | 9 | 0 | 0 | 0 | 15 | 191 |
| 1975 | 31 | 18 | 28 | 25 | 28 | 31 | 30 | 7 | 0 | 0 | 0 | 17 | 215 |
| 1976 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 1977 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1978 | 0 | 0 | 13 | 31 | 28 | 31 | 30 | 20 | 0 | 0 | 0 | 22 | 175 |
| 1979 | 0 | 0 | 0 | 10 | 17 | 31 | 20 | 0 | 0 | 0 | 0 | 0 | 78 |
| 1980 | 0 | 0 | 6 | 26 | 29 | 31 | 30 | 13 | 0 | 0 | 0 | 10 | 145 |
| 1981 | 0 | 0 | 0 | 4 | 28 | 26 | 15 | 0 | 0 | 0 | 0 | 0 | 73 |
| 1982 | 0 | 4 | 0 | 27 | 28 | 31 | 30 | 31 | 19 | 0 | 4 | 30 | 204 |
| 1983 | 31 | 30 | 31 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |
| 1984 | 15 | 15 | 31 | 31 | 29 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 143 |
| 1985 | 3 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 1986 | 6 | 2 | 3 | 0 | 19 | 31 | 30 | 11 | 0 | 0 | 0 | 0 | 102 |
| 1987 | 0 | 0 | 12 | 13 | 14 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 48 |
| 1988 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 1989 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 1992 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 1993 | 0 | 0 | 0 | 23 | 28 | 31 | 23 | 0 | 0 | 0 | 0 | 0 | 105 |
| 1994 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 1995 | 0 | 0 | 0 | 26 | 28 | 31 | 30 | 28 | 0 | 0 | 0 | 0 | 143 |
| 1996 | 5 | 25 | 2 | 2 | 29 | 31 | 21 | 0 | 0 | 0 | 0 | 0 | 115 |
| 1997 | 0 | 7 | 21 | 31 | 28 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 99 |
| 1998 | 0 | 0 | 0 | 21 | 28 | 31 | 30 | 31 | 30 | 31 | 6 | 0 | 208 |
| 1999 | 0 | 19 | 31 | 31 | 28 | 27 | 24 | 0 | 6 | 0 | 0 | 0 | 166 |
| 2000 | 0 | 4 | 9 | 11 | 21 | 31 | 17 | 3 | 0 | 0 | 0 | 0 | 96 |
| 2001 | 0 | 0 | 0 | 9 | 16 | 31 | 18 | 0 | 0 | 0 | 0 | 0 | 74 |
| 2002 | 0 | 0 | 15 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 |
| 2003 | 0 | 0 | 14 | 21 | 0 | 5 | 0 | 16 | 0 | 0 | 0 | 0 | 56 |
| 2004 | 0 | 0 | 9 | 5 | 9 | 14 | 0 | 0 | 0 | 0 | 9 | 0 | 46 |
| 2005 | 0 | 0 | 0 | 31 | 28 | 31 | 30 | 28 | 0 | 2 | 0 | 0 | 150 |
| 2006 | 0 | 5 | 4 | 31 | 20 | 31 | 30 | 31 | 16 | 0 | 0 | 0 | 168 |
| 2007 | 0 | 3 | 2 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 |
| 2008 | 0 | 0 | 0 | 12 | 29 | 31 | 5 | 0 | 0 | 0 | 0 | 0 | 77 |
| 2009 | 0 | 0 | 0 | 0 | 3 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 2010 | 1 | 0 | 7 | 13 | 28 | 31 | 30 | 16 | 0 | 0 | 0 | 0 | 126 |
| 2011 | 0 | 0 | 10 | 31 | 28 | 31 | 30 | 31 | 28 | 18 | 13 | 0 | 220 |
| 2012 | 0 | 0 | 0 | 2 | 0 | 0 | 27 | 1 | 0 | 0 | 0 | 0 | 30 |
| 2013 | 0 | 1 | 11 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 20 |
| **Average** | 2 | 3 | 6 | 14 | 17 | 18 | 14 | 8 | 3 | 2 | 2 | 3 | 91 |
| **Median** | 0 | 0 | 0 | 11 | 19 | 26 | 5 | 0 | 0 | 0 | 0 | 0 | 77 |
| **Minimum** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Maximum** | 31 | 30 | 31 | 31 | 29 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |

Data from USGS Gage 11152500

Estimate based on gaged flow plus estimated inflows from SIWTF, Salinas Stormwater and Blanco Drain

**Total: 7428**

Reflects recorded diversions at the SRDF

**Groundwater Recharge Project**
**Estimated No. Days with Flow of 60 cfs or Higher, Salinas River below SRDF, Current Condition**

| Water Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1932 | 0 | 0 | 7 | 31 | 29 | 31 | 15 | 0 | 0 | 0 | 0 | 0 | 113 |
| 1933 | 0 | 0 | 0 | 4 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 1934 | 0 | 0 | 0 | 15 | 7 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 49 |
| 1935 | 0 | 0 | 0 | 24 | 18 | 24 | 30 | 23 | 0 | 0 | 0 | 0 | 119 |
| 1936 | 0 | 0 | 0 | 4 | 26 | 31 | 30 | 10 | 0 | 0 | 0 | 0 | 101 |
| 1937 | 0 | 0 | 0 | 13 | 28 | 31 | 30 | 28 | 0 | 0 | 0 | 0 | 130 |
| 1938 | 0 | 0 | 21 | 16 | 28 | 31 | 30 | 31 | 12 | 0 | 0 | 0 | 169 |
| 1939 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 20 |
| 1940 | 0 | 0 | 0 | 22 | 29 | 31 | 30 | 19 | 0 | 0 | 0 | 0 | 131 |
| 1941 | 0 | 0 | 8 | 31 | 28 | 31 | 30 | 31 | 30 | 11 | 0 | 0 | 200 |
| 1942 | 0 | 0 | 16 | 31 | 28 | 31 | 30 | 31 | 16 | 0 | 0 | 0 | 183 |
| 1943 | 0 | 0 | 5 | 31 | 28 | 31 | 30 | 29 | 0 | 0 | 0 | 0 | 154 |
| 1944 | 0 | 0 | 0 | 0 | 24 | 31 | 30 | 12 | 0 | 0 | 0 | 0 | 97 |
| 1945 | 0 | 0 | 0 | 0 | 27 | 31 | 30 | 5 | 0 | 0 | 0 | 0 | 93 |
| 1946 | 0 | 0 | 10 | 31 | 28 | 12 | 25 | 0 | 0 | 0 | 0 | 0 | 106 |
| 1947 | 0 | 2 | 0 | 0 | 7 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 1948 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1949 | 0 | 0 | 0 | 0 | 0 | 28 | 2 | 0 | 0 | 0 | 0 | 0 | 30 |
| 1950 | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 1951 | 0 | 7 | 16 | 12 | 10 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 56 |
| 1952 | 0 | 0 | 2 | 31 | 29 | 31 | 30 | 14 | 0 | 0 | 0 | 0 | 137 |
| 1953 | 0 | 0 | 8 | 31 | 20 | 9 | 0 | 3 | 0 | 0 | 0 | 0 | 71 |
| 1954 | 0 | 0 | 0 | 0 | 13 | 12 | 19 | 0 | 0 | 0 | 0 | 0 | 44 |
| 1955 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1956 | 0 | 0 | 9 | 31 | 29 | 31 | 6 | 1 | 0 | 0 | 0 | 0 | 107 |
| 1957 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1958 | 0 | 0 | 0 | 0 | 25 | 31 | 30 | 31 | 2 | 26 | 31 | 30 | 206 |
| 1959 | 28 | 2 | 0 | 17 | 19 | 31 | 2 | 8 | 0 | 0 | 0 | 2 | 109 |
| 1960 | 0 | 0 | 0 | 0 | 26 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 38 |
| 1961 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1962 | 0 | 0 | 0 | 0 | 19 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 48 |
| 1963 | 0 | 0 | 0 | 1 | 28 | 31 | 30 | 20 | 0 | 0 | 0 | 0 | 110 |
| 1964 | 0 | 10 | 6 | 11 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 46 |
| 1965 | 0 | 0 | 3 | 31 | 20 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 72 |
| 1966 | 0 | 14 | 5 | 31 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 78 |
| 1967 | 0 | 0 | 26 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 29 | 298 |
| 1968 | 1 | 19 | 14 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 38 |
| 1969 | 0 | 0 | 0 | 15 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 257 |
| 1970 | 31 | 30 | 20 | 22 | 28 | 31 | 6 | 0 | 0 | 0 | 0 | 0 | 168 |
| 1971 | 3 | 1 | 17 | 31 | 14 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 74 |
| 1972 | 0 | 0 | 5 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 9 |
| 1973 | 2 | 10 | 0 | 15 | 28 | 31 | 30 | 12 | 0 | 0 | 0 | 0 | 128 |
| 1974 | 23 | 17 | 27 | 29 | 28 | 31 | 30 | 11 | 0 | 0 | 0 | 21 | 217 |
| 1975 | 31 | 22 | 28 | 31 | 28 | 31 | 30 | 8 | 0 | 0 | 0 | 19 | 228 |
| 1976 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 1977 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1978 | 0 | 0 | 14 | 31 | 28 | 31 | 30 | 21 | 0 | 0 | 0 | 26 | 181 |
| 1979 | 0 | 0 | 1 | 12 | 20 | 31 | 20 | 0 | 0 | 0 | 0 | 0 | 84 |
| 1980 | 0 | 0 | 6 | 27 | 29 | 31 | 30 | 14 | 0 | 0 | 5 | 12 | 154 |
| 1981 | 0 | 0 | 0 | 4 | 28 | 27 | 16 | 0 | 0 | 0 | 0 | 0 | 75 |
| 1982 | 0 | 6 | 0 | 27 | 28 | 31 | 30 | 31 | 22 | 0 | 7 | 30 | 212 |
| 1983 | 31 | 30 | 31 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |
| 1984 | 19 | 18 | 31 | 31 | 29 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 152 |
| 1985 | 3 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 1986 | 6 | 3 | 5 | 0 | 19 | 31 | 30 | 13 | 0 | 0 | 0 | 0 | 107 |
| 1987 | 0 | 3 | 17 | 19 | 15 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 65 |
| 1988 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 1989 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 1992 | 0 | 0 | 0 | 0 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| 1993 | 0 | 0 | 0 | 23 | 28 | 31 | 24 | 0 | 0 | 0 | 0 | 0 | 106 |
| 1994 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 1995 | 0 | 0 | 0 | 26 | 28 | 31 | 30 | 30 | 0 | 0 | 0 | 0 | 145 |
| 1996 | 13 | 28 | 4 | 3 | 29 | 31 | 22 | 0 | 0 | 0 | 0 | 0 | 130 |
| 1997 | 1 | 8 | 21 | 31 | 28 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 101 |
| 1998 | 0 | 0 | 0 | 21 | 28 | 31 | 30 | 31 | 30 | 31 | 7 | 0 | 209 |
| 1999 | 0 | 19 | 31 | 31 | 28 | 31 | 25 | 0 | 9 | 0 | 0 | 0 | 174 |
| 2000 | 0 | 4 | 10 | 12 | 22 | 31 | 20 | 5 | 0 | 0 | 0 | 3 | 107 |
| 2001 | 0 | 0 | 0 | 10 | 16 | 31 | 21 | 0 | 0 | 0 | 0 | 0 | 78 |
| 2002 | 0 | 0 | 20 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 |
| 2003 | 0 | 0 | 14 | 22 | 0 | 6 | 0 | 18 | 0 | 0 | 0 | 0 | 60 |
| 2004 | 0 | 0 | 10 | 5 | 10 | 15 | 0 | 0 | 0 | 0 | 15 | 0 | 55 |
| 2005 | 0 | 0 | 0 | 31 | 28 | 31 | 30 | 30 | 1 | 3 | 0 | 0 | 154 |
| 2006 | 0 | 10 | 5 | 31 | 24 | 31 | 30 | 31 | 17 | 0 | 0 | 0 | 179 |
| 2007 | 0 | 4 | 3 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 |
| 2008 | 0 | 0 | 0 | 13 | 29 | 31 | 6 | 0 | 0 | 0 | 0 | 0 | 79 |
| 2009 | 0 | 0 | 0 | 0 | 5 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| 2010 | 1 | 0 | 9 | 13 | 28 | 31 | 30 | 18 | 6 | 0 | 0 | 0 | 136 |
| 2011 | 0 | 0 | 10 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 15 | 0 | 237 |
| 2012 | 0 | 0 | 0 | 3 | 0 | 0 | 30 | 10 | 0 | 0 | 0 | 0 | 43 |
| 2013 | 0 | 1 | 13 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 |
| **Average** | 2 | 3 | 6 | 14 | 17 | 19 | 14 | 9 | 3 | 2 | 2 | 3 | 95 |
| **Median** | 0 | 0 | 0 | 13 | 20 | 27 | 6 | 0 | 0 | 0 | 0 | 0 | 79 |
| **Minimum** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Maximum** | 31 | 30 | 31 | 31 | 29 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |

Data from USGS Gage 11152500
Estimate based on gaged flow plus estimated inflows from SIWTF, Salinas Stormwater and Blanco Drain

**Total: 7814**

Reflects recorded diversions at the SRDF

**Groundwater Recharge Project**

**Estimated No. Days with Flow of 56 cfs or Higher, Salinas River below SRDF, Current Condition**

| Water Year | *Oct* | *Nov* | *Dec* | *Jan* | *Feb* | *Mar* | *Apr* | *May* | *Jun* | *Jul* | *Aug* | *Sep* | *Total* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *1932* | 0 | 0 | 7 | 31 | 29 | 31 | 15 | 0 | 0 | 0 | 0 | 0 | 113 |
| *1933* | 0 | 0 | 0 | 4 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| *1934* | 0 | 0 | 0 | 15 | 7 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 49 |
| *1935* | 0 | 0 | 0 | 24 | 19 | 25 | 30 | 24 | 0 | 0 | 0 | 0 | 122 |
| *1936* | 0 | 0 | 0 | 4 | 26 | 31 | 30 | 11 | 0 | 0 | 0 | 0 | 102 |
| *1937* | 0 | 0 | 0 | 13 | 28 | 31 | 30 | 28 | 0 | 0 | 0 | 0 | 130 |
| *1938* | 0 | 0 | 21 | 17 | 28 | 31 | 30 | 31 | 13 | 0 | 0 | 0 | 171 |
| *1939* | 0 | 0 | 0 | 0 | 0 | 20 | 5 | 0 | 0 | 0 | 0 | 0 | 25 |
| *1940* | 0 | 0 | 0 | 22 | 29 | 31 | 30 | 20 | 0 | 0 | 0 | 0 | 132 |
| *1941* | 0 | 0 | 8 | 31 | 28 | 31 | 30 | 31 | 30 | 12 | 0 | 0 | 201 |
| *1942* | 0 | 0 | 16 | 31 | 28 | 31 | 30 | 31 | 17 | 0 | 0 | 0 | 184 |
| *1943* | 0 | 0 | 5 | 31 | 28 | 31 | 30 | 29 | 0 | 0 | 0 | 0 | 154 |
| *1944* | 0 | 0 | 0 | 0 | 24 | 31 | 30 | 12 | 0 | 0 | 0 | 0 | 97 |
| *1945* | 0 | 0 | 0 | 0 | 27 | 31 | 30 | 5 | 0 | 0 | 0 | 0 | 93 |
| *1946* | 0 | 0 | 10 | 31 | 28 | 13 | 25 | 0 | 0 | 0 | 0 | 0 | 107 |
| *1947* | 0 | 2 | 0 | 0 | 8 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| *1948* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1949* | 0 | 0 | 0 | 0 | 0 | 28 | 2 | 0 | 0 | 0 | 0 | 0 | 30 |
| *1950* | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| *1951* | 0 | 7 | 16 | 12 | 11 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 57 |
| *1952* | 0 | 0 | 2 | 31 | 29 | 31 | 30 | 14 | 0 | 0 | 0 | 0 | 137 |
| *1953* | 0 | 0 | 8 | 31 | 20 | 10 | 0 | 3 | 0 | 0 | 0 | 0 | 72 |
| *1954* | 0 | 0 | 0 | 0 | 13 | 12 | 20 | 0 | 0 | 0 | 0 | 0 | 45 |
| *1955* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1956* | 0 | 0 | 9 | 31 | 29 | 31 | 7 | 2 | 0 | 0 | 0 | 0 | 109 |
| *1957* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1958* | 0 | 0 | 0 | 0 | 25 | 31 | 30 | 31 | 4 | 26 | 31 | 30 | 208 |
| *1959* | 30 | 2 | 0 | 25 | 28 | 31 | 3 | 8 | 0 | 0 | 0 | 2 | 129 |
| *1960* | 0 | 0 | 0 | 0 | 27 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 41 |
| *1961* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1962* | 0 | 0 | 0 | 0 | 19 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 49 |
| *1963* | 0 | 0 | 0 | 1 | 28 | 31 | 30 | 21 | 0 | 0 | 0 | 0 | 111 |
| *1964* | 0 | 10 | 14 | 11 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 54 |
| *1965* | 0 | 0 | 3 | 31 | 20 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 72 |
| *1966* | 0 | 15 | 5 | 31 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 79 |
| *1967* | 0 | 0 | 26 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 29 | 298 |
| *1968* | 1 | 20 | 14 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 39 |
| *1969* | 0 | 0 | 0 | 15 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 257 |
| *1970* | 31 | 30 | 22 | 23 | 28 | 31 | 6 | 0 | 0 | 0 | 0 | 0 | 171 |
| *1971* | 4 | 2 | 18 | 31 | 15 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 78 |
| *1972* | 0 | 0 | 5 | 1 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 11 |
| *1973* | 3 | 11 | 0 | 15 | 28 | 31 | 30 | 13 | 0 | 0 | 0 | 0 | 131 |
| *1974* | 24 | 21 | 28 | 29 | 28 | 31 | 30 | 12 | 0 | 0 | 0 | 25 | 228 |
| *1975* | 31 | 24 | 29 | 31 | 28 | 31 | 30 | 9 | 0 | 0 | 0 | 20 | 233 |
| *1976* | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| *1977* | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *1978* | 0 | 0 | 14 | 31 | 28 | 31 | 30 | 21 | 0 | 0 | 0 | 26 | 181 |
| *1979* | 0 | 1 | 4 | 13 | 20 | 31 | 21 | 0 | 0 | 0 | 0 | 0 | 90 |
| *1980* | 0 | 0 | 6 | 27 | 29 | 31 | 30 | 14 | 0 | 0 | 6 | 12 | 155 |
| *1981* | 0 | 0 | 0 | 4 | 28 | 28 | 17 | 0 | 0 | 0 | 0 | 0 | 77 |
| *1982* | 0 | 6 | 0 | 27 | 28 | 31 | 30 | 31 | 24 | 0 | 7 | 30 | 214 |
| *1983* | 31 | 30 | 31 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |
| *1984* | 20 | 18 | 31 | 31 | 29 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 154 |
| *1985* | 4 | 1 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| *1986* | 6 | 3 | 5 | 0 | 19 | 31 | 30 | 14 | 0 | 0 | 0 | 0 | 108 |
| *1987* | 0 | 4 | 19 | 23 | 16 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 75 |
| *1988* | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| *1989* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1990* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1991* | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| *1992* | 0 | 0 | 0 | 0 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| *1993* | 0 | 0 | 0 | 23 | 28 | 31 | 24 | 0 | 0 | 0 | 0 | 0 | 106 |
| *1994* | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| *1995* | 0 | 0 | 0 | 26 | 28 | 31 | 30 | 30 | 0 | 0 | 0 | 0 | 145 |
| *1996* | 14 | 28 | 4 | 3 | 29 | 31 | 23 | 0 | 0 | 0 | 0 | 0 | 132 |
| *1997* | 1 | 8 | 22 | 31 | 28 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 102 |
| *1998* | 0 | 0 | 0 | 22 | 28 | 31 | 30 | 31 | 30 | 31 | 7 | 1 | 211 |
| *1999* | 0 | 19 | 31 | 31 | 28 | 31 | 25 | 0 | 9 | 0 | 0 | 0 | 174 |
| *2000* | 0 | 4 | 10 | 12 | 22 | 31 | 22 | 8 | 0 | 0 | 0 | 5 | 114 |
| *2001* | 0 | 0 | 0 | 10 | 16 | 31 | 21 | 0 | 0 | 0 | 0 | 0 | 78 |
| *2002* | 0 | 0 | 21 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 |
| *2003* | 0 | 0 | 14 | 23 | 0 | 8 | 0 | 19 | 0 | 0 | 0 | 0 | 64 |
| *2004* | 0 | 0 | 11 | 5 | 11 | 15 | 0 | 0 | 0 | 1 | 15 | 0 | 58 |
| *2005* | 0 | 0 | 0 | 31 | 28 | 31 | 30 | 31 | 2 | 6 | 0 | 0 | 159 |
| *2006* | 0 | 10 | 6 | 31 | 26 | 31 | 30 | 31 | 17 | 0 | 0 | 0 | 182 |
| *2007* | 0 | 4 | 3 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 |
| *2008* | 0 | 0 | 2 | 14 | 29 | 31 | 7 | 0 | 0 | 0 | 0 | 0 | 83 |
| *2009* | 0 | 0 | 0 | 0 | 5 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| *2010* | 1 | 0 | 10 | 13 | 28 | 31 | 30 | 18 | 9 | 1 | 0 | 0 | 141 |
| *2011* | 0 | 0 | 10 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 15 | 0 | 237 |
| *2012* | 6 | 0 | 0 | 3 | 0 | 1 | 30 | 13 | 0 | 0 | 0 | 2 | 55 |
| *2013* | 3 | 1 | 13 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 |
| **Average** | 3 | 3 | 7 | 14 | 18 | 19 | 14 | 9 | 3 | 2 | 2 | 3 | 97 |
| **Median** | 0 | 0 | 0 | 13 | 22 | 28 | 7 | 0 | 0 | 0 | 0 | 0 | 83 |
| **Minimum** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Maximum** | 31 | 30 | 31 | 31 | 29 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |

Data from USGS Gage 11152500

Estimate based on gaged flow plus estimated inflows from SIWTF, Salinas Stormwater and Blanco Drain

**Total: 7984**

Reflects recorded diversions at the SRDF

**Groundwater Recharge Project**

**Estimated No. Days with Flow of 50 cfs or Higher, Salinas River below SRDF, Current Condition**

| Water Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1932 | 0 | 0 | 7 | 31 | 29 | 31 | 16 | 0 | 0 | 0 | 0 | 0 | 114 |
| 1933 | 0 | 0 | 0 | 4 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 |
| 1934 | 0 | 0 | 0 | 16 | 7 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 51 |
| 1935 | 0 | 0 | 0 | 24 | 21 | 25 | 30 | 25 | 0 | 0 | 0 | 0 | 125 |
| 1936 | 0 | 0 | 0 | 4 | 26 | 31 | 30 | 12 | 0 | 0 | 0 | 0 | 103 |
| 1937 | 0 | 0 | 0 | 14 | 28 | 31 | 30 | 29 | 0 | 0 | 0 | 0 | 132 |
| 1938 | 0 | 0 | 21 | 18 | 28 | 31 | 30 | 31 | 14 | 0 | 0 | 0 | 173 |
| 1939 | 0 | 0 | 0 | 0 | 0 | 20 | 5 | 0 | 0 | 0 | 0 | 0 | 25 |
| 1940 | 0 | 0 | 0 | 22 | 29 | 31 | 30 | 22 | 0 | 0 | 0 | 0 | 134 |
| 1941 | 0 | 0 | 8 | 31 | 28 | 31 | 30 | 31 | 30 | 14 | 0 | 0 | 203 |
| 1942 | 0 | 0 | 16 | 31 | 28 | 31 | 30 | 31 | 18 | 0 | 0 | 0 | 185 |
| 1943 | 0 | 0 | 5 | 31 | 28 | 31 | 30 | 31 | 1 | 0 | 0 | 0 | 157 |
| 1944 | 0 | 0 | 0 | 0 | 24 | 31 | 30 | 16 | 0 | 0 | 0 | 0 | 101 |
| 1945 | 0 | 0 | 0 | 0 | 27 | 31 | 30 | 6 | 0 | 0 | 0 | 0 | 94 |
| 1946 | 0 | 0 | 10 | 31 | 28 | 15 | 26 | 0 | 0 | 0 | 0 | 0 | 110 |
| 1947 | 0 | 2 | 0 | 0 | 9 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 15 |
| 1948 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1949 | 0 | 0 | 0 | 0 | 0 | 28 | 2 | 0 | 0 | 0 | 0 | 0 | 30 |
| 1950 | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 1951 | 0 | 7 | 16 | 12 | 12 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 59 |
| 1952 | 0 | 0 | 3 | 31 | 29 | 31 | 30 | 14 | 0 | 0 | 0 | 0 | 138 |
| 1953 | 0 | 0 | 9 | 31 | 21 | 10 | 0 | 4 | 0 | 0 | 0 | 0 | 75 |
| 1954 | 0 | 0 | 0 | 0 | 13 | 12 | 20 | 0 | 0 | 0 | 0 | 0 | 45 |
| 1955 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1956 | 0 | 0 | 9 | 31 | 29 | 31 | 9 | 2 | 0 | 0 | 0 | 0 | 111 |
| 1957 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1958 | 0 | 0 | 0 | 0 | 25 | 31 | 30 | 31 | 5 | 27 | 31 | 30 | 210 |
| 1959 | 30 | 2 | 0 | 26 | 28 | 31 | 4 | 13 | 0 | 0 | 0 | 3 | 137 |
| 1960 | 0 | 0 | 0 | 0 | 27 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 42 |
| 1961 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1962 | 0 | 0 | 0 | 0 | 19 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 49 |
| 1963 | 0 | 0 | 0 | 1 | 28 | 31 | 30 | 21 | 0 | 0 | 0 | 0 | 111 |
| 1964 | 0 | 12 | 31 | 13 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 76 |
| 1965 | 0 | 0 | 3 | 31 | 21 | 0 | 19 | 0 | 0 | 0 | 0 | 0 | 74 |
| 1966 | 0 | 16 | 6 | 31 | 28 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 84 |
| 1967 | 0 | 0 | 26 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 299 |
| 1968 | 4 | 21 | 17 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 47 |
| 1969 | 0 | 0 | 0 | 15 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 257 |
| 1970 | 31 | 30 | 25 | 24 | 28 | 31 | 7 | 0 | 0 | 0 | 0 | 0 | 176 |
| 1971 | 6 | 2 | 18 | 31 | 19 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 85 |
| 1972 | 0 | 0 | 5 | 1 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 12 |
| 1973 | 4 | 12 | 0 | 15 | 28 | 31 | 30 | 16 | 0 | 0 | 0 | 0 | 136 |
| 1974 | 25 | 30 | 31 | 29 | 28 | 31 | 30 | 14 | 0 | 0 | 0 | 27 | 245 |
| 1975 | 31 | 27 | 29 | 31 | 28 | 31 | 30 | 10 | 0 | 0 | 0 | 21 | 238 |
| 1976 | 11 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 |
| 1977 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1978 | 0 | 0 | 14 | 31 | 28 | 31 | 30 | 22 | 0 | 0 | 0 | 26 | 182 |
| 1979 | 0 | 2 | 7 | 13 | 21 | 31 | 21 | 0 | 0 | 0 | 0 | 0 | 95 |
| 1980 | 0 | 0 | 6 | 27 | 29 | 31 | 30 | 15 | 0 | 0 | 6 | 12 | 156 |
| 1981 | 0 | 0 | 0 | 4 | 28 | 29 | 18 | 0 | 0 | 0 | 0 | 0 | 79 |
| 1982 | 0 | 8 | 0 | 27 | 28 | 31 | 30 | 31 | 24 | 0 | 8 | 30 | 217 |
| 1983 | 31 | 30 | 31 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |
| 1984 | 21 | 18 | 31 | 31 | 29 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 156 |
| 1985 | 5 | 1 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 1986 | 6 | 3 | 5 | 1 | 20 | 31 | 30 | 15 | 0 | 1 | 0 | 0 | 112 |
| 1987 | 0 | 5 | 20 | 31 | 20 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 90 |
| 1988 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 1989 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 1992 | 0 | 0 | 0 | 0 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 1993 | 0 | 0 | 0 | 23 | 28 | 31 | 25 | 0 | 0 | 0 | 0 | 0 | 107 |
| 1994 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| 1995 | 0 | 0 | 0 | 26 | 28 | 31 | 30 | 31 | 0 | 2 | 0 | 0 | 148 |
| 1996 | 15 | 29 | 6 | 3 | 29 | 31 | 23 | 0 | 1 | 0 | 0 | 0 | 137 |
| 1997 | 1 | 8 | 22 | 31 | 28 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 103 |
| 1998 | 0 | 0 | 0 | 22 | 28 | 31 | 30 | 31 | 30 | 31 | 8 | 2 | 213 |
| 1999 | 0 | 19 | 31 | 31 | 28 | 31 | 25 | 0 | 9 | 0 | 0 | 1 | 175 |
| 2000 | 0 | 4 | 11 | 13 | 23 | 31 | 23 | 9 | 0 | 0 | 1 | 6 | 121 |
| 2001 | 0 | 0 | 0 | 13 | 16 | 31 | 22 | 5 | 0 | 0 | 0 | 0 | 87 |
| 2002 | 0 | 0 | 23 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 39 |
| 2003 | 0 | 0 | 14 | 23 | 0 | 8 | 0 | 20 | 0 | 0 | 0 | 0 | 65 |
| 2004 | 0 | 0 | 12 | 5 | 12 | 16 | 0 | 2 | 0 | 4 | 19 | 0 | 70 |
| 2005 | 0 | 0 | 0 | 31 | 28 | 31 | 30 | 31 | 3 | 8 | 0 | 0 | 162 |
| 2006 | 0 | 10 | 6 | 31 | 28 | 31 | 30 | 31 | 18 | 0 | 2 | 0 | 187 |
| 2007 | 0 | 4 | 3 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 |
| 2008 | 0 | 0 | 3 | 15 | 29 | 31 | 8 | 0 | 0 | 0 | 0 | 0 | 86 |
| 2009 | 0 | 0 | 0 | 0 | 5 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 17 |
| 2010 | 1 | 0 | 11 | 13 | 28 | 31 | 30 | 19 | 11 | 2 | 0 | 0 | 146 |
| 2011 | 0 | 0 | 10 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 15 | 0 | 237 |
| 2012 | 11 | 2 | 0 | 3 | 0 | 1 | 30 | 17 | 0 | 0 | 0 | 3 | 67 |
| 2013 | 10 | 1 | 13 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 |
| **Average** | 3 | 4 | 7 | 15 | 18 | 19 | 14 | 9 | 3 | 3 | 2 | 3 | 101 |
| **Median** | 0 | 0 | 0 | 13 | 23 | 28 | 9 | 0 | 0 | 0 | 0 | 0 | 90 |
| **Minimum** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Maximum** | 31 | 30 | 31 | 31 | 29 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |

Data from USGS Gage 11152500

Estimate based on gaged flow plus estimated inflows from SIWTF, Salinas Stormwater and Blanco Drain

**Total: 8252**

Reflects recorded diversions at the SRDF

**Groundwater Recharge Project**

**Estimated No. Days with Flow of 72 cfs or Higher, Salinas River below SRDF, Diverting Ag Wash Water and Stormwater**

| Water Year | *Oct* | *Nov* | *Dec* | *Jan* | *Feb* | *Mar* | *Apr* | *May* | *Jun* | *Jul* | *Aug* | *Sep* | *Total* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *1932* | 0 | 0 | 7 | 31 | 29 | 31 | 13 | 0 | 0 | 0 | 0 | 0 | 111 |
| *1933* | 0 | 0 | 0 | 4 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| *1934* | 0 | 0 | 0 | 14 | 7 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 46 |
| *1935* | 0 | 0 | 0 | 24 | 15 | 24 | 30 | 21 | 0 | 0 | 0 | 0 | 114 |
| *1936* | 0 | 0 | 0 | 4 | 26 | 31 | 30 | 8 | 0 | 0 | 0 | 0 | 99 |
| *1937* | 0 | 0 | 0 | 10 | 28 | 31 | 30 | 25 | 0 | 0 | 0 | 0 | 124 |
| *1938* | 0 | 0 | 20 | 14 | 28 | 31 | 30 | 31 | 9 | 0 | 0 | 0 | 163 |
| *1939* | 0 | 0 | 0 | 0 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 18 |
| *1940* | 0 | 0 | 0 | 21 | 29 | 31 | 30 | 16 | 0 | 0 | 0 | 0 | 127 |
| *1941* | 0 | 0 | 8 | 31 | 28 | 31 | 30 | 31 | 30 | 7 | 0 | 0 | 196 |
| *1942* | 0 | 0 | 16 | 31 | 28 | 31 | 30 | 31 | 13 | 0 | 0 | 0 | 180 |
| *1943* | 0 | 0 | 5 | 29 | 28 | 31 | 30 | 26 | 0 | 0 | 0 | 0 | 149 |
| *1944* | 0 | 0 | 0 | 0 | 24 | 31 | 30 | 10 | 0 | 0 | 0 | 0 | 95 |
| *1945* | 0 | 0 | 0 | 0 | 27 | 31 | 30 | 3 | 0 | 0 | 0 | 0 | 91 |
| *1946* | 0 | 0 | 10 | 31 | 28 | 9 | 24 | 0 | 0 | 0 | 0 | 0 | 102 |
| *1947* | 0 | 0 | 0 | 0 | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| *1948* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1949* | 0 | 0 | 0 | 0 | 0 | 28 | 1 | 0 | 0 | 0 | 0 | 0 | 29 |
| *1950* | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| *1951* | 0 | 5 | 15 | 12 | 9 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 51 |
| *1952* | 0 | 0 | 2 | 31 | 29 | 31 | 30 | 11 | 0 | 0 | 0 | 0 | 134 |
| *1953* | 0 | 0 | 8 | 31 | 18 | 7 | 0 | 2 | 0 | 0 | 0 | 0 | 66 |
| *1954* | 0 | 0 | 0 | 0 | 12 | 12 | 18 | 0 | 0 | 0 | 0 | 0 | 42 |
| *1955* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1956* | 0 | 0 | 9 | 31 | 29 | 31 | 4 | 0 | 0 | 0 | 0 | 0 | 104 |
| *1957* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1958* | 0 | 0 | 0 | 0 | 25 | 31 | 30 | 31 | 0 | 26 | 31 | 30 | 204 |
| *1959* | 8 | 0 | 0 | 10 | 18 | 29 | 0 | 6 | 0 | 0 | 0 | 1 | 72 |
| *1960* | 0 | 0 | 0 | 0 | 26 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 34 |
| *1961* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1962* | 0 | 0 | 0 | 0 | 19 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 48 |
| *1963* | 0 | 0 | 0 | 1 | 28 | 31 | 30 | 19 | 0 | 0 | 0 | 0 | 109 |
| *1964* | 0 | 9 | 0 | 10 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 37 |
| *1965* | 0 | 0 | 2 | 31 | 17 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 67 |
| *1966* | 0 | 14 | 4 | 25 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 67 |
| *1967* | 0 | 0 | 25 | 31 | 28 | 31 | 30 | 31 | 30 | 29 | 31 | 27 | 293 |
| *1968* | 0 | 16 | 10 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 28 |
| *1969* | 0 | 0 | 0 | 14 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 256 |
| *1970* | 31 | 30 | 14 | 22 | 25 | 31 | 3 | 0 | 0 | 0 | 0 | 0 | 156 |
| *1971* | 0 | 1 | 17 | 31 | 9 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 65 |
| *1972* | 0 | 0 | 5 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 7 |
| *1973* | 0 | 7 | 0 | 15 | 28 | 31 | 30 | 10 | 0 | 0 | 0 | 0 | 121 |
| *1974* | 15 | 8 | 23 | 28 | 28 | 31 | 30 | 9 | 0 | 0 | 0 | 14 | 186 |
| *1975* | 31 | 18 | 28 | 23 | 27 | 31 | 30 | 7 | 0 | 0 | 0 | 16 | 211 |
| *1976* | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| *1977* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1978* | 0 | 0 | 12 | 31 | 28 | 31 | 30 | 20 | 0 | 0 | 0 | 21 | 173 |
| *1979* | 0 | 0 | 0 | 9 | 17 | 31 | 19 | 0 | 0 | 0 | 0 | 0 | 76 |
| *1980* | 0 | 0 | 5 | 26 | 29 | 31 | 30 | 10 | 0 | 0 | 0 | 10 | 141 |
| *1981* | 0 | 0 | 0 | 4 | 28 | 26 | 14 | 0 | 0 | 0 | 0 | 0 | 72 |
| *1982* | 0 | 4 | 0 | 27 | 28 | 31 | 30 | 31 | 18 | 0 | 3 | 30 | 202 |
| *1983* | 31 | 30 | 31 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |
| *1984* | 15 | 15 | 31 | 31 | 29 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 143 |
| *1985* | 3 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| *1986* | 5 | 2 | 3 | 0 | 18 | 31 | 30 | 10 | 0 | 0 | 0 | 0 | 99 |
| *1987* | 0 | 0 | 10 | 13 | 13 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 45 |
| *1988* | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| *1989* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1990* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1991* | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| *1992* | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| *1993* | 0 | 0 | 0 | 23 | 28 | 31 | 23 | 0 | 0 | 0 | 0 | 0 | 105 |
| *1994* | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| *1995* | 0 | 0 | 0 | 26 | 28 | 31 | 30 | 28 | 0 | 0 | 0 | 0 | 143 |
| *1996* | 3 | 23 | 2 | 1 | 29 | 31 | 21 | 0 | 0 | 0 | 0 | 0 | 110 |
| *1997* | 0 | 6 | 21 | 31 | 28 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 98 |
| *1998* | 0 | 0 | 0 | 21 | 28 | 31 | 30 | 31 | 30 | 31 | 6 | 0 | 208 |
| *1999* | 0 | 19 | 31 | 31 | 28 | 25 | 24 | 0 | 4 | 0 | 0 | 0 | 162 |
| *2000* | 0 | 4 | 9 | 10 | 21 | 31 | 16 | 0 | 0 | 0 | 0 | 0 | 91 |
| *2001* | 0 | 0 | 0 | 9 | 16 | 31 | 18 | 0 | 0 | 0 | 0 | 0 | 74 |
| *2002* | 0 | 0 | 15 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 |
| *2003* | 0 | 0 | 14 | 21 | 0 | 5 | 0 | 15 | 0 | 0 | 0 | 0 | 55 |
| *2004* | 0 | 0 | 8 | 5 | 9 | 14 | 0 | 0 | 0 | 0 | 7 | 0 | 43 |
| *2005* | 0 | 0 | 0 | 31 | 28 | 31 | 30 | 28 | 0 | 1 | 0 | 0 | 149 |
| *2006* | 0 | 4 | 3 | 31 | 19 | 31 | 30 | 31 | 16 | 0 | 0 | 0 | 165 |
| *2007* | 0 | 3 | 2 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 |
| *2008* | 0 | 0 | 0 | 12 | 29 | 31 | 5 | 0 | 0 | 0 | 0 | 0 | 77 |
| *2009* | 0 | 0 | 0 | 0 | 3 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| *2010* | 0 | 0 | 6 | 12 | 28 | 31 | 30 | 15 | 0 | 0 | 0 | 0 | 122 |
| *2011* | 0 | 0 | 10 | 31 | 28 | 31 | 30 | 31 | 27 | 15 | 12 | 0 | 215 |
| *2012* | 0 | 0 | 0 | 2 | 0 | 0 | 24 | 1 | 0 | 0 | 0 | 0 | 27 |
| *2013* | 0 | 0 | 11 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 |
| **Average** | 2 | 3 | 6 | 13 | 17 | 18 | 14 | 8 | 3 | 2 | 2 | 3 | 89 |
| **Median** | 0 | 0 | 0 | 10 | 19 | 25 | 5 | 0 | 0 | 0 | 0 | 0 | 74 |
| **Minimum** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Maximum** | 31 | 30 | 31 | 31 | 29 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |

Data from USGS Gage 11152500

Estimate based on gaged flow plus estimated inflows from SIWTF, Salinas Stormwater and Blanco Drain

**Total:** **7325**

Reflects recorded diversions at the SRDF

**Groundwater Recharge Project**

**Estimated No. Days with Flow of 60 cfs or Higher, Salinas River below SRDF, Diverting Ag Wash Water and Stormwater**

| Water Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1932 | 0 | 0 | 7 | 31 | 29 | 31 | 15 | 0 | 0 | 0 | 0 | 0 | 113 |
| 1933 | 0 | 0 | 0 | 4 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 1934 | 0 | 0 | 0 | 15 | 7 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 48 |
| 1935 | 0 | 0 | 0 | 24 | 17 | 24 | 30 | 22 | 0 | 0 | 0 | 0 | 117 |
| 1936 | 0 | 0 | 0 | 4 | 26 | 31 | 30 | 10 | 0 | 0 | 0 | 0 | 101 |
| 1937 | 0 | 0 | 0 | 11 | 28 | 31 | 30 | 27 | 0 | 0 | 0 | 0 | 127 |
| 1938 | 0 | 0 | 20 | 16 | 28 | 31 | 30 | 31 | 11 | 0 | 0 | 0 | 167 |
| 1939 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 20 |
| 1940 | 0 | 0 | 0 | 21 | 29 | 31 | 30 | 18 | 0 | 0 | 0 | 0 | 129 |
| 1941 | 0 | 0 | 8 | 31 | 28 | 31 | 30 | 31 | 30 | 10 | 0 | 0 | 199 |
| 1942 | 0 | 0 | 16 | 31 | 28 | 31 | 30 | 31 | 15 | 0 | 0 | 0 | 182 |
| 1943 | 0 | 0 | 5 | 31 | 28 | 31 | 30 | 29 | 0 | 0 | 0 | 0 | 154 |
| 1944 | 0 | 0 | 0 | 0 | 24 | 31 | 30 | 11 | 0 | 0 | 0 | 0 | 96 |
| 1945 | 0 | 0 | 0 | 0 | 27 | 31 | 30 | 5 | 0 | 0 | 0 | 0 | 93 |
| 1946 | 0 | 0 | 10 | 31 | 28 | 12 | 25 | 0 | 0 | 0 | 0 | 0 | 106 |
| 1947 | 0 | 1 | 0 | 0 | 7 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 1948 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1949 | 0 | 0 | 0 | 0 | 0 | 28 | 2 | 0 | 0 | 0 | 0 | 0 | 30 |
| 1950 | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 1951 | 0 | 7 | 16 | 12 | 10 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 56 |
| 1952 | 0 | 0 | 2 | 31 | 29 | 31 | 30 | 13 | 0 | 0 | 0 | 0 | 136 |
| 1953 | 0 | 0 | 8 | 31 | 19 | 8 | 0 | 3 | 0 | 0 | 0 | 0 | 69 |
| 1954 | 0 | 0 | 0 | 0 | 13 | 12 | 19 | 0 | 0 | 0 | 0 | 0 | 44 |
| 1955 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1956 | 0 | 0 | 9 | 31 | 29 | 31 | 6 | 1 | 0 | 0 | 0 | 0 | 107 |
| 1957 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1958 | 0 | 0 | 0 | 0 | 25 | 31 | 30 | 31 | 2 | 26 | 31 | 30 | 206 |
| 1959 | 28 | 1 | 0 | 14 | 19 | 31 | 2 | 7 | 0 | 0 | 0 | 2 | 104 |
| 1960 | 0 | 0 | 0 | 0 | 26 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 36 |
| 1961 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1962 | 0 | 0 | 0 | 0 | 19 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 48 |
| 1963 | 0 | 0 | 0 | 1 | 28 | 31 | 30 | 20 | 0 | 0 | 0 | 0 | 110 |
| 1964 | 0 | 10 | 4 | 10 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 43 |
| 1965 | 0 | 0 | 3 | 31 | 19 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 71 |
| 1966 | 0 | 14 | 5 | 30 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 76 |
| 1967 | 0 | 0 | 25 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 28 | 296 |
| 1968 | 1 | 18 | 13 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 36 |
| 1969 | 0 | 0 | 0 | 14 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 256 |
| 1970 | 31 | 30 | 18 | 22 | 28 | 31 | 5 | 0 | 0 | 0 | 0 | 0 | 165 |
| 1971 | 2 | 1 | 17 | 31 | 12 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 70 |
| 1972 | 0 | 0 | 5 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 8 |
| 1973 | 2 | 10 | 0 | 15 | 28 | 31 | 30 | 11 | 0 | 0 | 0 | 0 | 127 |
| 1974 | 23 | 12 | 26 | 29 | 28 | 31 | 30 | 10 | 0 | 0 | 0 | 21 | 210 |
| 1975 | 31 | 21 | 28 | 29 | 28 | 31 | 30 | 8 | 0 | 0 | 0 | 18 | 224 |
| 1976 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 1977 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1978 | 0 | 0 | 12 | 31 | 28 | 31 | 30 | 20 | 0 | 0 | 0 | 25 | 177 |
| 1979 | 0 | 0 | 0 | 11 | 19 | 31 | 20 | 0 | 0 | 0 | 0 | 0 | 81 |
| 1980 | 0 | 0 | 6 | 27 | 29 | 31 | 30 | 13 | 0 | 0 | 5 | 11 | 152 |
| 1981 | 0 | 0 | 0 | 4 | 28 | 27 | 16 | 0 | 0 | 0 | 0 | 0 | 75 |
| 1982 | 0 | 6 | 0 | 27 | 28 | 31 | 30 | 31 | 20 | 0 | 7 | 30 | 210 |
| 1983 | 31 | 30 | 31 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |
| 1984 | 18 | 18 | 31 | 31 | 29 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 151 |
| 1985 | 3 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 1986 | 6 | 3 | 5 | 0 | 19 | 31 | 30 | 13 | 0 | 0 | 0 | 0 | 107 |
| 1987 | 0 | 2 | 16 | 18 | 14 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 60 |
| 1988 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 1989 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 1992 | 0 | 0 | 0 | 0 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| 1993 | 0 | 0 | 0 | 23 | 28 | 31 | 24 | 0 | 0 | 0 | 0 | 0 | 106 |
| 1994 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 1995 | 0 | 0 | 0 | 26 | 28 | 31 | 30 | 29 | 0 | 0 | 0 | 0 | 144 |
| 1996 | 10 | 26 | 4 | 3 | 29 | 31 | 22 | 0 | 0 | 0 | 0 | 0 | 125 |
| 1997 | 0 | 8 | 21 | 31 | 28 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| 1998 | 0 | 0 | 0 | 21 | 28 | 31 | 30 | 31 | 30 | 31 | 6 | 0 | 208 |
| 1999 | 0 | 19 | 31 | 31 | 28 | 29 | 25 | 0 | 8 | 0 | 0 | 0 | 171 |
| 2000 | 0 | 4 | 10 | 11 | 21 | 31 | 19 | 5 | 0 | 0 | 0 | 3 | 104 |
| 2001 | 0 | 0 | 0 | 9 | 16 | 31 | 21 | 0 | 0 | 0 | 0 | 0 | 77 |
| 2002 | 0 | 0 | 18 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 |
| 2003 | 0 | 0 | 14 | 22 | 0 | 6 | 0 | 18 | 0 | 0 | 0 | 0 | 60 |
| 2004 | 0 | 0 | 10 | 5 | 10 | 15 | 0 | 0 | 0 | 0 | 13 | 0 | 53 |
| 2005 | 0 | 0 | 0 | 31 | 28 | 31 | 30 | 29 | 1 | 3 | 0 | 0 | 153 |
| 2006 | 0 | 10 | 5 | 31 | 23 | 31 | 30 | 31 | 17 | 0 | 0 | 0 | 178 |
| 2007 | 0 | 3 | 2 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 |
| 2008 | 0 | 0 | 0 | 12 | 29 | 31 | 6 | 0 | 0 | 0 | 0 | 0 | 78 |
| 2009 | 0 | 0 | 0 | 0 | 5 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| 2010 | 1 | 0 | 8 | 13 | 28 | 31 | 30 | 17 | 3 | 0 | 0 | 0 | 131 |
| 2011 | 0 | 0 | 10 | 31 | 28 | 31 | 30 | 31 | 30 | 28 | 14 | 0 | 233 |
| 2012 | 0 | 0 | 0 | 3 | 0 | 0 | 30 | 8 | 0 | 0 | 0 | 0 | 41 |
| 2013 | 0 | 0 | 11 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 |
| **Average** | 2 | 3 | 6 | 14 | 17 | 18 | 14 | 8 | 3 | 2 | 2 | 3 | 94 |
| **Median** | 0 | 0 | 0 | 12 | 19 | 27 | 6 | 0 | 0 | 0 | 0 | 0 | 78 |
| **Minimum** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Maximum** | 31 | 30 | 31 | 31 | 29 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |

Data from USGS Gage 11152500

Estimate based on gaged flow plus estimated inflows from SIWTF, Salinas Stormwater and Blanco Drain

**Total: 7701**

Reflects recorded diversions at the SRDF

**Groundwater Recharge Project**

**Estimated No. Days with Flow of 56 cfs or Higher, Salinas River below SRDF, Diverting Ag Wash Water and Stormwater**

| Water Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1932 | 0 | 0 | 7 | 31 | 29 | 31 | 15 | 0 | 0 | 0 | 0 | 0 | 113 |
| 1933 | 0 | 0 | 0 | 4 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 1934 | 0 | 0 | 0 | 15 | 7 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 49 |
| 1935 | 0 | 0 | 0 | 24 | 19 | 24 | 30 | 23 | 0 | 0 | 0 | 0 | 120 |
| 1936 | 0 | 0 | 0 | 4 | 26 | 31 | 30 | 10 | 0 | 0 | 0 | 0 | 101 |
| 1937 | 0 | 0 | 0 | 13 | 28 | 31 | 30 | 28 | 0 | 0 | 0 | 0 | 130 |
| 1938 | 0 | 0 | 20 | 16 | 28 | 31 | 30 | 31 | 12 | 0 | 0 | 0 | 168 |
| 1939 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 20 |
| 1940 | 0 | 0 | 0 | 21 | 29 | 31 | 30 | 19 | 0 | 0 | 0 | 0 | 130 |
| 1941 | 0 | 0 | 8 | 31 | 28 | 31 | 30 | 31 | 30 | 11 | 0 | 0 | 200 |
| 1942 | 0 | 0 | 16 | 31 | 28 | 31 | 30 | 31 | 16 | 0 | 0 | 0 | 183 |
| 1943 | 0 | 0 | 5 | 31 | 28 | 31 | 30 | 29 | 0 | 0 | 0 | 0 | 154 |
| 1944 | 0 | 0 | 0 | 0 | 24 | 31 | 30 | 12 | 0 | 0 | 0 | 0 | 97 |
| 1945 | 0 | 0 | 0 | 0 | 27 | 31 | 30 | 5 | 0 | 0 | 0 | 0 | 93 |
| 1946 | 0 | 0 | 10 | 31 | 28 | 12 | 25 | 0 | 0 | 0 | 0 | 0 | 106 |
| 1947 | 0 | 1 | 0 | 0 | 7 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 1948 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1949 | 0 | 0 | 0 | 0 | 0 | 28 | 2 | 0 | 0 | 0 | 0 | 0 | 30 |
| 1950 | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 1951 | 0 | 7 | 16 | 12 | 10 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 56 |
| 1952 | 0 | 0 | 2 | 31 | 29 | 31 | 30 | 14 | 0 | 0 | 0 | 0 | 137 |
| 1953 | 0 | 0 | 8 | 31 | 20 | 9 | 0 | 3 | 0 | 0 | 0 | 0 | 71 |
| 1954 | 0 | 0 | 0 | 0 | 13 | 12 | 20 | 0 | 0 | 0 | 0 | 0 | 45 |
| 1955 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1956 | 0 | 0 | 9 | 31 | 29 | 31 | 6 | 2 | 0 | 0 | 0 | 0 | 108 |
| 1957 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1958 | 0 | 0 | 0 | 0 | 25 | 31 | 30 | 31 | 4 | 26 | 31 | 30 | 208 |
| 1959 | 28 | 2 | 0 | 18 | 19 | 31 | 2 | 8 | 0 | 0 | 0 | 2 | 110 |
| 1960 | 0 | 0 | 0 | 0 | 26 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 38 |
| 1961 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1962 | 0 | 0 | 0 | 0 | 19 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 49 |
| 1963 | 0 | 0 | 0 | 1 | 28 | 31 | 30 | 20 | 0 | 0 | 0 | 0 | 110 |
| 1964 | 0 | 10 | 8 | 10 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 47 |
| 1965 | 0 | 0 | 3 | 31 | 20 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 72 |
| 1966 | 0 | 14 | 5 | 31 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 78 |
| 1967 | 0 | 0 | 25 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 29 | 297 |
| 1968 | 1 | 20 | 14 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 39 |
| 1969 | 0 | 0 | 0 | 14 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 256 |
| 1970 | 31 | 30 | 20 | 22 | 28 | 31 | 6 | 0 | 0 | 0 | 0 | 0 | 168 |
| 1971 | 4 | 1 | 17 | 31 | 15 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 76 |
| 1972 | 0 | 0 | 5 | 1 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 10 |
| 1973 | 2 | 10 | 0 | 15 | 28 | 31 | 30 | 12 | 0 | 0 | 0 | 0 | 128 |
| 1974 | 23 | 17 | 27 | 29 | 28 | 31 | 30 | 11 | 0 | 0 | 0 | 21 | 217 |
| 1975 | 31 | 22 | 28 | 31 | 28 | 31 | 30 | 8 | 0 | 0 | 0 | 20 | 229 |
| 1976 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 1977 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1978 | 0 | 0 | 12 | 31 | 28 | 31 | 30 | 21 | 0 | 0 | 0 | 26 | 179 |
| 1979 | 0 | 1 | 2 | 12 | 20 | 31 | 21 | 0 | 0 | 0 | 0 | 0 | 87 |
| 1980 | 0 | 0 | 6 | 27 | 29 | 31 | 30 | 14 | 0 | 0 | 5 | 12 | 154 |
| 1981 | 0 | 0 | 0 | 4 | 28 | 28 | 16 | 0 | 0 | 0 | 0 | 0 | 76 |
| 1982 | 0 | 6 | 0 | 27 | 28 | 31 | 30 | 31 | 23 | 0 | 7 | 30 | 213 |
| 1983 | 31 | 30 | 31 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |
| 1984 | 20 | 18 | 31 | 31 | 29 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 153 |
| 1985 | 3 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 1986 | 6 | 3 | 5 | 0 | 19 | 31 | 30 | 13 | 0 | 0 | 0 | 0 | 107 |
| 1987 | 0 | 3 | 18 | 20 | 15 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 67 |
| 1988 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 1989 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 1992 | 0 | 0 | 0 | 0 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| 1993 | 0 | 0 | 0 | 23 | 28 | 31 | 24 | 0 | 0 | 0 | 0 | 0 | 106 |
| 1994 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 1995 | 0 | 0 | 0 | 26 | 28 | 31 | 30 | 30 | 0 | 0 | 0 | 0 | 145 |
| 1996 | 13 | 28 | 4 | 3 | 29 | 31 | 23 | 0 | 0 | 0 | 0 | 0 | 131 |
| 1997 | 1 | 8 | 21 | 31 | 28 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 101 |
| 1998 | 0 | 0 | 0 | 21 | 28 | 31 | 30 | 31 | 30 | 31 | 7 | 1 | 210 |
| 1999 | 0 | 19 | 31 | 31 | 28 | 31 | 25 | 0 | 9 | 0 | 0 | 0 | 174 |
| 2000 | 0 | 4 | 10 | 12 | 22 | 31 | 21 | 6 | 0 | 0 | 0 | 4 | 110 |
| 2001 | 0 | 0 | 0 | 10 | 16 | 31 | 21 | 0 | 0 | 0 | 0 | 0 | 78 |
| 2002 | 0 | 0 | 21 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 |
| 2003 | 0 | 0 | 14 | 22 | 0 | 7 | 0 | 18 | 0 | 0 | 0 | 0 | 61 |
| 2004 | 0 | 0 | 10 | 5 | 11 | 15 | 0 | 0 | 0 | 0 | 15 | 0 | 56 |
| 2005 | 0 | 0 | 0 | 31 | 28 | 31 | 30 | 30 | 2 | 5 | 0 | 0 | 157 |
| 2006 | 0 | 10 | 6 | 31 | 24 | 31 | 30 | 31 | 17 | 0 | 0 | 0 | 180 |
| 2007 | 0 | 4 | 3 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 29 |
| 2008 | 0 | 0 | 0 | 13 | 29 | 31 | 7 | 0 | 0 | 0 | 0 | 0 | 80 |
| 2009 | 0 | 0 | 0 | 0 | 5 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| 2010 | 1 | 0 | 9 | 13 | 28 | 31 | 30 | 18 | 7 | 0 | 0 | 0 | 137 |
| 2011 | 0 | 0 | 10 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 15 | 0 | 237 |
| 2012 | 0 | 0 | 0 | 3 | 0 | 0 | 30 | 10 | 0 | 0 | 0 | 0 | 43 |
| 2013 | 1 | 0 | 12 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 24 |
| **Average** | 3 | 3 | 6 | 14 | 17 | 19 | 14 | 9 | 3 | 2 | 2 | 3 | 96 |
| **Median** | 0 | 0 | 0 | 13 | 20 | 28 | 7 | 0 | 0 | 0 | 0 | 0 | 80 |
| **Minimum** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Maximum** | 31 | 30 | 31 | 31 | 29 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |

Data from USGS Gage 11152500

Estimate based on gaged flow plus estimated inflows from SIWTF, Salinas Stormwater and Blanco Drain

**Total: 7841**

Reflects recorded diversions at the SRDF

**Groundwater Recharge Project**

**Estimated No. Days with Flow of 50 cfs or Higher, Salinas River below SRDF, Diverting Ag Wash Water and Stormwater**

| Water Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1932 | 0 | 0 | 7 | 31 | 29 | 31 | 15 | 0 | 0 | 0 | 0 | 0 | 113 |
| 1933 | 0 | 0 | 0 | 4 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 1934 | 0 | 0 | 0 | 16 | 7 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 50 |
| 1935 | 0 | 0 | 0 | 24 | 20 | 24 | 30 | 24 | 0 | 0 | 0 | 0 | 122 |
| 1936 | 0 | 0 | 0 | 4 | 26 | 31 | 30 | 11 | 0 | 0 | 0 | 0 | 102 |
| 1937 | 0 | 0 | 0 | 13 | 28 | 31 | 30 | 29 | 0 | 0 | 0 | 0 | 131 |
| 1938 | 0 | 0 | 20 | 17 | 28 | 31 | 30 | 31 | 14 | 0 | 0 | 0 | 171 |
| 1939 | 0 | 0 | 0 | 0 | 0 | 20 | 5 | 0 | 0 | 0 | 0 | 0 | 25 |
| 1940 | 0 | 0 | 0 | 21 | 29 | 31 | 30 | 21 | 0 | 0 | 0 | 0 | 132 |
| 1941 | 0 | 0 | 8 | 31 | 28 | 31 | 30 | 31 | 30 | 13 | 0 | 0 | 202 |
| 1942 | 0 | 0 | 16 | 31 | 28 | 31 | 30 | 31 | 17 | 0 | 0 | 0 | 184 |
| 1943 | 0 | 0 | 5 | 31 | 28 | 31 | 30 | 30 | 1 | 0 | 0 | 0 | 156 |
| 1944 | 0 | 0 | 0 | 0 | 24 | 31 | 30 | 13 | 0 | 0 | 0 | 0 | 98 |
| 1945 | 0 | 0 | 0 | 0 | 27 | 31 | 30 | 6 | 0 | 0 | 0 | 0 | 94 |
| 1946 | 0 | 0 | 10 | 31 | 28 | 13 | 26 | 0 | 0 | 0 | 0 | 0 | 108 |
| 1947 | 0 | 1 | 0 | 0 | 9 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 1948 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1949 | 0 | 0 | 0 | 0 | 0 | 28 | 2 | 0 | 0 | 0 | 0 | 0 | 30 |
| 1950 | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 1951 | 0 | 7 | 16 | 12 | 11 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 57 |
| 1952 | 0 | 0 | 2 | 31 | 29 | 31 | 30 | 14 | 0 | 0 | 0 | 0 | 137 |
| 1953 | 0 | 0 | 9 | 31 | 21 | 10 | 0 | 4 | 0 | 0 | 0 | 0 | 75 |
| 1954 | 0 | 0 | 0 | 0 | 13 | 12 | 20 | 0 | 0 | 0 | 0 | 0 | 45 |
| 1955 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1956 | 0 | 0 | 9 | 31 | 29 | 31 | 8 | 2 | 0 | 0 | 0 | 0 | 110 |
| 1957 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1958 | 0 | 0 | 0 | 0 | 25 | 31 | 30 | 31 | 4 | 26 | 31 | 30 | 208 |
| 1959 | 30 | 2 | 0 | 25 | 28 | 31 | 3 | 9 | 0 | 0 | 0 | 2 | 130 |
| 1960 | 0 | 0 | 0 | 0 | 27 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 41 |
| 1961 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1962 | 0 | 0 | 0 | 0 | 19 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 49 |
| 1963 | 0 | 0 | 0 | 1 | 28 | 31 | 30 | 21 | 0 | 0 | 0 | 0 | 111 |
| 1964 | 0 | 12 | 27 | 11 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 70 |
| 1965 | 0 | 0 | 3 | 31 | 21 | 0 | 19 | 0 | 0 | 0 | 0 | 0 | 74 |
| 1966 | 0 | 15 | 5 | 31 | 28 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 81 |
| 1967 | 0 | 0 | 26 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 29 | 298 |
| 1968 | 1 | 20 | 15 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 40 |
| 1969 | 0 | 0 | 0 | 14 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 256 |
| 1970 | 31 | 30 | 23 | 24 | 28 | 31 | 6 | 0 | 0 | 0 | 0 | 0 | 173 |
| 1971 | 5 | 1 | 18 | 31 | 18 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 82 |
| 1972 | 0 | 0 | 5 | 1 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 11 |
| 1973 | 4 | 10 | 0 | 15 | 28 | 31 | 30 | 14 | 0 | 0 | 0 | 0 | 132 |
| 1974 | 24 | 22 | 30 | 29 | 28 | 31 | 30 | 13 | 0 | 0 | 0 | 27 | 234 |
| 1975 | 31 | 25 | 28 | 31 | 28 | 31 | 30 | 9 | 0 | 0 | 0 | 21 | 234 |
| 1976 | 11 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| 1977 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1978 | 0 | 0 | 13 | 31 | 28 | 31 | 30 | 22 | 0 | 0 | 0 | 26 | 181 |
| 1979 | 0 | 2 | 6 | 12 | 21 | 31 | 21 | 0 | 0 | 0 | 0 | 0 | 93 |
| 1980 | 0 | 0 | 6 | 27 | 29 | 31 | 30 | 15 | 0 | 0 | 6 | 12 | 156 |
| 1981 | 0 | 0 | 0 | 4 | 28 | 28 | 17 | 0 | 0 | 0 | 0 | 0 | 77 |
| 1982 | 0 | 7 | 0 | 27 | 28 | 31 | 30 | 31 | 24 | 0 | 7 | 30 | 215 |
| 1983 | 31 | 30 | 31 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |
| 1984 | 20 | 18 | 31 | 31 | 29 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 154 |
| 1985 | 4 | 1 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| 1986 | 6 | 3 | 5 | 0 | 19 | 31 | 30 | 14 | 0 | 0 | 0 | 0 | 108 |
| 1987 | 0 | 4 | 20 | 28 | 16 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 80 |
| 1988 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| 1989 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 1992 | 0 | 0 | 0 | 0 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 1993 | 0 | 0 | 0 | 23 | 28 | 31 | 24 | 0 | 0 | 0 | 0 | 0 | 106 |
| 1994 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 1995 | 0 | 0 | 0 | 26 | 28 | 31 | 30 | 31 | 0 | 0 | 0 | 0 | 146 |
| 1996 | 15 | 28 | 5 | 3 | 29 | 31 | 23 | 0 | 0 | 0 | 0 | 0 | 134 |
| 1997 | 1 | 8 | 21 | 31 | 28 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 102 |
| 1998 | 0 | 0 | 0 | 22 | 28 | 31 | 30 | 31 | 30 | 31 | 7 | 2 | 212 |
| 1999 | 0 | 19 | 31 | 31 | 28 | 31 | 25 | 0 | 9 | 0 | 0 | 0 | 174 |
| 2000 | 0 | 4 | 10 | 13 | 23 | 31 | 23 | 9 | 0 | 0 | 0 | 6 | 119 |
| 2001 | 0 | 0 | 0 | 11 | 16 | 31 | 21 | 3 | 0 | 0 | 0 | 0 | 82 |
| 2002 | 0 | 0 | 22 | 16 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 38 |
| 2003 | 0 | 0 | 14 | 23 | 0 | 8 | 0 | 19 | 0 | 0 | 0 | 0 | 64 |
| 2004 | 0 | 0 | 11 | 5 | 12 | 16 | 0 | 1 | 0 | 3 | 15 | 0 | 63 |
| 2005 | 0 | 0 | 0 | 31 | 28 | 31 | 30 | 31 | 3 | 7 | 0 | 0 | 161 |
| 2006 | 0 | 10 | 6 | 31 | 27 | 31 | 30 | 31 | 17 | 0 | 2 | 0 | 185 |
| 2007 | 0 | 4 | 3 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 |
| 2008 | 0 | 0 | 2 | 14 | 29 | 31 | 8 | 0 | 0 | 0 | 0 | 0 | 84 |
| 2009 | 0 | 0 | 0 | 0 | 5 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| 2010 | 1 | 0 | 10 | 13 | 28 | 31 | 30 | 18 | 9 | 1 | 0 | 0 | 141 |
| 2011 | 0 | 0 | 10 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 15 | 0 | 237 |
| 2012 | 9 | 1 | 0 | 3 | 0 | 1 | 30 | 14 | 0 | 0 | 0 | 2 | 60 |
| 2013 | 7 | 0 | 12 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 |
| **Average** | 3 | 3 | 7 | 15 | 18 | 19 | 14 | 9 | 3 | 3 | 2 | 3 | 99 |
| **Median** | 0 | 0 | 0 | 13 | 23 | 28 | 8 | 0 | 0 | 0 | 0 | 0 | 84 |
| **Minimum** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Maximum** | 31 | 30 | 31 | 31 | 29 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |

Data from USGS Gage 11152500

Estimate based on gaged flow plus estimated inflows from SIWTF, Salinas Stormwater and Blanco Drain

**Total:** **8083**

Reflects recorded diversions at the SRDF

**Groundwater Recharge Project**

**Estimated No. Days with Flow of 72 cfs or Higher, Salinas River below SRDF, Diverting at SIWTF, TP1 and Blanco Drain (2.99 cfs)**

| Water Year | *Oct* | *Nov* | *Dec* | *Jan* | *Feb* | *Mar* | *Apr* | *May* | *Jun* | *Jul* | *Aug* | *Sep* | *Total* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *1932* | 0 | 0 | 7 | 31 | 29 | 31 | 13 | 0 | 0 | 0 | 0 | 0 | 111 |
| *1933* | 0 | 0 | 0 | 4 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| *1934* | 0 | 0 | 0 | 14 | 7 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 46 |
| *1935* | 0 | 0 | 0 | 24 | 15 | 24 | 30 | 21 | 0 | 0 | 0 | 0 | 114 |
| *1936* | 0 | 0 | 0 | 4 | 26 | 31 | 30 | 8 | 0 | 0 | 0 | 0 | 99 |
| *1937* | 0 | 0 | 0 | 10 | 28 | 31 | 30 | 25 | 0 | 0 | 0 | 0 | 124 |
| *1938* | 0 | 0 | 20 | 14 | 28 | 31 | 30 | 31 | 8 | 0 | 0 | 0 | 162 |
| *1939* | 0 | 0 | 0 | 0 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 18 |
| *1940* | 0 | 0 | 0 | 21 | 29 | 31 | 30 | 15 | 0 | 0 | 0 | 0 | 126 |
| *1941* | 0 | 0 | 8 | 31 | 28 | 31 | 30 | 31 | 30 | 7 | 0 | 0 | 196 |
| *1942* | 0 | 0 | 16 | 31 | 28 | 31 | 30 | 31 | 12 | 0 | 0 | 0 | 179 |
| *1943* | 0 | 0 | 5 | 28 | 28 | 31 | 30 | 24 | 0 | 0 | 0 | 0 | 146 |
| *1944* | 0 | 0 | 0 | 0 | 24 | 31 | 30 | 10 | 0 | 0 | 0 | 0 | 95 |
| *1945* | 0 | 0 | 0 | 0 | 27 | 31 | 30 | 2 | 0 | 0 | 0 | 0 | 90 |
| *1946* | 0 | 0 | 10 | 31 | 28 | 9 | 24 | 0 | 0 | 0 | 0 | 0 | 102 |
| *1947* | 0 | 0 | 0 | 0 | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| *1948* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1949* | 0 | 0 | 0 | 0 | 0 | 28 | 1 | 0 | 0 | 0 | 0 | 0 | 29 |
| *1950* | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| *1951* | 0 | 5 | 15 | 12 | 8 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 50 |
| *1952* | 0 | 0 | 2 | 31 | 29 | 31 | 30 | 10 | 0 | 0 | 0 | 0 | 133 |
| *1953* | 0 | 0 | 8 | 31 | 17 | 7 | 0 | 2 | 0 | 0 | 0 | 0 | 65 |
| *1954* | 0 | 0 | 0 | 0 | 12 | 12 | 18 | 0 | 0 | 0 | 0 | 0 | 42 |
| *1955* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1956* | 0 | 0 | 9 | 31 | 29 | 31 | 3 | 0 | 0 | 0 | 0 | 0 | 103 |
| *1957* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1958* | 0 | 0 | 0 | 0 | 24 | 31 | 30 | 30 | 0 | 26 | 31 | 30 | 202 |
| *1959* | 7 | 0 | 0 | 9 | 18 | 29 | 0 | 6 | 0 | 0 | 0 | 1 | 70 |
| *1960* | 0 | 0 | 0 | 0 | 26 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 34 |
| *1961* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1962* | 0 | 0 | 0 | 0 | 19 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 47 |
| *1963* | 0 | 0 | 0 | 1 | 28 | 31 | 30 | 18 | 0 | 0 | 0 | 0 | 108 |
| *1964* | 0 | 8 | 0 | 10 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 |
| *1965* | 0 | 0 | 2 | 31 | 16 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 65 |
| *1966* | 0 | 14 | 3 | 24 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 65 |
| *1967* | 0 | 0 | 25 | 31 | 28 | 31 | 30 | 31 | 30 | 29 | 31 | 27 | 293 |
| *1968* | 0 | 16 | 10 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 28 |
| *1969* | 0 | 0 | 0 | 14 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 256 |
| *1970* | 31 | 30 | 12 | 22 | 25 | 31 | 3 | 0 | 0 | 0 | 0 | 0 | 154 |
| *1971* | 0 | 1 | 17 | 31 | 8 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 63 |
| *1972* | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| *1973* | 0 | 6 | 0 | 15 | 28 | 31 | 30 | 10 | 0 | 0 | 0 | 0 | 120 |
| *1974* | 14 | 8 | 22 | 28 | 28 | 31 | 30 | 8 | 0 | 0 | 0 | 14 | 183 |
| *1975* | 31 | 17 | 28 | 21 | 27 | 31 | 30 | 6 | 0 | 0 | 0 | 16 | 207 |
| *1976* | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| *1977* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1978* | 0 | 0 | 12 | 31 | 28 | 31 | 30 | 20 | 0 | 0 | 0 | 20 | 172 |
| *1979* | 0 | 0 | 0 | 8 | 16 | 31 | 19 | 0 | 0 | 0 | 0 | 0 | 74 |
| *1980* | 0 | 0 | 4 | 26 | 29 | 31 | 30 | 8 | 0 | 0 | 0 | 9 | 137 |
| *1981* | 0 | 0 | 0 | 4 | 28 | 26 | 14 | 0 | 0 | 0 | 0 | 0 | 72 |
| *1982* | 0 | 4 | 0 | 27 | 28 | 31 | 30 | 31 | 17 | 0 | 2 | 30 | 200 |
| *1983* | 31 | 30 | 31 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |
| *1984* | 14 | 13 | 31 | 31 | 29 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 140 |
| *1985* | 3 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| *1986* | 5 | 2 | 3 | 0 | 17 | 31 | 30 | 10 | 0 | 0 | 0 | 0 | 98 |
| *1987* | 0 | 0 | 9 | 11 | 13 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 42 |
| *1988* | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| *1989* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1990* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1991* | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| *1992* | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| *1993* | 0 | 0 | 0 | 23 | 28 | 31 | 23 | 0 | 0 | 0 | 0 | 0 | 105 |
| *1994* | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| *1995* | 0 | 0 | 0 | 26 | 28 | 31 | 30 | 27 | 0 | 0 | 0 | 0 | 142 |
| *1996* | 1 | 22 | 2 | 1 | 29 | 31 | 21 | 0 | 0 | 0 | 0 | 0 | 107 |
| *1997* | 0 | 6 | 21 | 31 | 28 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 98 |
| *1998* | 0 | 0 | 0 | 21 | 28 | 31 | 30 | 31 | 30 | 31 | 6 | 0 | 208 |
| *1999* | 0 | 19 | 31 | 31 | 28 | 24 | 24 | 0 | 4 | 0 | 0 | 0 | 161 |
| *2000* | 0 | 4 | 9 | 10 | 21 | 31 | 14 | 0 | 0 | 0 | 0 | 0 | 89 |
| *2001* | 0 | 0 | 0 | 8 | 16 | 31 | 17 | 0 | 0 | 0 | 0 | 0 | 72 |
| *2002* | 0 | 0 | 15 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 |
| *2003* | 0 | 0 | 14 | 21 | 0 | 5 | 0 | 14 | 0 | 0 | 0 | 0 | 54 |
| *2004* | 0 | 0 | 7 | 5 | 8 | 14 | 0 | 0 | 0 | 0 | 6 | 0 | 40 |
| *2005* | 0 | 0 | 0 | 31 | 28 | 31 | 30 | 27 | 0 | 1 | 0 | 0 | 148 |
| *2006* | 0 | 2 | 2 | 31 | 18 | 31 | 30 | 31 | 15 | 0 | 0 | 0 | 160 |
| *2007* | 0 | 3 | 2 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 |
| *2008* | 0 | 0 | 0 | 11 | 29 | 31 | 4 | 0 | 0 | 0 | 0 | 0 | 75 |
| *2009* | 0 | 0 | 0 | 0 | 3 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| *2010* | 0 | 0 | 6 | 12 | 28 | 31 | 30 | 15 | 0 | 0 | 0 | 0 | 122 |
| *2011* | 0 | 0 | 10 | 31 | 28 | 31 | 30 | 31 | 24 | 11 | 11 | 0 | 207 |
| *2012* | 0 | 0 | 0 | 2 | 0 | 0 | 24 | 1 | 0 | 0 | 0 | 0 | 27 |
| *2013* | 0 | 0 | 11 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 |
| **Average** | 2 | 3 | 5 | 13 | 17 | 18 | 14 | 8 | 3 | 2 | 2 | 3 | 88 |
| **Median** | 0 | 0 | 0 | 10 | 18 | 25 | 4 | 0 | 0 | 0 | 0 | 0 | 72 |
| **Minimum** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Maximum** | 31 | 30 | 31 | 31 | 29 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |

Data from USGS Gage 11152500

Estimate based on gaged flow plus estimated inflows from SIWTF, Salinas Stormwater and Blanco Drain

**Total: 7242**

Reflects recorded diversions at the SRDF

**Groundwater Recharge Project**

**Estimated No. Days with Flow of 60 cfs or Higher, Salinas River below SRDF, Diverting at SIWTF, TP1 and Blanco Drain (2.99 cfs)**

| Water Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1932 | 0 | 0 | 7 | 31 | 29 | 31 | 15 | 0 | 0 | 0 | 0 | 0 | 113 |
| 1933 | 0 | 0 | 0 | 4 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| 1934 | 0 | 0 | 0 | 15 | 7 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 48 |
| 1935 | 0 | 0 | 0 | 24 | 17 | 24 | 30 | 22 | 0 | 0 | 0 | 0 | 117 |
| 1936 | 0 | 0 | 0 | 4 | 26 | 31 | 30 | 9 | 0 | 0 | 0 | 0 | 100 |
| 1937 | 0 | 0 | 0 | 11 | 28 | 31 | 30 | 27 | 0 | 0 | 0 | 0 | 127 |
| 1938 | 0 | 0 | 20 | 15 | 28 | 31 | 30 | 31 | 10 | 0 | 0 | 0 | 165 |
| 1939 | 0 | 0 | 0 | 0 | 0 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 19 |
| 1940 | 0 | 0 | 0 | 21 | 29 | 31 | 30 | 17 | 0 | 0 | 0 | 0 | 128 |
| 1941 | 0 | 0 | 8 | 31 | 28 | 31 | 30 | 31 | 30 | 9 | 0 | 0 | 198 |
| 1942 | 0 | 0 | 16 | 31 | 28 | 31 | 30 | 31 | 14 | 0 | 0 | 0 | 181 |
| 1943 | 0 | 0 | 5 | 31 | 28 | 31 | 30 | 28 | 0 | 0 | 0 | 0 | 153 |
| 1944 | 0 | 0 | 0 | 0 | 24 | 31 | 30 | 11 | 0 | 0 | 0 | 0 | 96 |
| 1945 | 0 | 0 | 0 | 0 | 27 | 31 | 30 | 5 | 0 | 0 | 0 | 0 | 93 |
| 1946 | 0 | 0 | 10 | 31 | 28 | 12 | 25 | 0 | 0 | 0 | 0 | 0 | 106 |
| 1947 | 0 | 1 | 0 | 0 | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 1948 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1949 | 0 | 0 | 0 | 0 | 0 | 28 | 2 | 0 | 0 | 0 | 0 | 0 | 30 |
| 1950 | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| 1951 | 0 | 6 | 16 | 12 | 10 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 55 |
| 1952 | 0 | 0 | 2 | 31 | 29 | 31 | 30 | 13 | 0 | 0 | 0 | 0 | 136 |
| 1953 | 0 | 0 | 8 | 31 | 18 | 8 | 0 | 3 | 0 | 0 | 0 | 0 | 68 |
| 1954 | 0 | 0 | 0 | 0 | 12 | 12 | 19 | 0 | 0 | 0 | 0 | 0 | 43 |
| 1955 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1956 | 0 | 0 | 9 | 31 | 29 | 31 | 5 | 1 | 0 | 0 | 0 | 0 | 106 |
| 1957 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1958 | 0 | 0 | 0 | 0 | 25 | 31 | 30 | 31 | 2 | 26 | 31 | 30 | 206 |
| 1959 | 27 | 1 | 0 | 13 | 19 | 31 | 1 | 7 | 0 | 0 | 0 | 2 | 101 |
| 1960 | 0 | 0 | 0 | 0 | 26 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 36 |
| 1961 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1962 | 0 | 0 | 0 | 0 | 19 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 48 |
| 1963 | 0 | 0 | 0 | 1 | 28 | 31 | 30 | 20 | 0 | 0 | 0 | 0 | 110 |
| 1964 | 0 | 10 | 2 | 10 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 |
| 1965 | 0 | 0 | 3 | 31 | 19 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 70 |
| 1966 | 0 | 14 | 4 | 29 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 73 |
| 1967 | 0 | 0 | 25 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 28 | 296 |
| 1968 | 0 | 18 | 13 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 35 |
| 1969 | 0 | 0 | 0 | 14 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 256 |
| 1970 | 31 | 30 | 16 | 22 | 27 | 31 | 4 | 0 | 0 | 0 | 0 | 0 | 161 |
| 1971 | 2 | 1 | 17 | 31 | 12 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 70 |
| 1972 | 0 | 0 | 5 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 8 |
| 1973 | 1 | 10 | 0 | 15 | 28 | 31 | 30 | 11 | 0 | 0 | 0 | 0 | 126 |
| 1974 | 19 | 9 | 24 | 29 | 28 | 31 | 30 | 9 | 0 | 0 | 0 | 20 | 199 |
| 1975 | 31 | 21 | 28 | 29 | 28 | 31 | 30 | 8 | 0 | 0 | 0 | 18 | 224 |
| 1976 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 1977 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1978 | 0 | 0 | 12 | 31 | 28 | 31 | 30 | 20 | 0 | 0 | 0 | 23 | 175 |
| 1979 | 0 | 0 | 0 | 11 | 19 | 31 | 20 | 0 | 0 | 0 | 0 | 0 | 81 |
| 1980 | 0 | 0 | 6 | 27 | 29 | 31 | 30 | 13 | 0 | 0 | 2 | 11 | 149 |
| 1981 | 0 | 0 | 0 | 4 | 28 | 27 | 15 | 0 | 0 | 0 | 0 | 0 | 74 |
| 1982 | 0 | 6 | 0 | 27 | 28 | 31 | 30 | 31 | 20 | 0 | 6 | 30 | 209 |
| 1983 | 31 | 30 | 31 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |
| 1984 | 16 | 17 | 31 | 31 | 29 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 147 |
| 1985 | 3 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 1986 | 6 | 3 | 3 | 0 | 19 | 31 | 30 | 11 | 0 | 0 | 0 | 0 | 103 |
| 1987 | 0 | 0 | 16 | 15 | 14 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 55 |
| 1988 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 1989 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 1992 | 0 | 0 | 0 | 0 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| 1993 | 0 | 0 | 0 | 23 | 28 | 31 | 24 | 0 | 0 | 0 | 0 | 0 | 106 |
| 1994 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 1995 | 0 | 0 | 0 | 26 | 28 | 31 | 30 | 29 | 0 | 0 | 0 | 0 | 144 |
| 1996 | 8 | 26 | 3 | 3 | 29 | 31 | 22 | 0 | 0 | 0 | 0 | 0 | 122 |
| 1997 | 0 | 8 | 21 | 31 | 28 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| 1998 | 0 | 0 | 0 | 21 | 28 | 31 | 30 | 31 | 30 | 31 | 6 | 0 | 208 |
| 1999 | 0 | 19 | 31 | 31 | 28 | 29 | 25 | 0 | 7 | 0 | 0 | 0 | 170 |
| 2000 | 0 | 4 | 10 | 11 | 21 | 31 | 18 | 5 | 0 | 0 | 0 | 1 | 101 |
| 2001 | 0 | 0 | 0 | 9 | 16 | 31 | 21 | 0 | 0 | 0 | 0 | 0 | 77 |
| 2002 | 0 | 0 | 17 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 |
| 2003 | 0 | 0 | 14 | 22 | 0 | 6 | 0 | 16 | 0 | 0 | 0 | 0 | 58 |
| 2004 | 0 | 0 | 9 | 5 | 9 | 15 | 0 | 0 | 0 | 0 | 13 | 0 | 51 |
| 2005 | 0 | 0 | 0 | 31 | 28 | 31 | 30 | 29 | 0 | 3 | 0 | 0 | 152 |
| 2006 | 0 | 10 | 4 | 31 | 21 | 31 | 30 | 31 | 16 | 0 | 0 | 0 | 174 |
| 2007 | 0 | 3 | 2 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 |
| 2008 | 0 | 0 | 0 | 12 | 29 | 31 | 6 | 0 | 0 | 0 | 0 | 0 | 78 |
| 2009 | 0 | 0 | 0 | 0 | 3 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 2010 | 1 | 0 | 7 | 12 | 28 | 31 | 30 | 16 | 1 | 0 | 0 | 0 | 126 |
| 2011 | 0 | 0 | 10 | 31 | 28 | 31 | 30 | 31 | 30 | 25 | 14 | 0 | 230 |
| 2012 | 0 | 0 | 0 | 2 | 0 | 0 | 28 | 4 | 0 | 0 | 0 | 0 | 34 |
| 2013 | 0 | 0 | 11 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 |
| **Average** | 2 | 3 | 6 | 14 | 17 | 18 | 14 | 8 | 3 | 2 | 2 | 3 | 93 |
| **Median** | 0 | 0 | 0 | 12 | 19 | 27 | 6 | 0 | 0 | 0 | 0 | 0 | 78 |
| **Minimum** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Maximum** | 31 | 30 | 31 | 31 | 29 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |

Data from USGS Gage 11152500

Estimate based on gaged flow plus estimated inflows from SIWTF, Salinas Stormwater and Blanco Drain

**Total: 7604**

Reflects recorded diversions at the SRDF

**Groundwater Recharge Project**

**Estimated No. Days with Flow of 56 cfs or Higher, Salinas River below SRDF, Diverting at SIWTF, TP1 and Blanco Drain (2.99 cfs)**

| Water Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1932 | 0 | 0 | 7 | 31 | 29 | 31 | 15 | 0 | 0 | 0 | 0 | 0 | 113 |
| 1933 | 0 | 0 | 0 | 4 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 1934 | 0 | 0 | 0 | 15 | 7 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 49 |
| 1935 | 0 | 0 | 0 | 24 | 17 | 24 | 30 | 23 | 0 | 0 | 0 | 0 | 118 |
| 1936 | 0 | 0 | 0 | 4 | 26 | 31 | 30 | 10 | 0 | 0 | 0 | 0 | 101 |
| 1937 | 0 | 0 | 0 | 11 | 28 | 31 | 30 | 28 | 0 | 0 | 0 | 0 | 128 |
| 1938 | 0 | 0 | 20 | 16 | 28 | 31 | 30 | 31 | 11 | 0 | 0 | 0 | 167 |
| 1939 | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 20 |
| 1940 | 0 | 0 | 0 | 21 | 29 | 31 | 30 | 18 | 0 | 0 | 0 | 0 | 129 |
| 1941 | 0 | 0 | 8 | 31 | 28 | 31 | 30 | 31 | 30 | 10 | 0 | 0 | 199 |
| 1942 | 0 | 0 | 16 | 31 | 28 | 31 | 30 | 31 | 15 | 0 | 0 | 0 | 182 |
| 1943 | 0 | 0 | 5 | 31 | 28 | 31 | 30 | 29 | 0 | 0 | 0 | 0 | 154 |
| 1944 | 0 | 0 | 0 | 0 | 24 | 31 | 30 | 11 | 0 | 0 | 0 | 0 | 96 |
| 1945 | 0 | 0 | 0 | 0 | 27 | 31 | 30 | 5 | 0 | 0 | 0 | 0 | 93 |
| 1946 | 0 | 0 | 10 | 31 | 28 | 12 | 25 | 0 | 0 | 0 | 0 | 0 | 106 |
| 1947 | 0 | 1 | 0 | 0 | 7 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 1948 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1949 | 0 | 0 | 0 | 0 | 0 | 28 | 2 | 0 | 0 | 0 | 0 | 0 | 30 |
| 1950 | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 1951 | 0 | 7 | 16 | 12 | 10 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 56 |
| 1952 | 0 | 0 | 2 | 31 | 29 | 31 | 30 | 14 | 0 | 0 | 0 | 0 | 137 |
| 1953 | 0 | 0 | 8 | 31 | 19 | 9 | 0 | 3 | 0 | 0 | 0 | 0 | 70 |
| 1954 | 0 | 0 | 0 | 0 | 13 | 12 | 19 | 0 | 0 | 0 | 0 | 0 | 44 |
| 1955 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1956 | 0 | 0 | 9 | 31 | 29 | 31 | 6 | 1 | 0 | 0 | 0 | 0 | 107 |
| 1957 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1958 | 0 | 0 | 0 | 0 | 25 | 31 | 30 | 31 | 2 | 26 | 31 | 30 | 206 |
| 1959 | 28 | 2 | 0 | 14 | 19 | 31 | 2 | 7 | 0 | 0 | 0 | 2 | 105 |
| 1960 | 0 | 0 | 0 | 0 | 26 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 37 |
| 1961 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1962 | 0 | 0 | 0 | 0 | 19 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 48 |
| 1963 | 0 | 0 | 0 | 1 | 28 | 31 | 30 | 20 | 0 | 0 | 0 | 0 | 110 |
| 1964 | 0 | 10 | 5 | 10 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 44 |
| 1965 | 0 | 0 | 3 | 31 | 19 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 71 |
| 1966 | 0 | 14 | 5 | 31 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 77 |
| 1967 | 0 | 0 | 25 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 28 | 296 |
| 1968 | 1 | 18 | 14 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 37 |
| 1969 | 0 | 0 | 0 | 14 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 256 |
| 1970 | 31 | 30 | 20 | 22 | 28 | 31 | 5 | 0 | 0 | 0 | 0 | 0 | 167 |
| 1971 | 3 | 1 | 17 | 31 | 12 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 71 |
| 1972 | 0 | 0 | 5 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 9 |
| 1973 | 2 | 10 | 0 | 15 | 28 | 31 | 30 | 12 | 0 | 0 | 0 | 0 | 128 |
| 1974 | 23 | 16 | 27 | 29 | 28 | 31 | 30 | 10 | 0 | 0 | 0 | 21 | 215 |
| 1975 | 31 | 22 | 28 | 30 | 28 | 31 | 30 | 8 | 0 | 0 | 0 | 19 | 227 |
| 1976 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 1977 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1978 | 0 | 0 | 12 | 31 | 28 | 31 | 30 | 20 | 0 | 0 | 0 | 26 | 178 |
| 1979 | 0 | 0 | 0 | 11 | 19 | 31 | 20 | 0 | 0 | 0 | 0 | 0 | 81 |
| 1980 | 0 | 0 | 6 | 27 | 29 | 31 | 30 | 14 | 0 | 0 | 5 | 12 | 154 |
| 1981 | 0 | 0 | 0 | 4 | 28 | 27 | 16 | 0 | 0 | 0 | 0 | 0 | 75 |
| 1982 | 0 | 6 | 0 | 27 | 28 | 31 | 30 | 31 | 20 | 0 | 7 | 30 | 210 |
| 1983 | 31 | 30 | 31 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |
| 1984 | 19 | 18 | 31 | 31 | 29 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 152 |
| 1985 | 3 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 1986 | 6 | 3 | 5 | 0 | 19 | 31 | 30 | 13 | 0 | 0 | 0 | 0 | 107 |
| 1987 | 0 | 2 | 17 | 19 | 15 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 64 |
| 1988 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 1989 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 1992 | 0 | 0 | 0 | 0 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| 1993 | 0 | 0 | 0 | 23 | 28 | 31 | 24 | 0 | 0 | 0 | 0 | 0 | 106 |
| 1994 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 1995 | 0 | 0 | 0 | 26 | 28 | 31 | 30 | 30 | 0 | 0 | 0 | 0 | 145 |
| 1996 | 13 | 28 | 4 | 3 | 29 | 31 | 22 | 0 | 0 | 0 | 0 | 0 | 130 |
| 1997 | 0 | 8 | 21 | 31 | 28 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| 1998 | 0 | 0 | 0 | 21 | 28 | 31 | 30 | 31 | 30 | 31 | 6 | 0 | 208 |
| 1999 | 0 | 19 | 31 | 31 | 28 | 30 | 25 | 0 | 9 | 0 | 0 | 0 | 173 |
| 2000 | 0 | 4 | 10 | 11 | 22 | 31 | 20 | 5 | 0 | 0 | 0 | 3 | 106 |
| 2001 | 0 | 0 | 0 | 10 | 16 | 31 | 21 | 0 | 0 | 0 | 0 | 0 | 78 |
| 2002 | 0 | 0 | 18 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 |
| 2003 | 0 | 0 | 14 | 22 | 0 | 6 | 0 | 18 | 0 | 0 | 0 | 0 | 60 |
| 2004 | 0 | 0 | 10 | 5 | 10 | 15 | 0 | 0 | 0 | 0 | 15 | 0 | 55 |
| 2005 | 0 | 0 | 0 | 31 | 28 | 31 | 30 | 30 | 1 | 3 | 0 | 0 | 154 |
| 2006 | 0 | 10 | 5 | 31 | 23 | 31 | 30 | 31 | 17 | 0 | 0 | 0 | 178 |
| 2007 | 0 | 4 | 3 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 |
| 2008 | 0 | 0 | 0 | 13 | 29 | 31 | 6 | 0 | 0 | 0 | 0 | 0 | 79 |
| 2009 | 0 | 0 | 0 | 0 | 5 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| 2010 | 1 | 0 | 8 | 13 | 28 | 31 | 30 | 18 | 5 | 0 | 0 | 0 | 134 |
| 2011 | 0 | 0 | 10 | 31 | 28 | 31 | 30 | 31 | 30 | 30 | 14 | 0 | 235 |
| 2012 | 0 | 0 | 0 | 3 | 0 | 0 | 30 | 9 | 0 | 0 | 0 | 0 | 42 |
| 2013 | 0 | 0 | 11 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 |
| **Average** | 2 | 3 | 6 | 14 | 17 | 19 | 14 | 9 | 3 | 2 | 2 | 3 | 95 |
| **Median** | 0 | 0 | 0 | 12 | 19 | 27 | 6 | 0 | 0 | 0 | 0 | 0 | 79 |
| **Minimum** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Maximum** | 31 | 30 | 31 | 31 | 29 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |

Data from USGS Gage 11152500

Estimate based on gaged flow plus estimated inflows from SIWTF, Salinas Stormwater and Blanco Drain

**Total: 7755**

Reflects recorded diversions at the SRDF

**Groundwater Recharge Project**

**Estimated No. Days with Flow of 50 cfs or Higher, Salinas River below SRDF, Diverting at SIWTF, TP1 and Blanco Drain (2.99 cfs)**

| Water Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1932 | 0 | 0 | 7 | 31 | 29 | 31 | 15 | 0 | 0 | 0 | 0 | 0 | 113 |
| 1933 | 0 | 0 | 0 | 4 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 1934 | 0 | 0 | 0 | 15 | 7 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 49 |
| 1935 | 0 | 0 | 0 | 24 | 19 | 24 | 30 | 24 | 0 | 0 | 0 | 0 | 121 |
| 1936 | 0 | 0 | 0 | 4 | 26 | 31 | 30 | 11 | 0 | 0 | 0 | 0 | 102 |
| 1937 | 0 | 0 | 0 | 13 | 28 | 31 | 30 | 28 | 0 | 0 | 0 | 0 | 130 |
| 1938 | 0 | 0 | 20 | 17 | 28 | 31 | 30 | 31 | 13 | 0 | 0 | 0 | 170 |
| 1939 | 0 | 0 | 0 | 0 | 0 | 20 | 5 | 0 | 0 | 0 | 0 | 0 | 25 |
| 1940 | 0 | 0 | 0 | 21 | 29 | 31 | 30 | 20 | 0 | 0 | 0 | 0 | 131 |
| 1941 | 0 | 0 | 8 | 31 | 28 | 31 | 30 | 31 | 30 | 12 | 0 | 0 | 201 |
| 1942 | 0 | 0 | 16 | 31 | 28 | 31 | 30 | 31 | 17 | 0 | 0 | 0 | 184 |
| 1943 | 0 | 0 | 5 | 31 | 28 | 31 | 30 | 29 | 0 | 0 | 0 | 0 | 154 |
| 1944 | 0 | 0 | 0 | 0 | 24 | 31 | 30 | 12 | 0 | 0 | 0 | 0 | 97 |
| 1945 | 0 | 0 | 0 | 0 | 27 | 31 | 30 | 5 | 0 | 0 | 0 | 0 | 93 |
| 1946 | 0 | 0 | 10 | 31 | 28 | 13 | 25 | 0 | 0 | 0 | 0 | 0 | 107 |
| 1947 | 0 | 1 | 0 | 0 | 8 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| 1948 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1949 | 0 | 0 | 0 | 0 | 0 | 28 | 2 | 0 | 0 | 0 | 0 | 0 | 30 |
| 1950 | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 1951 | 0 | 7 | 16 | 12 | 11 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 57 |
| 1952 | 0 | 0 | 2 | 31 | 29 | 31 | 30 | 14 | 0 | 0 | 0 | 0 | 137 |
| 1953 | 0 | 0 | 8 | 31 | 20 | 10 | 0 | 3 | 0 | 0 | 0 | 0 | 72 |
| 1954 | 0 | 0 | 0 | 0 | 13 | 12 | 20 | 0 | 0 | 0 | 0 | 0 | 45 |
| 1955 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1956 | 0 | 0 | 9 | 31 | 29 | 31 | 7 | 2 | 0 | 0 | 0 | 0 | 109 |
| 1957 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1958 | 0 | 0 | 0 | 0 | 25 | 31 | 30 | 31 | 4 | 26 | 31 | 30 | 208 |
| 1959 | 30 | 2 | 0 | 25 | 28 | 31 | 3 | 8 | 0 | 0 | 0 | 2 | 129 |
| 1960 | 0 | 0 | 0 | 0 | 26 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 40 |
| 1961 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1962 | 0 | 0 | 0 | 0 | 19 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 49 |
| 1963 | 0 | 0 | 0 | 1 | 28 | 31 | 30 | 21 | 0 | 0 | 0 | 0 | 111 |
| 1964 | 0 | 10 | 14 | 11 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 54 |
| 1965 | 0 | 0 | 3 | 31 | 20 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 72 |
| 1966 | 0 | 15 | 5 | 31 | 28 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 80 |
| 1967 | 0 | 0 | 25 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 29 | 297 |
| 1968 | 1 | 20 | 14 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 39 |
| 1969 | 0 | 0 | 0 | 14 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 256 |
| 1970 | 31 | 30 | 21 | 23 | 28 | 31 | 6 | 0 | 0 | 0 | 0 | 0 | 170 |
| 1971 | 4 | 1 | 18 | 31 | 15 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 77 |
| 1972 | 0 | 0 | 5 | 1 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 11 |
| 1973 | 3 | 10 | 0 | 15 | 28 | 31 | 30 | 13 | 0 | 0 | 0 | 0 | 130 |
| 1974 | 23 | 20 | 28 | 29 | 28 | 31 | 30 | 12 | 0 | 0 | 0 | 25 | 226 |
| 1975 | 31 | 24 | 28 | 31 | 28 | 31 | 30 | 9 | 0 | 0 | 0 | 20 | 232 |
| 1976 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| 1977 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1978 | 0 | 0 | 13 | 31 | 28 | 31 | 30 | 21 | 0 | 0 | 0 | 26 | 180 |
| 1979 | 0 | 1 | 4 | 12 | 20 | 31 | 21 | 0 | 0 | 0 | 0 | 0 | 89 |
| 1980 | 0 | 0 | 6 | 27 | 29 | 31 | 30 | 14 | 0 | 0 | 6 | 12 | 155 |
| 1981 | 0 | 0 | 0 | 4 | 28 | 28 | 16 | 0 | 0 | 0 | 0 | 0 | 76 |
| 1982 | 0 | 7 | 0 | 27 | 28 | 31 | 30 | 31 | 24 | 0 | 7 | 30 | 215 |
| 1983 | 31 | 30 | 31 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |
| 1984 | 20 | 18 | 31 | 31 | 29 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 154 |
| 1985 | 4 | 1 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| 1986 | 6 | 3 | 5 | 0 | 19 | 31 | 30 | 14 | 0 | 0 | 0 | 0 | 108 |
| 1987 | 0 | 4 | 19 | 23 | 15 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 73 |
| 1988 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 1989 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 1992 | 0 | 0 | 0 | 0 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 1993 | 0 | 0 | 0 | 23 | 28 | 31 | 24 | 0 | 0 | 0 | 0 | 0 | 106 |
| 1994 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 1995 | 0 | 0 | 0 | 26 | 28 | 31 | 30 | 30 | 0 | 0 | 0 | 0 | 145 |
| 1996 | 14 | 28 | 4 | 3 | 29 | 31 | 23 | 0 | 0 | 0 | 0 | 0 | 132 |
| 1997 | 1 | 8 | 21 | 31 | 28 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 102 |
| 1998 | 0 | 0 | 0 | 22 | 28 | 31 | 30 | 31 | 30 | 31 | 7 | 1 | 211 |
| 1999 | 0 | 19 | 31 | 31 | 28 | 31 | 25 | 0 | 9 | 0 | 0 | 0 | 174 |
| 2000 | 0 | 4 | 10 | 12 | 22 | 31 | 22 | 8 | 0 | 0 | 0 | 5 | 114 |
| 2001 | 0 | 0 | 0 | 10 | 16 | 31 | 21 | 0 | 0 | 0 | 0 | 0 | 78 |
| 2002 | 0 | 0 | 21 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 |
| 2003 | 0 | 0 | 14 | 23 | 0 | 8 | 0 | 19 | 0 | 0 | 0 | 0 | 64 |
| 2004 | 0 | 0 | 11 | 5 | 11 | 16 | 0 | 0 | 0 | 1 | 15 | 0 | 59 |
| 2005 | 0 | 0 | 0 | 31 | 28 | 31 | 30 | 31 | 2 | 6 | 0 | 0 | 159 |
| 2006 | 0 | 10 | 6 | 31 | 26 | 31 | 30 | 31 | 17 | 0 | 0 | 0 | 182 |
| 2007 | 0 | 4 | 3 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 |
| 2008 | 0 | 0 | 2 | 14 | 29 | 31 | 7 | 0 | 0 | 0 | 0 | 0 | 83 |
| 2009 | 0 | 0 | 0 | 0 | 5 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| 2010 | 1 | 0 | 10 | 13 | 28 | 31 | 30 | 18 | 9 | 1 | 0 | 0 | 141 |
| 2011 | 0 | 0 | 10 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 15 | 0 | 237 |
| 2012 | 8 | 1 | 0 | 3 | 0 | 1 | 30 | 13 | 0 | 0 | 0 | 2 | 58 |
| 2013 | 3 | 0 | 12 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 |
| **Average** | 3 | 3 | 6 | 14 | 18 | 19 | 14 | 9 | 3 | 2 | 2 | 3 | 97 |
| **Median** | 0 | 0 | 0 | 13 | 22 | 28 | 7 | 0 | 0 | 0 | 0 | 0 | 83 |
| **Minimum** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Maximum** | 31 | 30 | 31 | 31 | 29 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |

Data from USGS Gage 11152500

Estimate based on gaged flow plus estimated inflows from SIWTF, Salinas Stormwater and Blanco Drain

**Total: 7971**

Reflects recorded diversions at the SRDF

**Groundwater Recharge Project**

**Estimated No. Days with Flow of 72 cfs or Higher, Salinas River below SRDF, Diverting at SIWTF, TP1 and Blanco Drain (6 cfs)**

| Water Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1932 | 0 | 0 | 7 | 31 | 29 | 31 | 13 | 0 | 0 | 0 | 0 | 0 | 111 |
| 1933 | 0 | 0 | 0 | 4 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| 1934 | 0 | 0 | 0 | 14 | 7 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 46 |
| 1935 | 0 | 0 | 0 | 24 | 15 | 24 | 30 | 21 | 0 | 0 | 0 | 0 | 114 |
| 1936 | 0 | 0 | 0 | 4 | 26 | 31 | 30 | 8 | 0 | 0 | 0 | 0 | 99 |
| 1937 | 0 | 0 | 0 | 10 | 28 | 31 | 30 | 25 | 0 | 0 | 0 | 0 | 124 |
| 1938 | 0 | 0 | 20 | 14 | 28 | 31 | 30 | 31 | 8 | 0 | 0 | 0 | 162 |
| 1939 | 0 | 0 | 0 | 0 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 18 |
| 1940 | 0 | 0 | 0 | 21 | 29 | 31 | 30 | 15 | 0 | 0 | 0 | 0 | 126 |
| 1941 | 0 | 0 | 8 | 31 | 28 | 31 | 30 | 31 | 30 | 6 | 0 | 0 | 195 |
| 1942 | 0 | 0 | 16 | 31 | 28 | 31 | 30 | 31 | 12 | 0 | 0 | 0 | 179 |
| 1943 | 0 | 0 | 5 | 28 | 28 | 31 | 30 | 24 | 0 | 0 | 0 | 0 | 146 |
| 1944 | 0 | 0 | 0 | 0 | 24 | 31 | 30 | 10 | 0 | 0 | 0 | 0 | 95 |
| 1945 | 0 | 0 | 0 | 0 | 27 | 31 | 30 | 2 | 0 | 0 | 0 | 0 | 90 |
| 1946 | 0 | 0 | 10 | 31 | 28 | 9 | 24 | 0 | 0 | 0 | 0 | 0 | 102 |
| 1947 | 0 | 0 | 0 | 0 | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| 1948 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1949 | 0 | 0 | 0 | 0 | 0 | 28 | 1 | 0 | 0 | 0 | 0 | 0 | 29 |
| 1950 | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| 1951 | 0 | 5 | 15 | 12 | 8 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 50 |
| 1952 | 0 | 0 | 2 | 31 | 29 | 31 | 30 | 10 | 0 | 0 | 0 | 0 | 133 |
| 1953 | 0 | 0 | 8 | 31 | 17 | 7 | 0 | 2 | 0 | 0 | 0 | 0 | 65 |
| 1954 | 0 | 0 | 0 | 0 | 12 | 12 | 18 | 0 | 0 | 0 | 0 | 0 | 42 |
| 1955 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1956 | 0 | 0 | 9 | 31 | 29 | 31 | 3 | 0 | 0 | 0 | 0 | 0 | 103 |
| 1957 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1958 | 0 | 0 | 0 | 0 | 24 | 31 | 30 | 30 | 0 | 26 | 31 | 30 | 202 |
| 1959 | 7 | 0 | 0 | 9 | 18 | 29 | 0 | 6 | 0 | 0 | 0 | 1 | 70 |
| 1960 | 0 | 0 | 0 | 0 | 26 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 34 |
| 1961 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1962 | 0 | 0 | 0 | 0 | 19 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 47 |
| 1963 | 0 | 0 | 0 | 1 | 28 | 31 | 30 | 18 | 0 | 0 | 0 | 0 | 108 |
| 1964 | 0 | 8 | 0 | 10 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 35 |
| 1965 | 0 | 0 | 2 | 31 | 16 | 0 | 16 | 0 | 0 | 0 | 0 | 0 | 65 |
| 1966 | 0 | 14 | 3 | 24 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 65 |
| 1967 | 0 | 0 | 25 | 31 | 28 | 31 | 30 | 31 | 30 | 29 | 31 | 27 | 293 |
| 1968 | 0 | 16 | 10 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 28 |
| 1969 | 0 | 0 | 0 | 14 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 256 |
| 1970 | 31 | 30 | 12 | 22 | 25 | 31 | 3 | 0 | 0 | 0 | 0 | 0 | 154 |
| 1971 | 0 | 1 | 17 | 31 | 8 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 63 |
| 1972 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 |
| 1973 | 0 | 6 | 0 | 15 | 28 | 31 | 30 | 10 | 0 | 0 | 0 | 0 | 120 |
| 1974 | 14 | 8 | 22 | 28 | 28 | 31 | 30 | 8 | 0 | 0 | 0 | 14 | 183 |
| 1975 | 31 | 17 | 28 | 21 | 27 | 31 | 30 | 6 | 0 | 0 | 0 | 16 | 207 |
| 1976 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 1977 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1978 | 0 | 0 | 12 | 31 | 28 | 31 | 30 | 20 | 0 | 0 | 0 | 20 | 172 |
| 1979 | 0 | 0 | 0 | 8 | 16 | 31 | 19 | 0 | 0 | 0 | 0 | 0 | 74 |
| 1980 | 0 | 0 | 4 | 26 | 29 | 31 | 30 | 8 | 0 | 0 | 0 | 9 | 137 |
| 1981 | 0 | 0 | 0 | 4 | 28 | 26 | 14 | 0 | 0 | 0 | 0 | 0 | 72 |
| 1982 | 0 | 4 | 0 | 27 | 28 | 31 | 30 | 31 | 17 | 0 | 2 | 30 | 200 |
| 1983 | 31 | 30 | 31 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |
| 1984 | 14 | 13 | 31 | 31 | 29 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 139 |
| 1985 | 3 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| 1986 | 5 | 2 | 3 | 0 | 17 | 31 | 30 | 10 | 0 | 0 | 0 | 0 | 98 |
| 1987 | 0 | 0 | 9 | 11 | 13 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 42 |
| 1988 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 1989 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 1992 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 1993 | 0 | 0 | 0 | 23 | 28 | 31 | 23 | 0 | 0 | 0 | 0 | 0 | 105 |
| 1994 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 1995 | 0 | 0 | 0 | 26 | 28 | 31 | 30 | 27 | 0 | 0 | 0 | 0 | 142 |
| 1996 | 1 | 22 | 2 | 1 | 29 | 31 | 21 | 0 | 0 | 0 | 0 | 0 | 107 |
| 1997 | 0 | 6 | 21 | 31 | 28 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 98 |
| 1998 | 0 | 0 | 0 | 21 | 28 | 31 | 30 | 31 | 30 | 31 | 6 | 0 | 208 |
| 1999 | 0 | 19 | 31 | 31 | 28 | 24 | 24 | 0 | 4 | 0 | 0 | 0 | 161 |
| 2000 | 0 | 4 | 9 | 10 | 21 | 31 | 14 | 0 | 0 | 0 | 0 | 0 | 89 |
| 2001 | 0 | 0 | 0 | 8 | 16 | 31 | 17 | 0 | 0 | 0 | 0 | 0 | 72 |
| 2002 | 0 | 0 | 15 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 |
| 2003 | 0 | 0 | 14 | 21 | 0 | 5 | 0 | 14 | 0 | 0 | 0 | 0 | 54 |
| 2004 | 0 | 0 | 7 | 5 | 8 | 14 | 0 | 0 | 0 | 0 | 6 | 0 | 40 |
| 2005 | 0 | 0 | 0 | 31 | 28 | 31 | 30 | 27 | 0 | 1 | 0 | 0 | 148 |
| 2006 | 0 | 2 | 2 | 31 | 18 | 31 | 30 | 31 | 15 | 0 | 0 | 0 | 160 |
| 2007 | 0 | 3 | 2 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 |
| 2008 | 0 | 0 | 0 | 11 | 29 | 31 | 4 | 0 | 0 | 0 | 0 | 0 | 75 |
| 2009 | 0 | 0 | 0 | 0 | 3 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 2010 | 0 | 0 | 6 | 12 | 28 | 31 | 30 | 15 | 0 | 0 | 0 | 0 | 122 |
| 2011 | 0 | 0 | 10 | 31 | 28 | 31 | 30 | 31 | 23 | 11 | 11 | 0 | 206 |
| 2012 | 0 | 0 | 0 | 2 | 0 | 0 | 24 | 1 | 0 | 0 | 0 | 0 | 27 |
| 2013 | 0 | 0 | 11 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 19 |
| **Average** | 2 | 3 | 5 | 13 | 17 | 18 | 14 | 8 | 3 | 2 | 2 | 3 | 88 |
| **Median** | 0 | 0 | 0 | 10 | 18 | 25 | 4 | 0 | 0 | 0 | 0 | 0 | 72 |
| **Minimum** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Maximum** | 31 | 30 | 31 | 31 | 29 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |

Data from USGS Gage 11152500

Estimate based on gaged flow plus estimated inflows from SIWTF, Salinas Stormwater and Blanco Drain

**Total: 7239**

Reflects recorded diversions at the SRDF

**Groundwater Recharge Project**

**Estimated No. Days with Flow of 60 cfs or Higher, Salinas River below SRDF, Diverting at SIWTF, TP1 and Blanco Drain (6 cfs)**

| Water Year | *Oct* | *Nov* | *Dec* | *Jan* | *Feb* | *Mar* | *Apr* | *May* | *Jun* | *Jul* | *Aug* | *Sep* | *Total* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *1932* | 0 | 0 | 7 | 31 | 29 | 31 | 15 | 0 | 0 | 0 | 0 | 0 | 113 |
| *1933* | 0 | 0 | 0 | 4 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| *1934* | 0 | 0 | 0 | 15 | 7 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 48 |
| *1935* | 0 | 0 | 0 | 24 | 17 | 24 | 30 | 22 | 0 | 0 | 0 | 0 | 117 |
| *1936* | 0 | 0 | 0 | 4 | 26 | 31 | 30 | 9 | 0 | 0 | 0 | 0 | 100 |
| *1937* | 0 | 0 | 0 | 11 | 28 | 31 | 30 | 27 | 0 | 0 | 0 | 0 | 127 |
| *1938* | 0 | 0 | 20 | 15 | 28 | 31 | 30 | 31 | 10 | 0 | 0 | 0 | 165 |
| *1939* | 0 | 0 | 0 | 0 | 0 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 19 |
| *1940* | 0 | 0 | 0 | 21 | 29 | 31 | 30 | 17 | 0 | 0 | 0 | 0 | 128 |
| *1941* | 0 | 0 | 8 | 31 | 28 | 31 | 30 | 31 | 30 | 9 | 0 | 0 | 198 |
| *1942* | 0 | 0 | 16 | 31 | 28 | 31 | 30 | 31 | 14 | 0 | 0 | 0 | 181 |
| *1943* | 0 | 0 | 5 | 31 | 28 | 31 | 30 | 28 | 0 | 0 | 0 | 0 | 153 |
| *1944* | 0 | 0 | 0 | 0 | 24 | 31 | 30 | 11 | 0 | 0 | 0 | 0 | 96 |
| *1945* | 0 | 0 | 0 | 0 | 27 | 31 | 30 | 5 | 0 | 0 | 0 | 0 | 93 |
| *1946* | 0 | 0 | 10 | 31 | 28 | 12 | 25 | 0 | 0 | 0 | 0 | 0 | 106 |
| *1947* | 0 | 1 | 0 | 0 | 6 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| *1948* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1949* | 0 | 0 | 0 | 0 | 0 | 28 | 2 | 0 | 0 | 0 | 0 | 0 | 30 |
| *1950* | 0 | 0 | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 |
| *1951* | 0 | 6 | 16 | 12 | 9 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 54 |
| *1952* | 0 | 0 | 2 | 31 | 29 | 31 | 30 | 13 | 0 | 0 | 0 | 0 | 136 |
| *1953* | 0 | 0 | 8 | 31 | 18 | 8 | 0 | 3 | 0 | 0 | 0 | 0 | 68 |
| *1954* | 0 | 0 | 0 | 0 | 12 | 12 | 19 | 0 | 0 | 0 | 0 | 0 | 43 |
| *1955* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1956* | 0 | 0 | 9 | 31 | 29 | 31 | 5 | 1 | 0 | 0 | 0 | 0 | 106 |
| *1957* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1958* | 0 | 0 | 0 | 0 | 25 | 31 | 30 | 31 | 2 | 26 | 31 | 30 | 206 |
| *1959* | 27 | 1 | 0 | 13 | 19 | 31 | 1 | 7 | 0 | 0 | 0 | 2 | 101 |
| *1960* | 0 | 0 | 0 | 0 | 26 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 36 |
| *1961* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1962* | 0 | 0 | 0 | 0 | 19 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 48 |
| *1963* | 0 | 0 | 0 | 1 | 28 | 31 | 30 | 20 | 0 | 0 | 0 | 0 | 110 |
| *1964* | 0 | 10 | 2 | 10 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 |
| *1965* | 0 | 0 | 3 | 31 | 19 | 0 | 17 | 0 | 0 | 0 | 0 | 0 | 70 |
| *1966* | 0 | 14 | 4 | 29 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 73 |
| *1967* | 0 | 0 | 25 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 28 | 296 |
| *1968* | 0 | 18 | 13 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 34 |
| *1969* | 0 | 0 | 0 | 14 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 256 |
| *1970* | 31 | 30 | 16 | 22 | 27 | 31 | 4 | 0 | 0 | 0 | 0 | 0 | 161 |
| *1971* | 2 | 1 | 17 | 31 | 11 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 69 |
| *1972* | 0 | 0 | 5 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 8 |
| *1973* | 1 | 10 | 0 | 15 | 28 | 31 | 30 | 11 | 0 | 0 | 0 | 0 | 126 |
| *1974* | 19 | 9 | 24 | 29 | 28 | 31 | 30 | 9 | 0 | 0 | 0 | 20 | 199 |
| *1975* | 31 | 21 | 28 | 29 | 28 | 31 | 30 | 8 | 0 | 0 | 0 | 18 | 224 |
| *1976* | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| *1977* | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *1978* | 0 | 0 | 12 | 31 | 28 | 31 | 30 | 20 | 0 | 0 | 0 | 23 | 175 |
| *1979* | 0 | 0 | 0 | 11 | 18 | 31 | 20 | 0 | 0 | 0 | 0 | 0 | 80 |
| *1980* | 0 | 0 | 6 | 27 | 29 | 31 | 30 | 13 | 0 | 0 | 2 | 11 | 149 |
| *1981* | 0 | 0 | 0 | 4 | 28 | 27 | 15 | 0 | 0 | 0 | 0 | 0 | 74 |
| *1982* | 0 | 6 | 0 | 27 | 28 | 31 | 30 | 31 | 20 | 0 | 6 | 30 | 209 |
| *1983* | 31 | 30 | 31 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |
| *1984* | 16 | 17 | 31 | 31 | 29 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 147 |
| *1985* | 3 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| *1986* | 6 | 3 | 3 | 0 | 19 | 31 | 30 | 11 | 0 | 0 | 0 | 0 | 103 |
| *1987* | 0 | 0 | 16 | 15 | 14 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 55 |
| *1988* | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| *1989* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1990* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1991* | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| *1992* | 0 | 0 | 0 | 0 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| *1993* | 0 | 0 | 0 | 23 | 28 | 31 | 24 | 0 | 0 | 0 | 0 | 0 | 106 |
| *1994* | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| *1995* | 0 | 0 | 0 | 26 | 28 | 31 | 30 | 29 | 0 | 0 | 0 | 0 | 144 |
| *1996* | 8 | 26 | 3 | 3 | 29 | 31 | 22 | 0 | 0 | 0 | 0 | 0 | 122 |
| *1997* | 0 | 8 | 21 | 31 | 28 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| *1998* | 0 | 0 | 0 | 21 | 28 | 31 | 30 | 31 | 30 | 31 | 6 | 0 | 208 |
| *1999* | 0 | 19 | 31 | 31 | 28 | 29 | 25 | 0 | 7 | 0 | 0 | 0 | 170 |
| *2000* | 0 | 4 | 10 | 11 | 21 | 31 | 17 | 5 | 0 | 0 | 0 | 1 | 100 |
| *2001* | 0 | 0 | 0 | 9 | 16 | 31 | 21 | 0 | 0 | 0 | 0 | 0 | 77 |
| *2002* | 0 | 0 | 17 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 |
| *2003* | 0 | 0 | 14 | 22 | 0 | 6 | 0 | 16 | 0 | 0 | 0 | 0 | 58 |
| *2004* | 0 | 0 | 9 | 5 | 9 | 15 | 0 | 0 | 0 | 0 | 13 | 0 | 51 |
| *2005* | 0 | 0 | 0 | 31 | 28 | 31 | 30 | 29 | 0 | 3 | 0 | 0 | 152 |
| *2006* | 0 | 10 | 4 | 31 | 21 | 31 | 30 | 31 | 16 | 0 | 0 | 0 | 174 |
| *2007* | 0 | 3 | 2 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 25 |
| *2008* | 0 | 0 | 0 | 12 | 29 | 31 | 6 | 0 | 0 | 0 | 0 | 0 | 78 |
| *2009* | 0 | 0 | 0 | 0 | 3 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| *2010* | 1 | 0 | 7 | 12 | 28 | 31 | 30 | 16 | 1 | 0 | 0 | 0 | 126 |
| *2011* | 0 | 0 | 10 | 31 | 28 | 31 | 30 | 31 | 30 | 23 | 13 | 0 | 227 |
| *2012* | 0 | 0 | 0 | 2 | 0 | 0 | 28 | 4 | 0 | 0 | 0 | 0 | 34 |
| *2013* | 0 | 0 | 11 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 |
| **Average** | 2 | 3 | 6 | 14 | 17 | 18 | 14 | 8 | 3 | 2 | 2 | 3 | 93 |
| **Median** | 0 | 0 | 0 | 12 | 19 | 27 | 6 | 0 | 0 | 0 | 0 | 0 | 78 |
| **Minimum** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Maximum** | 31 | 30 | 31 | 31 | 29 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |

Data from USGS Gage 11152500

Estimate based on gaged flow plus estimated inflows from SIWTF, Salinas Stormwater and Blanco Drain

**Total: 7596**

Reflects recorded diversions at the SRDF

**Groundwater Recharge Project**

**Estimated No. Days with Flow of 56 cfs or Higher, Salinas River below SRDF, Diverting at SIWTF, TP1 and Blanco Drain (6 cfs)**

| Water Year | *Oct* | *Nov* | *Dec* | *Jan* | *Feb* | *Mar* | *Apr* | *May* | *Jun* | *Jul* | *Aug* | *Sep* | *Total* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *1932* | 0 | 0 | 7 | 31 | 29 | 31 | 15 | 0 | 0 | 0 | 0 | 0 | 113 |
| *1933* | 0 | 0 | 0 | 4 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| *1934* | 0 | 0 | 0 | 15 | 7 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 49 |
| *1935* | 0 | 0 | 0 | 24 | 17 | 24 | 30 | 23 | 0 | 0 | 0 | 0 | 118 |
| *1936* | 0 | 0 | 0 | 4 | 26 | 31 | 30 | 10 | 0 | 0 | 0 | 0 | 101 |
| *1937* | 0 | 0 | 0 | 11 | 28 | 31 | 30 | 28 | 0 | 0 | 0 | 0 | 128 |
| *1938* | 0 | 0 | 20 | 16 | 28 | 31 | 30 | 31 | 11 | 0 | 0 | 0 | 167 |
| *1939* | 0 | 0 | 0 | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 20 |
| *1940* | 0 | 0 | 0 | 21 | 29 | 31 | 30 | 18 | 0 | 0 | 0 | 0 | 129 |
| *1941* | 0 | 0 | 8 | 31 | 28 | 31 | 30 | 31 | 30 | 10 | 0 | 0 | 199 |
| *1942* | 0 | 0 | 16 | 31 | 28 | 31 | 30 | 31 | 15 | 0 | 0 | 0 | 182 |
| *1943* | 0 | 0 | 5 | 31 | 28 | 31 | 30 | 29 | 0 | 0 | 0 | 0 | 154 |
| *1944* | 0 | 0 | 0 | 0 | 24 | 31 | 30 | 11 | 0 | 0 | 0 | 0 | 96 |
| *1945* | 0 | 0 | 0 | 0 | 27 | 31 | 30 | 5 | 0 | 0 | 0 | 0 | 93 |
| *1946* | 0 | 0 | 10 | 31 | 28 | 12 | 25 | 0 | 0 | 0 | 0 | 0 | 106 |
| *1947* | 0 | 1 | 0 | 0 | 7 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| *1948* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1949* | 0 | 0 | 0 | 0 | 0 | 28 | 2 | 0 | 0 | 0 | 0 | 0 | 30 |
| *1950* | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| *1951* | 0 | 7 | 16 | 12 | 10 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 56 |
| *1952* | 0 | 0 | 2 | 31 | 29 | 31 | 30 | 14 | 0 | 0 | 0 | 0 | 137 |
| *1953* | 0 | 0 | 8 | 31 | 19 | 8 | 0 | 3 | 0 | 0 | 0 | 0 | 69 |
| *1954* | 0 | 0 | 0 | 0 | 13 | 12 | 19 | 0 | 0 | 0 | 0 | 0 | 44 |
| *1955* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1956* | 0 | 0 | 9 | 31 | 29 | 31 | 6 | 1 | 0 | 0 | 0 | 0 | 107 |
| *1957* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1958* | 0 | 0 | 0 | 0 | 25 | 31 | 30 | 31 | 2 | 26 | 31 | 30 | 206 |
| *1959* | 28 | 2 | 0 | 14 | 19 | 31 | 2 | 7 | 0 | 0 | 0 | 2 | 105 |
| *1960* | 0 | 0 | 0 | 0 | 26 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 37 |
| *1961* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1962* | 0 | 0 | 0 | 0 | 19 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 48 |
| *1963* | 0 | 0 | 0 | 1 | 28 | 31 | 30 | 20 | 0 | 0 | 0 | 0 | 110 |
| *1964* | 0 | 10 | 5 | 10 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 44 |
| *1965* | 0 | 0 | 3 | 31 | 19 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 71 |
| *1966* | 0 | 14 | 5 | 31 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 77 |
| *1967* | 0 | 0 | 25 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 28 | 296 |
| *1968* | 1 | 18 | 14 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 37 |
| *1969* | 0 | 0 | 0 | 14 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 256 |
| *1970* | 31 | 30 | 20 | 22 | 28 | 31 | 5 | 0 | 0 | 0 | 0 | 0 | 167 |
| *1971* | 3 | 1 | 17 | 31 | 12 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 71 |
| *1972* | 0 | 0 | 5 | 0 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 8 |
| *1973* | 2 | 10 | 0 | 15 | 28 | 31 | 30 | 12 | 0 | 0 | 0 | 0 | 128 |
| *1974* | 23 | 16 | 27 | 29 | 28 | 31 | 30 | 10 | 0 | 0 | 0 | 21 | 215 |
| *1975* | 31 | 22 | 28 | 30 | 28 | 31 | 30 | 8 | 0 | 0 | 0 | 19 | 227 |
| *1976* | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| *1977* | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| *1978* | 0 | 0 | 12 | 31 | 28 | 31 | 30 | 20 | 0 | 0 | 0 | 26 | 178 |
| *1979* | 0 | 0 | 0 | 11 | 19 | 31 | 20 | 0 | 0 | 0 | 0 | 0 | 81 |
| *1980* | 0 | 0 | 6 | 27 | 29 | 31 | 30 | 14 | 0 | 0 | 5 | 12 | 154 |
| *1981* | 0 | 0 | 0 | 4 | 28 | 27 | 16 | 0 | 0 | 0 | 0 | 0 | 75 |
| *1982* | 0 | 6 | 0 | 27 | 28 | 31 | 30 | 31 | 20 | 0 | 7 | 30 | 210 |
| *1983* | 31 | 30 | 31 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |
| *1984* | 19 | 18 | 31 | 31 | 29 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 152 |
| *1985* | 3 | 1 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 |
| *1986* | 6 | 3 | 5 | 0 | 19 | 31 | 30 | 13 | 0 | 0 | 0 | 0 | 107 |
| *1987* | 0 | 2 | 17 | 19 | 14 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 63 |
| *1988* | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| *1989* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1990* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| *1991* | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| *1992* | 0 | 0 | 0 | 0 | 10 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| *1993* | 0 | 0 | 0 | 23 | 28 | 31 | 24 | 0 | 0 | 0 | 0 | 0 | 106 |
| *1994* | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| *1995* | 0 | 0 | 0 | 26 | 28 | 31 | 30 | 30 | 0 | 0 | 0 | 0 | 145 |
| *1996* | 13 | 28 | 4 | 3 | 29 | 31 | 22 | 0 | 0 | 0 | 0 | 0 | 130 |
| *1997* | 0 | 8 | 21 | 31 | 28 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| *1998* | 0 | 0 | 0 | 21 | 28 | 31 | 30 | 31 | 30 | 31 | 6 | 0 | 208 |
| *1999* | 0 | 19 | 31 | 31 | 28 | 30 | 25 | 0 | 8 | 0 | 0 | 0 | 172 |
| *2000* | 0 | 4 | 10 | 11 | 21 | 31 | 19 | 5 | 0 | 0 | 0 | 3 | 104 |
| *2001* | 0 | 0 | 0 | 10 | 16 | 31 | 21 | 0 | 0 | 0 | 0 | 0 | 78 |
| *2002* | 0 | 0 | 18 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 32 |
| *2003* | 0 | 0 | 14 | 22 | 0 | 6 | 0 | 18 | 0 | 0 | 0 | 0 | 60 |
| *2004* | 0 | 0 | 10 | 5 | 10 | 15 | 0 | 0 | 0 | 0 | 15 | 0 | 55 |
| *2005* | 0 | 0 | 0 | 31 | 28 | 31 | 30 | 30 | 1 | 3 | 0 | 0 | 154 |
| *2006* | 0 | 10 | 5 | 31 | 23 | 31 | 30 | 31 | 17 | 0 | 0 | 0 | 178 |
| *2007* | 0 | 4 | 3 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 28 |
| *2008* | 0 | 0 | 0 | 13 | 29 | 31 | 6 | 0 | 0 | 0 | 0 | 0 | 79 |
| *2009* | 0 | 0 | 0 | 0 | 5 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| *2010* | 1 | 0 | 8 | 13 | 28 | 31 | 30 | 18 | 3 | 0 | 0 | 0 | 132 |
| *2011* | 0 | 0 | 10 | 31 | 28 | 31 | 30 | 31 | 30 | 28 | 14 | 0 | 233 |
| *2012* | 0 | 0 | 0 | 3 | 0 | 0 | 30 | 7 | 0 | 0 | 0 | 0 | 40 |
| *2013* | 0 | 0 | 11 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 |
| **Average** | 2 | 3 | 6 | 14 | 17 | 19 | 14 | 8 | 3 | 2 | 2 | 3 | 94 |
| **Median** | 0 | 0 | 0 | 12 | 19 | 27 | 6 | 0 | 0 | 0 | 0 | 0 | 79 |
| **Minimum** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Maximum** | 31 | 30 | 31 | 31 | 29 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |

Data from USGS Gage 11152500

Estimate based on gaged flow plus estimated inflows from SIWTF, Salinas Stormwater and Blanco Drain

**Total: 7743**

Reflects recorded diversions at the SRDF

**Groundwater Recharge Project**

**Estimated No. Days with Flow of 50 cfs or Higher, Salinas River below SRDF, Diverting at SIWTF, TP1 and Blanco Drain (6 cfs)**

| Water Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1932 | 0 | 0 | 7 | 31 | 29 | 31 | 15 | 0 | 0 | 0 | 0 | 0 | 113 |
| 1933 | 0 | 0 | 0 | 4 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 1934 | 0 | 0 | 0 | 15 | 7 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 49 |
| 1935 | 0 | 0 | 0 | 24 | 19 | 24 | 30 | 24 | 0 | 0 | 0 | 0 | 121 |
| 1936 | 0 | 0 | 0 | 4 | 26 | 31 | 30 | 11 | 0 | 0 | 0 | 0 | 102 |
| 1937 | 0 | 0 | 0 | 13 | 28 | 31 | 30 | 28 | 0 | 0 | 0 | 0 | 130 |
| 1938 | 0 | 0 | 20 | 17 | 28 | 31 | 30 | 31 | 13 | 0 | 0 | 0 | 170 |
| 1939 | 0 | 0 | 0 | 0 | 0 | 20 | 5 | 0 | 0 | 0 | 0 | 0 | 25 |
| 1940 | 0 | 0 | 0 | 21 | 29 | 31 | 30 | 20 | 0 | 0 | 0 | 0 | 131 |
| 1941 | 0 | 0 | 8 | 31 | 28 | 31 | 30 | 31 | 30 | 12 | 0 | 0 | 201 |
| 1942 | 0 | 0 | 16 | 31 | 28 | 31 | 30 | 31 | 16 | 0 | 0 | 0 | 183 |
| 1943 | 0 | 0 | 5 | 31 | 28 | 31 | 30 | 29 | 0 | 0 | 0 | 0 | 154 |
| 1944 | 0 | 0 | 0 | 0 | 24 | 31 | 30 | 12 | 0 | 0 | 0 | 0 | 97 |
| 1945 | 0 | 0 | 0 | 0 | 27 | 31 | 30 | 5 | 0 | 0 | 0 | 0 | 93 |
| 1946 | 0 | 0 | 10 | 31 | 28 | 13 | 25 | 0 | 0 | 0 | 0 | 0 | 107 |
| 1947 | 0 | 1 | 0 | 0 | 8 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 1948 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1949 | 0 | 0 | 0 | 0 | 0 | 28 | 2 | 0 | 0 | 0 | 0 | 0 | 30 |
| 1950 | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 1951 | 0 | 7 | 16 | 12 | 11 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 57 |
| 1952 | 0 | 0 | 2 | 31 | 29 | 31 | 30 | 14 | 0 | 0 | 0 | 0 | 137 |
| 1953 | 0 | 0 | 8 | 31 | 20 | 10 | 0 | 3 | 0 | 0 | 0 | 0 | 72 |
| 1954 | 0 | 0 | 0 | 0 | 13 | 12 | 20 | 0 | 0 | 0 | 0 | 0 | 45 |
| 1955 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1956 | 0 | 0 | 9 | 31 | 29 | 31 | 7 | 2 | 0 | 0 | 0 | 0 | 109 |
| 1957 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1958 | 0 | 0 | 0 | 0 | 25 | 31 | 30 | 31 | 4 | 26 | 31 | 30 | 208 |
| 1959 | 30 | 2 | 0 | 25 | 28 | 31 | 3 | 8 | 0 | 0 | 0 | 2 | 129 |
| 1960 | 0 | 0 | 0 | 0 | 26 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 40 |
| 1961 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1962 | 0 | 0 | 0 | 0 | 19 | 30 | 0 | 0 | 0 | 0 | 0 | 0 | 49 |
| 1963 | 0 | 0 | 0 | 1 | 28 | 31 | 30 | 21 | 0 | 0 | 0 | 0 | 111 |
| 1964 | 0 | 10 | 14 | 11 | 19 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 54 |
| 1965 | 0 | 0 | 3 | 31 | 20 | 0 | 18 | 0 | 0 | 0 | 0 | 0 | 72 |
| 1966 | 0 | 15 | 5 | 31 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 79 |
| 1967 | 0 | 0 | 25 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 29 | 297 |
| 1968 | 1 | 20 | 14 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 39 |
| 1969 | 0 | 0 | 0 | 14 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 256 |
| 1970 | 31 | 30 | 21 | 23 | 28 | 31 | 6 | 0 | 0 | 0 | 0 | 0 | 170 |
| 1971 | 4 | 1 | 18 | 31 | 15 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 77 |
| 1972 | 0 | 0 | 5 | 1 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 11 |
| 1973 | 3 | 10 | 0 | 15 | 28 | 31 | 30 | 13 | 0 | 0 | 0 | 0 | 130 |
| 1974 | 23 | 20 | 28 | 29 | 28 | 31 | 30 | 12 | 0 | 0 | 0 | 25 | 226 |
| 1975 | 31 | 24 | 28 | 31 | 28 | 31 | 30 | 9 | 0 | 0 | 0 | 20 | 232 |
| 1976 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 |
| 1977 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 |
| 1978 | 0 | 0 | 13 | 31 | 28 | 31 | 30 | 21 | 0 | 0 | 0 | 26 | 180 |
| 1979 | 0 | 1 | 4 | 12 | 20 | 31 | 21 | 0 | 0 | 0 | 0 | 0 | 89 |
| 1980 | 0 | 0 | 6 | 27 | 29 | 31 | 30 | 14 | 0 | 0 | 6 | 12 | 155 |
| 1981 | 0 | 0 | 0 | 4 | 28 | 28 | 16 | 0 | 0 | 0 | 0 | 0 | 76 |
| 1982 | 0 | 7 | 0 | 27 | 28 | 31 | 30 | 31 | 23 | 0 | 7 | 30 | 214 |
| 1983 | 31 | 30 | 31 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |
| 1984 | 20 | 18 | 31 | 31 | 29 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 154 |
| 1985 | 4 | 1 | 0 | 0 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| 1986 | 6 | 3 | 5 | 0 | 19 | 31 | 30 | 14 | 0 | 0 | 0 | 0 | 108 |
| 1987 | 0 | 4 | 19 | 23 | 15 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 73 |
| 1988 | 0 | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| 1989 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1990 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 1991 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 9 |
| 1992 | 0 | 0 | 0 | 0 | 10 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 12 |
| 1993 | 0 | 0 | 0 | 23 | 28 | 31 | 24 | 0 | 0 | 0 | 0 | 0 | 106 |
| 1994 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 10 |
| 1995 | 0 | 0 | 0 | 26 | 28 | 31 | 30 | 30 | 0 | 0 | 0 | 0 | 145 |
| 1996 | 14 | 28 | 4 | 3 | 29 | 31 | 23 | 0 | 0 | 0 | 0 | 0 | 132 |
| 1997 | 1 | 8 | 21 | 31 | 28 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 101 |
| 1998 | 0 | 0 | 0 | 22 | 28 | 31 | 30 | 31 | 30 | 31 | 7 | 1 | 211 |
| 1999 | 0 | 19 | 31 | 31 | 28 | 31 | 25 | 0 | 9 | 0 | 0 | 0 | 174 |
| 2000 | 0 | 4 | 10 | 12 | 22 | 31 | 21 | 8 | 0 | 0 | 0 | 5 | 113 |
| 2001 | 0 | 0 | 0 | 10 | 16 | 31 | 21 | 0 | 0 | 0 | 0 | 0 | 78 |
| 2002 | 0 | 0 | 21 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 |
| 2003 | 0 | 0 | 14 | 23 | 0 | 8 | 0 | 19 | 0 | 0 | 0 | 0 | 64 |
| 2004 | 0 | 0 | 11 | 5 | 11 | 15 | 0 | 0 | 0 | 1 | 15 | 0 | 58 |
| 2005 | 0 | 0 | 0 | 31 | 28 | 31 | 30 | 31 | 2 | 6 | 0 | 0 | 159 |
| 2006 | 0 | 10 | 6 | 31 | 25 | 31 | 30 | 31 | 17 | 0 | 0 | 0 | 181 |
| 2007 | 0 | 4 | 3 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 |
| 2008 | 0 | 0 | 2 | 14 | 29 | 31 | 7 | 0 | 0 | 0 | 0 | 0 | 83 |
| 2009 | 0 | 0 | 0 | 0 | 5 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 16 |
| 2010 | 1 | 0 | 10 | 13 | 28 | 31 | 30 | 18 | 8 | 0 | 0 | 0 | 139 |
| 2011 | 0 | 0 | 10 | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 15 | 0 | 237 |
| 2012 | 8 | 1 | 0 | 3 | 0 | 1 | 30 | 12 | 0 | 0 | 0 | 2 | 57 |
| 2013 | 3 | 0 | 12 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 |
| **Average** | 3 | 3 | 6 | 14 | 18 | 19 | 14 | 9 | 3 | 2 | 2 | 3 | 97 |
| **Median** | 0 | 0 | 0 | 13 | 22 | 28 | 7 | 0 | 0 | 0 | 0 | 0 | 83 |
| **Minimum** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Maximum** | 31 | 30 | 31 | 31 | 29 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 365 |

Data from USGS Gage 11152500

Estimate based on gaged flow plus estimated inflows from SIWTF, Salinas Stormwater and Blanco Drain

**Total: 7960**

Reflects recorded diversions at the SRDF

**Scenario Notes:**

**Case 0:** Base Condition for Salinas River just downstream of Blanco Drain.
Flow = USGS Speckels, plus SIWTF outflow to River, plus Salinas Stormwater outfall,
plus inflows from Blanco Drain, minus SRDF (rubber dam) diversions and stormwater capture.

No diversions of Salinas stormwater or SIWTF water.
No diversions from Blanco Drain.
Rubber dam diversions 2010-2013 are balanced by extra flow at Spreckels.

**Case 1:** Divert both Salinas stormwater and SIWTF water.
No diversions from Blanco Drain.
Rubber dam diversions 2010-2013 are balanced by extra flow at Spreckels.

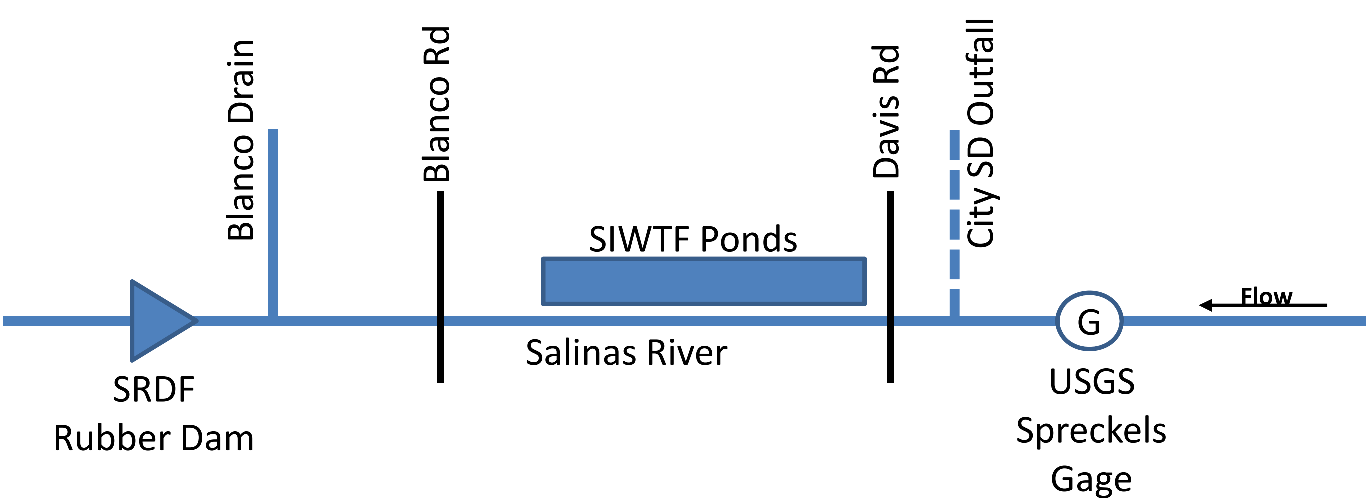
**Case 2:** Divert both Salinas stormwater and SIWTF water.
Divert up to 2.99 cfs from Blanco Drain.
Rubber dam diversions 2010-2013 are balanced by extra flow at Spreckels.

**Case 3:** Divert both Salinas stormwater and SIWTF water.
Divert up to 4.6 cfs from Blanco Drain.
Rubber dam diversions 2010-2013 are balanced by extra flow at Spreckels.

**Percentile Results:**
The flow with the nth percentile rank.
The 1.0 percetile flow is the highest daily flow.
The 0.50 percentile flow is the median daily flow.
The 0.01 percentile flow is exceeded 99% of the time (blank if 0.0 cfs).

**Daily Flow Data**
All daily results, sorted by date

**Data by month**
All daily results, sorted by month
Monthly Percentile ranking calcs, starting in column O

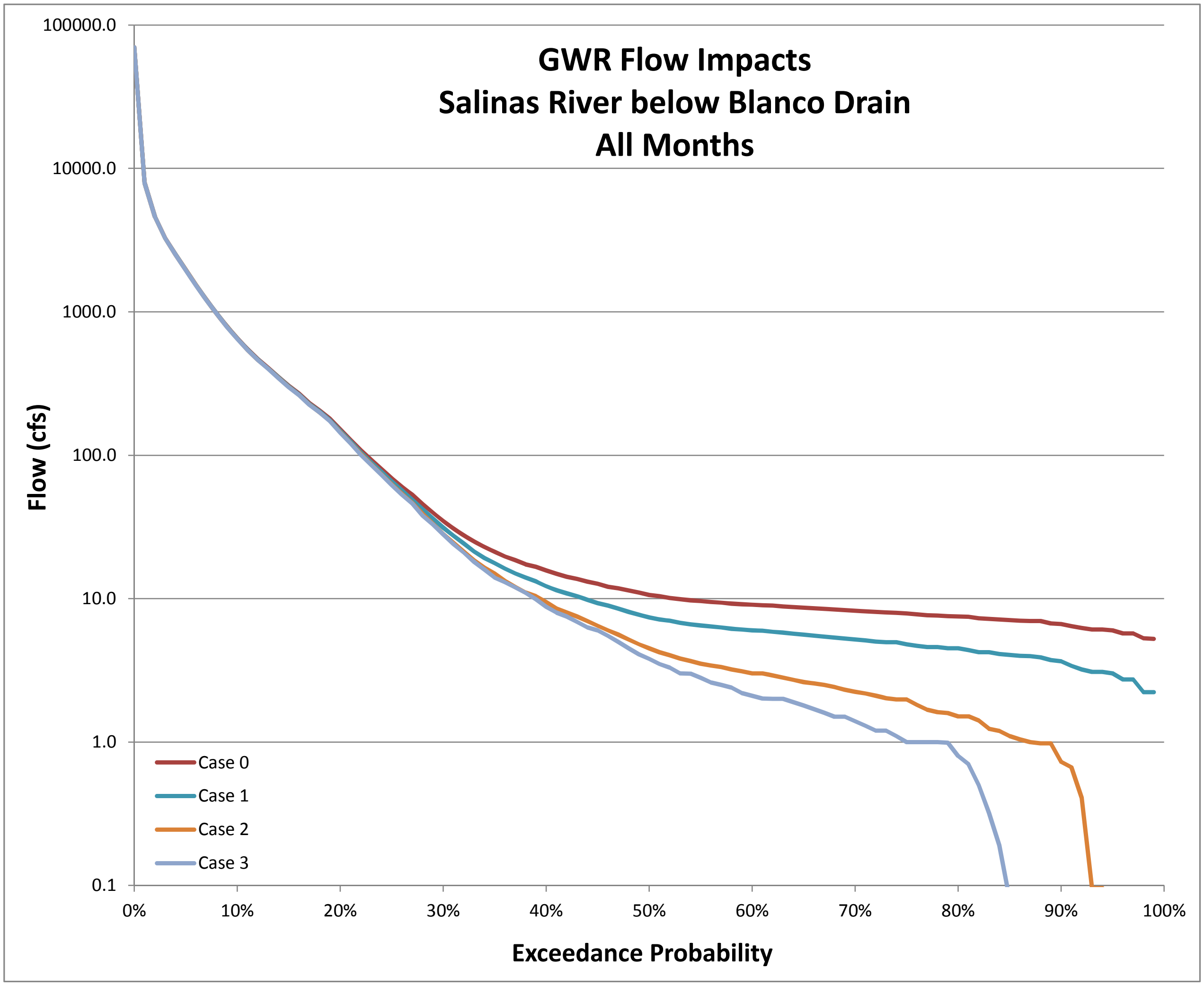


**Salinas River below Blanco Drain, Annual Percentile Flows (cfs)**

| Annual Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 1.00 | 69920.10 | 69904.02 | 69901.03 | 69900.00 |
| 0.99 | 7956.29 | 7949.56 | 7946.57 | 7945.80 |
| 0.98 | 4618.62 | 4614.02 | 4611.03 | 4610.00 |
| 0.97 | 3267.17 | 3264.02 | 3261.03 | 3260.00 |
| 0.96 | 2521.40 | 2514.09 | 2511.10 | 2510.00 |
| 0.95 | 1966.92 | 1963.92 | 1960.93 | 1960.00 |
| 0.94 | 1537.00 | 1533.40 | 1530.41 | 1530.00 |
| 0.93 | 1217.00 | 1214.00 | 1211.01 | 1210.00 |
| 0.92 | 980.00 | 977.00 | 974.01 | 973.00 |
| 0.91 | 789.78 | 786.78 | 783.79 | 783.00 |
| 0.90 | 657.19 | 653.94 | 650.95 | 650.00 |
| 0.89 | 549.02 | 546.00 | 543.01 | 542.00 |
| 0.88 | 467.61 | 464.08 | 461.09 | 461.00 |
| 0.87 | 408.13 | 404.82 | 402.01 | 401.54 |
| 0.86 | 352.24 | 349.23 | 346.24 | 345.00 |
| 0.85 | 305.23 | 301.99 | 299.00 | 298.00 |
| 0.84 | 268.81 | 265.66 | 262.76 | 262.00 |
| 0.83 | 231.65 | 228.23 | 225.38 | 225.00 |
| 0.82 | 205.30 | 202.01 | 199.02 | 199.00 |
| 0.81 | 179.89 | 176.40 | 173.41 | 173.00 |
| 0.80 | 151.66 | 148.25 | 145.26 | 144.01 |
| 0.79 | 127.71 | 124.61 | 121.63 | 121.00 |
| 0.78 | 108.41 | 105.02 | 102.03 | 101.00 |
| 0.77 | 92.77 | 89.29 | 86.46 | 86.00 |
| 0.76 | 80.02 | 76.61 | 73.97 | 73.00 |
| 0.75 | 69.32 | 65.85 | 63.00 | 62.00 |
| 0.74 | 60.02 | 56.61 | 53.62 | 53.00 |
| 0.73 | 53.00 | 49.40 | 46.58 | 46.00 |
| 0.72 | 45.61 | 42.04 | 39.05 | 38.01 |
| 0.71 | 39.82 | 36.23 | 33.32 | 33.00 |
| 0.70 | 34.68 | 31.23 | 28.24 | 28.00 |
| 0.69 | 30.97 | 27.35 | 24.62 | 24.00 |
| 0.68 | 27.71 | 24.23 | 21.24 | 21.00 |
| 0.67 | 25.00 | 21.23 | 18.54 | 18.00 |
| 0.66 | 23.01 | 19.23 | 16.41 | 16.00 |
| 0.65 | 21.23 | 17.66 | 15.00 | 14.00 |
| 0.64 | 19.66 | 16.23 | 13.24 | 13.00 |
| 0.63 | 18.58 | 15.01 | 12.02 | 12.00 |
| 0.62 | 17.33 | 14.02 | 11.03 | 11.00 |
| 0.61 | 16.67 | 13.23 | 10.41 | 9.90 |
| 0.60 | 15.73 | 12.23 | 9.50 | 8.80 |
| 0.59 | 14.89 | 11.50 | 8.53 | 8.00 |
| 0.58 | 14.20 | 10.90 | 8.01 | 7.50 |
| 0.57 | 13.73 | 10.40 | 7.51 | 6.90 |
| 0.56 | 13.12 | 9.80 | 7.00 | 6.30 |
| 0.55 | 12.70 | 9.31 | 6.47 | 6.00 |
| 0.54 | 12.11 | 8.97 | 6.02 | 5.50 |
| 0.53 | 11.80 | 8.51 | 5.62 | 5.00 |
| 0.52 | 11.41 | 8.10 | 5.20 | 4.50 |
| 0.51 | 11.01 | 7.72 | 4.81 | 4.10 |

| Annual Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 0.50 | 10.63 | 7.42 | 4.51 | 3.80 |
| 0.49 | 10.40 | 7.17 | 4.23 | 3.50 |
| 0.48 | 10.11 | 7.00 | 4.03 | 3.30 |
| 0.47 | 9.93 | 6.79 | 3.82 | 3.01 |
| 0.46 | 9.73 | 6.61 | 3.68 | 3.00 |
| 0.45 | 9.61 | 6.50 | 3.51 | 2.80 |
| 0.44 | 9.49 | 6.40 | 3.42 | 2.60 |
| 0.43 | 9.39 | 6.30 | 3.33 | 2.50 |
| 0.42 | 9.23 | 6.17 | 3.21 | 2.40 |
| 0.41 | 9.13 | 6.10 | 3.11 | 2.20 |
| 0.40 | 9.07 | 6.01 | 3.02 | 2.10 |
| 0.39 | 9.00 | 5.97 | 3.01 | 2.01 |
| 0.38 | 8.93 | 5.87 | 2.91 | 2.00 |
| 0.37 | 8.81 | 5.80 | 2.82 | 2.00 |
| 0.36 | 8.73 | 5.70 | 2.72 | 1.90 |
| 0.35 | 8.63 | 5.60 | 2.62 | 1.80 |
| 0.34 | 8.56 | 5.50 | 2.57 | 1.70 |
| 0.33 | 8.50 | 5.46 | 2.51 | 1.60 |
| 0.32 | 8.41 | 5.36 | 2.42 | 1.50 |
| 0.31 | 8.30 | 5.26 | 2.32 | 1.50 |
| 0.30 | 8.23 | 5.19 | 2.24 | 1.40 |
| 0.29 | 8.16 | 5.11 | 2.18 | 1.30 |
| 0.28 | 8.07 | 5.01 | 2.10 | 1.20 |
| 0.27 | 8.00 | 4.97 | 2.02 | 1.20 |
| 0.26 | 7.97 | 4.96 | 1.98 | 1.10 |
| 0.25 | 7.91 | 4.81 | 1.98 | 1.00 |
| 0.24 | 7.76 | 4.70 | 1.81 | 1.00 |
| 0.23 | 7.66 | 4.61 | 1.68 | 1.00 |
| 0.22 | 7.61 | 4.60 | 1.62 | 1.00 |
| 0.21 | 7.53 | 4.50 | 1.60 | 0.99 |
| 0.20 | 7.50 | 4.50 | 1.51 | 0.80 |
| 0.19 | 7.49 | 4.39 | 1.51 | 0.70 |
| 0.18 | 7.31 | 4.23 | 1.41 | 0.50 |
| 0.17 | 7.23 | 4.23 | 1.24 | 0.32 |
| 0.16 | 7.17 | 4.11 | 1.20 | 0.19 |
| 0.15 | 7.09 | 4.05 | 1.10 | 0.08 |
| 0.14 | 7.02 | 3.99 | 1.05 | 0.01 |
| 0.13 | 6.97 | 3.97 | 1.00 | 0.01 |
| 0.12 | 6.97 | 3.91 | 0.98 | 0.00 |
| 0.11 | 6.73 | 3.73 | 0.98 | 0.00 |
| 0.10 | 6.66 | 3.66 | 0.73 | 0.00 |
| 0.09 | 6.43 | 3.40 | 0.67 | 0.00 |
| 0.08 | 6.23 | 3.20 | 0.41 | 0.00 |
| 0.07 | 6.09 | 3.09 | 0.10 | 0.00 |
| 0.06 | 6.09 | 3.09 | 0.10 | 0.00 |
| 0.05 | 6.01 | 3.01 | 0.02 | 0.00 |
| 0.04 | 5.73 | 2.73 | 0.01 | 0.00 |
| 0.03 | 5.73 | 2.73 | 0.00 | 0.00 |
| 0.02 | 5.30 | 2.23 | 0.00 | 0.00 |
| 0.01 | 5.23 | 2.23 | 0.00 | 0.00 |

Case 0: No diversions (Base Condition).
Case 1: Divert both Salinas Stormwater and SIWTF; No Blanco Drain diversions.
Case 2: Divert both Salinas Stormwater and SIWTF; Divert up to 2.99 cfs from Blanco Drain.
Case 3: Divert both Salinas Stormwater and SIWTF; Divert up to 4.6 cfs from Blanco Drain.

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Note:
Measurement point for all cases is Salinas River just downstream of confluence with Blanco Drain.

SRDF diversions (from Salinas River behind rubber dam) occurred 2010-2013 for all cases above;
SRDF diversions balance extra flow at Spreckels during this period.

Total flow is the sum of the Salinas R. at Spreckels (USGS gage) plus storm runoff, plus SIWTF inflows,
plus flow in from Blanco Drain, minus SRDF diversions and stormwater capture.

**Salinas River below Blanco Drain, Percentile Flows by Month (cfs)**

| January Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 1.00 | 53406.68 | 53403.40 | 53400.41 | 53400.00 |
| 0.99 | 11328.40 | 11321.40 | 11318.41 | 11318.00 |
| 0.98 | 8439.81 | 8428.80 | 8425.81 | 8425.40 |
| 0.97 | 6109.50 | 6106.50 | 6103.51 | 6103.10 |
| 0.96 | 5050.01 | 5047.00 | 5044.01 | 5043.60 |
| 0.95 | 4375.90 | 4372.90 | 4369.91 | 4369.50 |
| 0.94 | 3870.06 | 3865.00 | 3862.01 | 3861.60 |
| 0.93 | 3403.11 | 3394.70 | 3391.71 | 3391.30 |
| 0.92 | 3046.40 | 3040.60 | 3037.61 | 3037.20 |
| 0.91 | 2799.50 | 2796.50 | 2793.51 | 2793.10 |
| 0.90 | 2544.61 | 2541.40 | 2538.41 | 2538.00 |
| 0.89 | 2136.20 | 2133.20 | 2130.21 | 2129.80 |
| 0.88 | 1926.40 | 1923.40 | 1920.41 | 1920.00 |
| 0.87 | 1686.64 | 1683.40 | 1680.41 | 1680.00 |
| 0.86 | 1486.40 | 1483.40 | 1480.41 | 1480.00 |
| 0.85 | 1305.22 | 1283.40 | 1280.41 | 1280.00 |
| 0.84 | 1146.40 | 1143.40 | 1140.41 | 1140.00 |
| 0.83 | 1026.40 | 1023.40 | 1020.41 | 1020.00 |
| 0.82 | 893.74 | 890.12 | 887.13 | 886.72 |
| 0.81 | 793.90 | 789.40 | 786.41 | 786.00 |
| 0.80 | 710.00 | 707.00 | 704.01 | 703.60 |
| 0.79 | 634.13 | 630.96 | 627.97 | 627.56 |
| 0.78 | 595.32 | 587.40 | 584.41 | 584.00 |
| 0.77 | 551.97 | 548.97 | 545.98 | 545.57 |
| 0.76 | 491.56 | 488.56 | 485.57 | 485.16 |
| 0.75 | 450.15 | 447.15 | 444.16 | 443.75 |
| 0.74 | 410.50 | 406.74 | 403.75 | 403.34 |
| 0.73 | 362.33 | 359.33 | 356.34 | 355.93 |
| 0.72 | 318.92 | 315.92 | 312.93 | 312.52 |
| 0.71 | 291.40 | 288.40 | 285.41 | 285.00 |
| 0.70 | 257.39 | 253.40 | 250.41 | 250.00 |
| 0.69 | 236.69 | 230.56 | 227.57 | 227.16 |
| 0.68 | 215.16 | 210.40 | 207.41 | 207.00 |
| 0.67 | 197.34 | 193.87 | 190.88 | 190.47 |
| 0.66 | 183.40 | 180.40 | 177.41 | 177.00 |
| 0.65 | 166.40 | 163.05 | 160.06 | 159.65 |
| 0.64 | 151.35 | 147.40 | 144.41 | 144.00 |
| 0.63 | 137.24 | 133.40 | 130.41 | 130.00 |
| 0.62 | 126.40 | 122.40 | 119.41 | 119.00 |
| 0.61 | 114.40 | 111.40 | 108.41 | 108.00 |
| 0.60 | 103.40 | 100.40 | 97.41 | 97.00 |
| 0.59 | 93.59 | 88.59 | 85.60 | 85.19 |
| 0.58 | 84.38 | 79.40 | 76.41 | 76.00 |
| 0.57 | 77.40 | 73.40 | 70.41 | 70.00 |
| 0.56 | 70.40 | 67.36 | 64.37 | 63.96 |
| 0.55 | 63.40 | 59.40 | 56.41 | 56.00 |
| 0.54 | 58.40 | 54.40 | 51.41 | 51.00 |
| 0.53 | 53.40 | 49.13 | 46.14 | 45.73 |
| 0.52 | 46.40 | 42.40 | 39.41 | 39.00 |
| 0.51 | 42.40 | 39.40 | 36.41 | 36.00 |

| January Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 0.50 | 39.40 | 34.90 | 31.91 | 31.50 |
| 0.49 | 33.40 | 29.40 | 26.41 | 26.00 |
| 0.48 | 30.09 | 25.40 | 22.41 | 22.00 |
| 0.47 | 26.42 | 21.40 | 18.41 | 18.00 |
| 0.46 | 23.40 | 18.40 | 15.41 | 15.00 |
| 0.45 | 20.66 | 16.40 | 13.41 | 13.00 |
| 0.44 | 19.40 | 15.40 | 12.41 | 12.00 |
| 0.43 | 18.16 | 13.40 | 10.41 | 10.00 |
| 0.42 | 16.63 | 13.40 | 10.41 | 10.00 |
| 0.41 | 16.40 | 12.90 | 9.91 | 9.50 |
| 0.40 | 16.19 | 12.40 | 9.41 | 9.00 |
| 0.39 | 15.60 | 11.80 | 8.81 | 8.40 |
| 0.38 | 14.90 | 11.20 | 8.21 | 7.80 |
| 0.37 | 14.40 | 10.82 | 7.83 | 7.42 |
| 0.36 | 13.90 | 10.20 | 7.21 | 6.80 |
| 0.35 | 13.43 | 9.90 | 6.91 | 6.50 |
| 0.34 | 12.90 | 9.29 | 6.30 | 5.89 |
| 0.33 | 12.50 | 8.50 | 5.51 | 5.10 |
| 0.32 | 11.90 | 8.11 | 5.12 | 4.71 |
| 0.31 | 11.50 | 7.77 | 4.78 | 4.37 |
| 0.30 | 11.10 | 7.40 | 4.41 | 4.00 |
| 0.29 | 10.71 | 7.40 | 4.41 | 4.00 |
| 0.28 | 10.40 | 7.25 | 4.26 | 3.85 |
| 0.27 | 10.40 | 7.00 | 4.01 | 3.60 |
| 0.26 | 10.20 | 6.70 | 3.71 | 3.30 |
| 0.25 | 10.00 | 6.50 | 3.51 | 3.10 |
| 0.24 | 9.70 | 6.40 | 3.41 | 3.00 |
| 0.23 | 9.50 | 6.40 | 3.41 | 3.00 |
| 0.22 | 9.40 | 6.40 | 3.41 | 3.00 |
| 0.21 | 9.40 | 6.40 | 3.41 | 3.00 |
| 0.20 | 9.40 | 6.20 | 3.21 | 2.80 |
| 0.19 | 9.30 | 6.10 | 3.11 | 2.70 |
| 0.18 | 9.10 | 5.90 | 2.91 | 2.50 |
| 0.17 | 9.00 | 5.70 | 2.71 | 2.30 |
| 0.16 | 8.75 | 5.50 | 2.51 | 2.10 |
| 0.15 | 8.60 | 5.40 | 2.41 | 2.00 |
| 0.14 | 8.40 | 5.10 | 2.11 | 1.70 |
| 0.13 | 8.10 | 5.00 | 2.01 | 1.60 |
| 0.12 | 8.00 | 4.70 | 1.71 | 1.30 |
| 0.11 | 7.76 | 4.70 | 1.71 | 1.30 |
| 0.10 | 7.70 | 3.98 | 0.99 | 0.58 |
| 0.09 | 7.18 | 3.59 | 0.60 | 0.19 |
| 0.08 | 6.84 | 3.47 | 0.48 | 0.07 |
| 0.07 | 6.47 | 3.40 | 0.41 | 0.00 |
| 0.06 | 6.42 | 3.40 | 0.41 | 0.00 |
| 0.05 | 6.40 | 3.40 | 0.41 | 0.00 |
| 0.04 | 6.40 | 3.40 | 0.41 | 0.00 |
| 0.03 | 6.40 | 3.40 | 0.41 | 0.00 |
| 0.02 | 6.40 | 3.40 | 0.41 | 0.00 |
| 0.01 | 6.40 | 3.40 | 0.41 | 0.00 |

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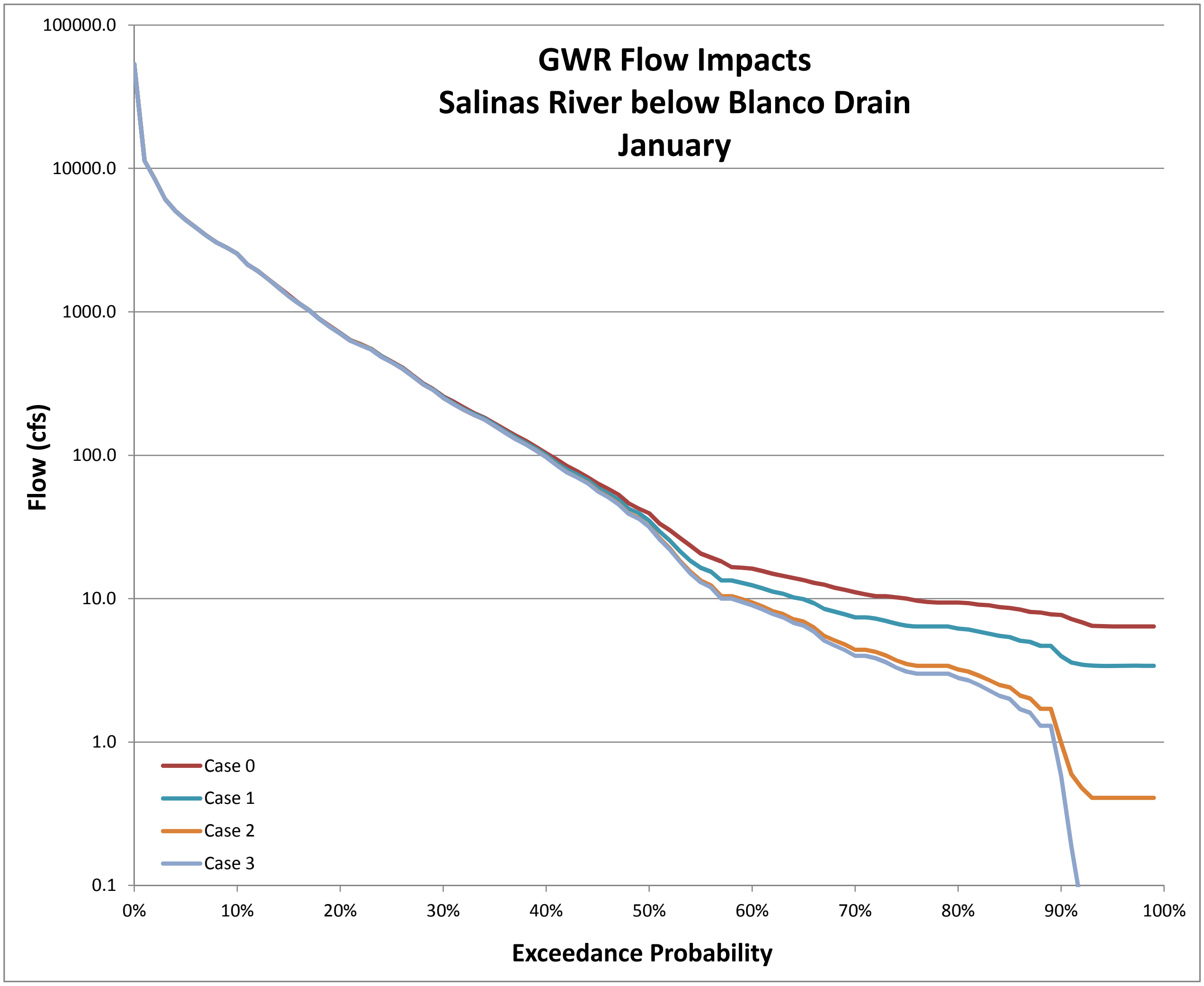


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SRDF diversions balance extra flow at Spreckels during this period.

Total flow is the sum of the Salinas R. at Spreckels (USGS gage) plus storm runoff, plus SIWTF inflows, plus flow in from Blanco Drain, minus SRDF diversions and stormwater capture.

**Salinas River below Blanco Drain, Percentile Flows by Month (cfs)**

February

| Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 1.00 | 69920.10 | 69904.02 | 69901.03 | 69900.00 |
| 0.99 | 20975.03 | 20956.02 | 20953.03 | 20952.00 |
| 0.98 | 15811.23 | 15808.02 | 15805.03 | 15804.00 |
| 0.97 | 12959.96 | 12956.02 | 12953.03 | 12952.00 |
| 0.96 | 9831.31 | 9816.02 | 9813.03 | 9812.00 |
| 0.95 | 8369.02 | 8366.02 | 8363.03 | 8362.00 |
| 0.94 | 7147.42 | 7144.42 | 7141.43 | 7140.40 |
| 0.93 | 6425.82 | 6422.82 | 6419.83 | 6418.80 |
| 0.92 | 5697.84 | 5691.22 | 5688.23 | 5687.20 |
| 0.91 | 4943.82 | 4940.82 | 4937.83 | 4936.80 |
| 0.90 | 4581.02 | 4578.02 | 4575.03 | 4574.00 |
| 0.89 | 4271.11 | 4266.42 | 4263.43 | 4262.40 |
| 0.88 | 3891.05 | 3888.02 | 3885.03 | 3884.00 |
| 0.87 | 3499.82 | 3496.82 | 3493.83 | 3492.80 |
| 0.86 | 3187.55 | 3184.42 | 3181.43 | 3180.40 |
| 0.85 | 2869.52 | 2862.02 | 2859.03 | 2858.00 |
| 0.84 | 2642.33 | 2638.42 | 2635.43 | 2634.40 |
| 0.83 | 2487.34 | 2484.02 | 2481.03 | 2480.00 |
| 0.82 | 2338.22 | 2335.22 | 2332.23 | 2331.20 |
| 0.81 | 2157.02 | 2154.02 | 2151.03 | 2150.00 |
| 0.80 | 2047.02 | 2044.02 | 2041.03 | 2040.00 |
| 0.79 | 1869.83 | 1866.82 | 1863.83 | 1862.80 |
| 0.78 | 1742.54 | 1738.82 | 1735.83 | 1734.80 |
| 0.77 | 1617.03 | 1614.02 | 1611.03 | 1610.00 |
| 0.76 | 1497.02 | 1494.02 | 1491.03 | 1490.00 |
| 0.75 | 1407.02 | 1404.02 | 1401.03 | 1400.00 |
| 0.74 | 1255.60 | 1252.42 | 1249.43 | 1248.40 |
| 0.73 | 1147.02 | 1144.02 | 1141.03 | 1140.00 |
| 0.72 | 1072.37 | 1069.22 | 1066.23 | 1065.20 |
| 0.71 | 1000.38 | 997.38 | 994.39 | 993.36 |
| 0.70 | 916.22 | 913.22 | 910.23 | 909.20 |
| 0.69 | 861.22 | 858.22 | 855.23 | 854.20 |
| 0.68 | 803.79 | 800.78 | 797.79 | 796.76 |
| 0.67 | 760.02 | 757.02 | 754.03 | 753.00 |
| 0.66 | 708.62 | 704.02 | 701.03 | 700.00 |
| 0.65 | 667.78 | 664.42 | 661.43 | 660.40 |
| 0.64 | 617.02 | 614.02 | 611.03 | 610.00 |
| 0.63 | 571.18 | 568.18 | 565.19 | 564.16 |
| 0.62 | 535.90 | 530.02 | 527.03 | 526.00 |
| 0.61 | 518.47 | 514.78 | 511.79 | 510.76 |
| 0.60 | 480.23 | 477.22 | 474.23 | 473.20 |
| 0.59 | 442.90 | 439.90 | 436.91 | 435.88 |
| 0.58 | 407.60 | 402.58 | 399.59 | 398.56 |
| 0.57 | 367.10 | 364.02 | 361.03 | 360.00 |
| 0.56 | 337.02 | 334.02 | 331.03 | 330.00 |
| 0.55 | 297.14 | 294.02 | 291.03 | 290.00 |
| 0.54 | 265.94 | 262.94 | 259.95 | 258.92 |
| 0.53 | 242.09 | 237.46 | 234.47 | 233.44 |
| 0.52 | 219.98 | 216.98 | 213.99 | 212.96 |
| 0.51 | 202.18 | 199.02 | 196.03 | 195.00 |

February

| Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 0.50 | 188.02 | 183.02 | 180.03 | 179.00 |
| 0.49 | 173.02 | 170.02 | 167.03 | 166.00 |
| 0.48 | 157.93 | 154.02 | 151.03 | 150.00 |
| 0.47 | 146.02 | 143.02 | 140.03 | 139.00 |
| 0.46 | 136.02 | 132.38 | 129.39 | 128.36 |
| 0.45 | 123.22 | 120.02 | 117.03 | 116.00 |
| 0.44 | 113.06 | 109.06 | 106.07 | 105.04 |
| 0.43 | 102.66 | 97.02 | 94.03 | 93.00 |
| 0.42 | 90.02 | 86.02 | 83.03 | 82.00 |
| 0.41 | 83.02 | 79.58 | 76.59 | 75.56 |
| 0.40 | 73.57 | 70.02 | 67.03 | 66.00 |
| 0.39 | 65.02 | 62.02 | 59.03 | 58.00 |
| 0.38 | 58.02 | 55.02 | 52.03 | 51.00 |
| 0.37 | 53.02 | 50.02 | 47.03 | 46.00 |
| 0.36 | 45.78 | 42.02 | 39.03 | 38.00 |
| 0.35 | 39.02 | 36.02 | 33.03 | 32.00 |
| 0.34 | 31.58 | 28.02 | 25.03 | 24.00 |
| 0.33 | 25.53 | 21.30 | 18.31 | 17.28 |
| 0.32 | 21.06 | 18.02 | 15.03 | 14.00 |
| 0.31 | 19.57 | 15.98 | 12.99 | 11.96 |
| 0.30 | 17.59 | 14.02 | 11.03 | 10.00 |
| 0.29 | 17.02 | 14.02 | 11.03 | 10.00 |
| 0.28 | 15.88 | 12.12 | 9.13 | 8.10 |
| 0.27 | 14.52 | 10.82 | 7.83 | 6.80 |
| 0.26 | 13.15 | 9.04 | 6.05 | 5.02 |
| 0.25 | 12.23 | 8.12 | 5.13 | 4.10 |
| 0.24 | 11.32 | 7.52 | 4.53 | 3.50 |
| 0.23 | 10.72 | 7.29 | 4.30 | 3.27 |
| 0.22 | 10.32 | 7.12 | 4.13 | 3.10 |
| 0.21 | 10.22 | 7.02 | 4.03 | 3.00 |
| 0.20 | 10.02 | 7.02 | 4.03 | 3.00 |
| 0.19 | 10.02 | 7.02 | 4.03 | 3.00 |
| 0.18 | 10.02 | 6.42 | 3.43 | 2.40 |
| 0.17 | 9.43 | 6.32 | 3.33 | 2.30 |
| 0.16 | 9.32 | 6.12 | 3.13 | 2.10 |
| 0.15 | 9.12 | 5.92 | 2.93 | 1.90 |
| 0.14 | 8.92 | 5.72 | 2.73 | 1.70 |
| 0.13 | 8.72 | 5.53 | 2.54 | 1.51 |
| 0.12 | 8.61 | 5.22 | 2.23 | 1.20 |
| 0.11 | 8.22 | 5.12 | 2.13 | 1.10 |
| 0.10 | 8.12 | 5.12 | 2.13 | 1.10 |
| 0.09 | 8.12 | 5.02 | 2.03 | 1.00 |
| 0.08 | 7.96 | 4.50 | 1.51 | 0.48 |
| 0.07 | 7.50 | 4.21 | 1.22 | 0.19 |
| 0.06 | 7.21 | 4.07 | 1.08 | 0.05 |
| 0.05 | 7.10 | 4.02 | 1.03 | 0.00 |
| 0.04 | 7.04 | 4.02 | 1.03 | 0.00 |
| 0.03 | 7.02 | 4.02 | 1.03 | 0.00 |
| 0.02 | 7.02 | 4.02 | 1.03 | 0.00 |
| 0.01 | 7.02 | 4.02 | 1.03 | 0.00 |

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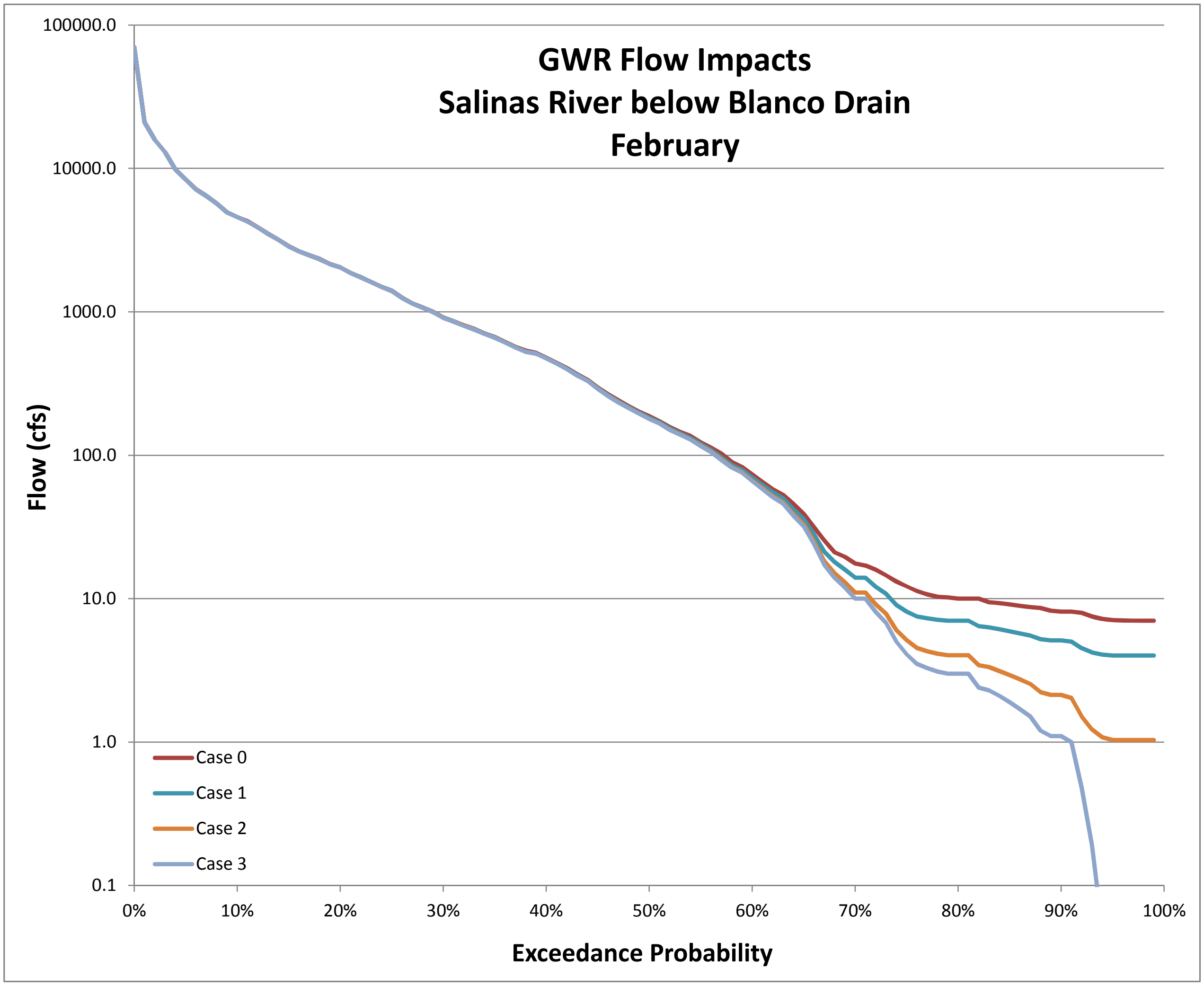


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SRDF diversions balance extra flow at Spreckels during this period.

Total flow is the sum of the Salinas R. at Spreckels (USGS gage) plus storm runoff, plus SIWTF inflows,
plus flow in from Blanco Drain, minus SRDF diversions and stormwater capture.

**Salinas River below Blanco Drain, Percentile Flows by Month (cfs)**

| March Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 1.00 | 64007.00 | 64004.00 | 64001.01 | 64000.00 |
| 0.99 | 16365.69 | 16358.00 | 16355.01 | 16354.00 |
| 0.98 | 10525.00 | 10522.00 | 10519.01 | 10518.00 |
| 0.97 | 8891.81 | 8888.80 | 8885.81 | 8884.80 |
| 0.96 | 7500.60 | 7497.60 | 7494.61 | 7493.60 |
| 0.95 | 6304.50 | 6301.50 | 6298.51 | 6297.50 |
| 0.94 | 5317.83 | 5314.80 | 5311.81 | 5310.80 |
| 0.93 | 4663.03 | 4659.20 | 4656.21 | 4655.20 |
| 0.92 | 4233.94 | 4228.40 | 4225.41 | 4224.40 |
| 0.91 | 3909.15 | 3904.00 | 3901.01 | 3900.00 |
| 0.90 | 3503.00 | 3500.00 | 3497.01 | 3496.00 |
| 0.89 | 3166.80 | 3163.80 | 3160.81 | 3159.80 |
| 0.88 | 2827.00 | 2824.00 | 2821.01 | 2820.00 |
| 0.87 | 2600.40 | 2597.40 | 2594.41 | 2593.40 |
| 0.86 | 2413.15 | 2406.60 | 2403.61 | 2402.60 |
| 0.85 | 2267.73 | 2264.00 | 2261.01 | 2260.00 |
| 0.84 | 2127.00 | 2124.00 | 2121.01 | 2120.00 |
| 0.83 | 2017.00 | 2014.00 | 2011.01 | 2010.00 |
| 0.82 | 1863.20 | 1860.20 | 1857.21 | 1856.20 |
| 0.81 | 1717.00 | 1714.00 | 1711.01 | 1710.00 |
| 0.80 | 1585.26 | 1582.00 | 1579.01 | 1578.00 |
| 0.79 | 1487.00 | 1484.00 | 1481.01 | 1480.00 |
| 0.78 | 1416.80 | 1413.80 | 1410.81 | 1409.80 |
| 0.77 | 1332.70 | 1329.70 | 1326.71 | 1325.70 |
| 0.76 | 1238.60 | 1234.00 | 1231.01 | 1230.00 |
| 0.75 | 1147.00 | 1144.00 | 1141.01 | 1140.00 |
| 0.74 | 1067.00 | 1064.00 | 1061.01 | 1060.00 |
| 0.73 | 1000.93 | 997.93 | 994.94 | 993.93 |
| 0.72 | 937.00 | 934.00 | 931.01 | 930.00 |
| 0.71 | 871.85 | 863.22 | 860.23 | 859.22 |
| 0.70 | 794.80 | 791.80 | 788.81 | 787.80 |
| 0.69 | 737.00 | 734.00 | 731.01 | 730.00 |
| 0.68 | 685.88 | 682.88 | 679.89 | 678.88 |
| 0.67 | 642.00 | 639.00 | 636.01 | 635.00 |
| 0.66 | 611.10 | 608.06 | 605.07 | 604.06 |
| 0.65 | 574.65 | 570.30 | 567.31 | 566.30 |
| 0.64 | 529.00 | 526.00 | 523.01 | 522.00 |
| 0.63 | 502.81 | 498.00 | 495.01 | 494.00 |
| 0.62 | 471.68 | 468.68 | 465.69 | 464.68 |
| 0.61 | 437.01 | 434.01 | 431.02 | 430.01 |
| 0.60 | 405.80 | 402.80 | 399.81 | 398.80 |
| 0.59 | 385.00 | 381.19 | 378.20 | 377.19 |
| 0.58 | 361.81 | 358.78 | 355.79 | 354.78 |
| 0.57 | 344.07 | 341.00 | 338.01 | 337.00 |
| 0.56 | 327.85 | 319.00 | 316.01 | 315.00 |
| 0.55 | 307.97 | 304.55 | 301.56 | 300.55 |
| 0.54 | 293.00 | 288.14 | 285.15 | 284.14 |
| 0.53 | 271.19 | 268.19 | 265.20 | 264.19 |
| 0.52 | 246.32 | 243.32 | 240.33 | 239.32 |
| 0.51 | 225.00 | 222.00 | 219.01 | 218.00 |

| March Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 0.50 | 216.00 | 212.50 | 209.51 | 208.50 |
| 0.49 | 198.00 | 195.00 | 192.01 | 191.00 |
| 0.48 | 178.00 | 174.68 | 171.69 | 170.68 |
| 0.47 | 160.27 | 157.27 | 154.28 | 153.27 |
| 0.46 | 145.00 | 142.00 | 139.01 | 138.00 |
| 0.45 | 124.00 | 121.00 | 118.01 | 117.00 |
| 0.44 | 111.00 | 107.04 | 104.05 | 103.04 |
| 0.43 | 95.00 | 92.00 | 89.01 | 88.00 |
| 0.42 | 83.00 | 80.00 | 77.01 | 76.00 |
| 0.41 | 71.81 | 68.81 | 65.82 | 64.81 |
| 0.40 | 60.00 | 57.00 | 54.01 | 53.00 |
| 0.39 | 51.00 | 48.00 | 45.01 | 44.00 |
| 0.38 | 43.00 | 39.00 | 36.01 | 35.00 |
| 0.37 | 38.00 | 34.00 | 31.01 | 30.00 |
| 0.36 | 31.00 | 27.00 | 24.01 | 23.00 |
| 0.35 | 25.28 | 21.35 | 18.36 | 17.35 |
| 0.34 | 22.00 | 18.00 | 15.01 | 14.00 |
| 0.33 | 19.00 | 14.06 | 11.07 | 10.06 |
| 0.32 | 17.00 | 14.00 | 11.01 | 10.00 |
| 0.31 | 17.00 | 13.00 | 10.01 | 9.00 |
| 0.30 | 15.63 | 11.56 | 8.57 | 7.56 |
| 0.29 | 14.50 | 10.99 | 8.00 | 6.99 |
| 0.28 | 13.90 | 10.50 | 7.51 | 6.50 |
| 0.27 | 13.40 | 10.00 | 7.01 | 6.00 |
| 0.26 | 12.80 | 9.40 | 6.41 | 5.40 |
| 0.25 | 12.30 | 8.42 | 5.43 | 4.42 |
| 0.24 | 11.47 | 8.00 | 5.01 | 4.00 |
| 0.23 | 11.00 | 7.70 | 4.71 | 3.70 |
| 0.22 | 10.70 | 7.50 | 4.51 | 3.50 |
| 0.21 | 10.50 | 7.30 | 4.31 | 3.30 |
| 0.20 | 10.27 | 7.00 | 4.01 | 3.00 |
| 0.19 | 10.00 | 6.70 | 3.71 | 2.70 |
| 0.18 | 9.70 | 6.40 | 3.41 | 2.40 |
| 0.17 | 9.40 | 6.20 | 3.21 | 2.20 |
| 0.16 | 9.20 | 6.00 | 3.01 | 2.00 |
| 0.15 | 9.00 | 6.00 | 3.01 | 2.00 |
| 0.14 | 9.00 | 5.90 | 2.91 | 1.90 |
| 0.13 | 8.90 | 5.80 | 2.81 | 1.80 |
| 0.12 | 8.80 | 5.70 | 2.71 | 1.70 |
| 0.11 | 8.60 | 5.50 | 2.51 | 1.50 |
| 0.10 | 8.31 | 5.20 | 2.21 | 1.20 |
| 0.09 | 8.20 | 5.10 | 2.11 | 1.10 |
| 0.08 | 8.00 | 5.00 | 2.01 | 1.00 |
| 0.07 | 7.99 | 4.78 | 1.79 | 0.78 |
| 0.06 | 7.32 | 4.21 | 1.22 | 0.21 |
| 0.05 | 7.15 | 4.11 | 1.12 | 0.11 |
| 0.04 | 7.06 | 4.02 | 1.03 | 0.03 |
| 0.03 | 7.01 | 4.00 | 1.01 | 0.00 |
| 0.02 | 7.00 | 4.00 | 1.01 | 0.00 |
| 0.01 | 7.00 | 4.00 | 1.01 | 0.00 |

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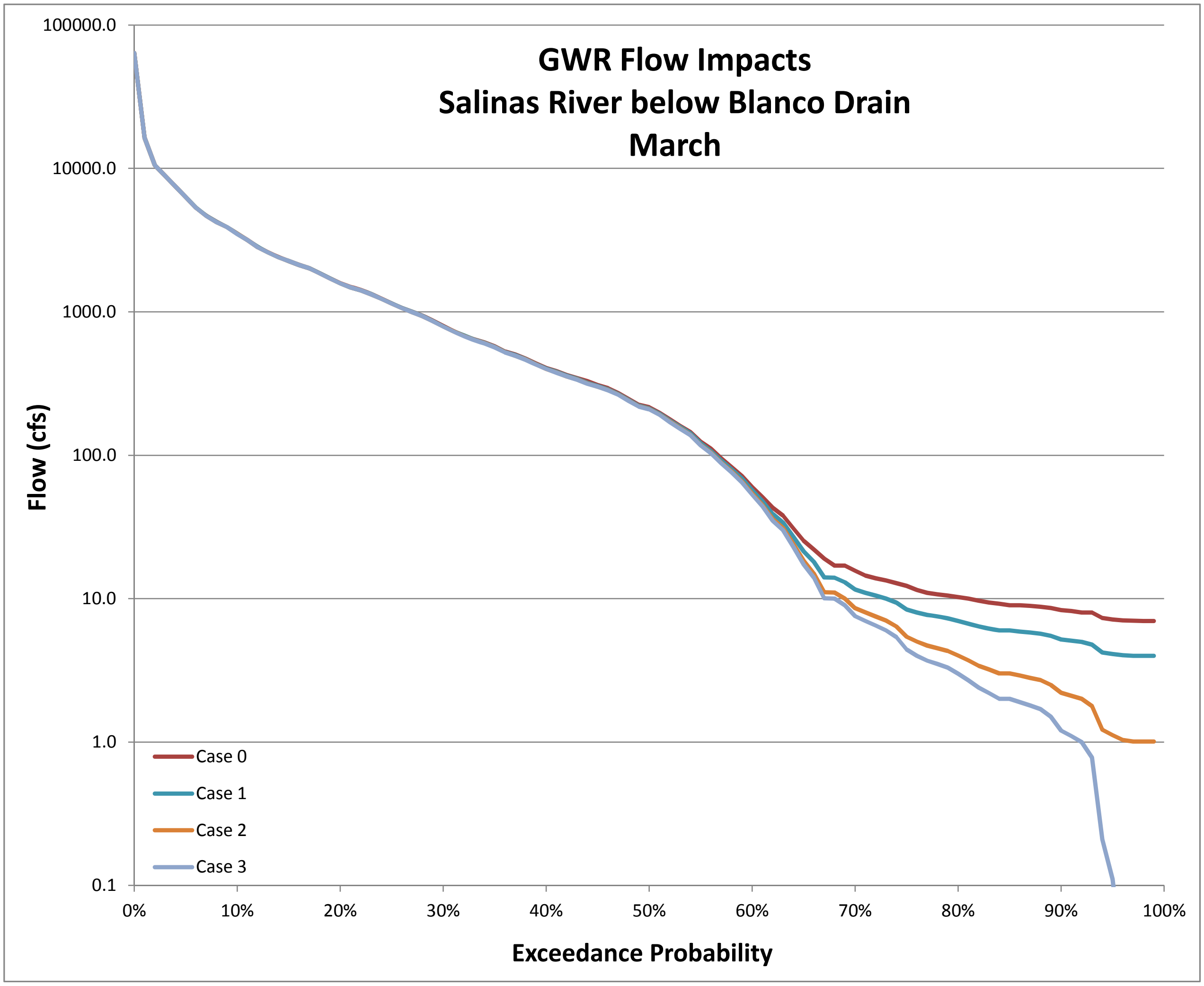


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Note:

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SRDF diversions (from Salinas River behind rubber dam) occurred 2010-2013 for all cases above;
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Total flow is the sum of the Salinas R. at Spreckels (USGS gage) plus storm runoff, plus SIWTF inflows, plus flow in from Blanco Drain, minus SRDF diversions and stormwater capture.

**Salinas River below Blanco Drain, Percentile Flows by Month (cfs)**

**April**

| Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 1.00 | 29527.85 | 29504.23 | 29501.24 | 29500.00 |
| 0.99 | 7745.93 | 7742.93 | 7739.94 | 7738.70 |
| 0.98 | 4378.43 | 4375.43 | 4372.44 | 4371.20 |
| 0.97 | 3221.83 | 3218.83 | 3215.84 | 3214.60 |
| 0.96 | 2896.13 | 2890.63 | 2887.64 | 2886.40 |
| 0.95 | 2568.74 | 2565.23 | 2562.24 | 2561.00 |
| 0.94 | 2331.83 | 2328.83 | 2325.84 | 2324.60 |
| 0.93 | 2087.23 | 2084.23 | 2081.24 | 2080.00 |
| 0.92 | 1880.07 | 1877.03 | 1874.04 | 1872.80 |
| 0.91 | 1761.03 | 1758.03 | 1755.04 | 1753.80 |
| 0.90 | 1627.23 | 1624.23 | 1621.24 | 1620.00 |
| 0.89 | 1477.23 | 1474.23 | 1471.24 | 1470.00 |
| 0.88 | 1347.23 | 1344.23 | 1341.24 | 1340.00 |
| 0.87 | 1250.53 | 1247.53 | 1244.54 | 1243.30 |
| 0.86 | 1157.23 | 1154.23 | 1151.24 | 1150.00 |
| 0.85 | 1077.23 | 1074.23 | 1071.24 | 1070.00 |
| 0.84 | 1006.23 | 1000.91 | 997.92 | 996.68 |
| 0.83 | 932.20 | 929.20 | 926.21 | 924.97 |
| 0.82 | 879.75 | 876.75 | 873.76 | 872.52 |
| 0.81 | 812.23 | 809.23 | 806.24 | 805.00 |
| 0.80 | 762.83 | 759.23 | 756.24 | 755.00 |
| 0.79 | 715.23 | 712.23 | 709.24 | 708.00 |
| 0.78 | 660.25 | 657.25 | 654.26 | 653.02 |
| 0.77 | 610.52 | 607.52 | 604.53 | 603.29 |
| 0.76 | 566.23 | 563.23 | 560.24 | 559.00 |
| 0.75 | 526.48 | 523.48 | 520.49 | 519.25 |
| 0.74 | 490.55 | 487.55 | 484.56 | 483.32 |
| 0.73 | 453.50 | 450.44 | 447.45 | 446.21 |
| 0.72 | 417.15 | 414.15 | 411.16 | 409.92 |
| 0.71 | 382.22 | 379.12 | 376.13 | 374.89 |
| 0.70 | 355.53 | 352.53 | 349.54 | 348.30 |
| 0.69 | 333.23 | 330.23 | 327.24 | 326.00 |
| 0.68 | 307.23 | 304.23 | 301.24 | 300.00 |
| 0.67 | 287.23 | 284.23 | 281.24 | 280.00 |
| 0.66 | 269.23 | 266.17 | 263.18 | 261.94 |
| 0.65 | 249.93 | 246.93 | 243.94 | 242.70 |
| 0.64 | 230.99 | 227.99 | 225.00 | 223.76 |
| 0.63 | 209.57 | 206.57 | 203.58 | 202.34 |
| 0.62 | 196.97 | 193.97 | 190.98 | 189.58 |
| 0.61 | 180.23 | 177.23 | 174.24 | 173.00 |
| 0.60 | 162.36 | 158.63 | 155.64 | 154.40 |
| 0.59 | 140.23 | 137.23 | 134.24 | 133.00 |
| 0.58 | 119.23 | 116.23 | 113.24 | 112.00 |
| 0.57 | 103.86 | 100.86 | 97.87 | 96.63 |
| 0.56 | 90.27 | 87.27 | 84.28 | 83.04 |
| 0.55 | 79.41 | 76.41 | 73.42 | 72.45 |
| 0.54 | 69.56 | 66.09 | 63.10 | 61.86 |
| 0.53 | 59.01 | 55.50 | 52.51 | 51.27 |
| 0.52 | 48.53 | 45.23 | 42.24 | 41.00 |
| 0.51 | 41.23 | 37.32 | 34.33 | 33.09 |

**April**

| Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 0.50 | 34.23 | 31.23 | 28.24 | 27.00 |
| 0.49 | 31.23 | 28.23 | 25.24 | 24.00 |
| 0.48 | 27.23 | 24.23 | 21.24 | 20.00 |
| 0.47 | 23.23 | 20.23 | 17.24 | 16.00 |
| 0.46 | 20.23 | 16.23 | 13.24 | 12.00 |
| 0.45 | 17.23 | 14.23 | 11.24 | 10.00 |
| 0.44 | 17.20 | 13.73 | 10.74 | 9.50 |
| 0.43 | 15.83 | 12.53 | 9.54 | 8.30 |
| 0.42 | 15.23 | 11.93 | 8.94 | 7.70 |
| 0.41 | 14.43 | 11.24 | 8.25 | 7.01 |
| 0.40 | 14.03 | 10.93 | 7.94 | 6.70 |
| 0.39 | 13.43 | 10.23 | 7.24 | 6.00 |
| 0.38 | 13.13 | 10.03 | 7.04 | 5.80 |
| 0.37 | 12.83 | 9.73 | 6.74 | 5.50 |
| 0.36 | 12.45 | 9.23 | 6.24 | 5.00 |
| 0.35 | 12.02 | 8.93 | 5.94 | 4.70 |
| 0.34 | 11.73 | 8.53 | 5.54 | 4.30 |
| 0.33 | 11.43 | 8.23 | 5.24 | 4.00 |
| 0.32 | 11.03 | 7.83 | 4.84 | 3.60 |
| 0.31 | 10.73 | 7.56 | 4.57 | 3.33 |
| 0.30 | 10.43 | 7.23 | 4.24 | 3.00 |
| 0.29 | 10.23 | 6.94 | 3.95 | 2.71 |
| 0.28 | 9.83 | 6.73 | 3.74 | 2.50 |
| 0.27 | 9.73 | 6.73 | 3.74 | 2.50 |
| 0.26 | 9.63 | 6.63 | 3.64 | 2.40 |
| 0.25 | 9.43 | 6.43 | 3.44 | 2.20 |
| 0.24 | 9.43 | 6.33 | 3.34 | 2.10 |
| 0.23 | 9.33 | 6.23 | 3.24 | 2.00 |
| 0.22 | 9.23 | 6.23 | 3.24 | 2.00 |
| 0.21 | 9.23 | 6.23 | 3.24 | 2.00 |
| 0.20 | 9.13 | 6.13 | 3.14 | 1.90 |
| 0.19 | 9.03 | 6.03 | 3.04 | 1.80 |
| 0.18 | 9.03 | 5.93 | 2.94 | 1.70 |
| 0.17 | 8.83 | 5.73 | 2.74 | 1.50 |
| 0.16 | 8.53 | 5.43 | 2.44 | 1.20 |
| 0.15 | 8.33 | 5.23 | 2.24 | 1.00 |
| 0.14 | 8.23 | 5.23 | 2.24 | 1.00 |
| 0.13 | 8.23 | 5.23 | 2.24 | 1.00 |
| 0.12 | 8.03 | 5.03 | 2.04 | 0.80 |
| 0.11 | 8.03 | 5.00 | 2.01 | 0.76 |
| 0.10 | 7.75 | 4.65 | 1.66 | 0.42 |
| 0.09 | 7.34 | 4.32 | 1.33 | 0.09 |
| 0.08 | 7.27 | 4.26 | 1.27 | 0.03 |
| 0.07 | 7.23 | 4.23 | 1.24 | 0.00 |
| 0.06 | 7.23 | 4.23 | 1.24 | 0.00 |
| 0.05 | 7.23 | 4.23 | 1.24 | 0.00 |
| 0.04 | 7.23 | 4.23 | 1.24 | 0.00 |
| 0.03 | 7.23 | 4.23 | 1.24 | 0.00 |
| 0.02 | 7.23 | 4.23 | 1.24 | 0.00 |
| 0.01 | 7.23 | 4.23 | 1.24 | 0.00 |

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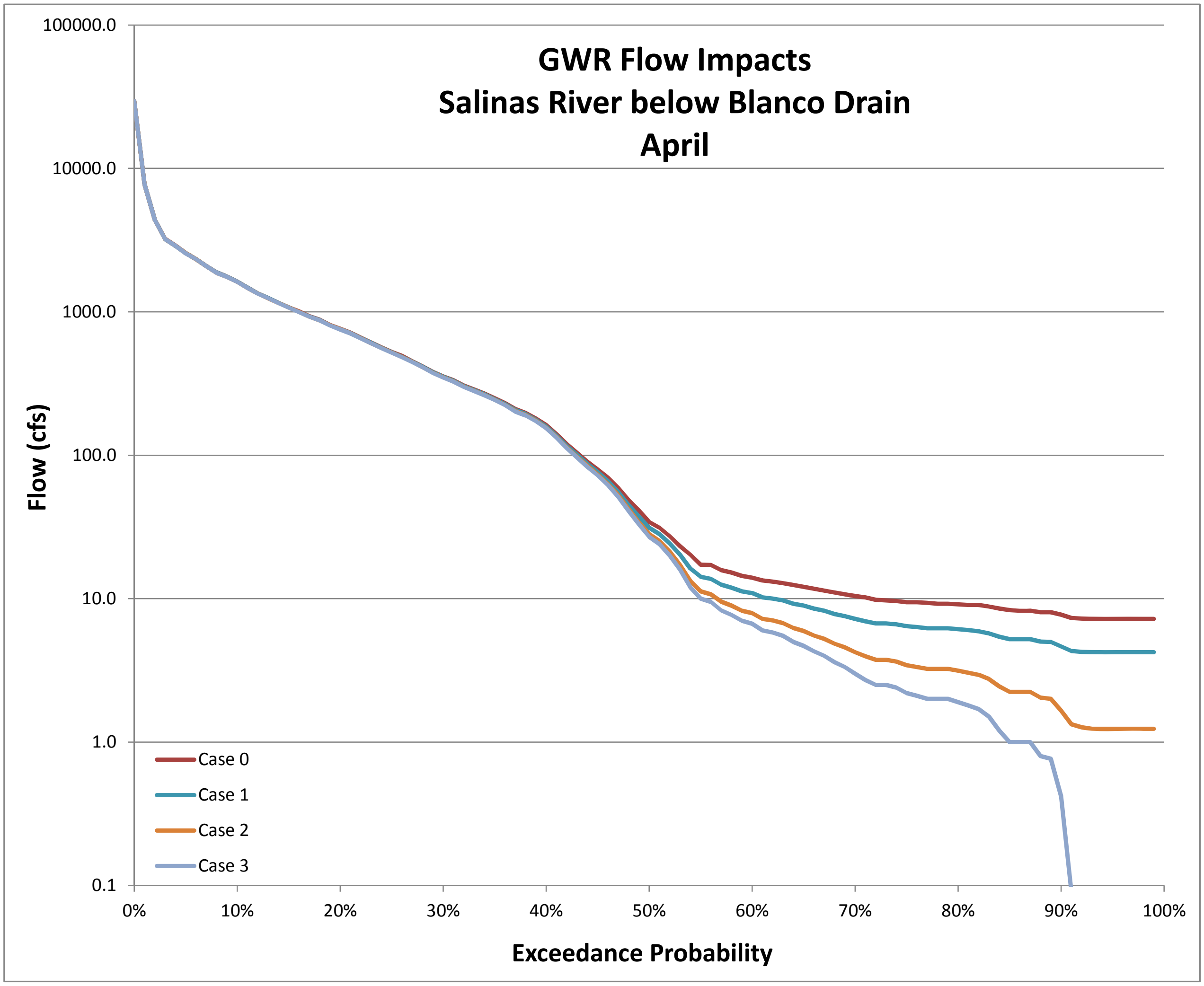


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**Salinas River below Blanco Drain, Percentile Flows by Month (cfs)**

| May Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 1.00 | 3476.66 | 3473.66 | 3470.67 | 3470.00 |
| 0.99 | 2607.96 | 2604.96 | 2601.97 | 2601.30 |
| 0.98 | 1216.66 | 1213.66 | 1210.67 | 1210.00 |
| 0.97 | 866.66 | 863.66 | 860.67 | 860.00 |
| 0.96 | 729.18 | 726.18 | 723.19 | 722.52 |
| 0.95 | 638.66 | 635.66 | 632.67 | 632.00 |
| 0.94 | 566.66 | 563.66 | 560.67 | 560.00 |
| 0.93 | 494.79 | 491.79 | 488.80 | 488.13 |
| 0.92 | 444.93 | 441.93 | 438.94 | 438.32 |
| 0.91 | 384.59 | 381.59 | 378.60 | 377.93 |
| 0.90 | 328.46 | 325.46 | 322.47 | 321.80 |
| 0.89 | 296.10 | 293.10 | 290.11 | 288.98 |
| 0.88 | 263.82 | 260.82 | 257.83 | 257.16 |
| 0.87 | 242.66 | 239.66 | 236.67 | 236.00 |
| 0.86 | 227.92 | 224.92 | 221.93 | 221.26 |
| 0.85 | 212.21 | 209.21 | 206.22 | 205.55 |
| 0.84 | 187.54 | 184.54 | 181.55 | 180.88 |
| 0.83 | 167.69 | 164.69 | 161.70 | 161.03 |
| 0.82 | 148.66 | 145.66 | 142.67 | 142.00 |
| 0.81 | 136.87 | 133.87 | 130.88 | 130.21 |
| 0.80 | 126.66 | 123.66 | 120.67 | 120.00 |
| 0.79 | 115.05 | 112.05 | 109.06 | 108.39 |
| 0.78 | 104.66 | 101.66 | 98.67 | 98.00 |
| 0.77 | 94.66 | 91.66 | 88.67 | 88.00 |
| 0.76 | 83.82 | 80.82 | 77.83 | 77.16 |
| 0.75 | 76.66 | 73.66 | 70.67 | 70.00 |
| 0.74 | 70.66 | 67.66 | 64.67 | 64.00 |
| 0.73 | 63.62 | 60.62 | 57.63 | 56.05 |
| 0.72 | 57.74 | 54.74 | 51.75 | 51.00 |
| 0.71 | 53.66 | 50.66 | 47.67 | 47.00 |
| 0.70 | 49.66 | 46.66 | 43.67 | 43.00 |
| 0.69 | 45.66 | 42.66 | 39.67 | 39.00 |
| 0.68 | 41.54 | 38.54 | 35.55 | 34.88 |
| 0.67 | 36.66 | 33.66 | 30.67 | 30.00 |
| 0.66 | 32.72 | 29.72 | 26.73 | 26.06 |
| 0.65 | 30.66 | 27.66 | 24.67 | 24.00 |
| 0.64 | 27.66 | 24.66 | 21.67 | 21.00 |
| 0.63 | 25.66 | 22.66 | 19.67 | 19.00 |
| 0.62 | 23.66 | 20.66 | 17.67 | 17.00 |
| 0.61 | 21.66 | 18.66 | 15.67 | 15.00 |
| 0.60 | 20.66 | 17.66 | 14.67 | 14.00 |
| 0.59 | 19.66 | 16.66 | 13.67 | 13.00 |
| 0.58 | 18.66 | 15.64 | 12.65 | 11.67 |
| 0.57 | 16.66 | 13.66 | 10.67 | 10.00 |
| 0.56 | 15.66 | 12.65 | 9.66 | 9.00 |
| 0.55 | 14.71 | 11.66 | 8.67 | 8.00 |
| 0.54 | 14.16 | 11.06 | 8.07 | 7.40 |
| 0.53 | 13.56 | 10.46 | 7.47 | 6.80 |
| 0.52 | 12.86 | 9.79 | 6.80 | 6.13 |
| 0.51 | 12.46 | 9.45 | 6.46 | 5.79 |

| May Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 0.50 | 11.96 | 8.91 | 5.92 | 5.25 |
| 0.49 | 11.57 | 8.56 | 5.57 | 4.90 |
| 0.48 | 11.03 | 7.86 | 4.87 | 4.20 |
| 0.47 | 10.66 | 7.66 | 4.67 | 4.00 |
| 0.46 | 10.46 | 7.44 | 4.45 | 3.79 |
| 0.45 | 9.96 | 6.80 | 3.81 | 3.15 |
| 0.44 | 9.46 | 6.36 | 3.37 | 2.70 |
| 0.43 | 9.16 | 6.16 | 3.17 | 2.50 |
| 0.42 | 9.16 | 6.06 | 3.07 | 2.40 |
| 0.41 | 8.96 | 5.96 | 2.97 | 2.30 |
| 0.40 | 8.86 | 5.77 | 2.78 | 2.11 |
| 0.39 | 8.76 | 5.66 | 2.67 | 2.00 |
| 0.38 | 8.66 | 5.66 | 2.67 | 2.00 |
| 0.37 | 8.66 | 5.56 | 2.57 | 1.90 |
| 0.36 | 8.56 | 5.56 | 2.57 | 1.90 |
| 0.35 | 8.46 | 5.46 | 2.47 | 1.80 |
| 0.34 | 8.46 | 5.46 | 2.47 | 1.80 |
| 0.33 | 8.36 | 5.36 | 2.37 | 1.70 |
| 0.32 | 8.36 | 5.36 | 2.37 | 1.70 |
| 0.31 | 8.26 | 5.26 | 2.27 | 1.60 |
| 0.30 | 8.26 | 5.16 | 2.17 | 1.50 |
| 0.29 | 8.16 | 5.16 | 2.17 | 1.50 |
| 0.28 | 8.16 | 5.16 | 2.17 | 1.50 |
| 0.27 | 8.06 | 5.06 | 2.07 | 1.40 |
| 0.26 | 8.06 | 4.96 | 1.97 | 1.30 |
| 0.25 | 7.96 | 4.96 | 1.97 | 1.30 |
| 0.24 | 7.96 | 4.96 | 1.97 | 1.30 |
| 0.23 | 7.86 | 4.86 | 1.87 | 1.20 |
| 0.22 | 7.76 | 4.76 | 1.77 | 1.10 |
| 0.21 | 7.66 | 4.66 | 1.67 | 1.00 |
| 0.20 | 7.66 | 4.66 | 1.67 | 1.00 |
| 0.19 | 7.66 | 4.66 | 1.67 | 1.00 |
| 0.18 | 7.66 | 4.65 | 1.66 | 0.99 |
| 0.17 | 7.59 | 4.53 | 1.54 | 0.87 |
| 0.16 | 7.46 | 4.43 | 1.44 | 0.78 |
| 0.15 | 7.36 | 4.26 | 1.27 | 0.60 |
| 0.14 | 7.16 | 4.16 | 1.17 | 0.50 |
| 0.13 | 7.16 | 4.16 | 1.17 | 0.50 |
| 0.12 | 7.07 | 3.96 | 0.97 | 0.30 |
| 0.11 | 6.86 | 3.78 | 0.79 | 0.12 |
| 0.10 | 6.72 | 3.71 | 0.72 | 0.05 |
| 0.09 | 6.66 | 3.66 | 0.67 | 0.00 |
| 0.08 | 6.66 | 3.66 | 0.67 | 0.00 |
| 0.07 | 6.66 | 3.66 | 0.67 | 0.00 |
| 0.06 | 6.66 | 3.66 | 0.67 | 0.00 |
| 0.05 | 6.66 | 3.66 | 0.67 | 0.00 |
| 0.04 | 6.66 | 3.66 | 0.67 | 0.00 |
| 0.03 | 6.66 | 3.66 | 0.67 | 0.00 |
| 0.02 | 6.66 | 3.66 | 0.67 | 0.00 |
| 0.01 | 6.66 | 3.66 | 0.67 | 0.00 |

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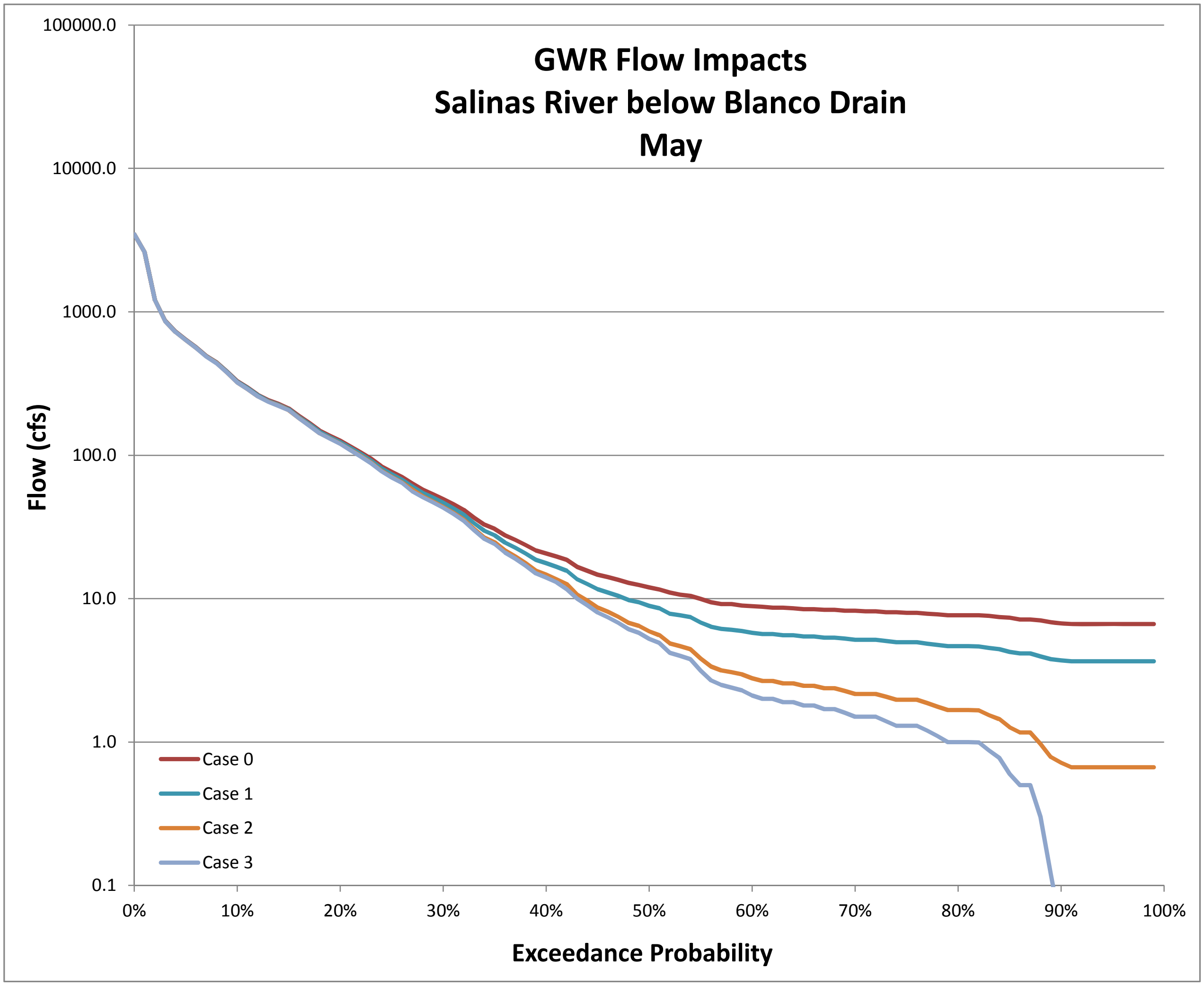


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**Salinas River below Blanco Drain, Percentile Flows by Month (cfs)**

**June**

| Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 1.00 | 1657.61 | 1654.61 | 1651.62 | 1650.01 |
| 0.99 | 455.81 | 452.81 | 449.82 | 448.21 |
| 0.98 | 421.71 | 418.71 | 415.72 | 414.11 |
| 0.97 | 346.84 | 343.84 | 340.85 | 339.24 |
| 0.96 | 243.17 | 240.17 | 237.18 | 235.57 |
| 0.95 | 207.66 | 204.66 | 201.67 | 200.06 |
| 0.94 | 158.37 | 155.37 | 152.38 | 150.77 |
| 0.93 | 127.35 | 124.35 | 121.36 | 119.75 |
| 0.92 | 105.45 | 102.45 | 99.46 | 97.85 |
| 0.91 | 84.50 | 81.50 | 78.51 | 76.90 |
| 0.90 | 68.61 | 65.61 | 62.62 | 61.01 |
| 0.89 | 58.12 | 55.12 | 52.13 | 50.52 |
| 0.88 | 46.61 | 43.61 | 40.62 | 39.01 |
| 0.87 | 40.94 | 37.94 | 34.95 | 33.34 |
| 0.86 | 36.75 | 33.75 | 30.76 | 29.15 |
| 0.85 | 32.61 | 29.61 | 26.62 | 25.01 |
| 0.84 | 29.04 | 26.04 | 23.05 | 21.44 |
| 0.83 | 27.58 | 24.58 | 21.59 | 19.98 |
| 0.82 | 24.61 | 21.61 | 18.62 | 17.01 |
| 0.81 | 22.61 | 19.61 | 16.62 | 15.01 |
| 0.80 | 21.61 | 18.61 | 15.62 | 14.01 |
| 0.79 | 19.61 | 16.61 | 13.62 | 12.01 |
| 0.78 | 17.62 | 14.61 | 11.62 | 10.01 |
| 0.77 | 16.61 | 13.61 | 10.62 | 9.01 |
| 0.76 | 15.61 | 12.61 | 9.62 | 8.01 |
| 0.75 | 15.61 | 12.61 | 9.62 | 8.01 |
| 0.74 | 14.61 | 11.61 | 8.62 | 7.01 |
| 0.73 | 14.01 | 11.01 | 8.02 | 6.41 |
| 0.72 | 13.62 | 10.61 | 7.62 | 6.01 |
| 0.71 | 13.21 | 10.21 | 7.22 | 5.61 |
| 0.70 | 12.81 | 9.74 | 6.75 | 5.14 |
| 0.69 | 12.20 | 9.11 | 6.12 | 4.51 |
| 0.68 | 11.91 | 8.81 | 5.82 | 4.21 |
| 0.67 | 11.61 | 8.61 | 5.62 | 4.01 |
| 0.66 | 11.11 | 8.11 | 5.12 | 3.51 |
| 0.65 | 10.91 | 7.91 | 4.92 | 3.31 |
| 0.64 | 10.61 | 7.61 | 4.62 | 3.01 |
| 0.63 | 10.61 | 7.61 | 4.62 | 3.01 |
| 0.62 | 10.41 | 7.41 | 4.42 | 2.81 |
| 0.61 | 10.21 | 7.21 | 4.22 | 2.61 |
| 0.60 | 10.11 | 7.11 | 4.12 | 2.51 |
| 0.59 | 10.11 | 7.11 | 4.12 | 2.51 |
| 0.58 | 10.01 | 7.01 | 4.02 | 2.41 |
| 0.57 | 9.91 | 6.91 | 3.92 | 2.31 |
| 0.56 | 9.81 | 6.81 | 3.82 | 2.21 |
| 0.55 | 9.81 | 6.81 | 3.82 | 2.21 |
| 0.54 | 9.71 | 6.71 | 3.72 | 2.11 |
| 0.53 | 9.61 | 6.61 | 3.62 | 2.01 |
| 0.52 | 9.61 | 6.61 | 3.62 | 2.01 |
| 0.51 | 9.61 | 6.61 | 3.62 | 2.01 |

**June**

| Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 0.50 | 9.61 | 6.61 | 3.62 | 2.01 |
| 0.49 | 9.51 | 6.51 | 3.52 | 1.91 |
| 0.48 | 9.41 | 6.41 | 3.42 | 1.81 |
| 0.47 | 9.41 | 6.41 | 3.42 | 1.81 |
| 0.46 | 9.31 | 6.31 | 3.32 | 1.71 |
| 0.45 | 9.21 | 6.21 | 3.22 | 1.61 |
| 0.44 | 9.21 | 6.21 | 3.22 | 1.61 |
| 0.43 | 9.11 | 6.11 | 3.12 | 1.51 |
| 0.42 | 9.11 | 6.11 | 3.12 | 1.51 |
| 0.41 | 9.01 | 6.01 | 3.02 | 1.41 |
| 0.40 | 9.01 | 6.01 | 3.02 | 1.41 |
| 0.39 | 8.91 | 5.91 | 2.92 | 1.31 |
| 0.38 | 8.81 | 5.81 | 2.82 | 1.21 |
| 0.37 | 8.81 | 5.81 | 2.82 | 1.21 |
| 0.36 | 8.81 | 5.81 | 2.82 | 1.21 |
| 0.35 | 8.81 | 5.81 | 2.82 | 1.21 |
| 0.34 | 8.81 | 5.81 | 2.82 | 1.21 |
| 0.33 | 8.81 | 5.81 | 2.82 | 1.21 |
| 0.32 | 8.71 | 5.71 | 2.72 | 1.11 |
| 0.31 | 8.71 | 5.71 | 2.72 | 1.11 |
| 0.30 | 8.71 | 5.71 | 2.72 | 1.11 |
| 0.29 | 8.61 | 5.61 | 2.62 | 1.01 |
| 0.28 | 8.61 | 5.61 | 2.62 | 1.01 |
| 0.27 | 8.61 | 5.61 | 2.62 | 1.01 |
| 0.26 | 8.61 | 5.61 | 2.62 | 1.01 |
| 0.25 | 8.61 | 5.61 | 2.62 | 1.01 |
| 0.24 | 8.61 | 5.61 | 2.62 | 1.01 |
| 0.23 | 8.46 | 5.46 | 2.47 | 0.86 |
| 0.22 | 8.41 | 5.41 | 2.42 | 0.81 |
| 0.21 | 8.41 | 5.41 | 2.42 | 0.81 |
| 0.20 | 8.26 | 5.26 | 2.27 | 0.66 |
| 0.19 | 8.19 | 5.17 | 2.18 | 0.57 |
| 0.18 | 8.11 | 5.11 | 2.12 | 0.51 |
| 0.17 | 8.01 | 5.01 | 2.02 | 0.41 |
| 0.16 | 7.81 | 4.81 | 1.82 | 0.21 |
| 0.15 | 7.66 | 4.66 | 1.67 | 0.06 |
| 0.14 | 7.61 | 4.61 | 1.62 | 0.01 |
| 0.13 | 7.61 | 4.61 | 1.62 | 0.01 |
| 0.12 | 7.61 | 4.61 | 1.62 | 0.01 |
| 0.11 | 7.61 | 4.61 | 1.62 | 0.01 |
| 0.10 | 7.61 | 4.61 | 1.62 | 0.01 |
| 0.09 | 7.61 | 4.61 | 1.62 | 0.01 |
| 0.08 | 7.61 | 4.61 | 1.62 | 0.01 |
| 0.07 | 7.61 | 4.61 | 1.62 | 0.01 |
| 0.06 | 7.61 | 4.61 | 1.62 | 0.01 |
| 0.05 | 7.61 | 4.61 | 1.62 | 0.01 |
| 0.04 | 7.61 | 4.61 | 1.62 | 0.01 |
| 0.03 | 7.61 | 4.61 | 1.62 | 0.01 |
| 0.02 | 7.61 | 4.61 | 1.62 | 0.01 |
| 0.01 | 7.61 | 4.61 | 1.62 | 0.01 |

Case 0: No diversions (Base Condition).
Case 1: Divert both Salinas Stormwater and SIWTF; No Blanco Drain diversions.
Case 2: Divert both Salinas Stormwater and SIWTF; Divert up to 2.99 cfs from Blanco Drain.
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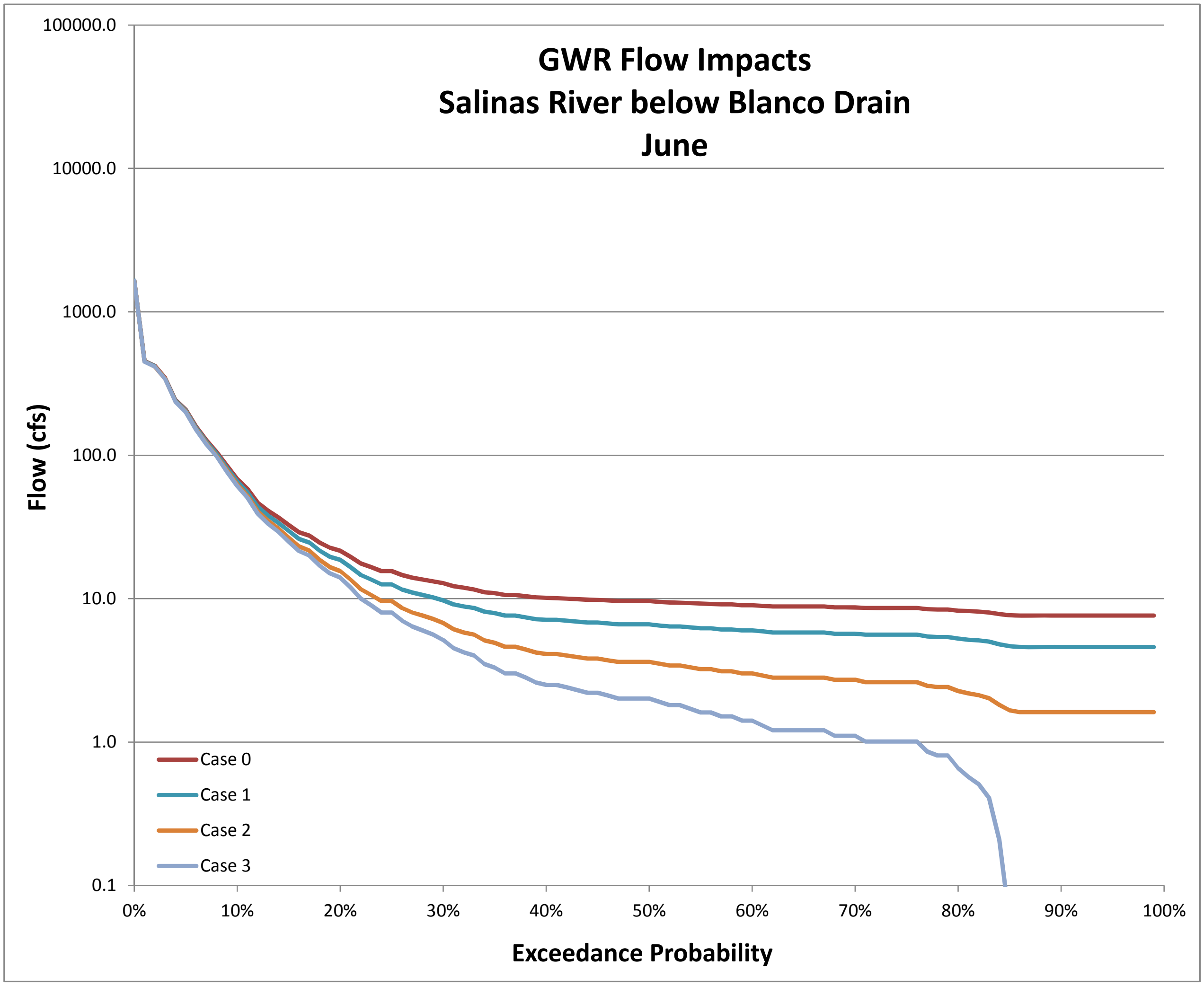


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Note:
Measurement point for all cases is Salinas River just downstream of confluence with Blanco Drain.

SRDF diversions (from Salinas River behind rubber dam) occurred 2010-2013 for all cases above;
SRDF diversions balance extra flow at Spreckels during this period.

Total flow is the sum of the Salinas R. at Spreckels (USGS gage) plus storm runoff, plus SIWTF inflows, plus flow in from Blanco Drain, minus SRDF diversions and stormwater capture.

**Salinas River below Blanco Drain, Percentile Flows by Month (cfs)**

July

| Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 1.00 | 489.50 | 486.50 | 483.51 | 482.00 |
| 0.99 | 372.27 | 369.27 | 366.28 | 364.77 |
| 0.98 | 291.58 | 288.58 | 285.59 | 284.08 |
| 0.97 | 195.58 | 192.58 | 189.59 | 188.08 |
| 0.96 | 155.22 | 152.22 | 149.23 | 147.72 |
| 0.95 | 119.40 | 116.40 | 113.41 | 111.90 |
| 0.94 | 87.04 | 84.04 | 81.05 | 79.54 |
| 0.93 | 71.38 | 68.38 | 65.39 | 63.78 |
| 0.92 | 53.50 | 50.50 | 47.51 | 46.00 |
| 0.91 | 42.81 | 39.81 | 36.82 | 35.29 |
| 0.90 | 35.50 | 32.50 | 29.51 | 28.00 |
| 0.89 | 31.50 | 28.50 | 25.51 | 24.00 |
| 0.88 | 27.50 | 24.50 | 21.51 | 20.00 |
| 0.87 | 24.50 | 21.50 | 18.51 | 17.00 |
| 0.86 | 22.34 | 19.34 | 16.35 | 14.77 |
| 0.85 | 19.50 | 16.50 | 13.51 | 12.00 |
| 0.84 | 17.40 | 14.40 | 11.41 | 9.88 |
| 0.83 | 16.50 | 13.50 | 10.51 | 9.00 |
| 0.82 | 15.20 | 12.20 | 9.21 | 7.70 |
| 0.81 | 14.42 | 11.42 | 8.43 | 6.90 |
| 0.80 | 13.90 | 10.90 | 7.91 | 6.35 |
| 0.79 | 13.00 | 10.00 | 7.01 | 5.50 |
| 0.78 | 12.30 | 9.30 | 6.31 | 4.80 |
| 0.77 | 11.76 | 8.70 | 5.71 | 4.20 |
| 0.76 | 11.20 | 8.20 | 5.21 | 3.70 |
| 0.75 | 10.80 | 7.80 | 4.81 | 3.30 |
| 0.74 | 10.44 | 7.40 | 4.41 | 2.90 |
| 0.73 | 10.10 | 7.10 | 4.11 | 2.60 |
| 0.72 | 9.90 | 6.90 | 3.91 | 2.40 |
| 0.71 | 9.80 | 6.80 | 3.81 | 2.30 |
| 0.70 | 9.70 | 6.70 | 3.71 | 2.20 |
| 0.69 | 9.60 | 6.60 | 3.61 | 2.10 |
| 0.68 | 9.50 | 6.50 | 3.51 | 2.00 |
| 0.67 | 9.50 | 6.50 | 3.51 | 2.00 |
| 0.66 | 9.50 | 6.50 | 3.51 | 2.00 |
| 0.65 | 9.50 | 6.50 | 3.51 | 2.00 |
| 0.64 | 9.40 | 6.40 | 3.41 | 1.90 |
| 0.63 | 9.40 | 6.40 | 3.41 | 1.90 |
| 0.62 | 9.30 | 6.30 | 3.31 | 1.80 |
| 0.61 | 9.30 | 6.30 | 3.31 | 1.80 |
| 0.60 | 9.20 | 6.20 | 3.21 | 1.70 |
| 0.59 | 9.20 | 6.20 | 3.21 | 1.70 |
| 0.58 | 9.10 | 6.10 | 3.11 | 1.60 |
| 0.57 | 9.10 | 6.10 | 3.11 | 1.60 |
| 0.56 | 9.10 | 6.10 | 3.11 | 1.60 |
| 0.55 | 9.10 | 6.10 | 3.11 | 1.60 |
| 0.54 | 9.00 | 6.00 | 3.01 | 1.50 |
| 0.53 | 9.00 | 6.00 | 3.01 | 1.50 |
| 0.52 | 9.00 | 6.00 | 3.01 | 1.50 |
| 0.51 | 9.00 | 6.00 | 3.01 | 1.50 |

July

| Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 0.50 | 9.00 | 6.00 | 3.01 | 1.50 |
| 0.49 | 9.00 | 6.00 | 3.01 | 1.50 |
| 0.48 | 8.90 | 5.90 | 2.91 | 1.40 |
| 0.47 | 8.90 | 5.90 | 2.91 | 1.40 |
| 0.46 | 8.80 | 5.80 | 2.81 | 1.30 |
| 0.45 | 8.80 | 5.80 | 2.81 | 1.30 |
| 0.44 | 8.80 | 5.80 | 2.81 | 1.30 |
| 0.43 | 8.70 | 5.70 | 2.71 | 1.20 |
| 0.42 | 8.70 | 5.70 | 2.71 | 1.20 |
| 0.41 | 8.70 | 5.70 | 2.71 | 1.20 |
| 0.40 | 8.60 | 5.60 | 2.61 | 1.10 |
| 0.39 | 8.60 | 5.60 | 2.61 | 1.10 |
| 0.38 | 8.50 | 5.50 | 2.51 | 1.00 |
| 0.37 | 8.50 | 5.50 | 2.51 | 1.00 |
| 0.36 | 8.50 | 5.50 | 2.51 | 1.00 |
| 0.35 | 8.50 | 5.50 | 2.51 | 1.00 |
| 0.34 | 8.50 | 5.50 | 2.51 | 1.00 |
| 0.33 | 8.50 | 5.50 | 2.51 | 1.00 |
| 0.32 | 8.50 | 5.50 | 2.51 | 1.00 |
| 0.31 | 8.50 | 5.50 | 2.51 | 1.00 |
| 0.30 | 8.40 | 5.40 | 2.41 | 0.90 |
| 0.29 | 8.30 | 5.30 | 2.31 | 0.80 |
| 0.28 | 8.30 | 5.30 | 2.31 | 0.80 |
| 0.27 | 8.17 | 5.15 | 2.16 | 0.65 |
| 0.26 | 8.06 | 5.06 | 2.07 | 0.56 |
| 0.25 | 8.00 | 5.00 | 2.01 | 0.50 |
| 0.24 | 8.00 | 5.00 | 2.01 | 0.50 |
| 0.23 | 7.96 | 4.96 | 1.97 | 0.46 |
| 0.22 | 7.80 | 4.80 | 1.81 | 0.30 |
| 0.21 | 7.70 | 4.70 | 1.71 | 0.20 |
| 0.20 | 7.62 | 4.62 | 1.63 | 0.11 |
| 0.19 | 7.50 | 4.50 | 1.51 | 0.00 |
| 0.18 | 7.50 | 4.50 | 1.51 | 0.00 |
| 0.17 | 7.50 | 4.50 | 1.51 | 0.00 |
| 0.16 | 7.50 | 4.50 | 1.51 | 0.00 |
| 0.15 | 7.50 | 4.50 | 1.51 | 0.00 |
| 0.14 | 7.50 | 4.50 | 1.51 | 0.00 |
| 0.13 | 7.50 | 4.50 | 1.51 | 0.00 |
| 0.12 | 7.50 | 4.50 | 1.51 | 0.00 |
| 0.11 | 7.50 | 4.50 | 1.51 | 0.00 |
| 0.10 | 7.50 | 4.50 | 1.51 | 0.00 |
| 0.09 | 7.50 | 4.50 | 1.51 | 0.00 |
| 0.08 | 7.50 | 4.50 | 1.51 | 0.00 |
| 0.07 | 7.50 | 4.50 | 1.51 | 0.00 |
| 0.06 | 7.50 | 4.50 | 1.51 | 0.00 |
| 0.05 | 7.50 | 4.50 | 1.51 | 0.00 |
| 0.04 | 7.50 | 4.50 | 1.51 | 0.00 |
| 0.03 | 7.50 | 4.50 | 1.51 | 0.00 |
| 0.02 | 7.50 | 4.50 | 1.51 | 0.00 |
| 0.01 | 7.50 | 4.50 | 1.51 | 0.00 |

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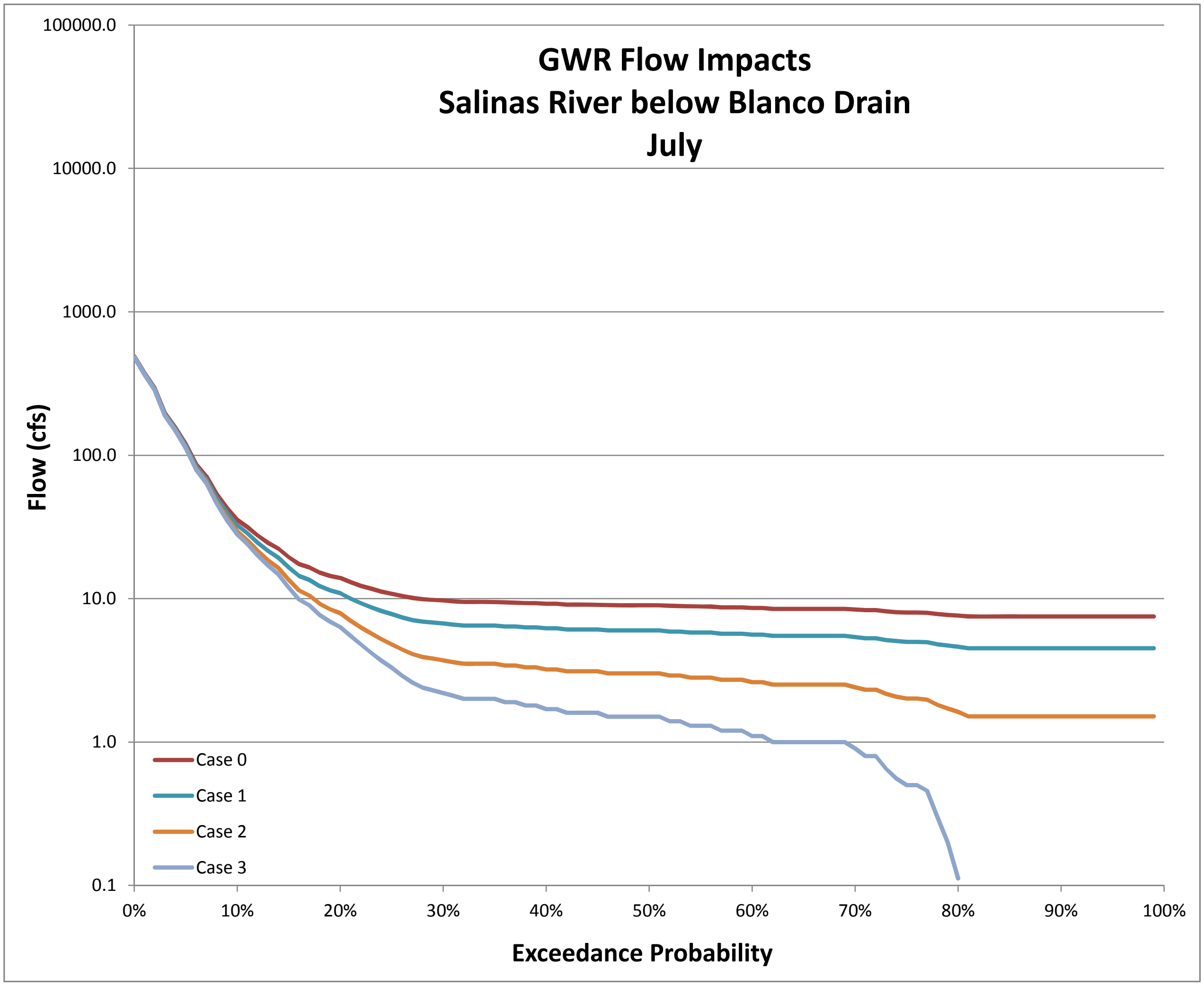


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plus flow in from Blanco Drain, minus SRDF diversions and stormwater capture.

**Salinas River below Blanco Drain, Percentile Flows by Month (cfs)**

| August Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 1.00 | 426.97 | 423.97 | 420.98 | 420.00 |
| 0.99 | 310.74 | 307.74 | 304.75 | 303.77 |
| 0.98 | 220.51 | 217.51 | 214.52 | 213.54 |
| 0.97 | 193.74 | 190.74 | 187.75 | 186.77 |
| 0.96 | 184.41 | 181.41 | 178.42 | 177.44 |
| 0.95 | 94.82 | 91.82 | 88.83 | 87.85 |
| 0.94 | 73.97 | 70.97 | 67.98 | 67.00 |
| 0.93 | 52.97 | 49.97 | 46.98 | 46.00 |
| 0.92 | 40.97 | 37.97 | 34.98 | 34.00 |
| 0.91 | 35.28 | 32.28 | 29.29 | 28.12 |
| 0.90 | 31.29 | 28.29 | 25.30 | 24.00 |
| 0.89 | 27.97 | 24.97 | 21.98 | 21.00 |
| 0.88 | 25.97 | 22.97 | 19.98 | 18.68 |
| 0.87 | 22.14 | 19.14 | 16.15 | 15.00 |
| 0.86 | 20.87 | 17.87 | 14.88 | 13.27 |
| 0.85 | 18.97 | 15.97 | 12.98 | 12.00 |
| 0.84 | 16.97 | 13.97 | 10.98 | 10.00 |
| 0.83 | 15.77 | 12.77 | 9.78 | 8.60 |
| 0.82 | 14.27 | 11.17 | 8.18 | 7.00 |
| 0.81 | 12.97 | 9.89 | 6.90 | 5.91 |
| 0.80 | 12.17 | 9.15 | 6.16 | 5.01 |
| 0.79 | 11.97 | 8.97 | 5.98 | 5.00 |
| 0.78 | 11.77 | 8.77 | 5.78 | 4.80 |
| 0.77 | 11.17 | 8.17 | 5.18 | 4.20 |
| 0.76 | 10.69 | 7.61 | 4.62 | 3.60 |
| 0.75 | 10.27 | 7.27 | 4.28 | 3.30 |
| 0.74 | 9.97 | 6.97 | 3.98 | 3.00 |
| 0.73 | 9.77 | 6.77 | 3.78 | 2.80 |
| 0.72 | 9.67 | 6.67 | 3.68 | 2.70 |
| 0.71 | 9.47 | 6.47 | 3.48 | 2.50 |
| 0.70 | 9.37 | 6.37 | 3.38 | 2.40 |
| 0.69 | 9.20 | 6.17 | 3.18 | 2.20 |
| 0.68 | 9.17 | 6.17 | 3.18 | 2.20 |
| 0.67 | 8.98 | 5.97 | 2.98 | 2.00 |
| 0.66 | 8.97 | 5.97 | 2.98 | 2.00 |
| 0.65 | 8.97 | 5.97 | 2.98 | 2.00 |
| 0.64 | 8.97 | 5.97 | 2.98 | 2.00 |
| 0.63 | 8.87 | 5.87 | 2.88 | 1.90 |
| 0.62 | 8.77 | 5.77 | 2.78 | 1.80 |
| 0.61 | 8.67 | 5.67 | 2.68 | 1.70 |
| 0.60 | 8.57 | 5.57 | 2.58 | 1.60 |
| 0.59 | 8.47 | 5.47 | 2.48 | 1.50 |
| 0.58 | 8.47 | 5.47 | 2.48 | 1.50 |
| 0.57 | 8.47 | 5.47 | 2.48 | 1.50 |
| 0.56 | 8.37 | 5.37 | 2.38 | 1.40 |
| 0.55 | 8.37 | 5.37 | 2.38 | 1.40 |
| 0.54 | 8.27 | 5.27 | 2.28 | 1.30 |
| 0.53 | 8.27 | 5.27 | 2.28 | 1.30 |
| 0.52 | 8.17 | 5.17 | 2.18 | 1.20 |
| 0.51 | 8.17 | 5.17 | 2.18 | 1.20 |

| August Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 0.50 | 8.17 | 5.17 | 2.18 | 1.20 |
| 0.49 | 8.07 | 5.07 | 2.08 | 1.10 |
| 0.48 | 8.07 | 5.07 | 2.08 | 1.10 |
| 0.47 | 7.97 | 4.97 | 1.98 | 1.00 |
| 0.46 | 7.97 | 4.97 | 1.98 | 1.00 |
| 0.45 | 7.97 | 4.97 | 1.98 | 1.00 |
| 0.44 | 7.97 | 4.97 | 1.98 | 1.00 |
| 0.43 | 7.97 | 4.97 | 1.98 | 1.00 |
| 0.42 | 7.97 | 4.97 | 1.98 | 1.00 |
| 0.41 | 7.97 | 4.97 | 1.98 | 1.00 |
| 0.40 | 7.97 | 4.97 | 1.98 | 1.00 |
| 0.39 | 7.97 | 4.97 | 1.98 | 1.00 |
| 0.38 | 7.97 | 4.97 | 1.98 | 1.00 |
| 0.37 | 7.97 | 4.97 | 1.98 | 1.00 |
| 0.36 | 7.97 | 4.97 | 1.98 | 1.00 |
| 0.35 | 7.97 | 4.97 | 1.98 | 1.00 |
| 0.34 | 7.97 | 4.97 | 1.98 | 0.99 |
| 0.33 | 7.87 | 4.87 | 1.88 | 0.90 |
| 0.32 | 7.77 | 4.77 | 1.78 | 0.80 |
| 0.31 | 7.77 | 4.77 | 1.78 | 0.80 |
| 0.30 | 7.74 | 4.72 | 1.73 | 0.71 |
| 0.29 | 7.64 | 4.64 | 1.65 | 0.61 |
| 0.28 | 7.47 | 4.47 | 1.48 | 0.50 |
| 0.27 | 7.47 | 4.47 | 1.48 | 0.50 |
| 0.26 | 7.47 | 4.42 | 1.43 | 0.40 |
| 0.25 | 7.22 | 4.20 | 1.21 | 0.22 |
| 0.24 | 7.17 | 4.17 | 1.18 | 0.20 |
| 0.23 | 7.17 | 4.17 | 1.18 | 0.20 |
| 0.22 | 7.17 | 4.17 | 1.18 | 0.20 |
| 0.21 | 7.07 | 4.07 | 1.08 | 0.10 |
| 0.20 | 6.99 | 3.98 | 0.99 | 0.00 |
| 0.19 | 6.97 | 3.97 | 0.98 | 0.00 |
| 0.18 | 6.97 | 3.97 | 0.98 | 0.00 |
| 0.17 | 6.97 | 3.97 | 0.98 | 0.00 |
| 0.16 | 6.97 | 3.97 | 0.98 | 0.00 |
| 0.15 | 6.97 | 3.97 | 0.98 | 0.00 |
| 0.14 | 6.97 | 3.97 | 0.98 | 0.00 |
| 0.13 | 6.97 | 3.97 | 0.98 | 0.00 |
| 0.12 | 6.97 | 3.97 | 0.98 | 0.00 |
| 0.11 | 6.97 | 3.97 | 0.98 | 0.00 |
| 0.10 | 6.97 | 3.97 | 0.98 | 0.00 |
| 0.09 | 6.97 | 3.97 | 0.98 | 0.00 |
| 0.08 | 6.97 | 3.97 | 0.98 | 0.00 |
| 0.07 | 6.97 | 3.97 | 0.98 | 0.00 |
| 0.06 | 6.97 | 3.97 | 0.98 | 0.00 |
| 0.05 | 6.97 | 3.97 | 0.98 | 0.00 |
| 0.04 | 6.97 | 3.97 | 0.98 | 0.00 |
| 0.03 | 6.97 | 3.97 | 0.98 | 0.00 |
| 0.02 | 6.97 | 3.97 | 0.98 | 0.00 |
| 0.01 | 6.97 | 3.97 | 0.98 | 0.00 |

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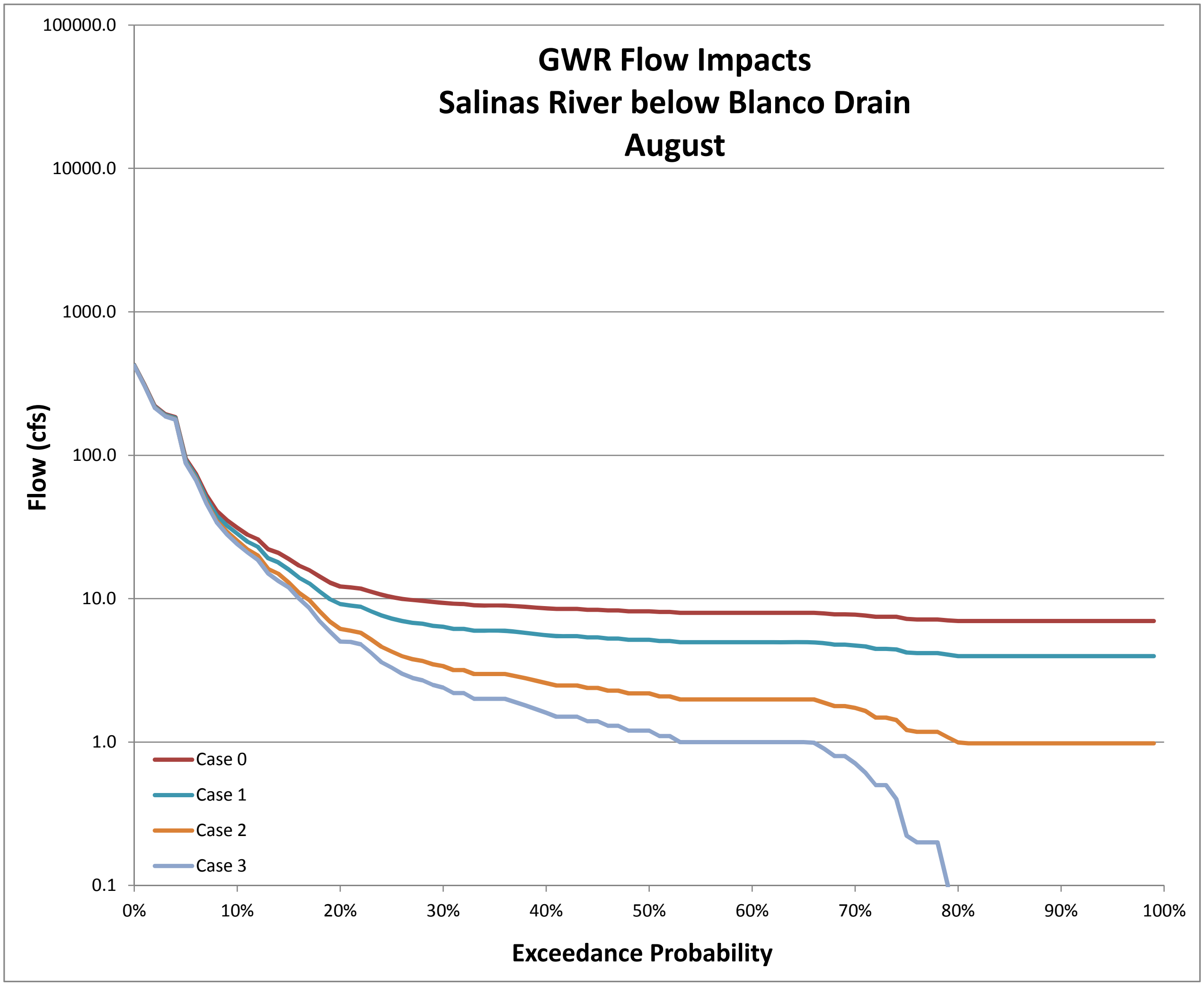


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**Salinas River below Blanco Drain, Percentile Flows by Month (cfs)**

| September Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 1.00 | 507.09 | 504.09 | 501.10 | 501.00 |
| 0.99 | 415.32 | 412.32 | 409.33 | 409.23 |
| 0.98 | 374.09 | 371.09 | 368.10 | 368.00 |
| 0.97 | 250.78 | 247.78 | 244.79 | 244.69 |
| 0.96 | 192.37 | 187.73 | 184.74 | 184.64 |
| 0.95 | 143.14 | 140.14 | 137.15 | 137.05 |
| 0.94 | 122.09 | 119.09 | 116.10 | 116.00 |
| 0.93 | 105.09 | 102.09 | 99.10 | 99.00 |
| 0.92 | 87.65 | 84.65 | 81.66 | 81.56 |
| 0.91 | 66.09 | 63.09 | 60.10 | 60.00 |
| 0.90 | 53.09 | 50.09 | 47.10 | 47.00 |
| 0.89 | 40.38 | 37.09 | 34.10 | 34.00 |
| 0.88 | 34.07 | 30.89 | 27.90 | 27.23 |
| 0.87 | 30.09 | 26.91 | 23.92 | 23.82 |
| 0.86 | 27.09 | 24.04 | 21.10 | 21.00 |
| 0.85 | 24.09 | 21.09 | 18.11 | 18.00 |
| 0.84 | 21.09 | 18.09 | 15.10 | 15.00 |
| 0.83 | 18.77 | 15.77 | 12.95 | 12.00 |
| 0.82 | 15.88 | 12.88 | 9.89 | 9.22 |
| 0.81 | 14.08 | 11.08 | 8.09 | 7.88 |
| 0.80 | 13.09 | 10.09 | 7.10 | 7.00 |
| 0.79 | 12.19 | 9.11 | 6.16 | 6.00 |
| 0.78 | 12.09 | 9.09 | 6.10 | 6.00 |
| 0.77 | 12.09 | 9.09 | 6.10 | 6.00 |
| 0.76 | 11.61 | 8.59 | 5.60 | 5.50 |
| 0.75 | 11.39 | 8.39 | 5.40 | 5.10 |
| 0.74 | 10.99 | 7.89 | 4.90 | 4.80 |
| 0.73 | 10.59 | 7.49 | 4.50 | 4.40 |
| 0.72 | 10.39 | 7.29 | 4.30 | 4.20 |
| 0.71 | 10.09 | 7.09 | 4.10 | 4.00 |
| 0.70 | 10.09 | 7.09 | 4.10 | 4.00 |
| 0.69 | 9.79 | 6.79 | 3.80 | 3.70 |
| 0.68 | 9.79 | 6.79 | 3.80 | 3.70 |
| 0.67 | 9.59 | 6.59 | 3.60 | 3.50 |
| 0.66 | 9.49 | 6.48 | 3.49 | 3.39 |
| 0.65 | 9.29 | 6.29 | 3.30 | 3.20 |
| 0.64 | 9.16 | 6.09 | 3.10 | 3.00 |
| 0.63 | 9.09 | 6.09 | 3.10 | 3.00 |
| 0.62 | 9.09 | 6.09 | 3.10 | 3.00 |
| 0.61 | 8.99 | 5.99 | 3.00 | 2.90 |
| 0.60 | 8.89 | 5.80 | 2.81 | 2.70 |
| 0.59 | 8.69 | 5.69 | 2.70 | 2.60 |
| 0.58 | 8.49 | 5.49 | 2.50 | 2.40 |
| 0.57 | 8.39 | 5.39 | 2.40 | 2.30 |
| 0.56 | 8.29 | 5.29 | 2.30 | 2.20 |
| 0.55 | 8.29 | 5.29 | 2.30 | 2.20 |
| 0.54 | 8.19 | 5.19 | 2.20 | 2.10 |
| 0.53 | 8.19 | 5.19 | 2.20 | 2.10 |
| 0.52 | 8.09 | 5.09 | 2.10 | 2.00 |
| 0.51 | 8.09 | 5.09 | 2.10 | 2.00 |

| September Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 0.50 | 7.96 | 4.96 | 1.97 | 1.80 |
| 0.49 | 7.79 | 4.79 | 1.80 | 1.60 |
| 0.48 | 7.59 | 4.59 | 1.60 | 1.50 |
| 0.47 | 7.59 | 4.59 | 1.60 | 1.50 |
| 0.46 | 7.59 | 4.59 | 1.60 | 1.50 |
| 0.45 | 7.59 | 4.55 | 1.56 | 1.40 |
| 0.44 | 7.49 | 4.49 | 1.50 | 1.40 |
| 0.43 | 7.49 | 4.49 | 1.50 | 1.34 |
| 0.42 | 7.39 | 4.39 | 1.40 | 1.30 |
| 0.41 | 7.29 | 4.29 | 1.30 | 1.20 |
| 0.40 | 7.19 | 4.19 | 1.20 | 1.10 |
| 0.39 | 7.18 | 4.09 | 1.10 | 1.00 |
| 0.38 | 7.09 | 4.09 | 1.10 | 1.00 |
| 0.37 | 7.09 | 4.09 | 1.10 | 1.00 |
| 0.36 | 7.09 | 4.09 | 1.10 | 1.00 |
| 0.35 | 7.09 | 4.09 | 1.10 | 1.00 |
| 0.34 | 7.09 | 4.09 | 1.10 | 1.00 |
| 0.33 | 7.09 | 4.09 | 1.10 | 1.00 |
| 0.32 | 7.09 | 4.09 | 1.10 | 1.00 |
| 0.31 | 7.09 | 4.09 | 1.10 | 1.00 |
| 0.30 | 7.09 | 4.08 | 1.09 | 0.90 |
| 0.29 | 6.96 | 3.95 | 0.96 | 0.80 |
| 0.28 | 6.89 | 3.89 | 0.90 | 0.69 |
| 0.27 | 6.69 | 3.69 | 0.70 | 0.50 |
| 0.26 | 6.59 | 3.59 | 0.60 | 0.40 |
| 0.25 | 6.29 | 3.29 | 0.30 | 0.20 |
| 0.24 | 6.19 | 3.19 | 0.20 | 0.10 |
| 0.23 | 6.19 | 3.19 | 0.20 | 0.10 |
| 0.22 | 6.19 | 3.19 | 0.20 | 0.10 |
| 0.21 | 6.12 | 3.11 | 0.12 | 0.02 |
| 0.20 | 6.09 | 3.09 | 0.10 | 0.00 |
| 0.19 | 6.09 | 3.09 | 0.10 | 0.00 |
| 0.18 | 6.09 | 3.09 | 0.10 | 0.00 |
| 0.17 | 6.09 | 3.09 | 0.10 | 0.00 |
| 0.16 | 6.09 | 3.09 | 0.10 | 0.00 |
| 0.15 | 6.09 | 3.09 | 0.10 | 0.00 |
| 0.14 | 6.09 | 3.09 | 0.10 | 0.00 |
| 0.13 | 6.09 | 3.09 | 0.10 | 0.00 |
| 0.12 | 6.09 | 3.09 | 0.10 | 0.00 |
| 0.11 | 6.09 | 3.09 | 0.10 | 0.00 |
| 0.10 | 6.09 | 3.09 | 0.10 | 0.00 |
| 0.09 | 6.09 | 3.09 | 0.10 | 0.00 |
| 0.08 | 6.09 | 3.09 | 0.10 | 0.00 |
| 0.07 | 6.09 | 3.09 | 0.10 | 0.00 |
| 0.06 | 6.09 | 3.09 | 0.10 | 0.00 |
| 0.05 | 6.09 | 3.09 | 0.10 | 0.00 |
| 0.04 | 6.09 | 3.09 | 0.10 | 0.00 |
| 0.03 | 6.09 | 3.09 | 0.10 | 0.00 |
| 0.02 | 6.09 | 3.09 | 0.10 | 0.00 |
| 0.01 | 6.09 | 3.09 | 0.10 | 0.00 |

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Case 1: Divert both Salinas Stormwater and SIWTF; No Blanco Drain diversions.
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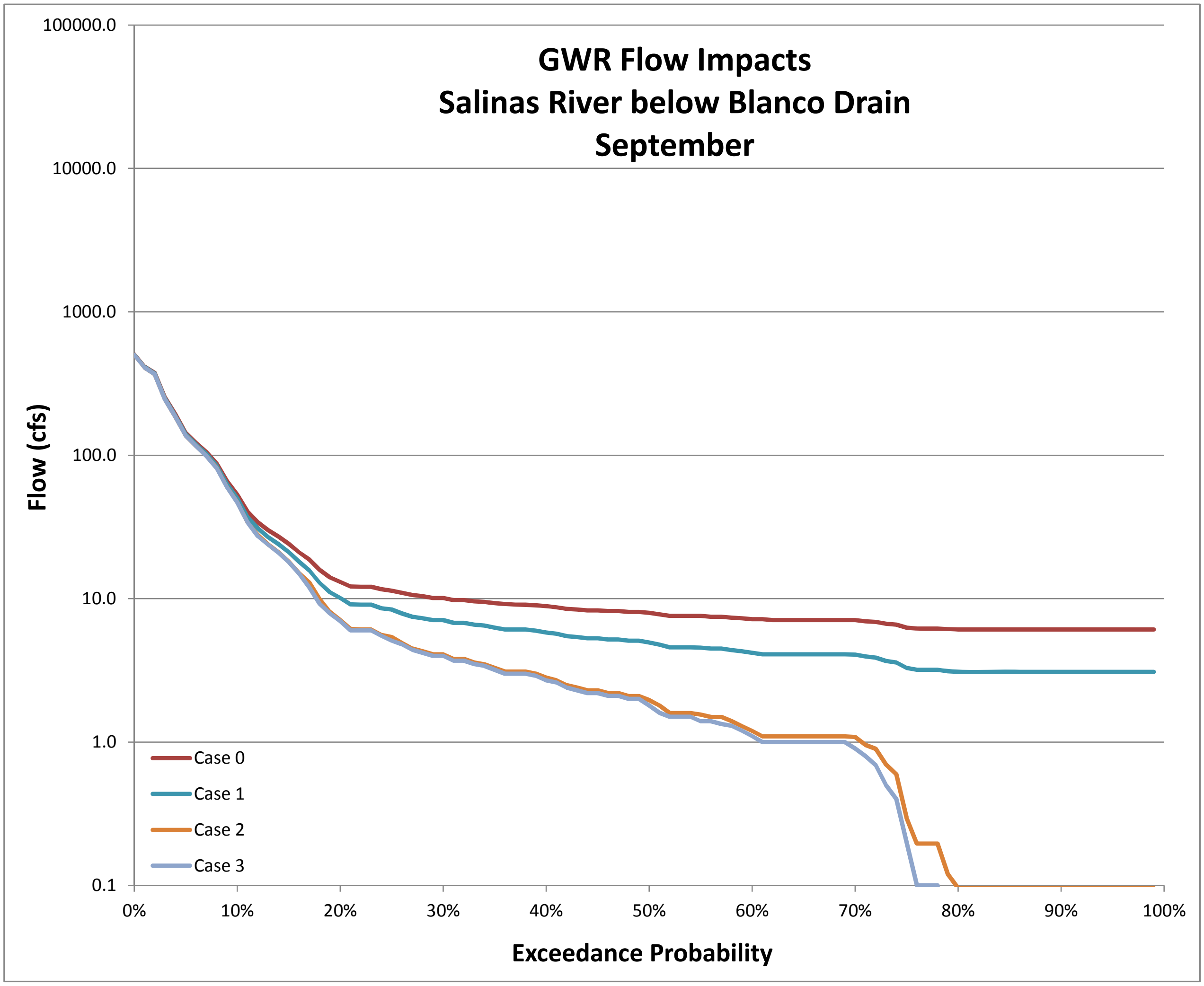


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Note:
Measurement point for all cases is Salinas River just downstream of confluence with Blanco Drain.

SRDF diversions (from Salinas River behind rubber dam) occurred 2010-2013 for all cases above;
SRDF diversions balance extra flow at Spreckels during this period.

Total flow is the sum of the Salinas R. at Spreckels (USGS gage) plus storm runoff, plus SIWTF inflows,
plus flow in from Blanco Drain, minus SRDF diversions and stormwater capture.

**Salinas River below Blanco Drain, Percentile Flows by Month (cfs)**

**October**

| Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 1.00 | 540.73 | 537.73 | 535.00 | 535.00 |
| 0.99 | 304.85 | 301.85 | 299.12 | 299.12 |
| 0.98 | 239.85 | 236.85 | 234.12 | 234.12 |
| 0.97 | 210.73 | 207.73 | 205.00 | 205.00 |
| 0.96 | 165.33 | 162.33 | 159.60 | 159.60 |
| 0.95 | 95.73 | 92.73 | 90.00 | 90.00 |
| 0.94 | 74.73 | 71.73 | 69.00 | 69.00 |
| 0.93 | 67.73 | 64.73 | 62.00 | 62.00 |
| 0.92 | 59.73 | 56.73 | 54.00 | 54.00 |
| 0.91 | 53.73 | 50.13 | 47.39 | 47.39 |
| 0.90 | 45.73 | 42.53 | 39.80 | 39.80 |
| 0.89 | 40.73 | 37.73 | 35.00 | 35.00 |
| 0.88 | 36.73 | 33.73 | 31.00 | 31.00 |
| 0.87 | 32.73 | 29.73 | 27.00 | 27.00 |
| 0.86 | 30.71 | 26.65 | 23.92 | 23.92 |
| 0.85 | 26.44 | 22.73 | 20.00 | 20.00 |
| 0.84 | 23.73 | 20.73 | 18.00 | 18.00 |
| 0.83 | 22.49 | 18.73 | 16.00 | 16.00 |
| 0.82 | 20.73 | 17.73 | 15.00 | 15.00 |
| 0.81 | 19.73 | 16.09 | 13.72 | 13.72 |
| 0.80 | 18.73 | 14.73 | 12.00 | 12.00 |
| 0.79 | 17.73 | 14.73 | 12.00 | 12.00 |
| 0.78 | 17.73 | 14.73 | 12.00 | 12.00 |
| 0.77 | 17.41 | 13.73 | 11.00 | 11.00 |
| 0.76 | 15.73 | 12.73 | 10.00 | 10.00 |
| 0.75 | 15.23 | 11.93 | 9.20 | 9.20 |
| 0.74 | 14.73 | 11.33 | 8.60 | 8.60 |
| 0.73 | 14.23 | 11.09 | 8.36 | 8.30 |
| 0.72 | 13.73 | 10.73 | 8.00 | 8.00 |
| 0.71 | 13.73 | 10.43 | 7.81 | 7.81 |
| 0.70 | 13.15 | 9.73 | 7.00 | 7.00 |
| 0.69 | 12.73 | 9.73 | 7.00 | 7.00 |
| 0.68 | 12.33 | 9.23 | 6.50 | 6.50 |
| 0.67 | 12.06 | 8.73 | 6.00 | 6.00 |
| 0.66 | 11.69 | 8.29 | 5.60 | 5.60 |
| 0.65 | 11.13 | 7.73 | 5.00 | 5.00 |
| 0.64 | 10.63 | 7.24 | 4.60 | 4.60 |
| 0.63 | 10.23 | 6.93 | 4.30 | 4.30 |
| 0.62 | 9.80 | 6.53 | 3.80 | 3.80 |
| 0.61 | 9.43 | 6.23 | 3.50 | 3.50 |
| 0.60 | 9.23 | 6.23 | 3.50 | 3.50 |
| 0.59 | 9.23 | 6.13 | 3.40 | 3.40 |
| 0.58 | 9.03 | 5.83 | 3.10 | 3.10 |
| 0.57 | 8.83 | 5.73 | 3.00 | 3.00 |
| 0.56 | 8.55 | 5.53 | 2.80 | 2.80 |
| 0.55 | 8.43 | 5.43 | 2.70 | 2.70 |
| 0.54 | 8.33 | 5.33 | 2.60 | 2.60 |
| 0.53 | 8.33 | 5.23 | 2.50 | 2.50 |
| 0.52 | 8.23 | 5.23 | 2.50 | 2.50 |
| 0.51 | 8.23 | 5.13 | 2.40 | 2.40 |

**October**

| Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 0.50 | 8.13 | 5.03 | 2.30 | 2.30 |
| 0.49 | 7.93 | 4.93 | 2.20 | 2.20 |
| 0.48 | 7.93 | 4.83 | 2.10 | 2.10 |
| 0.47 | 7.83 | 4.83 | 2.10 | 2.10 |
| 0.46 | 7.73 | 4.73 | 2.00 | 2.00 |
| 0.45 | 7.73 | 4.53 | 1.80 | 1.80 |
| 0.44 | 7.43 | 4.40 | 1.67 | 1.67 |
| 0.43 | 7.33 | 4.23 | 1.50 | 1.50 |
| 0.42 | 7.23 | 4.23 | 1.50 | 1.50 |
| 0.41 | 7.23 | 4.23 | 1.50 | 1.50 |
| 0.40 | 7.23 | 4.23 | 1.50 | 1.50 |
| 0.39 | 7.14 | 4.13 | 1.40 | 1.40 |
| 0.38 | 7.03 | 4.03 | 1.30 | 1.30 |
| 0.37 | 6.93 | 3.93 | 1.20 | 1.20 |
| 0.36 | 6.93 | 3.93 | 1.20 | 1.20 |
| 0.35 | 6.83 | 3.83 | 1.10 | 1.10 |
| 0.34 | 6.83 | 3.83 | 1.10 | 1.10 |
| 0.33 | 6.73 | 3.73 | 1.00 | 1.00 |
| 0.32 | 6.73 | 3.73 | 1.00 | 1.00 |
| 0.31 | 6.73 | 3.73 | 1.00 | 1.00 |
| 0.30 | 6.73 | 3.73 | 1.00 | 1.00 |
| 0.29 | 6.73 | 3.73 | 1.00 | 1.00 |
| 0.28 | 6.67 | 3.53 | 0.80 | 0.80 |
| 0.27 | 6.43 | 3.43 | 0.70 | 0.70 |
| 0.26 | 6.42 | 3.23 | 0.50 | 0.50 |
| 0.25 | 6.23 | 3.03 | 0.34 | 0.34 |
| 0.24 | 5.95 | 2.75 | 0.07 | 0.07 |
| 0.23 | 5.73 | 2.73 | 0.00 | 0.00 |
| 0.22 | 5.73 | 2.73 | 0.00 | 0.00 |
| 0.21 | 5.73 | 2.73 | 0.00 | 0.00 |
| 0.20 | 5.73 | 2.73 | 0.00 | 0.00 |
| 0.19 | 5.73 | 2.73 | 0.00 | 0.00 |
| 0.18 | 5.73 | 2.73 | 0.00 | 0.00 |
| 0.17 | 5.73 | 2.73 | 0.00 | 0.00 |
| 0.16 | 5.73 | 2.73 | 0.00 | 0.00 |
| 0.15 | 5.73 | 2.73 | 0.00 | 0.00 |
| 0.14 | 5.73 | 2.73 | 0.00 | 0.00 |
| 0.13 | 5.73 | 2.73 | 0.00 | 0.00 |
| 0.12 | 5.73 | 2.73 | 0.00 | 0.00 |
| 0.11 | 5.73 | 2.73 | 0.00 | 0.00 |
| 0.10 | 5.73 | 2.73 | 0.00 | 0.00 |
| 0.09 | 5.73 | 2.73 | 0.00 | 0.00 |
| 0.08 | 5.73 | 2.73 | 0.00 | 0.00 |
| 0.07 | 5.73 | 2.73 | 0.00 | 0.00 |
| 0.06 | 5.73 | 2.73 | 0.00 | 0.00 |
| 0.05 | 5.73 | 2.73 | 0.00 | 0.00 |
| 0.04 | 5.73 | 2.73 | 0.00 | 0.00 |
| 0.03 | 5.73 | 2.73 | 0.00 | 0.00 |
| 0.02 | 5.73 | 2.73 | 0.00 | 0.00 |
| 0.01 | 5.73 | 2.73 | 0.00 | 0.00 |

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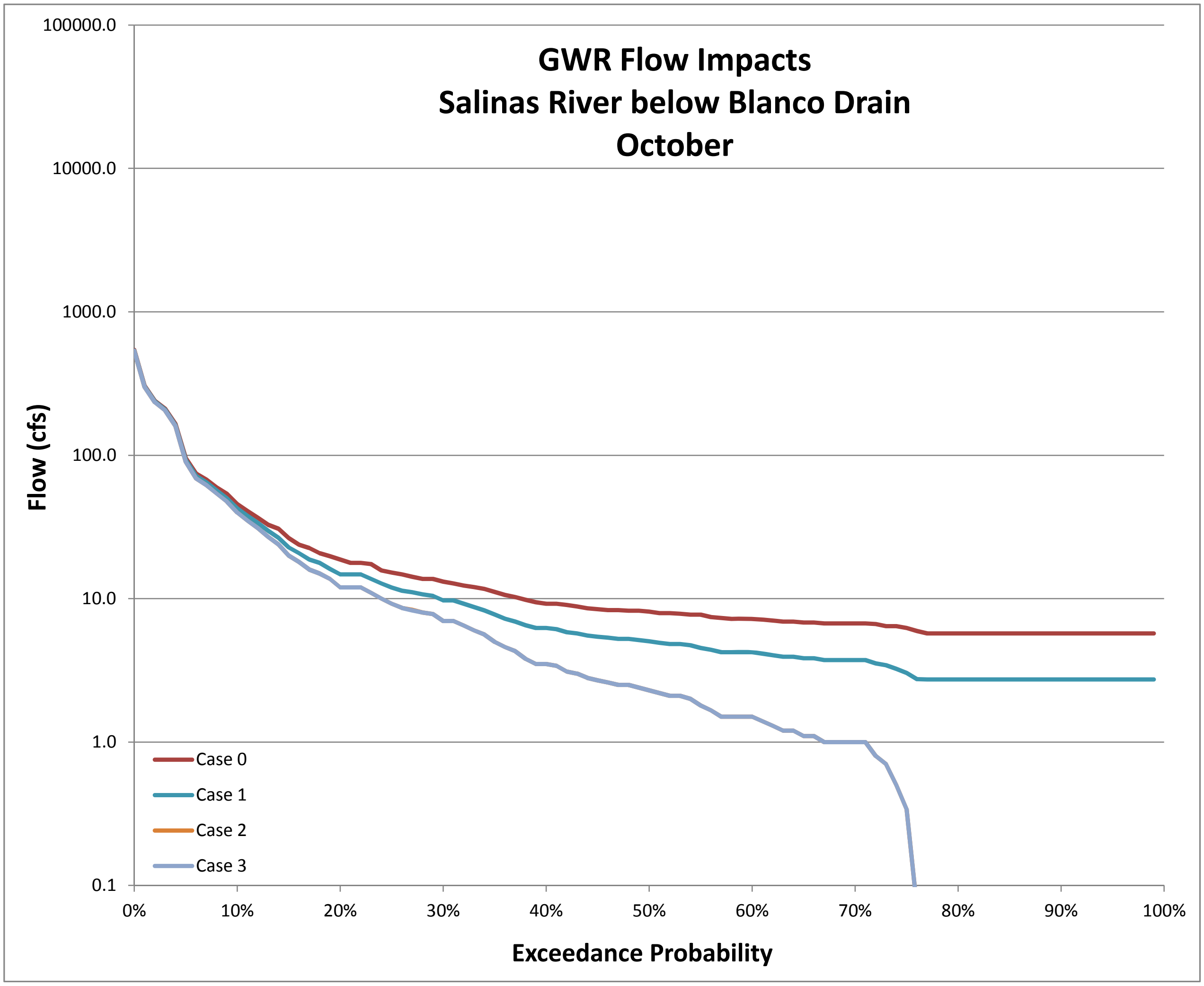


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plus flow in from Blanco Drain, minus SRDF diversions and stormwater capture.

**Salinas River below Blanco Drain, Percentile Flows by Month (cfs)**

| November Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 1.00 | 1265.31 | 1262.23 | 1260.00 | 1260.00 |
| 0.99 | 348.75 | 341.78 | 339.55 | 339.55 |
| 0.98 | 315.11 | 312.11 | 309.88 | 309.88 |
| 0.97 | 277.79 | 274.56 | 272.33 | 272.33 |
| 0.96 | 228.11 | 224.67 | 222.44 | 222.44 |
| 0.95 | 139.98 | 136.98 | 134.75 | 134.75 |
| 0.94 | 114.55 | 111.55 | 109.32 | 109.32 |
| 0.93 | 96.77 | 92.23 | 90.00 | 90.00 |
| 0.92 | 83.23 | 80.23 | 78.00 | 78.00 |
| 0.91 | 73.23 | 69.23 | 67.00 | 67.00 |
| 0.90 | 65.23 | 61.23 | 59.00 | 59.00 |
| 0.89 | 58.26 | 52.44 | 50.21 | 50.21 |
| 0.88 | 50.23 | 47.23 | 45.00 | 45.00 |
| 0.87 | 42.37 | 37.23 | 35.00 | 35.00 |
| 0.86 | 35.38 | 30.77 | 28.54 | 28.54 |
| 0.85 | 31.09 | 27.23 | 25.00 | 25.00 |
| 0.84 | 28.23 | 24.23 | 22.00 | 22.00 |
| 0.83 | 26.23 | 22.23 | 20.00 | 20.00 |
| 0.82 | 25.23 | 21.23 | 19.00 | 19.00 |
| 0.81 | 23.72 | 20.23 | 18.00 | 18.00 |
| 0.80 | 23.23 | 19.23 | 17.00 | 17.00 |
| 0.79 | 22.23 | 18.23 | 16.00 | 16.00 |
| 0.78 | 20.96 | 17.23 | 15.00 | 15.00 |
| 0.77 | 20.23 | 17.23 | 15.00 | 15.00 |
| 0.76 | 19.23 | 16.23 | 14.00 | 14.00 |
| 0.75 | 19.23 | 16.23 | 14.00 | 14.00 |
| 0.74 | 19.23 | 15.23 | 13.00 | 13.00 |
| 0.73 | 18.23 | 14.23 | 12.00 | 12.00 |
| 0.72 | 17.23 | 14.23 | 12.00 | 12.00 |
| 0.71 | 17.23 | 14.23 | 12.00 | 12.00 |
| 0.70 | 17.23 | 13.23 | 11.00 | 11.00 |
| 0.69 | 16.23 | 13.23 | 11.00 | 11.00 |
| 0.68 | 15.23 | 11.73 | 9.50 | 9.50 |
| 0.67 | 14.73 | 11.60 | 9.36 | 9.36 |
| 0.66 | 14.23 | 10.73 | 8.50 | 8.50 |
| 0.65 | 13.63 | 10.13 | 7.90 | 7.90 |
| 0.64 | 13.13 | 9.93 | 7.70 | 7.70 |
| 0.63 | 12.93 | 9.73 | 7.50 | 7.50 |
| 0.62 | 12.73 | 9.45 | 7.22 | 7.22 |
| 0.61 | 12.31 | 8.73 | 6.50 | 6.50 |
| 0.60 | 11.82 | 8.43 | 6.20 | 6.20 |
| 0.59 | 11.43 | 8.23 | 6.00 | 6.00 |
| 0.58 | 11.23 | 7.83 | 5.60 | 5.60 |
| 0.57 | 10.83 | 7.41 | 5.17 | 5.17 |
| 0.56 | 10.52 | 7.22 | 4.98 | 4.98 |
| 0.55 | 10.23 | 6.93 | 4.70 | 4.70 |
| 0.54 | 9.93 | 6.54 | 4.31 | 4.31 |
| 0.53 | 9.63 | 6.23 | 4.00 | 4.00 |
| 0.52 | 9.23 | 5.93 | 3.70 | 3.70 |
| 0.51 | 9.03 | 5.53 | 3.30 | 3.30 |

| November Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 0.50 | 8.63 | 5.23 | 3.00 | 3.00 |
| 0.49 | 8.40 | 5.23 | 3.00 | 3.00 |
| 0.48 | 8.23 | 4.93 | 2.70 | 2.70 |
| 0.47 | 8.03 | 4.73 | 2.50 | 2.50 |
| 0.46 | 7.83 | 4.73 | 2.50 | 2.50 |
| 0.45 | 7.73 | 4.53 | 2.30 | 2.30 |
| 0.44 | 7.63 | 4.43 | 2.20 | 2.20 |
| 0.43 | 7.51 | 4.23 | 2.00 | 2.00 |
| 0.42 | 7.33 | 4.23 | 2.00 | 2.00 |
| 0.41 | 7.23 | 4.23 | 2.00 | 2.00 |
| 0.40 | 7.23 | 4.23 | 2.00 | 2.00 |
| 0.39 | 7.23 | 4.23 | 2.00 | 2.00 |
| 0.38 | 7.23 | 4.03 | 1.80 | 1.80 |
| 0.37 | 7.13 | 3.73 | 1.50 | 1.50 |
| 0.36 | 6.83 | 3.63 | 1.40 | 1.40 |
| 0.35 | 6.73 | 3.45 | 1.21 | 1.21 |
| 0.34 | 6.53 | 3.43 | 1.20 | 1.20 |
| 0.33 | 6.43 | 3.33 | 1.10 | 1.10 |
| 0.32 | 6.33 | 3.33 | 1.10 | 1.10 |
| 0.31 | 6.33 | 3.23 | 1.00 | 1.00 |
| 0.30 | 6.23 | 3.23 | 1.00 | 1.00 |
| 0.29 | 6.23 | 3.23 | 1.00 | 1.00 |
| 0.28 | 6.23 | 3.19 | 0.96 | 0.96 |
| 0.27 | 6.19 | 3.03 | 0.80 | 0.80 |
| 0.26 | 6.06 | 2.96 | 0.73 | 0.73 |
| 0.25 | 6.01 | 2.51 | 0.27 | 0.27 |
| 0.24 | 5.54 | 2.26 | 0.03 | 0.03 |
| 0.23 | 5.40 | 2.23 | 0.01 | 0.01 |
| 0.22 | 5.26 | 2.23 | 0.00 | 0.00 |
| 0.21 | 5.23 | 2.23 | 0.00 | 0.00 |
| 0.20 | 5.23 | 2.23 | 0.00 | 0.00 |
| 0.19 | 5.23 | 2.23 | 0.00 | 0.00 |
| 0.18 | 5.23 | 2.23 | 0.00 | 0.00 |
| 0.17 | 5.23 | 2.23 | 0.00 | 0.00 |
| 0.16 | 5.23 | 2.23 | 0.00 | 0.00 |
| 0.15 | 5.23 | 2.23 | 0.00 | 0.00 |
| 0.14 | 5.23 | 2.23 | 0.00 | 0.00 |
| 0.13 | 5.23 | 2.23 | 0.00 | 0.00 |
| 0.12 | 5.23 | 2.23 | 0.00 | 0.00 |
| 0.11 | 5.23 | 2.23 | 0.00 | 0.00 |
| 0.10 | 5.23 | 2.23 | 0.00 | 0.00 |
| 0.09 | 5.23 | 2.23 | 0.00 | 0.00 |
| 0.08 | 5.23 | 2.23 | 0.00 | 0.00 |
| 0.07 | 5.23 | 2.23 | 0.00 | 0.00 |
| 0.06 | 5.23 | 2.23 | 0.00 | 0.00 |
| 0.05 | 5.23 | 2.23 | 0.00 | 0.00 |
| 0.04 | 5.23 | 2.23 | 0.00 | 0.00 |
| 0.03 | 5.23 | 2.23 | 0.00 | 0.00 |
| 0.02 | 5.23 | 2.23 | 0.00 | 0.00 |
| 0.01 | 5.23 | 2.23 | 0.00 | 0.00 |

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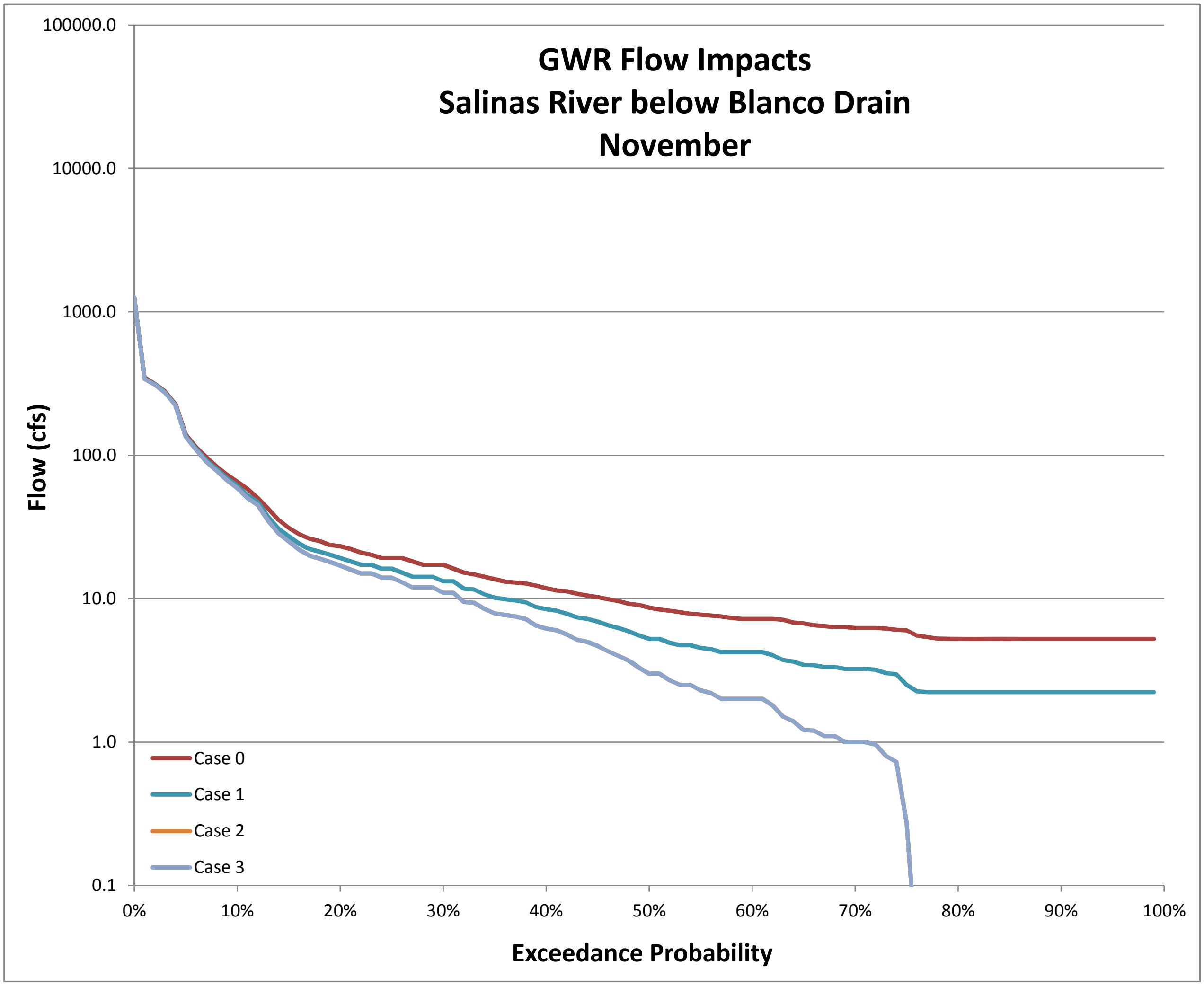


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Note:

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**Salinas River below Blanco Drain, Percentile Flows by Month (cfs)**

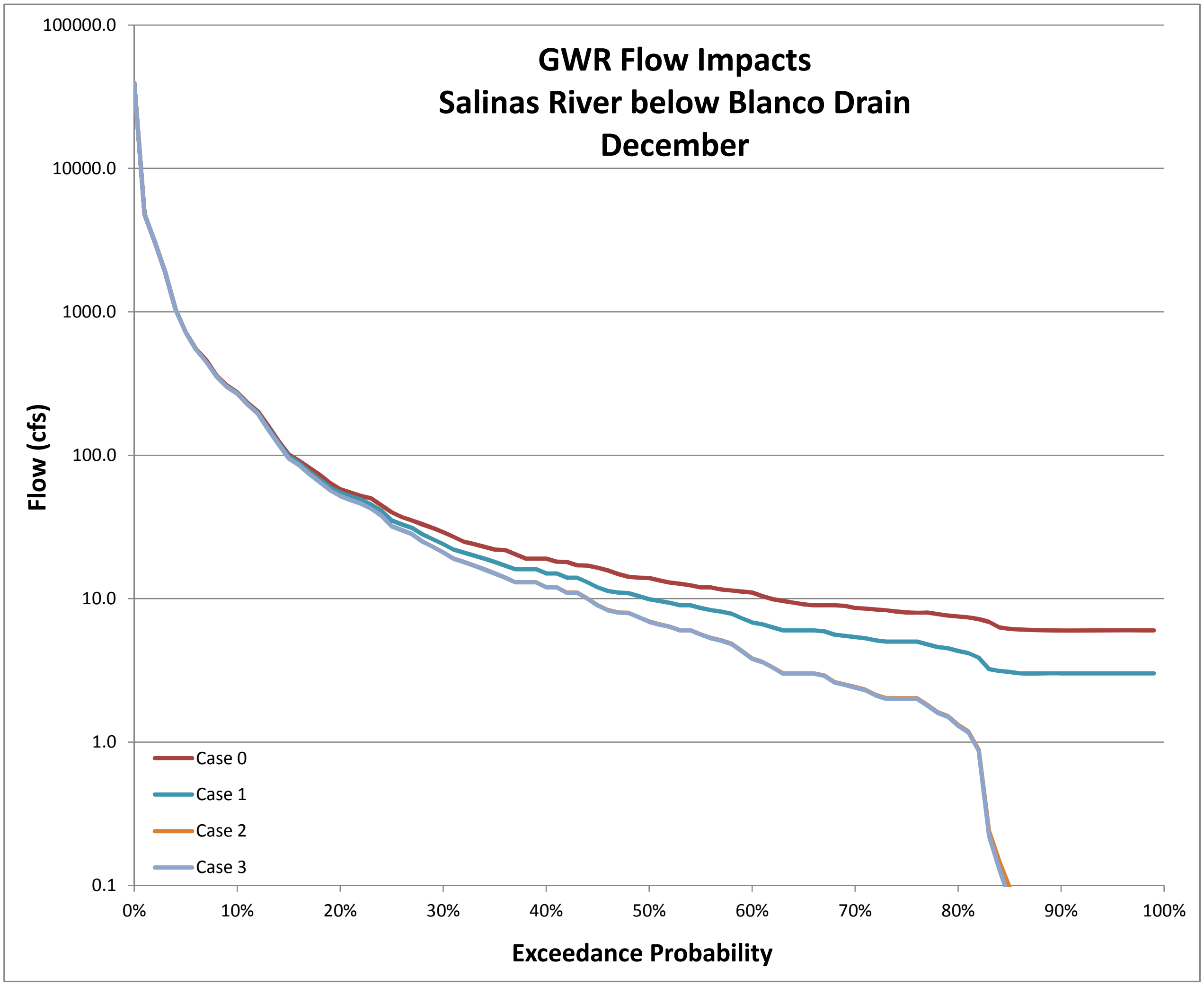
**December**

| Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 1.00 | 39606.01 | 39603.01 | 39600.02 | 39600.00 |
| 0.99 | 4780.81 | 4777.81 | 4774.82 | 4774.80 |
| 0.98 | 3076.23 | 3059.70 | 3056.71 | 3056.69 |
| 0.97 | 1896.81 | 1893.81 | 1890.82 | 1890.80 |
| 0.96 | 1047.48 | 1044.21 | 1041.22 | 1041.20 |
| 0.95 | 721.01 | 718.01 | 715.02 | 715.00 |
| 0.94 | 549.69 | 546.69 | 543.70 | 543.68 |
| 0.93 | 459.01 | 448.85 | 445.86 | 445.84 |
| 0.92 | 358.45 | 355.45 | 352.46 | 352.44 |
| 0.91 | 306.74 | 303.09 | 300.10 | 300.08 |
| 0.90 | 275.01 | 272.01 | 269.02 | 269.00 |
| 0.89 | 232.09 | 229.09 | 226.10 | 226.08 |
| 0.88 | 203.09 | 198.37 | 195.38 | 195.36 |
| 0.87 | 160.96 | 154.65 | 151.66 | 151.64 |
| 0.86 | 125.77 | 122.77 | 119.78 | 119.76 |
| 0.85 | 101.21 | 98.21 | 95.22 | 95.20 |
| 0.84 | 91.49 | 88.49 | 85.50 | 85.48 |
| 0.83 | 81.92 | 77.01 | 74.02 | 74.00 |
| 0.82 | 73.01 | 68.05 | 65.06 | 65.04 |
| 0.81 | 64.01 | 60.01 | 57.02 | 57.00 |
| 0.80 | 58.01 | 55.01 | 52.02 | 52.00 |
| 0.79 | 55.01 | 51.89 | 48.90 | 48.88 |
| 0.78 | 52.01 | 49.01 | 46.02 | 46.00 |
| 0.77 | 50.01 | 45.45 | 42.46 | 42.44 |
| 0.76 | 44.80 | 41.01 | 38.02 | 38.00 |
| 0.75 | 40.01 | 35.01 | 32.02 | 32.00 |
| 0.74 | 37.01 | 33.01 | 30.02 | 30.00 |
| 0.73 | 35.01 | 31.01 | 28.02 | 28.00 |
| 0.72 | 32.94 | 28.01 | 25.02 | 25.00 |
| 0.71 | 31.01 | 26.01 | 23.02 | 23.00 |
| 0.70 | 29.01 | 24.01 | 21.02 | 21.00 |
| 0.69 | 27.01 | 22.01 | 19.02 | 19.00 |
| 0.68 | 25.01 | 21.01 | 18.02 | 18.00 |
| 0.67 | 24.01 | 20.01 | 17.02 | 17.00 |
| 0.66 | 23.01 | 19.01 | 16.02 | 16.00 |
| 0.65 | 22.01 | 18.01 | 15.02 | 15.00 |
| 0.64 | 21.83 | 17.01 | 14.02 | 14.00 |
| 0.63 | 20.33 | 16.01 | 13.02 | 13.00 |
| 0.62 | 19.04 | 16.01 | 13.02 | 13.00 |
| 0.61 | 19.01 | 16.01 | 13.02 | 13.00 |
| 0.60 | 19.01 | 15.01 | 12.02 | 12.00 |
| 0.59 | 18.11 | 15.01 | 12.02 | 12.00 |
| 0.58 | 18.01 | 14.01 | 11.02 | 11.00 |
| 0.57 | 17.12 | 14.01 | 11.02 | 11.00 |
| 0.56 | 17.01 | 13.01 | 10.02 | 10.00 |
| 0.55 | 16.44 | 11.97 | 8.98 | 8.96 |
| 0.54 | 15.75 | 11.30 | 8.31 | 8.29 |
| 0.53 | 14.81 | 11.01 | 8.02 | 8.00 |
| 0.52 | 14.23 | 10.95 | 7.96 | 7.94 |
| 0.51 | 14.01 | 10.41 | 7.42 | 7.40 |

**December**

| Percentile | Case 0: | Case 1: | Case 2: | Case 3: |
|---|---|---|---|---|
| 0.50 | 13.91 | 9.91 | 6.92 | 6.90 |
| 0.49 | 13.41 | 9.61 | 6.62 | 6.60 |
| 0.48 | 12.98 | 9.36 | 6.37 | 6.36 |
| 0.47 | 12.69 | 9.01 | 6.02 | 6.00 |
| 0.46 | 12.41 | 9.01 | 6.02 | 6.00 |
| 0.45 | 12.01 | 8.61 | 5.62 | 5.60 |
| 0.44 | 12.01 | 8.31 | 5.32 | 5.30 |
| 0.43 | 11.61 | 8.11 | 5.12 | 5.10 |
| 0.42 | 11.41 | 7.83 | 4.84 | 4.82 |
| 0.41 | 11.21 | 7.31 | 4.32 | 4.30 |
| 0.40 | 11.01 | 6.81 | 3.82 | 3.80 |
| 0.39 | 10.41 | 6.61 | 3.62 | 3.60 |
| 0.38 | 9.91 | 6.31 | 3.32 | 3.30 |
| 0.37 | 9.62 | 6.01 | 3.02 | 3.00 |
| 0.36 | 9.41 | 6.01 | 3.02 | 3.00 |
| 0.35 | 9.11 | 6.01 | 3.02 | 3.00 |
| 0.34 | 9.01 | 6.01 | 3.02 | 3.00 |
| 0.33 | 9.01 | 5.91 | 2.92 | 2.90 |
| 0.32 | 9.01 | 5.61 | 2.62 | 2.60 |
| 0.31 | 8.91 | 5.51 | 2.52 | 2.50 |
| 0.30 | 8.61 | 5.41 | 2.42 | 2.40 |
| 0.29 | 8.51 | 5.31 | 2.32 | 2.30 |
| 0.28 | 8.41 | 5.12 | 2.13 | 2.12 |
| 0.27 | 8.31 | 5.01 | 2.02 | 2.00 |
| 0.26 | 8.11 | 5.01 | 2.02 | 2.00 |
| 0.25 | 8.01 | 5.01 | 2.02 | 2.00 |
| 0.24 | 8.01 | 5.01 | 2.02 | 2.00 |
| 0.23 | 8.01 | 4.81 | 1.82 | 1.80 |
| 0.22 | 7.81 | 4.61 | 1.62 | 1.60 |
| 0.21 | 7.61 | 4.51 | 1.52 | 1.50 |
| 0.20 | 7.51 | 4.31 | 1.32 | 1.30 |
| 0.19 | 7.41 | 4.18 | 1.19 | 1.17 |
| 0.18 | 7.21 | 3.88 | 0.89 | 0.87 |
| 0.17 | 6.90 | 3.23 | 0.24 | 0.22 |
| 0.16 | 6.32 | 3.14 | 0.15 | 0.13 |
| 0.15 | 6.16 | 3.09 | 0.10 | 0.08 |
| 0.14 | 6.10 | 3.01 | 0.02 | 0.00 |
| 0.13 | 6.03 | 3.01 | 0.02 | 0.00 |
| 0.12 | 6.01 | 3.01 | 0.02 | 0.00 |
| 0.11 | 6.01 | 3.01 | 0.02 | 0.00 |
| 0.10 | 6.01 | 3.01 | 0.02 | 0.00 |
| 0.09 | 6.01 | 3.01 | 0.02 | 0.00 |
| 0.08 | 6.01 | 3.01 | 0.02 | 0.00 |
| 0.07 | 6.01 | 3.01 | 0.02 | 0.00 |
| 0.06 | 6.01 | 3.01 | 0.02 | 0.00 |
| 0.05 | 6.01 | 3.01 | 0.02 | 0.00 |
| 0.04 | 6.01 | 3.01 | 0.02 | 0.00 |
| 0.03 | 6.01 | 3.01 | 0.02 | 0.00 |
| 0.02 | 6.01 | 3.01 | 0.02 | 0.00 |
| 0.01 | 6.01 | 3.01 | 0.02 | 0.00 |

Case 0: No diversions (Base Condition).
Case 1: Divert both Salinas Stormwater and SIWTF; No Blanco Drain diversions.
Case 2: Divert both Salinas Stormwater and SIWTF; Divert up to 2.99 cfs from Blanco Drain.
Case 3: Divert both Salinas Stormwater and SIWTF; Divert up to 4.6 cfs from Blanco Drain.




**Case 0** No diversions (Base Condition).

**Case 1** Divert both Salinas Stormwater and SIWTF; No Blanco Drain diversions.

**Case 2** Divert both Salinas Stormwater and SIWTF; Divert up to 2.99 cfs from Blanco Drain.

**Case 3** Divert both Salinas Stormwater and SIWTF; Divert up to 4.6 cfs from Blanco Drain.

Note:

Measurement point for all cases is Salinas River just downstream of confluence with Blanco Drain.

SRDF diversions (from Salinas River behind rubber dam) occurred 2010-2013 for all cases above; SRDF diversions balance extra flow at Spreckels during this period.

Total flow is the sum of the Salinas R. at Spreckels (USGS gage) plus storm runoff, plus SIWTF inflows, plus flow in from Blanco Drain, minus SRDF diversions and stormwater capture.

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# Appendix P

# Reclamation Ditch Yield Study

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# RECLAMATION DITCH YIELD STUDY

**Prepared for**

## MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

**Prepared by**


**Schaaf & Wheeler**

CONSULTING CIVIL ENGINEERS
3 QUAIL RUN CIRCLE, SUITE 101
SALINAS, CA 93907


**March 2015**

Cover photos: Reclamation Ditch below Carr Lake at Sherwood Drive and Hwy 101, summer and winter 2004.

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D. Analysis Statistical Outputs
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**Table i. Acronyms Used in this Report**

| Acronym | Description |
|---|---|
| AFY, ac-ft/yr | Acre-feet/year |
| cfs | Cubic foot per second |
| ft/s | Foot per second |
| gpd | Gallons per day |
| mgd | Million gallons per day |
| mg/L | Milligrams per liter |
| µg/L | Micrograms per liter |
| MPN | Most Probable Number |
| ng/L | Nanogram per liter |
| ppb | Parts per billion |
| ppm | Parts per million |
| | |
| ASBS | Areas of Special Biological Significance |
| ASR | Aquifer Storage and Recovery |
| BMP | Best management practice |
| CAW, CalAm | California American Water Company |
| CCAMP | Central Coast Ambient Monitoring Program |
| CCoWS | Central Coast Watershed Studies Program |
| CCR | California Code of Regulations |
| CCRWQCB | Central Coast Regional Water Quality Control Board |
| CDPH | California Department of Public Health |
| CEQA | California Environmental Quality Act |
| CSIP | Castroville Seawater Intrusion Project |
| CWC | California Water Code |
| DWR | California Department of Water Resources |
| GWR | Groundwater Replenishment |
| MCWRA | Monterey County Water Resources Agency |
| MPWMD, District | Monterey Peninsula Water Management District |
| MRSWMP | Monterey Regional Stormwater Management Program |
| MRWPCA, Agency | Monterey Regional Water Pollution Control Agency |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic and Atmospheric Administration |
| NRCS | USDA Natural Resources Conservation Service |
| RTP | MRWPCA Regional Treatment Plant |
| SIWTF | Salinas Industrial Wastewater Treatment Facility |
| SRDF | Salinas River Diversion Facility |
| SRDP | Salinas River Diversion Project |
| SVRP | Salinas Valley Reclamation Plant |
| SVWP | Salinas Valley Water Project |
| SVGB | Salinas Valley Groundwater Basin |
| SWRCB | California State Water Resources Control Board |
| USACE | U.S. Army Corps of Engineers |
| USBR | U.S. Bureau of Reclamation |
| USGS | U.S. Geologic Survey |

**Table ii. Units of Measure Used in this Report**

| Unit | Equals |
|---|---|
| 1 acre-foot | = 43,560 cubic feet<br>= 325,851 gallons |
| 1 cubic foot | = 7.48 gallons |
| 1 cfs | = 448.8 gallons per minute |
| 1 MGD | = 1,000,000 gallons/day<br>= 1,120 acre-feet / year |
| 1 mg/L | = 1 ppm<br>= $1 / 10^6$ |
| 1 µg/L | = .001 mg/L<br>= 1 ppb<br>=$1 / 10^9$ |
| 1 ng/L | = 0.001 µg/L<br>= 1 part per trillion<br>= $1 / 10^{12}$ |

## Summary of Reclamation Ditch Yield Study

The Monterey Peninsula Water Management District (MPWMD) and the Monterey Regional Water Pollution Control Agency (MRWPCA) are jointly sponsoring the proposed Pure Water Monterey Groundwater Replenishment Project (Proposed Project), a water supply project that will serve northern Monterey County. The project will provide purified water for recharge of the Seaside Groundwater Basin that serves as drinking water supply, and recycled water to augment the existing Castroville Seawater Intrusion Project agricultural irrigation supply. One of the proposed sources of water supply to be developed for this project is surface water flowing in the Reclamation Ditch and Tembladero Slough. The purpose of this study was to (1) analyze water availability in the Reclamation Ditch, (2) provide an engineering analysis of the potential yields and the infrastructure required to capture and convey those flows to the Proposed Project, and (3) assess the potential project impacts on hydrology and water quality in the Reclamation Ditch and Tembladero Slough.

The Reclamation Ditch watershed is approximately 157 square miles that includes headlands, agricultural areas, the City of Salinas and portions of Castroville and Prunedale. Summer flows are predominantly agricultural tile drainage. Winter flows include runoff from throughout the basin.

Yields were estimated for two diversion points, the Reclamation Ditch at Davis Road and Tembladero Slough at Castroville. These locations were selected based on their proximity to existing wastewater collection facilities, which may be used to convey the flows to the MRWPCA Regional Treatment Plant. Maximum diversion rates were based upon the average historic flows in the Reclamation Ditch, the available conveyance capacity in the existing wastewater collection systems and assumed minimum in-stream flows rates to maintain existing habitat. Water rights permit applications for diversions less than 3 cfs may be processed more quickly than applications requesting higher diversion rates, so the Proposed Project includes an initial phase with 2.99 cfs diversions, and a second phase with higher diversion rates. The estimated annual yields are shown in Table S-1, below.

**Table S-1: Estimated Annual Diversions**

| **Proposed Project, Initial Water Rights Permits** | | |
|---|---|---|
| **Location** | **Diversion Rate (cfs)** | **Annual Diversion (AF)** |
| Davis Road | 2.99 | 1,088 |
| Castroville | 2.99 | 1,162 |
| Total | | 2,250 |
| **Proposed Project, Ultimate Water Rights Permits** | | |
| **Location** | **Diversion Rate (cfs)** | **Annual Diversion (AF)** |
| Davis Road | 6.0 | 1,521 |
| Castroville | 2.99 | 1,134 |
| Total | | 2,655 |

The yields in Table S-1 assume a minimum in-stream flow requirement of 0.69 cfs at Davis Road during the months of June through November, and 2.0 cfs during the months of December through May when higher flows are required for fish migration. A minimum in-stream flow of 1 cfs was assumed for the Tembladero Slough at Castroville in all months.

Flows in the Reclamation Ditch and Tembladero Slough below the proposed diversion facilities were estimated using a mass balance model, and a statistical analysis was performed on the results. Diverting stream flows to the Proposed Project would reduce average monthly flows in the Reclamation Ditch by up to 79% during the dry summer months, and by 12% to 40% during the wet winter months.

# Section 1 - Introduction

## 1.1 Project Description

The Monterey Peninsula Water Management District (MPWMD) and the Monterey Regional Water Pollution Control Agency (MRWPCA) are jointly sponsoring the proposed Pure Water Monterey Groundwater Replenishment Project (Proposed Project), a water supply project that will serve northern Monterey County. The project will provide purified water for recharge of the Seaside Groundwater Basin that serves as drinking water supply, and recycled water to augment the existing Castroville Seawater Intrusion Project agricultural irrigation supply.

Source water for the project would include agricultural wash water from the City of Salinas Industrial Wastewater Collection System, stormwater from MRWPCA member cities, secondary-treated effluent from the MRWPCA Regional Treatment Plant, and surface water diverted from the Reclamation Ditch, Tembladero Slough and Blanco Drain. Water supplied to the Proposed Project would undergo primary and secondary treatment at the existing Regional Treatment Plant. The portion used for groundwater recharge would then undergo advanced treatment at a new facility to be located at the MRWPCA site, and then be conveyed to the Seaside Groundwater Basin for injection. The portion used for agricultural irrigation would undergo tertiary treatment at the existing Salinas Valley Reclamation Plant, and distribution through the Castroville Seawater Intrusion Project system.

The MRWPCA provides wastewater treatment for municipalities along the Monterey Bay from Pacific Grove north to Moss Landing, and inland to the City of Salinas. Wastewater is collected in an interceptor pipeline system and conveyed to the Regional Treatment Plant (RTP), located two miles north of the City of Marina. A large portion of this incoming flow is tertiary treated and used for unrestricted agricultural irrigation within the Castroville Seawater Intrusion Project system in the northern Salinas Valley. Flow that is not sent to the tertiary treatment system is discharged through an outfall to Monterey Bay after receiving secondary treatment. The RTP has an average dry weather design capacity of 29.6 million gallons per day (mgd) and a peak wet weather design capacity of 75.6 mgd. It currently receives and treats approximately 17 to 18 mgd of average dry weather flow and therefore has capacity to treat additional flows. The interceptor pipeline system also has currently unused or excess conveyance capacity. Most of the new source waters would be conveyed to the RTP using the existing wastewater collection system.

Transfers of source water flowing in known and definite channels, such as the Reclamation Ditch, to the GWR project would be a consumptive use that may require an appropriative permit from the State Water Resources Control Board (SWRCB). The purpose of this study was to analyze water availability in the Reclamation Ditch and provide an engineering analysis of the potential yields and the infrastructure required to capture and convey those flows to the RTP. The study also provides a preliminary analysis of the water quality and hydrologic impacts of the

Proposed Project. This hydrologic information and analysis may then be used in a permit application to the SWRCB.

### 1.2 Water Source Description

The Reclamation Ditch watershed is approximately 157 square miles that includes headlands, agricultural areas, the City of Salinas and portions of Castroville and Prunedale. The Ditch, created between 1917 and 1920, is a network of excavated earthen channels used to drain surface runoff generated in the watershed. It captures Alisal Creek at Smith Lake, southeast of the City of Salinas, Gabilan and Natividad Creeks within the City at Carr Lake, and Santa Rita Creek west of the City. The Ditch is a major drainage channel that flows from east to west through Salinas and continues west where it drains into Tembladero Slough, then the Old Salinas River Channel, and ultimately into Moss Landing Harbor through the Potrero Road Tide Gates. See Figures A-1, Reclamation District No. 1665, and A-2, Reclamation Ditch Watershed and Zone 9 Boundary.

The Reclamation Ditch is perennial downstream of agricultural and urban development. According to USGS records, flow west of Salinas at the San Jon Road gage only ceased on three days between 1971 and 1985, and on those days, standing water was probably still present throughout most of the Reclamation Ditch. The presence of standing water is reflective of historical conditions, since the area was a system of lakes. However, the presence of dry-season flow is a consequence of dry-season urban discharges and agricultural tailwater[1]. Annual runoff at the USGS gage station at San Jon Road for Water Years 1971-2012 has averaged 11,220 AFY. This average has declined by almost a third in recent years as water conservation practices have reduced the amount of agricultural irrigation. Monthly average flows for the San Jon gage are tabulated below. The gage was inactive from March 1986 to May 2002. Recorded flows prior to February 1986 reflect the maximum daily flow[2] and not the true daily mean. In the dry season months (June to October), the daily maximum and average flows are nominally equal, but in the wet months, the data will skew slightly higher than using true daily average flows.

[1] Casagrande, J. & Watson, F. (2006) Reclamation Ditch Watershed Assessment and Management Plan: Part A - Watershed Assessment. Monterey County Water Resources Agency and the Watershed Institute, California State University Monterey Bay. 283 pp.

[2] USGS Water-Data Report 2012, 11152650 Reclamation Ditch near Salinas, CA

**Table 1-1: USGS Flow Data, Station 11152650, Reclamation Ditch at San Jon Road**

| Mean Monthly Data, Water Years 1971-2012[3] | | | Compiled Daily Data, JAN 2003 – DEC 2013 | |
|---|---|---|---|---|
| Month | Mean Flow (cfs) | Net Flow (AF) | Mean Flow (cfs) | Net Flow (AF) |
| OCT | 6.32 | 389 | 4.88 | 300 |
| NOV | 11.6 | 690 | 4.93 | 293 |
| DEC | 16.9 | 1,039 | 16.97 | 1,044 |
| JAN | 27.8 | 1,709 | 21.62 | 1,329 |
| FEB | 32.3 | 1,810 | 21.48 | 1,203 |
| MAR | 36.6 | 2,250 | 25.99 | 1,598 |
| APR | 22.2 | 1,321 | 15.21 | 905 |
| MAY | 8.02 | 493 | 4.27 | 263 |
| JUN | 6.1 | 363 | 3.33 | 198 |
| JUL | 5.76 | 354 | 3.13 | 193 |
| AUG | 6.06 | 373 | 2.94 | 181 |
| SEP | 5.19 | 309 | 2.23 | 133 |
| ANNUAL | | 11,220 | | 7,640 |

Summer flows in the Reclamation Ditch come from urban runoff and agricultural return flows. The primary source of this water is groundwater from the Salinas Valley Groundwater Basin. Approximately 12,000 acres in north Monterey County receive recycled water for agricultural irrigation under the Castroville Seawater Intrusion Project (CSIP), which is intended to reduce well pumping along the coast. The MRWPCA operates the Salinas Valley Reclamation Plant adjacent to the RTP to produce tertiary treated and disinfected recycled water for this system. About half of the CSIP service area is tributary to the Reclamation Ditch. Since 2010, Salinas River water has also been included in the CSIP deliveries, as discussed below.

The Reclamation Ditch is maintained by the Monterey County Water Resources Agency (MCWRA). The Ditch is a trapezoidal channel which connects a series of natural creeks and seasonal lakes. Flows from some tributary channels, such as Markley Swamp, are controlled by flap gates to prevent high seasonal flows from backing up into these side channels. The lakes are FEMA floodways for major storm events, but are used for irrigated agriculture during the majority of the time. In several locations, the MCWRA operates pump stations to drain low points along the tributary channels to improve the drainage for agricultural use. There are no gates or control structures within the main stem of the Reclamation Ditch system other than the tides gates at Potrero Road.

[3] USGS Water-Data Report 2012, 11152650 Reclamation Ditch near Salinas, CA

**Figure 1.1: Reclamation Ditch at Alisal Street**

The Salinas Valley Groundwater Basin is the primary source of water supply in the Salinas Valley. The Salinas River recharges the aquifer through percolation in the Upper Valley and Forebay sub-areas (see figure A-3). Historically, the river flowed seasonally, with little to no flows in the late summer months. To augment the natural aquifer recharge, the MCWRA operates two reservoirs in the upper valley: San Antonio Reservoir (water right permit 12261) and Nacimiento Reservoir (water right permits 10137 and 21089). Water is released from these reservoirs to maintain year-round flow in the Salinas River for aquifer recharge. Permits 12261 and 10137 allow MCWRA to redivert flows released to the Salinas River at the Salinas River Diversion Facility (SRDF), located near the MRWPCA RTP. This water is currently used to augment the recycled water supplies for the CSIP. The permit for SRDF operation requires certain seasonal flow releases for habitat maintenance in the main-stem river channel and in the Salinas River Lagoon. Of note, during summer operation of the SRDF, a minimum bypass flow of 2 cfs be maintained for the Salinas Lagoon.

During the summer months, the Salinas River flows into the Old Salinas River Channel through a gated culvert at the Salinas Lagoon. Direct discharge to the ocean is blocked by a seasonal sand bar which forms across the mouth of the Salinas Lagoon due to wave and tidal action in the

Monterey Bay. Discharge from the lagoon through the culvert is limited to 100 cfs[4]. The Old Salinas River channel is controlled by tide gates at Potrero Road in Moss Landing. River flows combine with Tembladero Slough flows approximately 1.2-miles above the tide gates. During high winter flows in the Salinas River, the sand bar breaches and the river flows directly to the Bay. When this occurs, MCWRA closes the slide gate to the Old Salinas River, and only Tembladero Slough flows through the Potrero Road tide gates.

The water quality in the Reclamation Ditch is generally poor, containing high levels of nitrates and pesticides and low levels of dissolved oxygen. The Reclamation Ditch (Salinas Reclamation Canal) and all of its tributary streams are on the California Listing of Water Quality Limited Stream Segments, as reported under Section 303(d) of the Federal Clean Water Act. A summary matrix of 303(d) listed streams is at Table B-1. Water quality is discussed in greater detail in Section 4 of the Report.

Aquatic habitats within the Reclamation Ditch system are poor. In addition to the poor water quality, the Ditch is generally maintained as a drainage canal without tree canopy. The adjacent agricultural lands are used for growing table crops (leafy greens, berries and artichokes). The growers prevent vegetation from establishing along the Ditch banks to discourage birds and rodents from nesting near their fields. Within the City of Salinas, the Reclamation Ditch is an urban watercourse with steep sides and numerous pipe culverts or bridges with lined inverts. Three of the tributary streams, Alisal, Gabilan and Natividad Creek, extend beyond the agricultural areas into the Gabilan Range. The upper portions of these streams are in a more natural state, although the adjacent lands are used for ranching and cattle grazing. Rainbow trout may have been introduced to the upper reaches of Gabilan Creek for an unknown period ending in 1958[5]. Any fish migration from the ocean to these upper reaches would occur in the winter months (November to March) during high seasonal flows, and downstream migration of juvenile fish would occur in the spring (March to May). These creeks are general dry above Old Stage Road in Salinas during the summer months.

[4] Schaaf & Wheeler, Old Salinas River Channel, Fish Screen Hydraulic Study, March 2009

[5] Casagrande, J. & Watson, F. (2006) Reclamation Ditch Watershed Assessment and Management Plan: Part A - Watershed Assessment. Monterey County Water Resources Agency and the Watershed Institute, California State University Monterey Bay, pp 174.

# Section 2 - Yield Estimation

## 2.1 Methodology

As stated in the Project Description, water supplies for the GWR Project will be conveyed to the RTP using existing excess capacity in the MRWPCA interceptor system. Potential diversion points along the Reclamation Ditch were identified that were in close proximity to existing wastewater collection and conveyance facilities. Estimates of stream flow capture from the Reclamation Ditch system were made for two locations: the Reclamation Ditch at Davis Road and Tembladero Slough at the MRWPCA Castroville pump station. The Davis Road location is adjacent to a City of Salinas 54-inch sanitary sewer main which flows to the MRWPCA Salinas Pump Station.

Flow data for the Reclamation Ditch at San Jon Road (USGS Gage No 11152650) was used as the basis of this analysis. A second stream gage exists on Gabilan Creek well above Carr Lake. This gage was not included in the estimate because of its distance from the diversion points.

The drainage basin above the USGS Gage is listed as 53.2 square-miles, which is incorrect. In the earlier Reclamation Ditch Zone 9 Report, Schaaf & Wheeler calculated the sub-basin sizes for the entire Reclamation Ditch watershed (see figure A-4). Based on that data, the basin size above the USGS gage is 109.4 square-miles. The drainage basin above the proposed diversion point on the Reclamation Ditch at Davis Road is 102.5 square-miles, or 93.7% of the gaged area. The drainage basin above the MRWPCA Castroville Pump Station is 152.7 square-miles, or 140% of the gaged area.

Historic mean daily flows at the two diversion points were calculated by scaling the recorded flows at San Jon Road by the factors listed above (see Appendix B, Tables B-2 and B-3). For the Davis Road diversion point, the two areas are nearly the same and therefore the estimate is fairly reliable. For the Castroville diversion point, the difference in basin size is significant, and the additional area is predominantly irrigated agriculture, which may result in higher tile drain return flows than this method would indicate. The scaled value may therefore be considered conservatively low.

Diversions at the two locations were calculated on a daily basis using the following formulas:

> Available Flow = (Daily Flow) - (In-stream Flow Target)
>
> IF (Available Flow) < 0, Daily Diversion = 0
>
> IF (Available Flow) <= (Target Diversion), Daily Diversion = Available Flow
>
> IF (Available Flow) > (Target Diversion), Daily Diversion = Target Diversion

In-stream flow targets for habitat maintenance from 0.67 cfs to 2 cfs were used in the yield estimations, as discussed in Section 2.2. Daily diversions were converted to acre-feet and summed by month.

Target diversion rates were based upon available flows and the existing conveyance capacity in the sanitary sewer system. At the Davis Road diversion point, there is an existing 54-inch City of Salinas sanitary sewer main (see figure A-5), which conveys flows to the MRWPCA Salinas Pump Station (see figure A-6). The full pipeline profile was not available, but the profile of downstream segments showed slopes of 0.0006 and greater. We assumed that the limiting segment in the pipeline would have a slope of 0.0003, which would allow gravity flow at 2.44 ft/s with d/D of 0.9. This equates to a maximum Q of 36.3 cfs, or 23.5 mgd. The 54-inch sanitary sewer was metered in summer 2010 as part of a capacity study for the MRWPCA Salinas Pump Station[6]. The average dry weather flow in that main was about 7 mgd. The diurnal peaking factor (per the City's 2004 SSMP) is 1.6, so the Peak Dry Weather Flow (PDWF) is 11.2 mgd or 17.3 cfs. That leaves up to 19 cfs of conveyance capacity within the gravity main to carry dry weather flows from the Reclamation Ditch. This pipeline is projected to approach full capacity as the City is built-out[7], but that may take several decades to occur. The Salinas Pump Station has a rated capacity of 35.4 MGD and sees PDWF of 19 MGD[8], leaving 16.4 MGD of available conveyance capacity.

Mean summer flows in the Reclamation Ditch are typically less than 5 cfs at San Jon Rd (period May to October, see Table 2-1). Average daily flows exceed 3 cfs about 30% of the time, and exceed 6 cfs only 5% of the time (see Table 2-2). Therefore, 6 cfs was used as the maximum diversion rate for the Davis Road site. Diversions were calculated for the Reclamation Ditch at Davis Road using diversion targets from 1.0 cfs to 6.0 cfs, assuming an in-stream flow requirement from 0.67 to 2.0 cfs to maintain aquatic and riparian habitats. The permitting process for a water right diversion under 3 cfs is shorter than for a larger water right, so the Proposed Project assumes an initial water right diversion permit at 2.99 cfs, and an ultimate water right allowing diversions at up to 6 cfs. The annual yield results are presented in Table 2-3, below. Monthly diversion estimates are shown in Table B-4.

[6] Carollo Engineers, Technical Memorandum, Salinas Sewage Conveyance Study 2011
[7] CDM, Salinas Sanitary Sewer Master Plan, 2004
[8] Carollo Engineers, Technical Memorandum, Salinas Sewage Conveyance Study 2011

**Table 2-1: Average Reclamation Ditch Flow at San Jon Rd (cfs)**

| Year | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2002 | | | | | | 1.1 | 1.3 | 1.8 | 2.0 | 1.7 | 8.1 | 34.1 |
| 2003 | 12.2 | 5.7 | 6.0 | 9.0 | 2.6 | 2.0 | 1.3 | 0.9 | 1.5 | 0.8 | 2.9 | 24.3 |
| 2004 | 17.2 | 38.5 | 6.4 | 3.2 | 2.8 | 3.6 | 2.9 | 3.1 | 2.4 | 14.9 | 2.1 | 30.2 |
| 2005 | 46.8 | 33.7 | 58.9 | 16.5 | 7.5 | 5.8 | 5.5 | 4.0 | 3.2 | 3.0 | 3.2 | 17.7 |
| 2006 | 30.3 | 4.3 | 49.7 | 67.9 | 8.6 | 5.2 | 5.0 | 4.0 | 3.4 | 2.2 | 7.0 | 13.4 |
| 2007 | 4.7 | 17.9 | 4.8 | 6.4 | 4.7 | 3.6 | 3.6 | 3.7 | 3.4 | 4.1 | 2.6 | 6.2 |
| 2008 | 36.6 | 28.3 | 2.6 | 3.2 | 2.5 | 2.0 | 2.0 | 2.2 | 1.7 | 1.7 | 4.6 | 15.3 |
| 2009 | 8.1 | 38.6 | 17.7 | 3.4 | 3.7 | 1.3 | 2.7 | 3.1 | 2.0 | 13.7 | 0.9 | 7.6 |
| 2010 | 36.7 | 29.1 | 43.3 | 29.0 | 5.6 | 3.9 | 3.9 | 3.2 | 2.1 | 2.9 | 12.1 | 23.8 |
| 2011 | 19.7 | 32.6 | 75.8 | 9.5 | 5.2 | 4.6 | 3.7 | 2.9 | 2.3 | 7.8 | 7.7 | 1.2 |
| 2012 | 10.3 | 3.4 | 17.9 | 17.1 | 2.4 | 3.1 | 2.3 | 3.6 | 1.4 | 1.6 | 9.8 | 45.8 |
| 2013 | 15.3 | 3.6 | 2.7 | 2.1 | 1.5 | 1.5 | 1.6 | 1.7 | 1.1 | 1.0 | 1.4 | 1.4 |
| 2014 | 1.4 | 13.4 | 10.6 | 4.6 | 1.2 | 1.2 | 1.3 | 1.5 | 1.4 | 2.5 | 7.0 | 122.2 |
| **AVG** | **19.9** | **20.8** | **24.7** | **14.3** | **4.0** | **3.0** | **2.9** | **2.7** | **2.1** | **4.5** | **5.3** | **26.4** |

**Table 2-2: Maximum Reclamation Ditch Flow at San Jon Rd (cfs)[9]**

| Year | JAN | FEB | MAR | APR | MAY | JUN | JUL | AUG | SEP | OCT | NOV | DEC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2002 | | | | | | 1.6 | 1.9 | 2.8 | 2.6 | 3.1 | 78.0 | 151.0 |
| 2003 | 115.0 | 68.0 | 78.0 | 45.0 | 7.7 | 2.6 | 1.9 | 1.5 | 2.3 | 9.3 | 15.0 | 220.0 |
| 2004 | 155.0 | 197.0 | 43.0 | 4.4 | 4.2 | 7.0 | 4.1 | 4.3 | 3.8 | 82.0 | 10.0 | 247.0 |
| 2005 | 206.0 | 133.0 | 245.0 | 97.0 | 38.0 | 15.0 | 9.1 | 6.4 | 4.9 | 6.9 | 19.0 | 86.0 |
| 2006 | 188.0 | 20.0 | 114.0 | 270.0 | 51.0 | 7.6 | 6.1 | 5.7 | 6.3 | 5.8 | 89.0 | 94.0 |
| 2007 | 33.0 | 77.0 | 27.0 | 30.0 | 13.0 | 4.3 | 5.4 | 5.0 | 22.0 | 36.0 | 26.0 | 45.0 |
| 2008 | 111.0 | 156.0 | 13.0 | 8.5 | 4.4 | 2.7 | 6.2 | 3.3 | 3.6 | 11.0 | 36.0 | 91.0 |
| 2009 | 76.0 | 138.0 | 157.0 | 7.3 | 12.0 | 2.0 | 4.4 | 13.0 | 5.2 | 163.0 | 1.5 | 52.0 |
| 2010 | 186.0 | 168.0 | 270.0 | 233.0 | 25.0 | 6.0 | 6.1 | 4.8 | 3.2 | 14.0 | 83.0 | 211.0 |
| 2011 | 200.0 | 174.0 | 257.0 | 34.0 | 26.0 | 10.0 | 5.6 | 3.7 | 3.3 | 110.0 | 60.0 | 3.0 |
| 2012 | 131.0 | 24.0 | 191.0 | 140.0 | 5.7 | 12.0 | 3.7 | 5.7 | 3.9 | 6.2 | 190.0 | 188.0 |
| 2013 | 203.0 | 26.0 | 27.0 | 7.9 | 2.4 | 2.3 | 2.2 | 2.4 | 3.3 | 2.5 | 20.0 | 12.0 |
| 2014 | 4.6 | 125.0 | 116.0 | 45.0 | 1.9 | 1.8 | 1.9 | 2.5 | 4.5 | 37.0 | 95.0 | 400.0 |

[9] Source: USGS gage 11152650, daily average flows in cfs

**Table 2-3: Estimated Yields from the Reclamation Ditch at Davis Road**

| Bypass and Diversion Targets | Annual Diversion (AF) |
|---|---|
| Bypass 1 cfs, Max Diversion 1 cfs | 541.2 |
| Bypass 1 cfs, Max Diversion 2 cfs | 906.2 |
| Bypass 1 cfs, Max Diversion 2.9 cfs | 1,134.7 |
| Bypass 1 cfs, Max Diversion 2.99 cfs | 1,153.8 |
| Bypass 1 cfs, Max Diversion 3 cfs | 1,155.9 |
| Bypass 1 cfs, Max Diversion 4 cfs | 1,337.5 |
| Bypass 1 cfs, Max Diversion 5 cfs | 1,484.0 |
| Bypass 1 cfs, Max Diversion 6 cfs | 1,610.6 |
| Bypass 2 cfs, Max Diversion 2.99 cfs | 794.7 |
| Bypass 2 cfs, Max Diversion 6 cfs | 1185.7 |
| Bypass 0.67 cfs, Max Diversion 2 cfs | 1,014.3 |
| Bypass 0.67, Max Diversion 2.99 cfs | 1,295.6 |
| Bypass 0.67, Max Diversion 6 cfs | 1,783.2 |

The estimates above include diversions during wet winter months. Peak wet weather flows in the City's sanitary sewer system may not allow for capture of peak winter flows from the Reclamation Ditch (i.e., there may not be 6 cfs of available capacity in the collection system when there is 6 cfs available for diversion). The 6 cfs diversion rate was used for facility sizing, as discussed in Section 3.

At the Castroville diversion point on Tembladero Slough, the MRWPCA Castroville Pump Station has a rated capacity of 3.2 MGD. The peak dry weather flow is listed at 1.2 MGD, leaving 2 MGD of excess summer capacity, or 3.1 cfs. The peak wet weather flow is listed at 2.0 MGD, leaving 1.2 MGD of excess winter capacity, or 2.2 cfs. Diversions were calculated for Tembladero Slough using diversion targets from 2.2 cfs to 3.5 cfs, assuming an in-stream flow requirement of 1.0 cfs. The annual yield results are tabulated below. The Proposed Project assumes a diversion rate of 2.99 cfs to allow for the simpler water rights permitting process. Monthly diversion estimates are shown in Table B-5.

**Table 2-4: Estimated Yields from Tembladero Slough at Castroville**

| Bypass and Diversion Targets | Annual Diversion (AF) |
|---|---|
| Bypass 1 cfs, Max Diversion 2.2 cfs | 1,234.5 |
| Bypass 1 cfs, Max Diversion 2.5 cfs | 1,355.1 |
| Bypass 1 cfs, Max Diversion 2.9 cfs | 1,501.7 |
| Bypass 1 cfs, Max Diversion 2.99 cfs | 1,532.5 |
| Bypass 1 cfs, Max Diversion 3 cfs | 1,535.9 |
| Bypass 1 cfs, Max Diversion 3.5 cfs | 1,694.4 |

Estimates were also prepared for diverting at both stations concurrently. This option entails higher capital and operating costs, but the potential yields are higher because you can capture more of the lower basin flows from Santa Rita and Merritt Creeks. It also reduced the potential of not being able to capture high winter flows due to competition with City of Salinas peak wet weather flows in the municipal collection system. The annual yield results are tabulated below. Monthly diversion estimates are shown in Table B-6. As can be seen, more total flow is captured when the daily maximum diversion of 6 cfs is divided between the two sites. Even after increasing the in-stream bypass requirement to 2 cfs, the total annual diversion is higher than applying the 6 cfs target at the Davis Road site alone. In the final two estimates, seasonal in-stream flow targets of 0.67 cfs in the summer and 2.0 cfs in the winter were assumed, with the higher flows required in during the fish migration season, discussed below.

**Table 2-5: Estimated Yields from Two Diversion Locations**

| Bypass and Diversion Targets | Annual Diversion (AF) |
|---|---|
| Bypass 1 cfs, Max Diversion 2 cfs (net 4 cfs) | 1,834.1 |
| Bypass 1 cfs, Max Diversion 2.9 cfs (net 5.8 cfs) | 2,220.5 |
| Bypass 1 cfs, Max Diversion 2.99 cfs (net 5.98 cfs) | 2,252.0 |
| Bypass 1 cfs, Max Diversion 3 cfs (net 6 cfs) | 2,255.5 |
| Bypass 2 cfs, Max Diversion 3 cfs (net 6 cfs) | 1,770.5 |
| Bypass 1 cfs, Divert 6 cfs RD, 2.99 cfs TS (net 8.99 cfs) | 2,562.3 |
| Bypass 2 cfs, Divert 6 cfs RD, 2.99 cfs TS (net 8.99 cfs) | 2,049.6 |
| Seasonal Bypass, Div 2.99 cfs both sites (net 5.98 cfs) | 2,249.9 |
| Seasonal Bypass, Divert 6 cfs RD, 2.99 cfs TS (net 8.99 cfs) | 2,654.8 |

Notes:
Same diversion target at both sites, unless noted otherwise
Seasonal bypass targets: 0.69 cfs at Davis Rd (JUN-NOV), 2 cfs at Davis Rd (DEC-MAY), 1 cfs at Castroville (JAN-DEC)

## 2.2 In-Stream Flow Requirements

For the initial analysis, we assumed a minimum in-stream flow of 1 cfs must be maintained prior to making any diversions. This was based upon the typical minimum summer flow rate as recorded at the USGS gage 11152650 on the Reclamation Ditch. A minimum in-stream flow was not established in the documents reviewed, but habitats for some aquatic species were identified in the source reports.

**Figure 2.1: USGS Station 11152650 (flowing at 4.9 cfs)**

The USGS Gaging Station on the Reclamation Ditch uses a weir gage, as shown in Figure 2.1, above. The rating curve for this station is provided at Figure 2.2. A log-log plot is required to show the change in depth vs. flow at lower flow rates. As can be seen in the graph, the water level at the gaging station is 0.7 feet above the datum when the flow is 1 cfs. However, the gage datum is not the weir crest, so a flow of 1 cfs is only about 0.1 ft deep across the weir. As seen in the photograph, the water depths above and below the gaging weir are deeper, and the change in channel water level tracks with the recorded gage height. At 7 cfs, the gage height increases to 1.1 feet. Therefore, diverting at the maximum target of 6 cfs would, in the most extreme case (i.e., diverting 6 cfs and bypassing 1 cfs), reduce the water level in the channel by 0.4 feet. At higher flow rates, a 6 cfs flow reduction produces a smaller change in water depth.

**Figure 2.2: Rating Curve for USGS Station 11152650, log-log Plot[10]**


Figures 2.3 and 2.4, below, show the cumulative effects of diverting flows from the Reclamation Ditch. Tables B-7 and B-8 with the underlying data are included in Appendix B. In Figure 2.3, flows with no diversion at Davis Road are compared to flows after capturing up to 6 cfs with a 1 cfs minimum bypass. The flow reductions range from 15% in the winter months to 65% in the summer. Note that despite this flow reduction, the summer water surface would only be reduced by 0.4 feet. In Figure 2.4, the same comparison is made, but a 2 cfs minimum bypass is modeled. The summer flows would be reduced by only 40% under this scenario. Under the seasonal by-pass scenario (leaving the first 2 cfs in-stream from December through May, and leaving 0.69 cfs in-stream from June through November), the summer flow reduction reaches 79% when diverting up to 6 cfs at Davis Road.

The Tembladero Slough is tidally influenced from the Old Salinas River Channel up to Highway 183 in Castroville. The backwater condition caused by the tide gates would prevent measurable reductions in water levels throughout that reach. The potential change in water level in the Reclamation Ditch below the Davis Road diversion site should not affect riparian species along the creek banks, which are adapted to seasonally varying water levels.

[10] USGS Gaging Station website

**Figure 2.3: Flows Comparison for 6 cfs Diversion with 1 CFS Bypass**

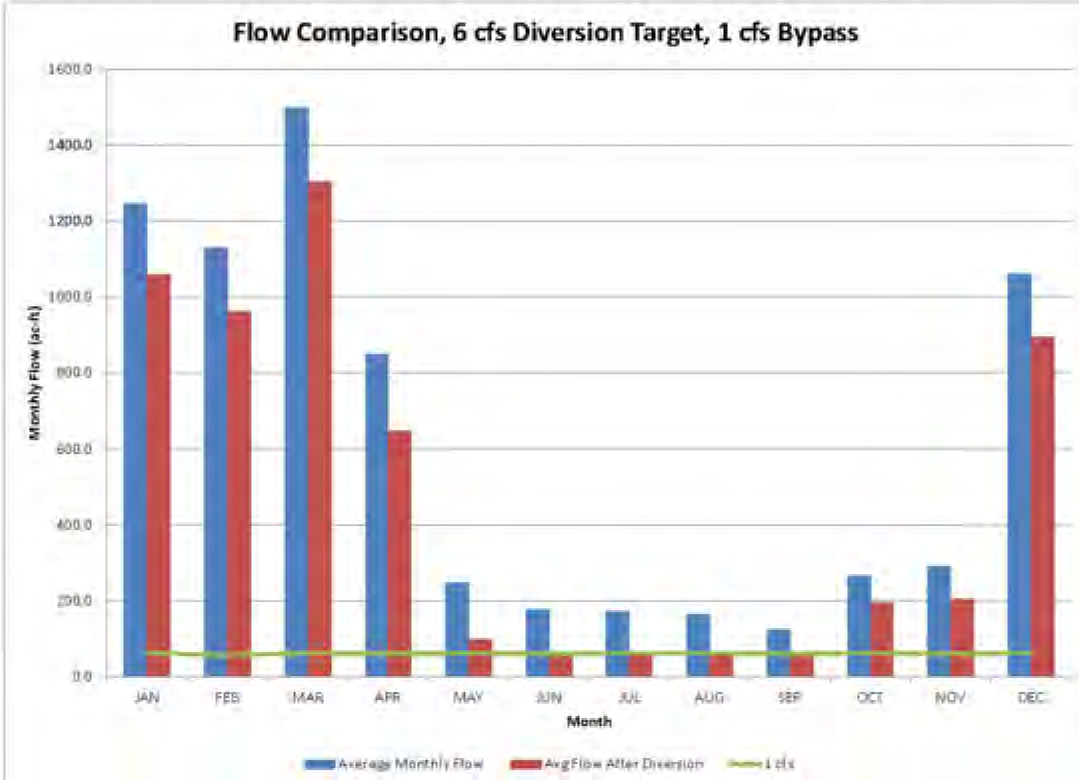
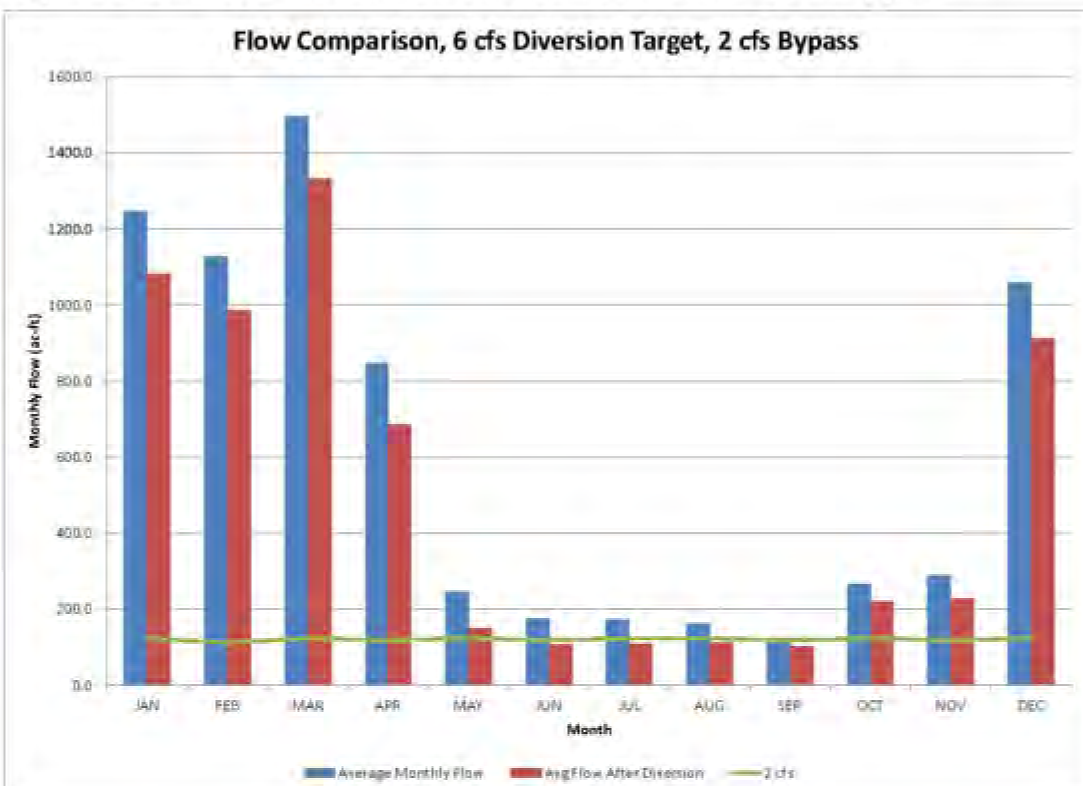



**Figure 2.4: Flows Comparison for 6 cfs Diversion with 2 CFS Bypass**



Reduced flows may affect migratory fish species which traverse the Tembladero Slough and Reclamation Ditch to and from Gabilan Creek, which has been identified as suitable habitat for South-Central California Coast Steelhead[11]. Objects in the channel bottom, such as the USGS stream gage or riprap placed for erosion control, present obstacles to fish passage at low flows but are submerged at higher flows. The steelhead are adapted to the seasonal availability of passage flows, with adults migrating upstream in December through March to spawn, and with juveniles migrating downstream in April through May to reach the ocean or tidal estuaries. To evaluate the effects of the proposed project on fish passage, flow exceedance curves were developed for the current condition and four project scenarios (see Appendix D). The four modeled scenarios are:

Case 1: Divert up to 2.99 cfs at Davis Road, leaving 2 cfs in-stream during the migration season (December-May), and 0.69 cfs in-stream during the other months (June-October). Divert up to 2.99 cfs at Castroville, leaving 1 cfs in-stream year-round.

Case 2: Divert up to 6 cfs at Davis Road, leaving 2 cfs in-stream during the migration season (December-May), and 0.69 cfs in-stream during the other months (June-October). Divert up to 2.99 cfs at Castroville, leaving 1 cfs in-stream year-round.

Case 3: Divert up to 2.99 cfs at Davis Road, leaving 1 cfs in-stream year-round. Divert up to 2.99 cfs at Castroville, leaving 1 cfs in-stream year-round.

Case 4: Divert up to 6 cfs at Davis Road, leaving 1 cfs in-stream year-round. Divert up to 2.99 cfs at Castroville, leaving 1 cfs in-stream year-round.

A qualified fisheries biologist identified several locations along the Reclamation Ditch and Tembladero Slough that present obstacles to fish passage[12]. Based upon his estimation of the flow rate needed to submerge the obstacle and allow the depth of flow needed for passage, the biologist may then use the flow exceedance curves to determine if the project will significantly affect the number of days the passage flows occur. Those results are reported separately in the Technical Memorandum by Hagar Environmental Science.

The obstacles identified were man-made erosion controls within the Reclamation Ditch, including stone rip-rap downstream of bridge crossings and the concrete weir and apron at the USGS stream gage. No obstacles to fish passage were identified in the Tembladero Slough, which has several feet of water depth even during dry seasons. The most restrictive location was the gaging weir at San Jon Road. If the proposed project diversions are found to have significant effects on fish passage, the effects may be mitigated in several ways.

---

[11] Reclamation Ditch Watershed Assessment and Management Strategy, Part A: Watershed Assessment, 2004

[12] Hagar Environmental Science, 2015

First, the obstacles may be removed or modified. Stone riprap for erosion control may be replaced with smaller, grouted stone or cast-in-place concrete. The concrete apron below the gaging weir may be replaced with a concrete lined plunge pool or a center channel. This would not remove the weir itself as an obstacle, but it would allow migrating fish a path to approach the weir before jumping.

A second mitigation method would be to determine the flow rate required to allow fish passage, and not divert flows at Davis Road when the base flow in the channel would otherwise allow passage. For the San Jon Road location, Hagar Environmental Science estimated the passage flow for upstream migration of adults at 78 cfs, and the passage flow for downstream migration of juveniles at 31 cfs. During the adult migration months of December through February, diversions would not be made when the base flow in the channel is between 78 and 84 cfs. If the flow is greater than 84 cfs, diverting 6 cfs for the project would still leave at least 78 cfs in-stream. Similarly, during the smolt migration months of March through May, diversions would not be made when the base flow in the channel is between 31 and 39 cfs. Schaaf & Wheeler estimated the passage flows separately, with higher results: 90 cfs for downstream migration of smolts and 121 cfs for upstream migration of adults. Because of the varying channel geometry across the short run of the weir and apron, the depth of flow on the downstream apron should be field measured during a rain event and a depth to flow curve developed.

The estimated average diversions at Davis Road when applying these non-diversion windows are shown in Table 2-6. The baseline scenario used is a 6 cfs target diversion rate, with a winter seasonal by-pass of 2 cfs and a summer season bypass of 0.69 cfs. The original model with no diversion windows is included for comparison. Project yields are reduced by approximately 1%, with the differences occurring in the wet season months. The non-diversion windows at Davis Road did not increase the yield of the Tembladero Slough diversion at Castroville, which remained 1,134 AFY in all cases.

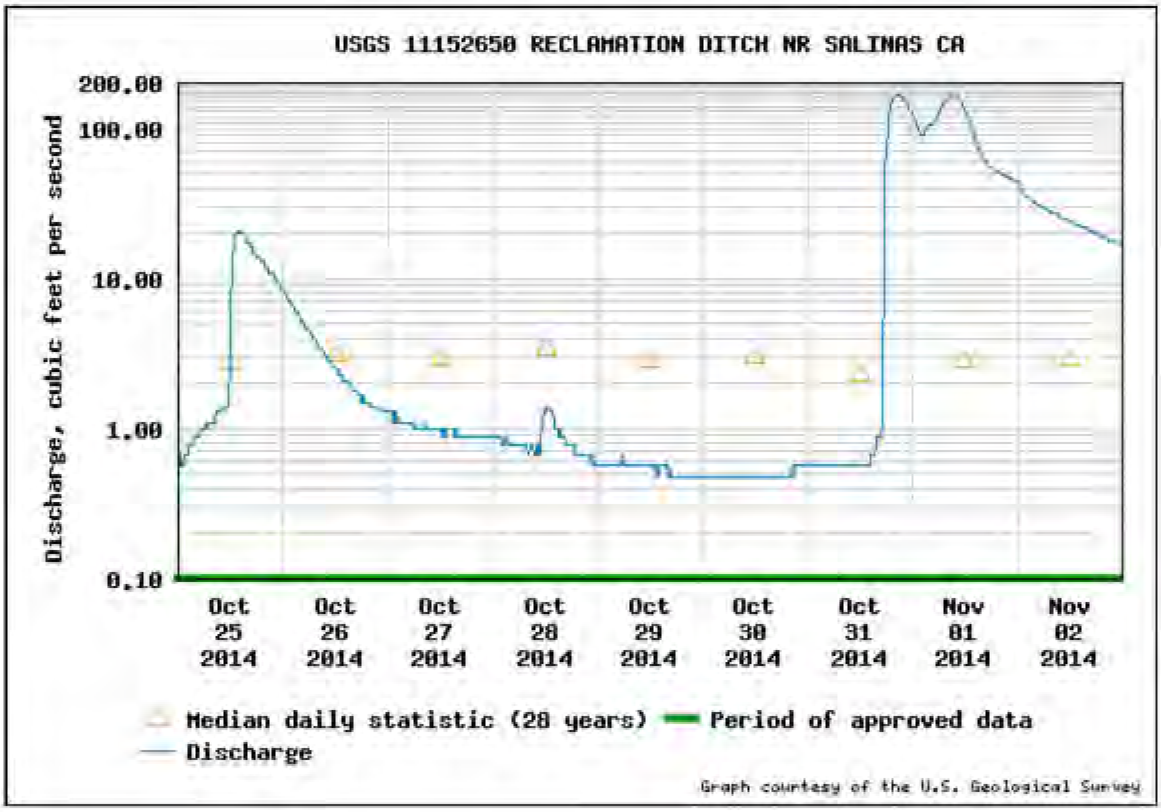
**Table 2-6: Estimated Davis Road Diversions with Mitigation Windows**

| Smolt | Adult | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 31 | 78 | 157 | 141 | 158 | 159 | 96 | 132 | 129 | 121 | 80 | 87 | 98 | 142 | 1,500 |
| 90 | 121 | 161 | 140 | 165 | 161 | 97 | 132 | 129 | 121 | 80 | 87 | 98 | 144 | 1,515 |
| 0 | 0 | 162 | 143 | 165 | 162 | 97 | 132 | 129 | 121 | 80 | 87 | 98 | 146 | 1,521 |

Smolt migration window March-May, Adult migration window December-February

The model uses mean daily streamflow data from the USGS gage at San Jon Road. Actual flow rates in the Reclamation Ditch rise and fall quickly following a rain event due the rapid inflow of runoff from the City of Salinas. Figure 2.5, below, shows the gaged flow following two rain events in 2014. On 10/25/2014, 0.2 inch of rainfall was recorded at Salinas Airport. The flow at San Jon Road peaked at 20 cfs, but the recorded average for the day was 7.5 cfs. On 10/31/2014, 1.0 inch of rainfall was recorded, with 0.4 inch recorded on the following day. The flow on 10/31/2014 peaked at 190 cfs, but the recorded average for that day was 37 cfs, and only 95 cfs for the following day. For comparison, the 2-year, 1-hour storm for Salinas is 0.4 inch, and the 2-year, 24-hour storm is 1.6 inches. What this shows is that more passage events occur during the year than the current modeling method can describe, and the corresponding non-diversion passage windows will occur more frequently as well.

**Figure 2.5: Discharge Curve at San Jon Road, 10/25/2014-11/02/2014**



## 2.3 Water Rights

Water that enters surface streams and rivers is considered water of the state. A water rights permit is required to impound or divert waters of the state, except for certain riparian uses. Diverting stormwater and agricultural return flows in the Reclamation Ditch and Tembladero Slough would be subject to water rights permitting rules. Existing surface water rights were researched to assess potential impacts to current water right holders or challenges to the proposed diversions.

The State Water Resources Control Board Electronic Water Rights Information Management System (eWRIMS) was queried to identify existing water rights in the Reclamation Ditch Watershed. A listing of all current water rights for Monterey County was obtained using a database query. The Points of Diversion (PODs) within the Reclamation Ditch watershed and vicinity were identified using the on-line GIS mapping tool. The POD listing was used to create a tailored list of water rights within the area of interest (see Table B-9).

**Figure 2.6: SWRCB eWRIMS Interface**


The SWRCB Water Rights Order 98-08, Declaration of Fully Appropriated Stream Systems in California, identifies those stream segments which cannot support additional authorizations for diversion. Neither the Reclamation Ditch nor the Lower Salinas River were listed in that decision, so there is no regulatory prohibition on requesting a water right on this stream.

The water rights listing includes several water right types:

- Appropriative, for the diversion and use of surface water.
- Stockpond, for the on-stream impoundment and use of water.

- Statements of Diversion and Use, for reporting riparian use of surface water and for the use of groundwater. Statements of Diversion and Use are also used for claims of pre-1914 appropriative water rights. The limitation of the eWRIMS database is that most Claimed water rights do not appear with a Face Amount the way Appropriative Rights are listed.

The listing incudes four large surface water rights on the Salinas River which are owned by MCWRA. The point of diversion at the SRDF (small blue square on the map above) was within the data capture for the list, and these rights were left in the table for information only.

The existing points of diversion within the Reclamation Ditch watershed below the City of Salinas are all for groundwater use. The sources for these are variously listed as "Salinas River Underflow," "Salinas Valley Basin," or "Groundwater." The shallow "A-Aquifer" groundwater in this area is not used due to poor water quality. Wells in this area tap the Pressure and East Side subareas of the Salinas Valley Groundwater Basin (SVGB), which is recharged in the Forebay and Upper Valley subareas. Diverting surface water for this project should not affect groundwater yields from the SVGB.

Above the City of Salinas, there are 16 surface water rights or claims listed, with face value diversion amounts totaling 2,155 AFY (see Table B-10). There are also 19 stock ponds listed of various sizes. All of these sites are above Old Stage Road within the Alisal, Gabilan and Natividad Creeks watersheds. The annual usage reports for 2011 and 2012 were reviewed, to the extent available. Reported use ranged from 3% to 71% of the total face value amount. The majority of these rights are limited to wet season diversions (NOV – APR), and will not affect summer channel flows. Because these rights are all located above the existing gage, the gaged flow values did not require adjustment. Likewise, the proposed diversion points for this project are well below the diversion points for these rights, so adding this project will not affect current surface water right holders.

# Section 3 - Facility Requirements

## 3.1 Description and Sizing

Conceptual designs were developed for diversion facilities at the two locations analyzed. The following design criteria and assumptions were used:

- The inlet would be located within the channel bottom
- The inlet will be screened to minimize fish and trash capture
- The pump station would consist of a wet well with submersible pumps
- The force main from the station will connect to a gravity portion of the existing sanitary sewer collection system (assumed discharge at atmospheric pressure)
- The minimum velocity in the force main shall be 2 feet/second to prevent the settling of suspended sediments in the pipeline.
- The maximum velocity in the force main shall be less than 8 feet/second to limit the friction losses

The conceptual design diagrams are provided in Appendix C.

The inlet structure consists of a concrete box with a screened inlet. The inlet must be sized to allow full flow through the screen with a maximum velocity of 1 ft/s to allow fish to escape. Assume the screen has an open area of 50%, and that 50% of the screen is blinded by trash/vegetation. For a maximum flow of 6 cfs:

$A_{screen}$ = 6 cfs / [(1 ft/s) x (50% screen openings) x (50% blinded)] = 24 sq-ft

Minimum dimensions: 4-ft wide x 6-ft long

The channel invert will be concrete lined with a permanent low-flow channel adjacent to the inlet. This will prevent capturing the required minimum by-pass flows. The channel banks above the inlet structure will be protected with grouted rip-rap to prevent scour and potential bank sloughing into the by-pass and inlet. Concrete steps should be installed above the inlet to facilitate maintenance access.

The inlet will connect to the wet well through a large diameter pipe, sloped towards the wet well. The wet well is an 8-ft diameter manhole, with mounting rails to facilitate the installation and removal of the submersible pumps. Within the wet well, the pumps will be set below the inlet pipe elevation. The pump operation will be controlled by a pressure transducer in the wet well, with float switches for backup control and alarms. Because the system will be discharging to the municipal sanitary sewer, pressure transducers or float switches must be installed in the receiving system to shut off this station when the receiving sewer is flowing full.

The force main to the sanitary sewer system should be C900 PVC pressure pipe, with a check valve and isolation valve located outside the wet well in a separate vault. The pipeline should be installed with a minimum of 3-ft of cover in the pipe trench. It will connect to the sanitary system at an existing manhole. If the existing sewer is deeper than the new force main, the force main should be installed with an interior drop (pipeline to the manhole invert) to minimize the turbulence and the release of $H_2S$ that it causes.

The pumps may operate at fixed speed or under variable speed control. Operation under fixed speed is simpler to design, but may require excessive cycling if the inflow rates are significantly lower than the pump design point. Variable speed control will allow the pumps to start and stop less frequently during the summer when flows are below 2 cfs.

For the Davis Road diversion point, two station configurations were considered. Option 1 assumed two pumps, primary and alternate, each sized to deliver 6 cfs through a shared force main. A 17 hp pump is required to provide 6 cfs of flow at that station. Option 2 assumed two independent pumps with separate force mains, each sized to deliver 3 cfs. An 8 hp pump is required to provide 3 cfs of flow. In either case, the station may be constructed next to the existing sanitary sewer main, minimizing the length of force main required. System Curves for the two configurations are provided in Figure 3.1 and Figure 3.2.

Looking at the statistics for flows at the USGS Gage at San Jon Road:

| | |
|---|---|
| Flows are less than 1 cfs: | 8% of the time |
| Flows are between 1 and 4 cfs: | 69% of the time |
| Flows exceed 5 cfs: | 23% of the time |

Given these operating conditions, we recommend installing 3 cfs pumps with parallel force mains. If redundancy is required, a third 3 cfs pump may be installed.

The Reclamation Ditch is designed to carry the 1% (100-year) storm event. The southern bank of the Reclamation Ditch where this pump station would be located is not shown as being within the 100-year flood-plain[13]. However, it would make sense to install the electrical equipment for this station on elevated panels.

The proposed station location is adjacent to the existing railroad right-of-way, as well as MCWRA's maintenance right-of-way. Due to these restrictions, it may not be possible to provide security fencing around the pump station and controls.

[13] FEMA Flood Insurance Rate Map, Map Panel 06053C0216G, April 2009 (see Appendix A)

**Figure 3.1: Davis Road Option 1, Two 6 cfs pumps**

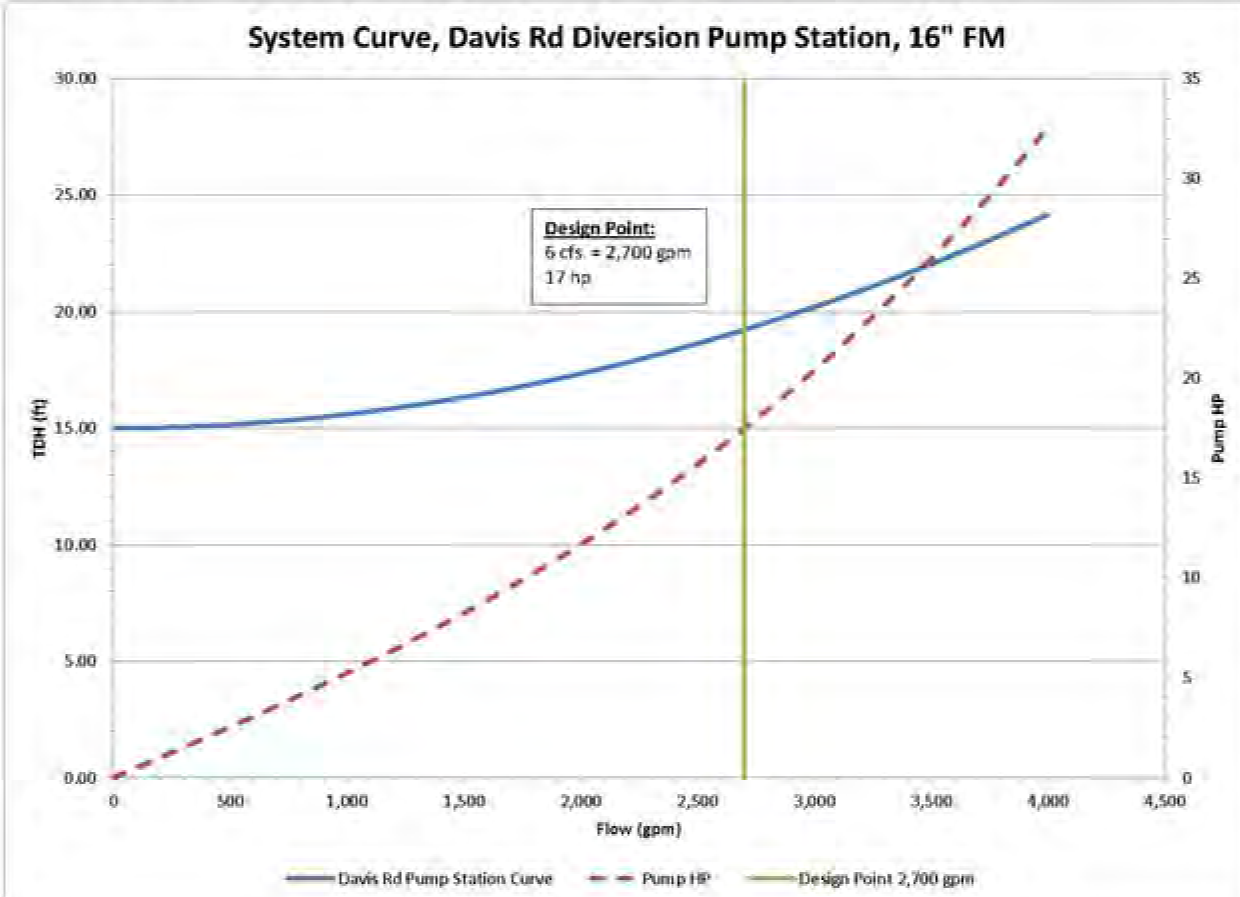
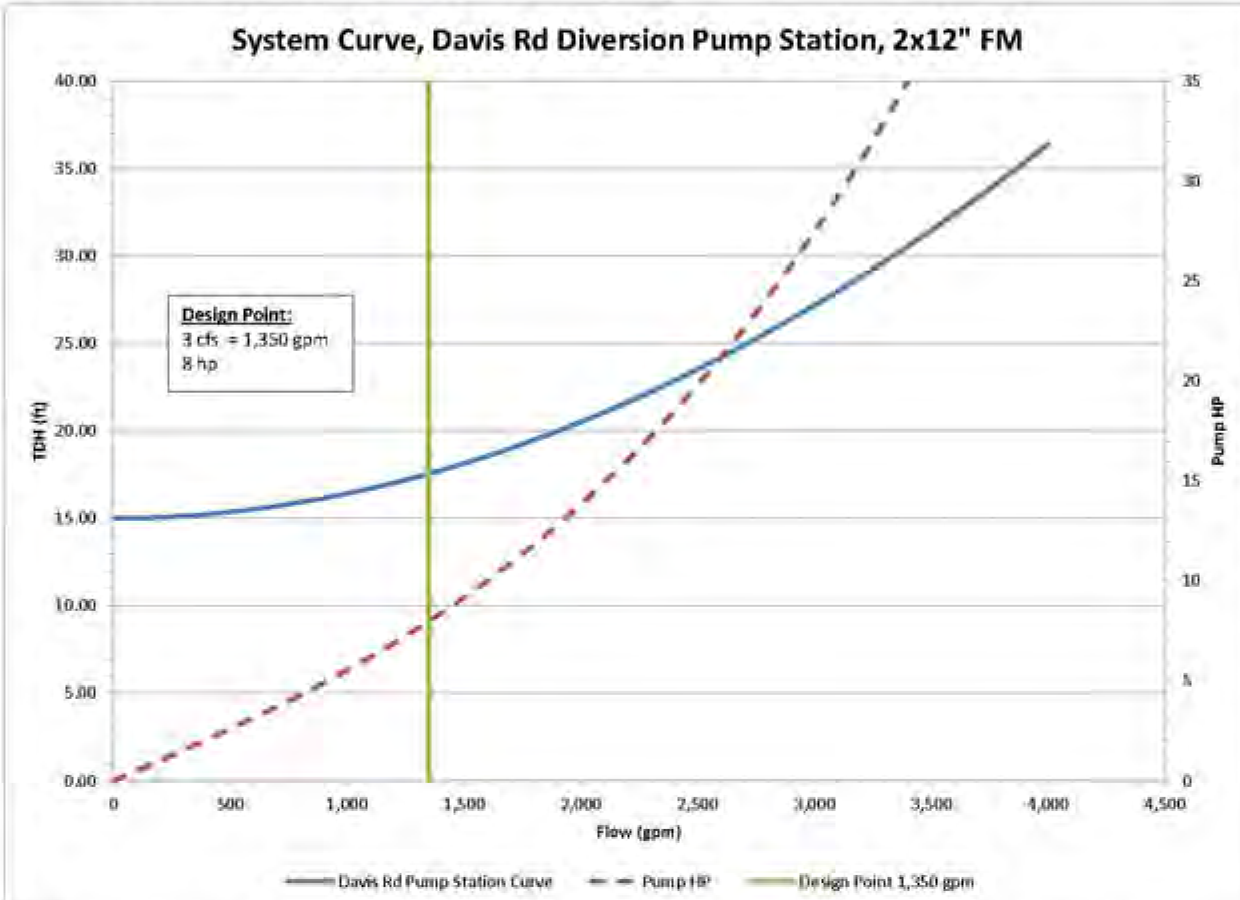


**Figure 3.2: Davis Road Option 2, Two 3 cfs pumps**

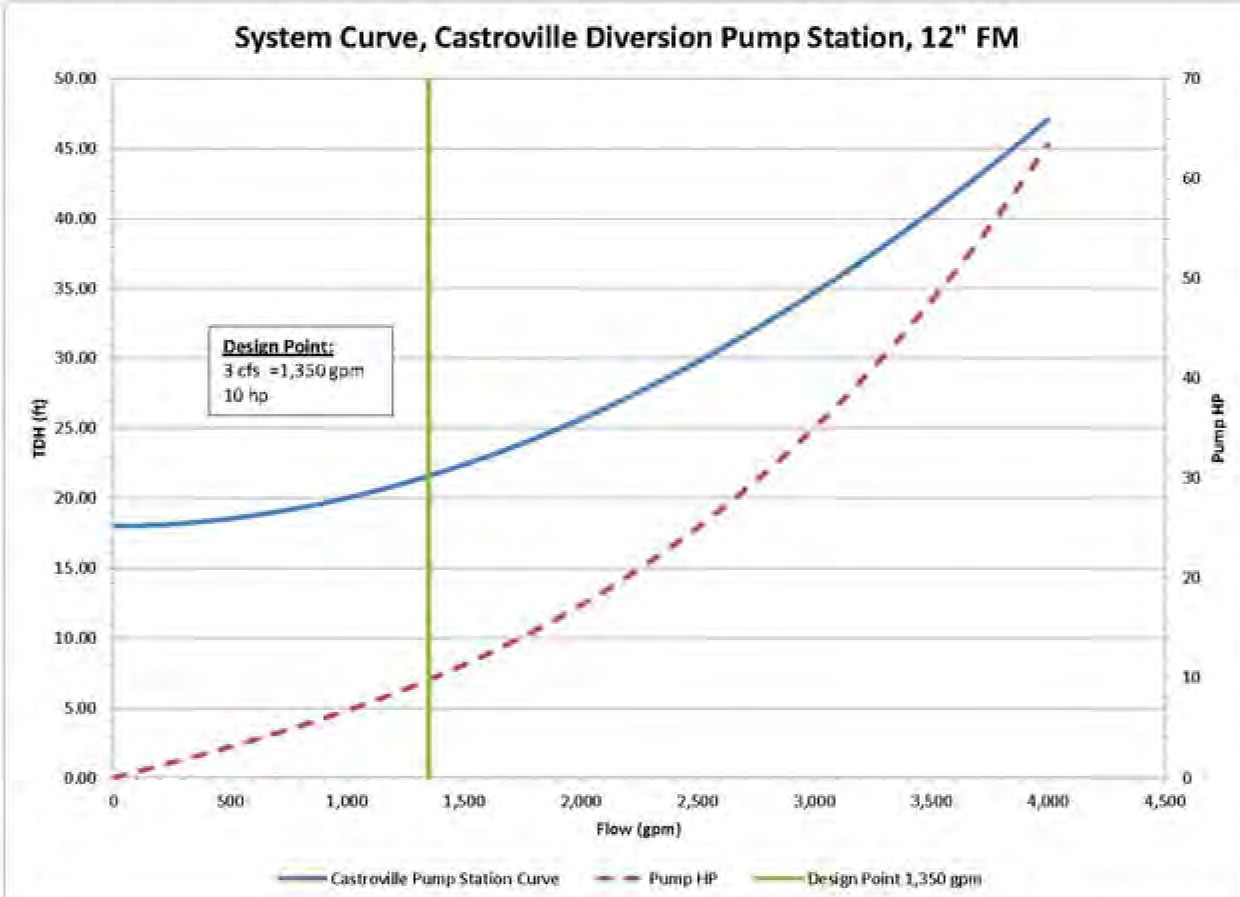



For the Castroville diversion point, the station will be similarly configured. The only difference is that the force main must be longer to reach the gravity manhole upstream of the MRWPCA Castroville Pump Station. A 10 hp pump is required to provide 3 cfs of flow at this station, due to the deeper wet well and longer force main. The system curve is provided at Figure 3.3.

The proposed station location is adjacent to MCWRA's maintenance right-of-way, in a lane also used for farm traffic. Due to the close proximity to the Castroville Pump Station, it may be possible to locate the electrical equipment at the existing building and avoid installing a free-standing panel. The site is within the 100-year floodplain, so the power and control equipment must be elevated above the base flood elevation of 13-ft[14].

[14] FEMA Flood Insurance Rate Map, Map Panel 06053C0070G, April 2009 (see Appendix A)

**Figure 3.3: Castroville Pump Station**



### 3.2 Costs

Capital costs were estimated for three pump station configurations, a 6 cfs station at Davis Road, a 3 cfs station at Davis Road, and a 3 cfs station at Castroville, summarized in Table 3-1, below. Detailed estimates are provided in Tables C-4, C-5 and C-6 in Appendix C. Non-construction costs (design, permitting, legal, etc.) were estimated as 40% of the construction cost.

Right-of-way acquisition costs were not included in the capital cost estimates. The proposed sites are within county or city rights-of-way, so standard encroachment fees should apply.

**Table 3-1: Estimated Capital Costs**

| | Davis Rd 6 cfs Pumps | Davis Rd 3 cfs Pumps | Castroville 3 cfs Pumps |
|---|---|---|---|
| Estimated Construction Cost | $352,000 | $346,000 | $331,000 |
| Inspection and Testing (15%) | $53,000 | $52,000 | $50,000 |
| Construction Contingency (20%) | $70,000 | $69,000 | $66,000 |
| Estimated Total Construction Cost | $475,000 | $467,000 | $447,000 |
| | | | |
| Design, Permitting, Legal (40%) | $190,000 | $186,800 | $178,800 |

Costs are in 1st Quarter 2014 dollars

The City of Salinas has standard capacity charges and monthly fees for connecting to the sanitary sewer collection system, which would apply to the Davis Road Pump Station. These fees are not included in this estimate, but should be considered if this option is pursued.

Similarly, the MRWPCA has standard capacity charges for connection to the regional wastewater system, based upon the flow rate, the biological oxygen demand (BOD) and the suspended solids concentration, and monthly charges for wastewater treatment. These fees are not included in this estimate, because the MRWPCA is a sponsor of the GWR Project. The primary, secondary and advanced treatment costs for this source of supply will appear in the overall project cost analysis.

Annual operating and debt service costs for each configuration were estimated using the following planning factors:

- Debt service assumes a 30-year bond at 4% annual interest
- Annual operation and maintenance of pump stations is estimated at 2.5% of the capital cost
- Annual operation and maintenance of pipelines is estimated at 1% of the capital cost
- Electrical power cost is assumed at $0.16 per kWh
- Assume the station operates 365 days a year

The factors above provide an order-of-magnitude estimate of annual costs, which may be used in comparing project configurations. The estimated annual costs are provided below.

**Table 3-2: Estimated Annual Costs, 6 cfs Pump Station at Davis Road**

| Category | Basis | Annual $ |
|---|---|---|
| **Capital Repayment** | | |
| Assume 30-year bond at 4% | $475,000.00 | $27,469.30 |
| **Annual Operation and Maintenance** | | |
| Assume 2.5% of Pump Station Capital Cost | $461,500.00 | $11,537.50 |
| Assume 1.0% of Pipeline Capital Cost | $13,500.00 | $337.50 |
| **Electrical Power** | | |
| Number of operating days/year | 336 | |
| Pumps: 17 HP (0.7457 kW/hp) | 12.7 | |
| Estimated annual kWh | 102,227 | |
| Assumed cost per KWH | $0.16 | $16,356.24 |
| **Total Estimated Annual Cost** | | **$55,700.00** |

**Table 3-3: Estimated Annual Costs, 3 cfs Pump Station at Davis Road**

| Category | Basis | Annual $ |
|---|---|---|
| **Capital Repayment** | | |
| Assume 30-year bond at 4% | $467,000.00 | $27,006.66 |
| **Annual Operation and Maintenance** | | |
| Assume 2.5% of Pump Station Capital Cost | $434,600.00 | $10,865.00 |
| Assume 1.0% of Pipeline Capital Cost | $32,400.00 | $810.00 |
| **Electrical Power** | | |
| Number of operating days/year | 336 | |
| Pumps: 8 HP (0.7457 kW/hp) | 6.0 | |
| Estimated annual kWh | 48,107 | |
| Assumed cost per KWH | $0.16 | $7,697.06 |
| **Total Estimated Annual Cost** | | **$46,400.00** |

**Table 3-4: Estimated Annual Costs, 3 cfs Pump Station at Castroville**

| Category | Basis | Annual $ |
|---|---|---|
| **Capital Repayment** | | |
| Assume 30-year bond at 4% | $447,000.00 | $25,850.05 |
| **Annual Operation and Maintenance** | | |
| Assume 2.5% of Pump Station Capital Cost | $422,700.00 | $10,567.50 |
| Assume 1.0% of Pipeline Capital Cost | $24,300.00 | $607.50 |
| **Electrical Power** | | |
| Number of operating days/year | 336 | |
| Pumps: 110 HP (0.7457 kW/hp) | 7.5 | |
| Estimated annual kWh | 60,133 | |
| Assumed cost per KWH | $0.16 | $9,621.32 |
| **Total Estimated Annual Cost** | | **$46,600.00** |

# Section 4 - Water Quality

## 4.1 Summary of Current Condition

The Central Coast Regional Water Quality Control Board (CCRWQCB) Water Quality Control Plan for the Central Coast Basin (Basin Plan) designated beneficial uses of the Reclamation Ditch as including water contact recreation, non-contact water recreation, wildlife habitat, warm water fish habitat and commercial or sport fishing. These are the minimum uses listed for all inland water bodies within the region, unless specific water quality information caused the RWQCB to remove a specific use (e.g., not listing water contact recreation for a stream segment listed for fecal coliform contamination). The Tembladero Slough is designated as having additional beneficial uses of estuarine habitat, rare/threatened/endangered species, and spawning/reproduction/early development habitat. Table B-11 in Appendix B lists the Basin Plan designations for all stream segments in the lower Salinas Valley.

CCRWQCB Order No. R3-2012-0011 (Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands) found that:

> "...toxicity resulting from agricultural discharges of pesticides has severely impacted aquatic life in Central Coast streams...Twenty-two sites in the region, 13 of which are located in the lower Salinas/Tembladero watershed area, and the remainder in the lower Santa Maria area, have been toxic in 95% (215) of the 227 samples evaluated."

The Reclamation Ditch (Salinas Reclamation Canal) and Tembladero Slough are listed as impaired water bodies pursuant to Section 303(d) of the Clean Water Act for ammonia, fecal coliform, pesticides, nitrate, toxicity and other parameters. Water quality has been sampled and monitored for the past 15 years under various programs, including the Central Coast Ambient Monitoring Program (CCAMP) under the RWQCB, the Central Coast Watershed Studies (CCoWS) program of the Watershed Institute at California State University Monterey Bay, and the Cooperative Monitoring Program under the Conditional Waiver of Waste Discharges from Irrigated Lands (Ag Waiver). The results of these programs have been consolidated in Table B-12, Stream Water Quality, for the Reclamation Ditch, Tembladero Slough and all tributary water bodies. Figure A-9 shows the primary sampling locations.

The Reclamation Ditch and Tembladero Slough are not designated for use as municipal or domestic water supply, so Total Maximum Daily Loads (TMDL) for pollutants had to be established by the RWQCB. The Central Coast RWQCB adopted order R3-2013-0008 to establish certain TMDLs for the lower Salinas River Basin in 2013. These and other applicable water quality standards are consolidated in Table B-13, Total Maximum Daily Loads. A summary of the key parameters for the Reclamation Ditch are shown in Table 4-1, and for Tembladero Slough in Table 4-2.

**Table 4-1: Water Quality Parameters, Reclamation Ditch below Carr Lake**

| Parameter | Units | Mean | Max | Standard |
|---|---|---|---|---|
| Ammonia as N, Unionized | mg/L | 0.029 | 0.25 | 0.025 |
| Ammonia as NH3 | mg/L | 0.61 | 6.00 | 0.025 |
| Chloride | mg/L | 106.41 | 200.00 | 150 |
| Chlorophyll a, water column | mg/L | 0.016 | 0.15 | 0.015 |
| Chlorpyrifos | mg/L | 0.0016 | 0.055 | 0.00025 |
| Coliform, Fecal | MPN/100 ml | 17,954 | 160,001 | 400 |
| Coliform, Total | MPN/100 ml | 53,966 | 160,001 | 1000 |
| Diazinon | mg/L | 0.10 | 3.16 | 0.00016 |
| Dissolved Solids, Total | mg/L | 641.83 | 1,080.00 | 1000 |
| Nitrate as N | mg/L | 13.00 | 69.10 | 8.0 |
| OrthoPhosphate as P | mg/L | 0.65 | 12.90 | 0.30 |
| Oxygen, Dissolved | mg/L | 0.93 | 6.58 | > 5.0 |
| Suspended Solids, Total | mg/L | 69.46 | 385.00 | 500 |
| Turbidity | NTU | 141.51 | 1,454.00 | 10 |

**Table 4-2: Water Quality Parameters, Tembladero Slough**

| Parameter | Units | Mean | Max | Standard |
|---|---|---|---|---|
| Ammonia as N, Unionized | mg/L | 0.010 | 0.074 | 0.025 |
| Ammonia as NH3 | mg/L | 0.030 | 0.060 | 0.025 |
| Chloride | mg/L | 876.41 | 9,600.00 | 150 |
| Chlorophyll a, water column | mg/L | 0.037 | 0.66 | 0.015 |
| Chlorpyrifos | mg/L | 0.011 | 0.070 | 0.00025 |
| Coliform, Fecal | MPN/100 ml | 2,310 | 54,000 | 400 |
| Coliform, Total | MPN/100 ml | 29,307 | 240,001 | 1000 |
| Diazinon | mg/L | 0.20 | 0.52 | 0.00016 |
| Dissolved Solids, Total | mg/L | 2,024.71 | 18,000.00 | 1000 |
| Nitrate as N | mg/L | 28.59 | 107.00 | 8.0 |
| OrthoPhosphate as P | mg/L | 0.43 | 1.20 | 0.30 |
| Oxygen, Dissolved | mg/L | 0.60 | 8.98 | > 5.0 |
| Suspended Solids, Total | mg/L | 133.85 | 1,600.00 | 500 |
| Turbidity | NTU | 211.18 | 2,663.00 | 10 |

## 4.2 Potential Pollutant Removal

A benefit of the proposed GWR Project is that it can accept waters of marginal quality as source water because of the proposed routing through the sanitary sewer collection system to the MRWPCA Regional Treatment Plant and then to the existing tertiary treatment or the proposed advanced treatment system. Water diverted from the Reclamation Ditch and/or Tembladero Slough will remove a portion of the current pollutant load from the streams. The water quality within the streams may not noticeably improve, particularly in the summer months when the source flows are mainly agricultural tile drainage. The reduction in pollutant-loaded flows should have a positive effect on the water quality in the Moss Landing Harbor below Potrero Road tide gates.

Pollutant removal was estimated using the conversion formula 1 mg/L = 2.7 pounds/acre-foot. The tables below show the estimates for diverting 6 cfs at Davis Road, 3 cfs at Davis Road, and 3 cfs at Castroville. The current annual flow total is included for comparison.

**Table 4-3: Estimated Pollutant Removal at Davis Road, 6 cfs capacity**

| Pollutant | Average Conc. | Average Annual Flow | Average Pollutant Load | Diverted Flow | Diverted Pollutant Load |
|---|---|---|---|---|---|
| | (mg/L) | (AFY) | (lb/yr) | (AFY) | (lb/yr) |
| Ammonia as N, Unionized | 0.029 | 7,640 | 597 | 1,611 | 126 |
| Ammonia as NH3 | 0.61 | 7,640 | 12,581 | 1,611 | 2,653 |
| Chloride | 106.41 | 7,640 | 2,195,025 | 1,611 | 462,852 |
| Chlorophyll a, water column | 0.016 | 7,640 | 332 | 1,611 | 70 |
| Chlorpyrifos | 0.0016 | 7,640 | 32 | 1,611 | 7 |
| Diazinon | 0.10 | 7,640 | 2,058 | 1,611 | 434 |
| Dissolved Solids, Total | 641.83 | 7,640 | 13,239,724 | 1,611 | 2,791,780 |
| Nitrate as N | 13.00 | 7,640 | 268,084 | 1,611 | 56,529 |
| OrthoPhosphate as P | 0.65 | 7,640 | 13,327 | 1,611 | 2,810 |
| Suspended Solids, Total | 69.46 | 7,640 | 1,432,718 | 1,611 | 302,108 |

**Table 4-4: Estimated Pollutant Removal at Davis Road, 3 cfs capacity**

| Pollutant | Average Conc. | Average Annual Flow | Average Pollutant Load | Diverted Flow | Diverted Pollutant Load |
|---|---|---|---|---|---|
| | (mg/L) | (AFY) | (lb/yr) | (AFY) | (lb/yr) |
| Ammonia as N, Unionized | 0.029 | 7,640 | 597 | 1,156 | 90 |
| Ammonia as NH3 | 0.61 | 7,640 | 12,581 | 1,156 | 1,904 |
| Chloride | 106.41 | 7,640 | 2,195,025 | 1,156 | 332,127 |
| Chlorophyll a, water column | 0.016 | 7,640 | 332 | 1,156 | 50 |
| Chlorpyrifos | 0.0016 | 7,640 | 32 | 1,156 | 5 |
| Diazinon | 0.10 | 7,640 | 2,058 | 1,156 | 311 |
| Dissolved Solids, Total | 641.83 | 7,640 | 13,239,724 | 1,156 | 2,003,288 |
| Nitrate as N | 13.00 | 7,640 | 268,084 | 1,156 | 40,563 |
| OrthoPhosphate as P | 0.65 | 7,640 | 13,327 | 1,156 | 2,017 |
| Suspended Solids, Total | 69.46 | 7,640 | 1,432,718 | 1,156 | 216,783 |

**Table 4-5: Estimated Pollutant Removal at Castroville, 3 cfs capacity**

| Pollutant | Average Conc. | Average Annual Flow | Average Pollutant Load | Diverted Flow | Diverted Pollutant Load |
|---|---|---|---|---|---|
| | (mg/L) | (AFY) | (lb/yr) | (AFY) | (lb/yr) |
| Ammonia as N, Unionized | 0.010 | 10,696 | 836 | 1,536 | 120 |
| Ammonia as NH3 | 0.03 | 10,696 | 17,613 | 1,536 | 2,529 |
| Chloride | 876.41 | 10,696 | 3,073,036 | 1,536 | 441,304 |
| Chlorophyll a, water column | 0.037 | 10,696 | 464 | 1,536 | 67 |
| Chlorpyrifos | 0.0111 | 10,696 | 45 | 1,536 | 6 |
| Diazinon | 0.20 | 10,696 | 2,881 | 1,536 | 414 |
| Dissolved Solids, Total | 2,024.71 | 10,696 | 18,535,614 | 1,536 | 2,661,808 |
| Nitrate as N | 28.59 | 10,696 | 375,317 | 1,536 | 53,897 |
| OrthoPhosphate as P | 0.43 | 10,696 | 18,658 | 1,536 | 2,679 |
| Suspended Solids, Total | 133.85 | 10,696 | 2,005,805 | 1,536 | 288,044 |

## 4.3 Salinity in the Tembladero Slough

The Tembladero Slough and Old Salinas River channel are tidally influenced, with a well-defined halocline (higher salinity at the bottom of the channel[15]). The tidal effects are dampened by the tide (flap) gates on the Old Salinas River at Potrero Road, but brackish water still passes through the gates. The upstream migration of the saline layer is controlled, in part, by freshwater inflows that provide dilution at low flows and which push the salt water downstream at higher flows. The estuary typically sees seasonal increases in salinity, with peak levels occurring in late

[15] Central Coast Watershed Studies Program, 2010 and 2014 reports on Spatial and Temporal Variations on Streamflow and Water Quality in the Tembladero Slough

summer before the on-set of winter rains. Students in the Central Coast Watershed Studies Program at CSUMB studied salinity in the Tembladero Slough on several days in November 2010 and again in November 2014. Calendar year 2010 was a wet year, and also the first year that the Salinas River Diversion Facility (SRDF) was in operation. Releases from San Antonio and Nacimiento Reservoirs were increased for rediversion at the SRDF, and while the facility was operating a minimum of 2 cfs was released to the Salinas Lagoon, which is tributary to the Old Salinas River Channel. In 2010, the lagoon opened to the ocean on December 25 (after the 2010 sampling period was completed), and stayed open until September 21, 2011. Conversely, the 2014 sampling period came at the end of an extended drought, with record low rainfall during the period 2012-2014. The Salinas River Lagoon was last open to the ocean on January 27, 2013. The SRDF was not operated during the summer of 2014, so there were no upstream reservoir releases augmenting flows into the lagoon and the Old Salinas River.

The 2010 study found salinities at the lower end of the Tembladero Slough ranging from 1 to 15 parts per thousand (ppt). In 2014, salinities at that location ranged from 1 to 20 ppt. Seawater has salinity of about 35 ppt, so while there was a definite increase in salinity due to the prolonged drought, the Slough remained a brackish estuary. There were rainfall events during both the 2010 and 2014 sampling periods, and the post-rainfall sampling showed similar low salinities (under 1 ppt) in both years. The 2014 study extended the water sampling upstream into the Reclamation Ditch, and found that increased salinity extended as far upstream as Haro Road in Castroville, and that the halocline ended downstream of the town (salinity levels were uniform across the depth of the channel).

The Proposed Project will divert up to 80% of the available flows from the Reclamation Ditch/Tembladero Slough in the summer months (June to October), which may result in increased salinity near the water surface, and/or longer periods of salinity accumulation in the Tembladero Slough before seasonal flushing by winter runoff. Diversions from the Reclamation Ditch and Tembladero Slough would be most needed by the Project during dry years when irrigation demands are highest. Due to the tidal influence, water levels in the Slough would not be noticeably affected by the project, so wetland species would not see a loss of wetted habitat, only an increase in the duration of periods of higher salinity.

## Section 5 - Hydrology Considerations

The California Environmental Quality Act (CEQA) requires that effects of the Proposed Project on surface water hydrology be analyzed to identify impacts in the following areas:

a. Would the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on- or off-site?

The diversion of flows from the Reclamation Ditch and Tembladero Slough may reduce the amount of sediment carried into the Old Salinas River and Moss Landing Harbor, but this reduction will be small. When diverting summer flows, the channel velocities and suspended sediment loads are low. Erosion and sediment transport occur during peak flows during and after rainfall events. These diversions may not be required to operate during wet winter months when storm runoff typically occurs. In that case, the conveyance of sediment from the Reclamation Ditch/Tembladero Slough into the Old Salinas River will be no greater than under the current condition.

The channel around the inlet structure for the diversion pump station would be lined with concrete to prevent local scour and erosion. The construction of the diversion structures and pipelines will require open-cut excavation, which will require the use of erosion and sediment controls to prevent the migration of sediments into the river. The Castroville diversion structure may require a temporary cofferdam to facilitate construction of the inlet structure.

b. Would the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site?

The proposed project components would increase impervious areas by a small amount (less than 1000 square feet each) at the Davis Road and Castroville sites. The Project would not substantially alter the existing drainage patterns of any of the proposed project sites.

c. Would the project create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?

The Project would add pump stations along the Reclamation Ditch at Davis Road and along the Tembladero Slough in Castroville. Up to 1,000 sq-ft of impervious surface may be added at each site, and runoff from the new hardscape would be directed to the existing drainage channels. The soils at these sites are Type C (runoff coefficient >80), so the increase in runoff will be small and within the available existing drainage system conveyance capacity. No impact is expected under this criterion.

d. Would the project place within a 100-year flood hazard area structures that would impede or redirect flood flows?

The proposed diversion pump stations at Davis Road and Castroville will include inlet structures in the channel bottom. These inlets must include a screen to exclude fish and trash, and must be configured to not alter the conveyance capacity of the Reclamation Ditch / Tembladero Slough.

Structures on the channel bank would be located within a 100-year flood hazard area, but will not impede or reduce flood flows because they are relatively small (less than 100 square feet) and would be located at sites that currently contain other above-ground structures of much larger size and profile, most notably the roadway bridge abutments immediately upstream.

**Appendix A: Figures**

Figure A-1: Reclamation District No. 1665
Figure A-2: Reclamation Ditch Watershed and Zone 9 Boundary
Figure A-3: Salinas Valley Groundwater Basin, Hydrologic Subareas
Figure A-4: Reclamation Ditch Sub-Watersheds and Areas Table
Figure A-5: Salinas Sanitary Sewer System
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Figure A-8: FEMA FIRMette, Castroville Pump Station w/FEMA Zone Definitions
Figure A-9: CCAMP/CMP Water Quality Sampling Sites

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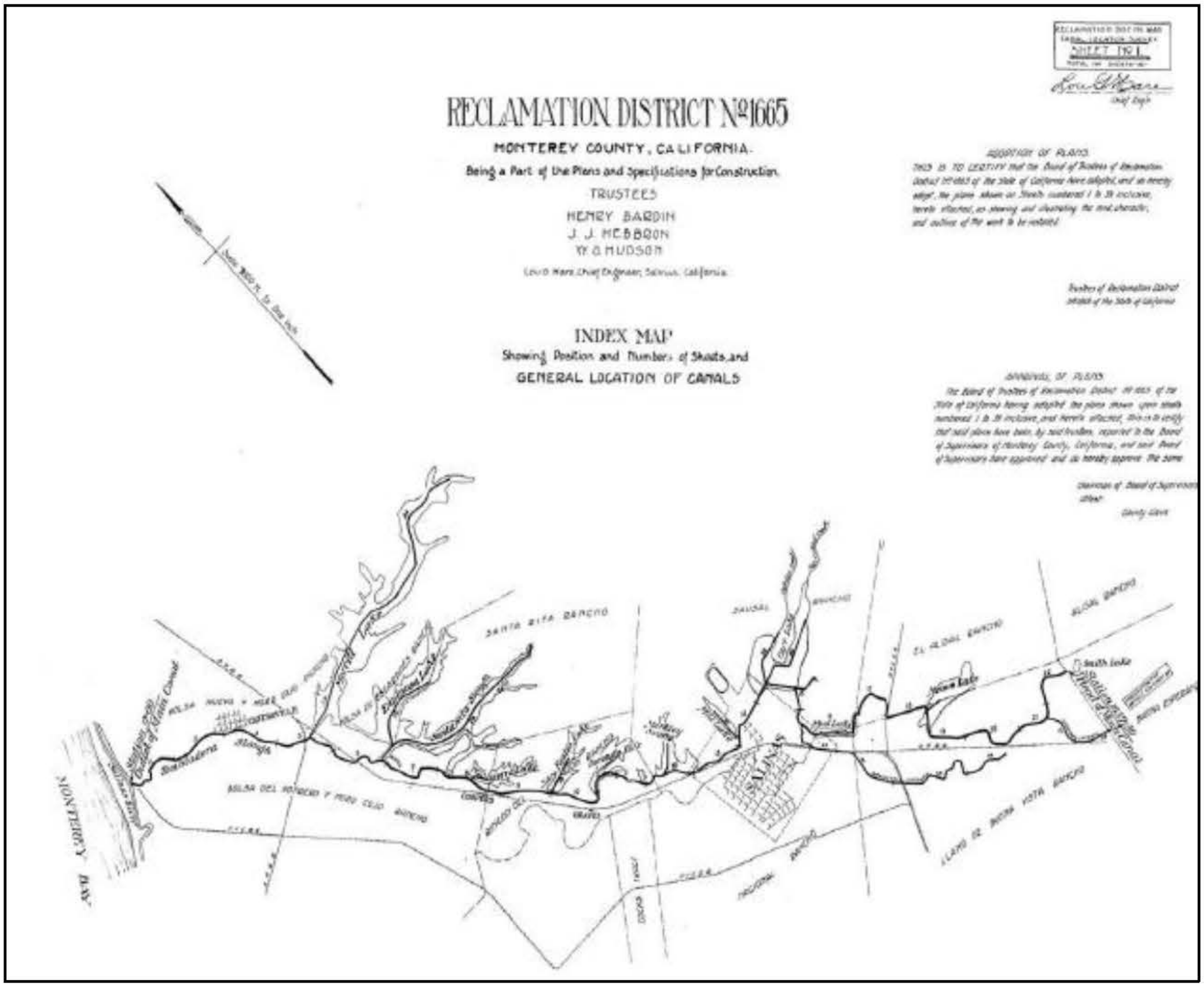



**Figure A-1: Reclamation District No. 1665**

Source: Reclamation Ditch Watershed Assessment and Management Strategy, The Watershed Institute, CSUMB, 2004

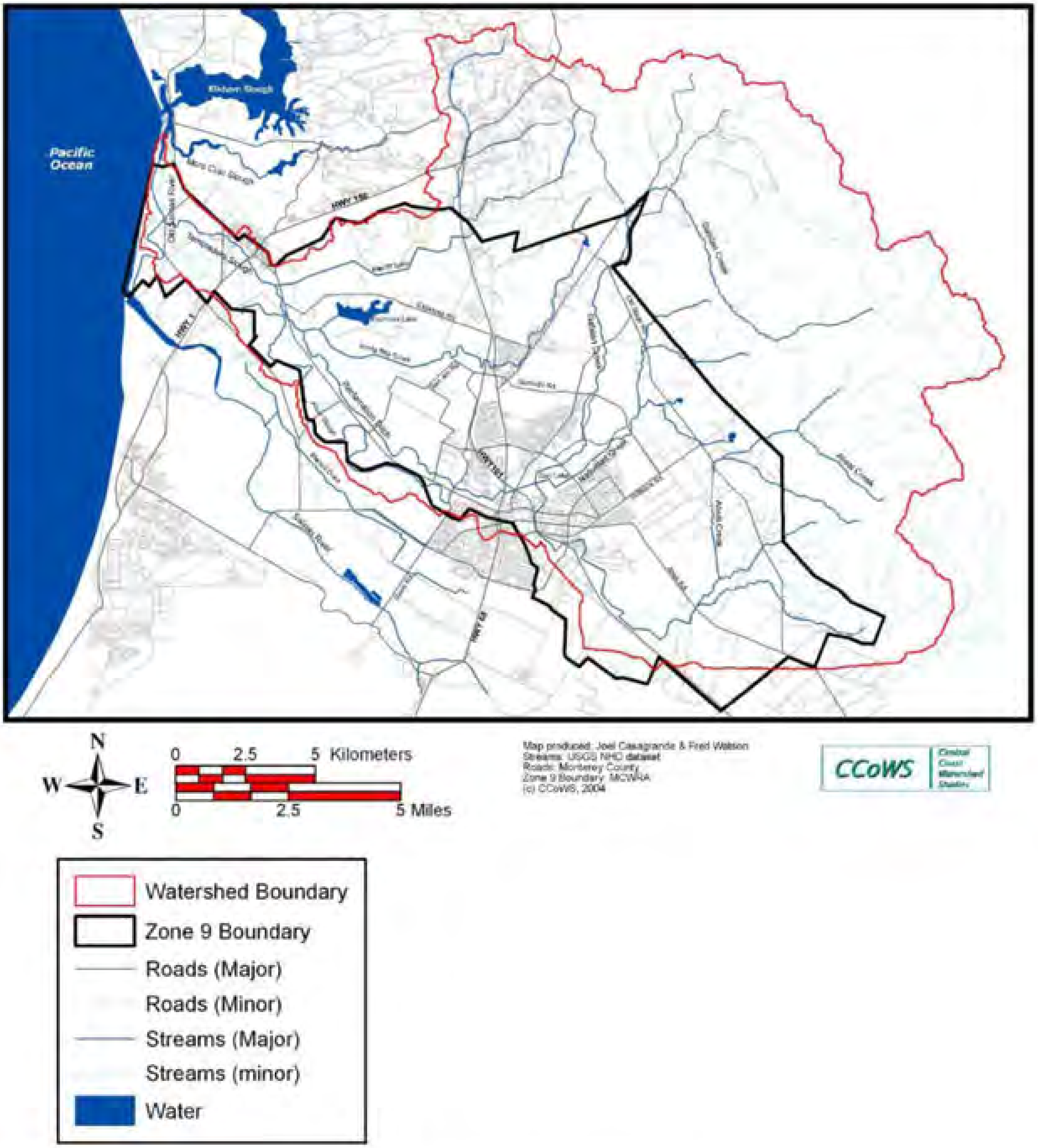



**Figure A-2: Reclamation Ditch Watershed and Zone 9 Boundary**

Source: Reclamation Ditch Watershed Assessment and Management Strategy, The Watershed Institute, CSUMB, 2004


**Figure A-3: Salinas Valley Groundwater Basin, Hydrologic Subareas**

Source: MCWRA Annual Groundwater Report

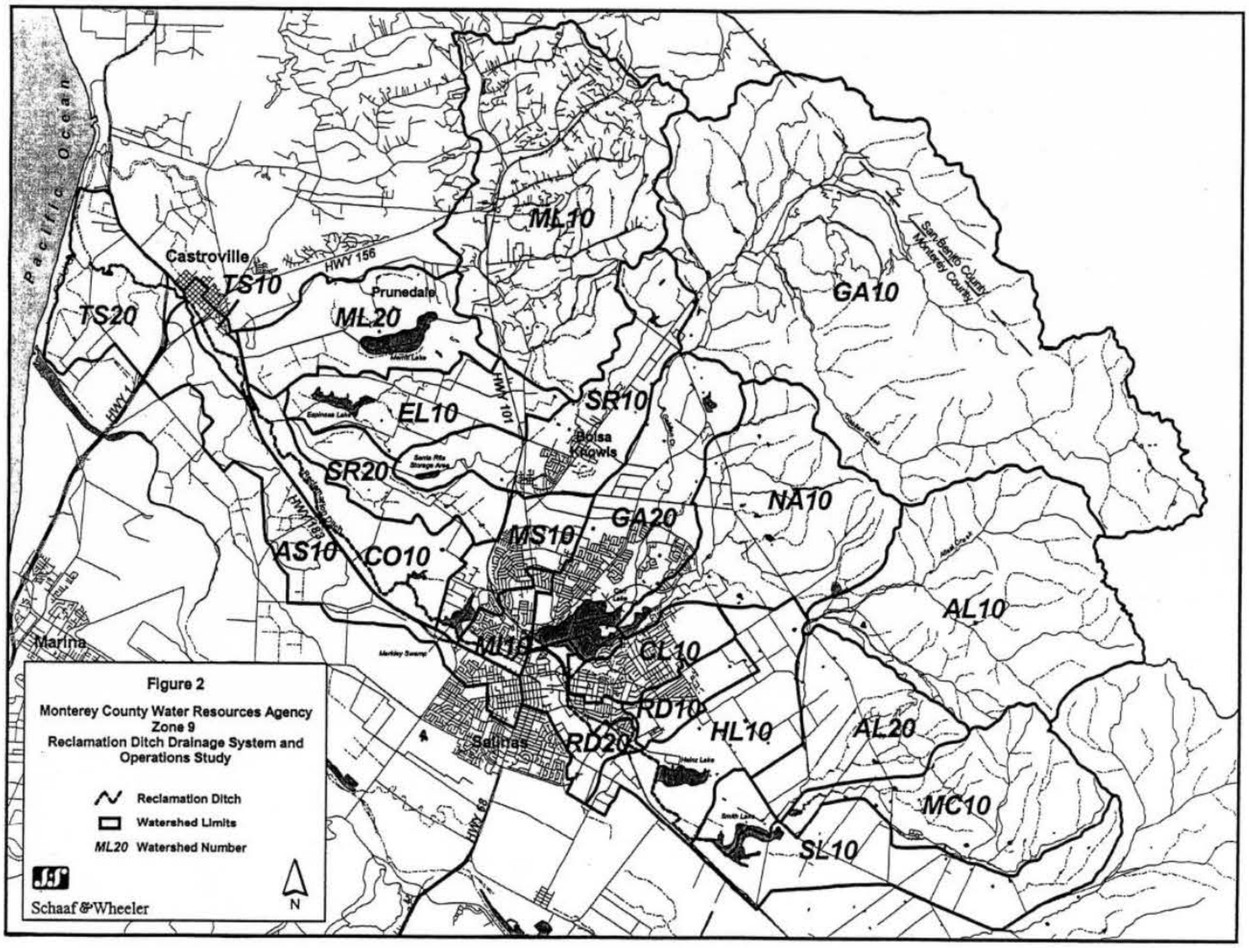



**Figure A-4: Reclamation Ditch Sub-Watersheds and Areas Table**

Areas Table on following page

Source: Zone 9 and Reclamation Ditch Operations Study, Schaaf & Wheeler, 1999

Figure A-4 (Continued)

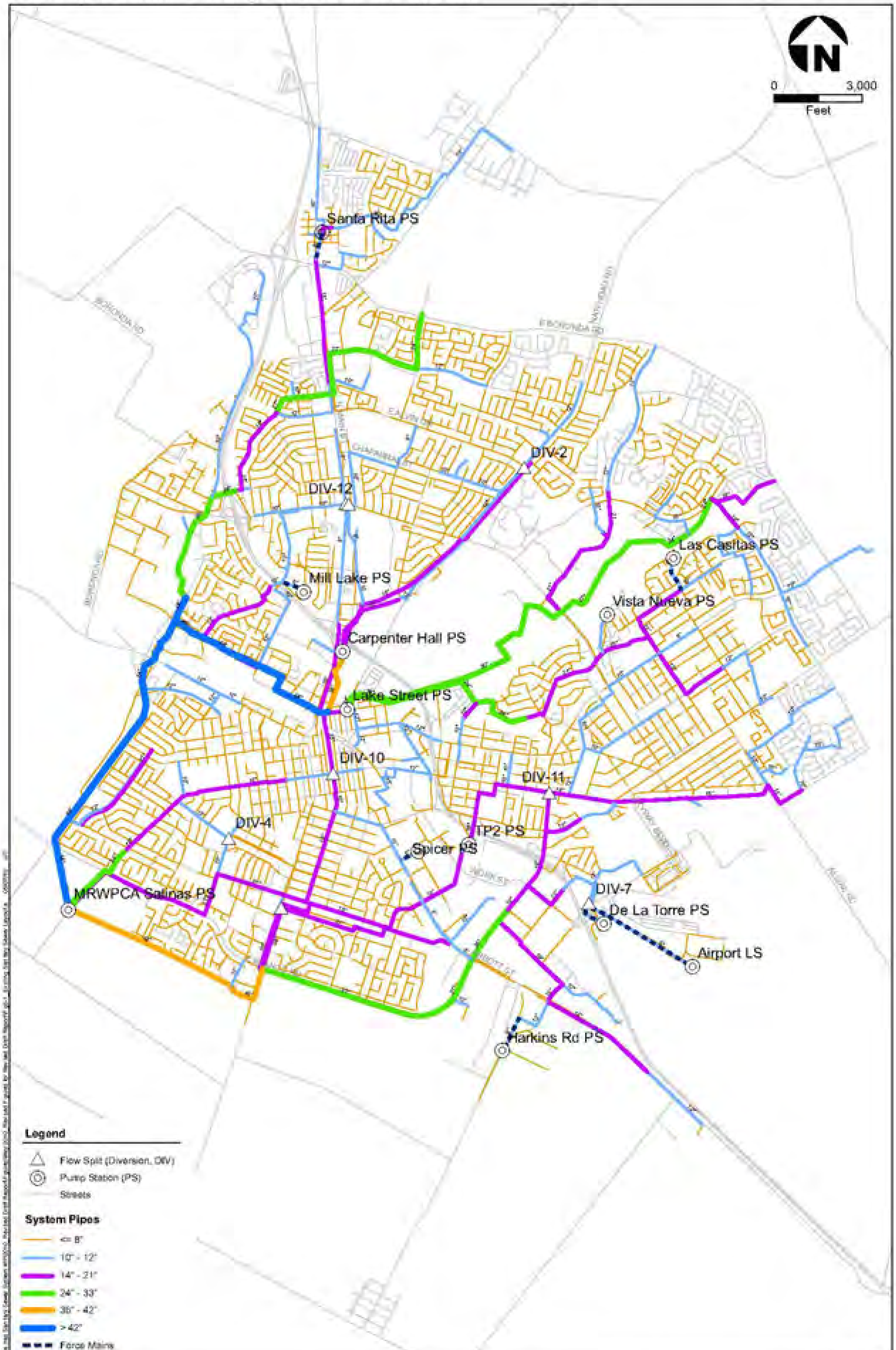
| BASIN | AREA sq-mi | USGS Gage San Jon Road | | Diversion Point 1 Davis Road | | Diversion Point 2 Castroville PS | |
|---|---|---|---|---|---|---|---|
| AL10 | 14.4 | GA10 | 36.7 | GA10 | 36.7 | AL10 | 14.4 |
| AL20 | 5.45 | GA20 | 7.9 | GA20 | 7.9 | AL20 | 5.45 |
| AS10 | 5.94 | MI10 | 1.26 | MI10 | 1.26 | AS10 | 5.94 |
| CL10 | 2.39 | RD20 | 2.17 | RD20 | 2.17 | CL10 | 2.39 |
| CO10 | 3.98 | RD10 | 1.57 | RD10 | 1.57 | CO10 | 3.98 |
| EL10 | 4.35 | CL10 | 2.39 | CL10 | 2.39 | EL10 | 4.35 |
| GA10 | 36.7 | NA10 | 9.82 | NA10 | 9.82 | GA10 | 36.7 |
| GA20 | 7.9 | AL10 | 14.4 | AL10 | 14.4 | GA20 | 7.9 |
| HL10 | 5.79 | AL20 | 5.45 | AL20 | 5.45 | HL10 | 5.79 |
| MC10 | 7.27 | HL10 | 5.79 | HL10 | 5.79 | MC10 | 7.27 |
| MI10 | 1.26 | MC10 | 7.27 | MC10 | 7.27 | MI10 | 1.26 |
| ML10 | 16.87 | SL10 | 7.76 | SL10 | 7.76 | ML10 | 16.87 |
| ML20 | 5.62 | CO10 | 3.98 | | | ML20 | 5.62 |
| MS10 | 2.9 | MS10 | 2.9 | | | MS10 | 2.9 |
| NA10 | 9.82 | | | | | NA10 | 9.82 |
| RD10 | 1.57 | | | | | RD10 | 1.57 |
| RD20 | 2.17 | | | | | RD20 | 2.17 |
| SL10 | 7.76 | | | | | SL10 | 7.76 |
| SR10 | 6.73 | | | | | SR10 | 6.73 |
| SR20 | 3.03 | | | | | SR20 | 3.03 |
| TS10 | 0.841 | | | | | TS10 | 0.841 |
| TS20 | 4.23 | | | | | | |
| TOTAL | 156.971 | TOTAL | 109.360 | TOTAL | 102.480 | TOTAL | 152.741 |

Source: Annex B-3 of Reclamation Ditch Zone 9 System Operations Study

Scaling Factors:

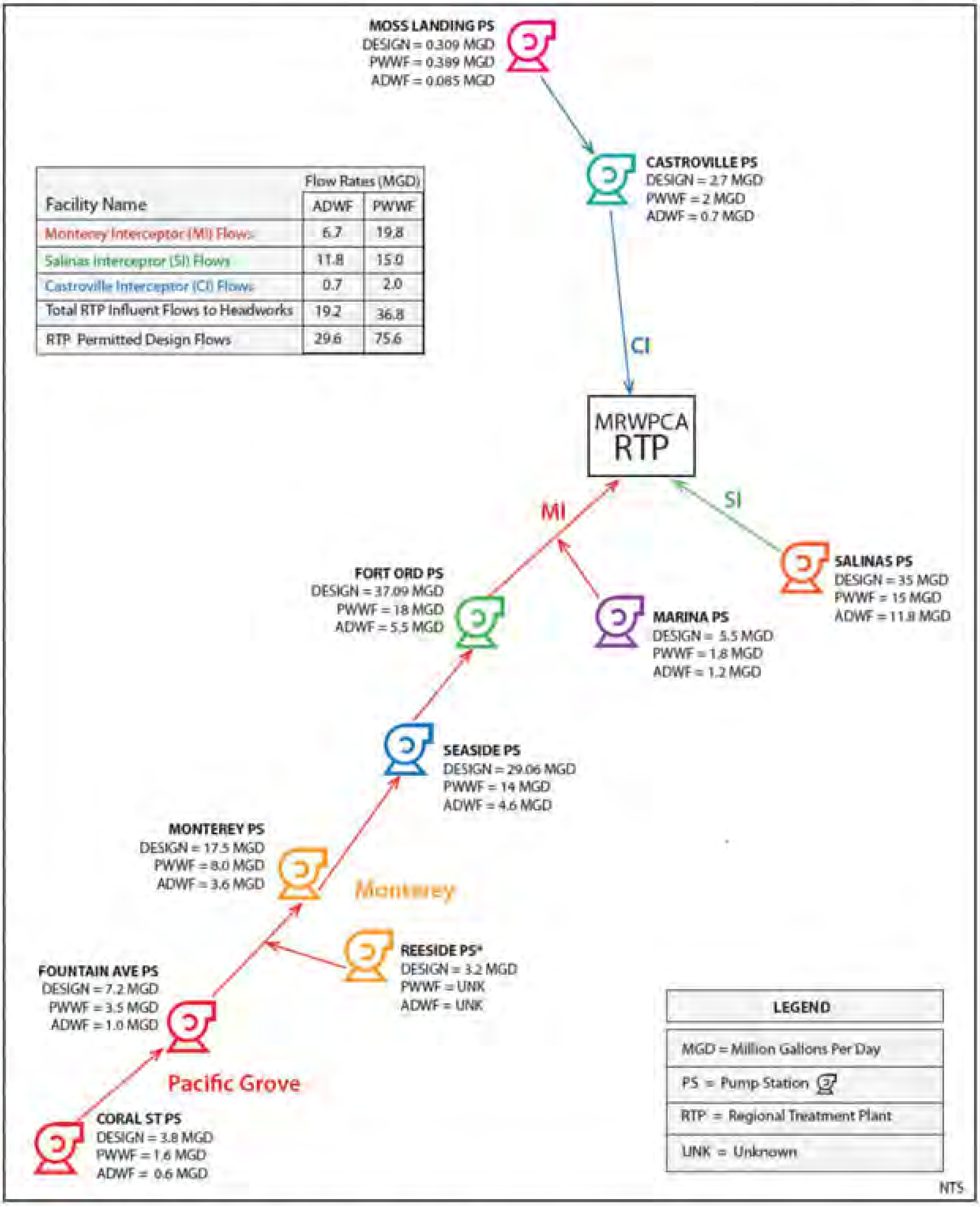
| | |
|---|---|
| USGS Gage to Davis Rd: | 0.94 |
| USGS Gage to Castroville PS: | 1.40 |
| USGS Gage to Full Basin: | 1.44 |

Figure A-5: Salinas Sanitary Sewer System (CDM, 2004)




CDM

Figure 3-1
Existing Sanitary Sewer System Layout
Salinas Sewer System Master Plan




| Facility Name | Flow Rates (MGD) | |
|---|---|---|
| | ADWF | PWWF |
| Monterey Interceptor (MI) Flows | 6.7 | 19.8 |
| Salinas Interceptor (SI) Flows | 11.8 | 15.0 |
| Castroville Interceptor (CI) Flows | 0.7 | 2.0 |
| Total RTP Influent Flows to Headworks | 19.2 | 36.8 |
| RTP Permitted Design Flows | 29.6 | 75.6 |

**Figure A-6: MRWPCA Interceptor System Schematic**

Source: Brezack and Associates Planners, September 2013

Figure A-7: FEMA FIRMette, Davis Road Pump Station

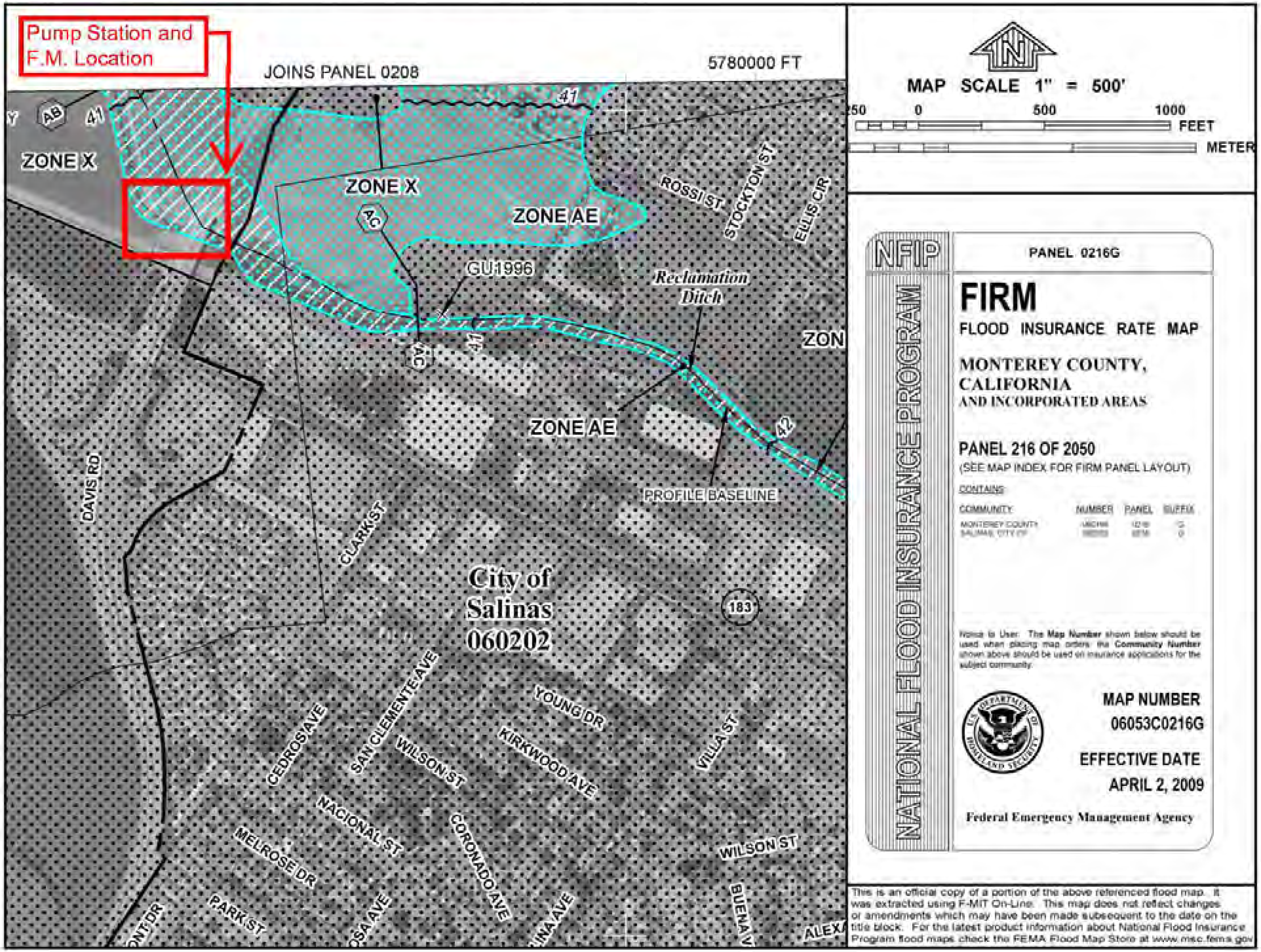


Figure A-8: FEMA FIRMette, Castroville Pump Station

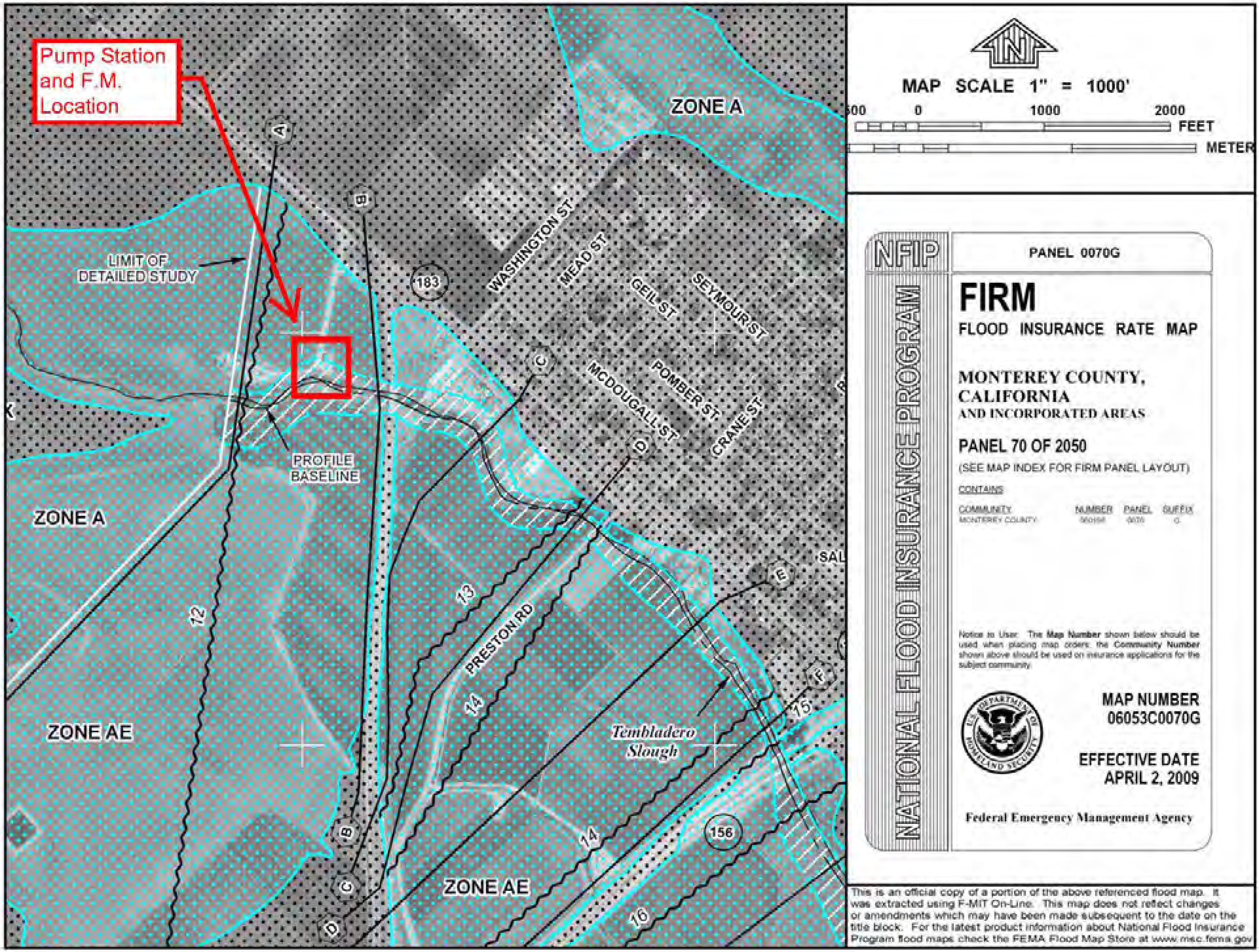


Figure A-8 (Continued)

## Definitions of FEMA Flood Zones

Flood zones are geographic areas that FEMA has defined according to varying levels of flood risk and type of flooding. These zones are depicted on the published Flood Insurance Rate Map (FIRM) or Flood Hazard Boundary Map (FHBM).

## Special Flood Hazard Areas – High Risk

Special Flood Hazard Areas represent the area subject to inundation by 1-percent-annual chance flood. Structures located within the SFHA have a 26-percent chance of flooding during the life of a standard 30-year mortgage. Federal floodplain management regulations and mandatory flood insurance purchase requirements apply in these zones.

| ZONE | DESCRIPTION |
|---|---|
| A | Areas subject to inundation by the 1-percent-annual-chance flood event. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown. |
| AE, A1-A30 | Areas subject to inundation by the 1-percent-annual-chance flood event determined by detailed methods. BFEs are shown within these zones. (Zone AE is used on new and revised maps in place of Zones A1–A30.) |
| AH | Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are 1–3 feet. BFEs derived from detailed hydraulic analyses are shown in this zone. |
| AO | Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are 1–3 feet. Average flood depths derived from detailed hydraulic analyses are shown within this zone. |
| AR | Areas that result from the decertification of a previously accredited flood protection system that is determined to be in the process of being restored to provide base flood protection. |
| A99 | Areas subject to inundation by the 1-percent-annual-chance flood event, but which will ultimately be protected upon completion of an under-construction Federal flood protection system. These are areas of special flood hazard where enough progress has been made on the construction of a protection system, such as dikes, dams, and levees, to consider it complete for insurance rating purposes. Zone A99 may be used only when the flood protection system has reached specified statutory progress toward completion. No BFEs or flood depths are shown. |

Figure A-8 (Continued)

## Coastal High Hazard Areas – High Risk

Coastal High Hazard Areas (CHHA) represent the area subject to inundation by 1-percent-annual chance flood, extending from offshore to the inland limit of a primary front al dune along an open coast and any other area subject to high velocity wave action from storms or seismic sources. Structures located within the CHHA have a 26-percent chance of flooding during the life of a standard 30-year mortgage. Federal floodplain management regulations and mandatory purchase requirements apply in these zones.

| ZONE | DESCRIPTION |
|---|---|
| V | Areas along coasts subject to inundation by the 1-percent-annual-chance flood event with additional hazards associated with storm-induced waves. Because detailed coastal analyses have not been performed, no BFEs or flood depths are shown. |
| VE, V1-V30 | Areas along coasts subject to inundation by the 1-percent-annual-chance flood event with additional hazards due to storm-induced velocity wave action. BFEs derived from detailed hydraulic coastal analyses are shown within these zones. (Zone VE is used on new and revised maps in place of Zones V1–V30.) |

## Moderate and Minimal Risk Areas

Areas of moderate or minimal hazard are studied based upon the principal source of flood in the area. However, buildings in these zones could be flooded by severe, concentrated rainfall coupled with inadequate local drainage systems. Local stormwater drainage systems are not normally considered in a community's flood insurance study. The failure of a local drainage system can create areas of high flood risk within these zones. Flood insurance is available in participating communities, but is not required by regulation in these zones. Nearly 25-percent of all flood claims filed are for structures located within these zones.

| ZONE | DESCRIPTION |
|---|---|
| B, X (shaded) | Moderate risk areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-annual-chance flood by a levee. No BFEs or base flood depths are shown within these zones. (Zone X (shaded) is used on new and revised maps in place of Zone B.) |
| C, X (unshaded) | Minimal risk areas outside the 1-percent and .2-percent-annual-chance floodplains. No BFEs or base flood depths are shown within these zones. (Zone X (unshaded) is used on new and revised maps in place of Zone C.) |

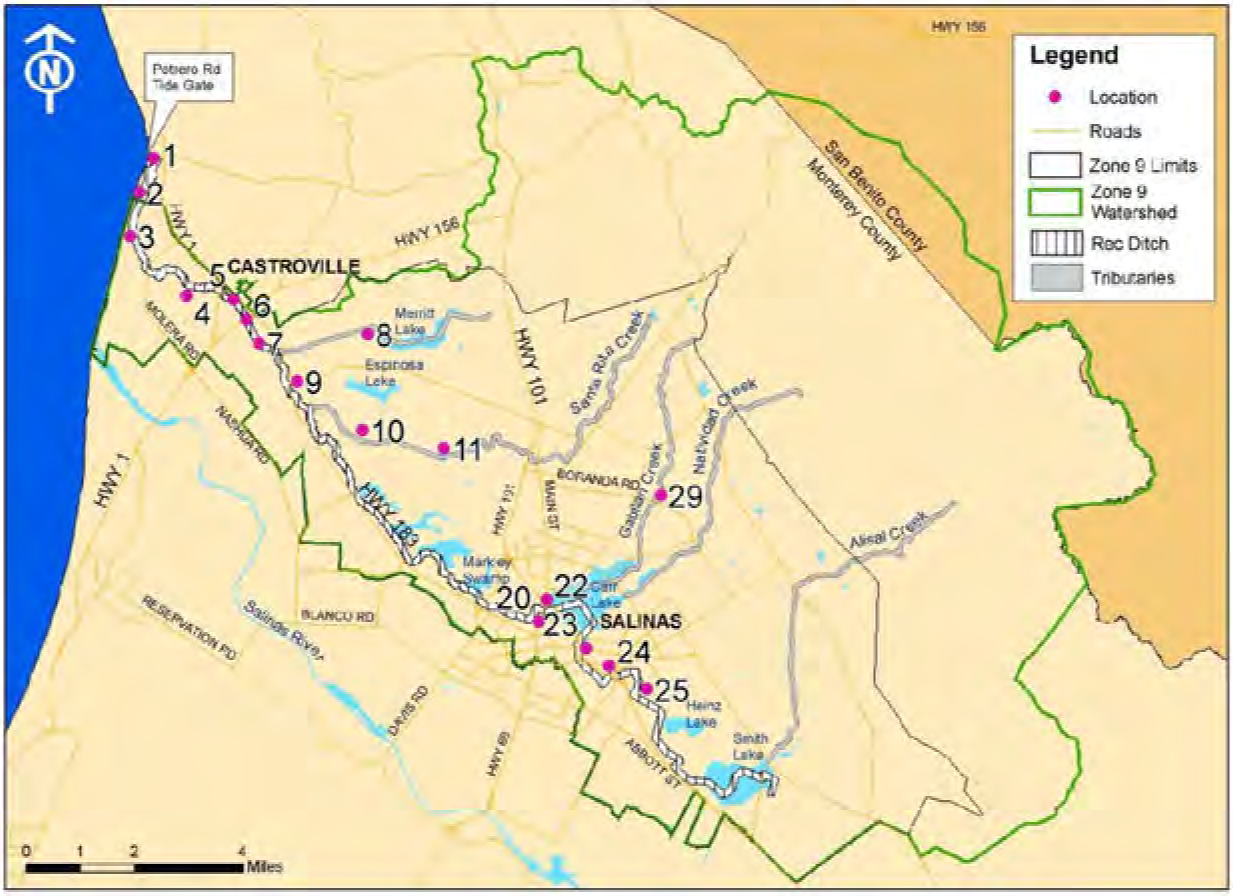
## Undetermined Risk Areas

| ZONE | DESCRIPTION |
|---|---|
| D | Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities. |


| # | Site ID | Site Name |
|---|---|---|
| 1 | 306MOR | Moro Cojo Slough @ Highway 1 |
| 2 | 309OLD | Old Salinas River @ Monterey Dunes Way |
| 3 | 309TEH | Tembladero Slough @ Haro |
| 4 | 309MER | Merrit Ditch u/s of 183 |
| 5 | 309ESP | Espinosa Slough u/s of Alisal Slough |
| 6 | 309ASB | Alisal Slough @ White Barn |
| 7 | 309BLA | Lower Salinas River/Blanco? |
| 8 | 309JON | Lower Salinas River |
| 9 | 309GAB | Gabilan Creek @ Independence Road and East Boranda Road |
| 10 | 309NAT | Natividad Creek? |
| 11 | 309ALG | Alisal Creek? |
| 12 | 309SSP | Salinas River @ El Toro Creek |
| 13 | 309QUI | Quail Creek |
| 14 | 309SAC | Salinas River @ Chualar bridge on River Road |
| 15 | 309CRR | Chualar Creek |
| 36 | 309GRN | Salinas River @ Elm Rd in Greenfield |
| 37 | 309SAG | Salinas River @ Gonzales River Rd Bridge |

**Figure A-9: CCAMP/CMP Water Sampling Sites**

Source: Central Coast Region Conditional Waiver Cooperative Monitoring Program, 5 Year Evaluation Report, Larry Walker & Associates, 2010


Legend
Location
Roads
Zone 9 Limits
Zone 9 Watershed
Rec Ditch
Tributaries
Pebero Rd Tide Gate
CASTROVILLE
SALINAS
HWY 156
HWY 1
HWY 101
HWY 183
HWY 68
MAIN ST
BORONDA RD
MOLERA RD
NASHUA RD
BLANCO RD
RESERVATION RD
DAVIS RD
ABBOTT ST
Merritt Lake
Espinosa Lake
Markey Swamp
Carr Lake
Heinz Lake
Smith Lake
Santa Rita Creek
Natividad Creek
Gabilan Creek
Alisal Creek
Salinas River
San Benito County
Monterey County
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11
20
22
23
24
25
29
0 1 2 4 Miles

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**Appendix B: Tables**

Table B-1: 2010 California 303(d) Listing
Table B-2: Average Monthly Flows (cfs), Reclamation Ditch and Tembladero Slough
Table B-3: Average Monthly Flows (AF), Reclamation Ditch and Tembladero Slough
Table B-4: Average Monthly Yields, Reclamation Ditch at Davis Road
Table B-5: Average Monthly Yields, Tembladero Slough at Castroville
Table B-6: Average Monthly Yields, Diverting at both Davis Road and Castroville
Table B-7: In-Stream Flows Comparison, 6 cfs Diversion Target, 1 cfs Bypass
Table B-8: In-Stream Flows Comparison, 6 cfs Diversion Target, 2 cfs Bypass
Table B-9: Water Rights Database GIS Capture, PODs near Salinas
Table B-10: Surface Water Rights and Claims in the Reclamation Ditch Basin
Table B-11: Identified Uses of Inland Surface Waters, Lower Salinas Hydrologic Unit (Extract from CC RWQCB 2011 Basin Plan)
Table B-12: Stream Water Quality, Reclamation Ditch Watershed
Table B-13: Total Maximum Daily Loads

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**Table B-1: 2010 California 303(d) Listing**

| Listed for: | Ammonia (Unionized) | Chlordane | Chloride | Chlorophyll-a | Chlorpyrifos | Copper | DDD (Dichlorodiphenyldichloroethane) | Diazinon | Dieldrin | Electrical Conductivity | Enterococcus | Escherichia coli (E. coli) | Fecal Coliform | Low Dissolved Oxygen | Nickel | Nitrate | Nutrients | Pathogens | PCBs (Polychlorinated biphenyls) | Pesticides | pH | Priority Organics | Sediment Toxicity | Sedimentation/Siltation | Sodium | Temperature, water | Total Coliform | Total Dissolved Solids | Toxaphene | Turbidity | Unknown Toxicity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Water Body** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Alisal Creek (Monterey County) | | | | X | | | | | | | | | X | | | X | | | | | | | | | X | | | | | | |
| Alisal Slough (Monterey County) | | | | | | | | | | | | | | X | | X | | | | | | | X | | | | | | | | X |
| Blanco Drain | | | | | X | | | X | | | | | | X | | X | | | | X | | | | | | | | | | X | |
| Espinosa Lake | | | | | X | | | X | | | | | | | | | | | | | | | | | | | | | | | |
| Espinosa Slough | X | | | | | | | X | | | | | | | | X | | | | X | X | X | X | | | | | | | X | X |
| Gabilan Creek | X | | | | | | | | | | | | X | | | X | | | | | X | | X | | | | | | | X | X |
| Merrit Ditch | X | | | | | | | | | | | | | X | | X | | | | | | | X | | | | | | | X | X |
| Moss Landing Harbor | | | | | X | | | X | | | | | | X | X | | | X | | X | X | | X | X | | | | | | | |
| Natividad Creek | X | | | | | | | | | | | X | | X | | X | | | | | X | | X | | | X | | | | X | X |
| Old Salinas River | | | | X | X | | | X | | | | X | X | X | | X | | | | | X | | X | | | | | | | X | X |
| Old Salinas River Estuary | | | | | | | | | | | | | | | | | X | | | X | | | | | | | | | | | |
| **Salinas Reclamation Canal** | **X** | | | | **X** | **X** | | **X** | | | | **X** | **X** | **X** | | **X** | | | | **X** | **X** | **X** | **X** | | | | | | | **X** | **X** |
| Salinas River (lower, estuary to near Gonzales Rd crossing, watersheds 30910 and 30920) | | X | X | | X | | X | X | X | X | X | X | X | | | X | | | X | X | X | | | | X | | | X | X | X | X |
| Salinas River Lagoon (North) | | | | | | | | | | | | | | | | | X | | | X | | | | | | | | | | | |
| Santa Rita Creek (Monterey County) | X | | | | | | | | | | | X | X | X | | X | | | | | | | | | X | | | | | X | |
| Tembladero Slough | | | | X | X | | | X | | | X | X | X | | | X | X | | | X | X | | X | | | | X | | | X | X |

**Table B-2: Reclamation Ditch - Scaled Flows at Davis Road and at Castroville Pump Station (Tembladero Slough)**

Average flow at Davis Rd. (CFS)

| Rec Ditch CFS | Month | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | Grand Total |
| 2002 | | | | | | 1.07 | 1.20 | 1.66 | 1.86 | 1.57 | 7.58 | 31.94 | 6.74 |
| 2003 | 11.41 | 5.35 | 5.65 | 8.45 | 2.41 | 1.85 | 1.21 | 0.87 | 1.45 | 0.77 | 2.74 | 22.74 | 5.43 |
| 2004 | 16.09 | 36.12 | 6.02 | 3.02 | 2.59 | 3.36 | 2.76 | 2.90 | 2.25 | 13.94 | 1.92 | 28.29 | 9.88 |
| 2005 | 43.90 | 31.60 | 55.20 | 15.46 | 7.01 | 5.43 | 5.20 | 3.72 | 2.98 | 2.84 | 3.00 | 16.61 | 16.05 |
| 2006 | 28.44 | 4.07 | 46.57 | 63.64 | 8.07 | 4.87 | 4.64 | 3.74 | 3.16 | 2.10 | 6.60 | 12.52 | 15.75 |
| 2007 | 4.40 | 16.76 | 4.53 | 5.97 | 4.39 | 3.40 | 3.34 | 3.50 | 3.21 | 3.87 | 2.42 | 5.80 | 5.05 |
| 2008 | 34.77 | 26.54 | 2.45 | 3.03 | 2.31 | 1.89 | 1.84 | 2.07 | 1.64 | 1.60 | 4.32 | 14.31 | 7.98 |
| 2009 | 7.56 | 36.14 | 16.59 | 3.16 | 3.45 | 1.19 | 2.51 | 2.87 | 1.87 | 12.82 | 0.82 | 7.11 | 7.84 |
| 2010 | 34.38 | 27.26 | 40.61 | 27.21 | 5.25 | 3.69 | 3.67 | 3.00 | 1.98 | 2.70 | 11.34 | 22.34 | 15.23 |
| 2011 | 18.43 | 30.57 | 70.99 | 8.86 | 4.88 | 4.30 | 3.48 | 2.72 | 2.14 | 7.30 | 7.21 | 1.17 | 13.45 |
| 2012 | 9.62 | 3.16 | 16.74 | 15.99 | 2.23 | 2.93 | 2.19 | 3.38 | 1.35 | 1.47 | 9.14 | 42.87 | 9.31 |
| 2013 | 14.31 | 3.40 | 2.51 | 1.95 | 1.43 | 1.37 | 1.46 | 1.53 | 1.01 | 0.90 | 1.32 | 1.29 | 2.71 |
| 2014 | 1.31 | 12.52 | 9.91 | 4.31 | 1.16 | 1.15 | 1.25 | | | | | | 4.42 |
| **Grand Total** | **18.68** | **19.48** | **23.15** | **13.42** | **3.76** | **2.81** | **2.67** | **2.66** | **2.07** | **4.32** | **4.87** | **17.25** | **9.47** |
| | | | | | | | | | | | | | |
| Average | 18.7 | 19.5 | 23.1 | 13.4 | 3.8 | 2.8 | 2.7 | 2.7 | 2.1 | 4.3 | 4.9 | 17.2 | 9.2 |
| Minimum | 1.3 | 3.2 | 2.5 | 1.9 | 1.2 | 1.1 | 1.2 | 0.9 | 1.0 | 0.8 | 0.8 | 1.2 | 2.7 |
| Maximum | 43.9 | 36.1 | 71.0 | 63.6 | 8.1 | 5.4 | 5.2 | 3.7 | 3.2 | 13.9 | 11.3 | 42.9 | 16.1 |

Scaled flow at Castroville (CFS)

| Tembladero CFS | Month | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | Grand Total |
| 2002 | | | | | | 1.22 | 1.28 | 1.51 | 1.61 | 1.46 | 9.66 | 45.65 | 8.98 |
| 2003 | 15.54 | 7.15 | 7.79 | 10.80 | 3.06 | 1.61 | 1.29 | 1.09 | 1.40 | 0.99 | 3.19 | 32.21 | 7.21 |
| 2004 | 22.83 | 52.03 | 7.89 | 3.49 | 3.26 | 2.61 | 2.06 | 2.17 | 1.80 | 18.72 | 2.09 | 41.29 | 13.26 |
| 2005 | 62.95 | 45.18 | 79.72 | 20.13 | 7.60 | 5.12 | 4.78 | 2.88 | 2.26 | 2.30 | 2.92 | 23.14 | 21.54 |
| 2006 | 40.19 | 5.15 | 66.61 | 92.11 | 9.24 | 4.29 | 3.95 | 2.74 | 2.45 | 1.78 | 8.05 | 17.19 | 21.22 |
| 2007 | 5.85 | 23.59 | 5.59 | 7.41 | 4.47 | 2.42 | 2.44 | 2.57 | 2.91 | 4.41 | 2.62 | 7.90 | 5.89 |
| 2008 | 48.41 | 37.68 | 3.32 | 3.60 | 3.05 | 1.62 | 1.67 | 1.71 | 1.50 | 1.71 | 5.17 | 19.77 | 10.70 |
| 2009 | 10.53 | 51.64 | 23.24 | 3.61 | 4.01 | 1.27 | 1.96 | 2.56 | 1.66 | 18.15 | 1.04 | 9.27 | 10.50 |
| 2010 | 49.60 | 39.09 | 57.75 | 38.12 | 6.00 | 2.81 | 2.78 | 2.22 | 1.67 | 2.55 | 15.37 | 31.75 | 20.73 |
| 2011 | 26.48 | 44.14 | 104.16 | 10.72 | 5.58 | 3.53 | 2.55 | 2.04 | 1.75 | 9.43 | 8.82 | 1.67 | 18.33 |
| 2012 | 13.78 | 4.27 | 23.61 | 22.51 | 2.94 | 2.49 | 1.77 | 2.68 | 1.36 | 1.54 | 12.40 | 61.65 | 12.66 |
| 2013 | 20.22 | 4.62 | 3.45 | 2.69 | 2.11 | 1.37 | 1.41 | 1.45 | 1.16 | 1.09 | 1.75 | 1.82 | 3.61 |
| 2014 | 1.88 | 17.46 | 13.90 | 5.75 | 1.73 | 1.26 | 1.30 | | | | | | 6.05 |
| **Grand Total** | **26.52** | **27.70** | **33.09** | **18.41** | **4.42** | **2.43** | **2.25** | **2.13** | **1.79** | **5.35** | **6.09** | **24.44** | **12.69** |
| | | | | | | | | | | | | | |
| Average | 26.5 | 27.7 | 33.1 | 18.4 | 4.4 | 2.4 | 2.2 | 2.1 | 1.8 | 5.3 | 6.1 | 24.4 | 12.4 |
| Minimum | 1.9 | 4.3 | 3.3 | 2.7 | 1.7 | 1.2 | 1.3 | 1.1 | 1.2 | 1.0 | 1.0 | 1.7 | 3.6 |
| Maximum | 63.0 | 52.0 | 104.2 | 92.1 | 9.2 | 5.1 | 4.8 | 2.9 | 2.9 | 18.7 | 15.4 | 61.7 | 21.5 |

USGS Gage at San Jon Rd (CFS)

| Avg Flow at Gage | Month | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | Grand Total |
| 2002 | | | | | | 1.14 | 1.28 | 1.77 | 1.98 | 1.68 | 8.09 | 34.08 | 7.19 |
| 2003 | 12.18 | 5.71 | 6.03 | 9.02 | 2.57 | 1.98 | 1.29 | 0.93 | 1.54 | 0.82 | 2.92 | 24.27 | 5.79 |
| 2004 | 17.17 | 38.55 | 6.42 | 3.23 | 2.76 | 3.59 | 2.95 | 3.09 | 2.40 | 14.87 | 2.05 | 30.19 | 10.54 |
| 2005 | 46.85 | 33.73 | 58.91 | 16.50 | 7.48 | 5.79 | 5.55 | 3.97 | 3.18 | 3.03 | 3.20 | 17.72 | 17.13 |
| 2006 | 30.35 | 4.34 | 49.70 | 67.92 | 8.61 | 5.20 | 4.95 | 3.99 | 3.37 | 2.24 | 7.04 | 13.36 | 16.81 |
| 2007 | 4.70 | 17.89 | 4.84 | 6.37 | 4.69 | 3.63 | 3.57 | 3.74 | 3.42 | 4.14 | 2.58 | 6.19 | 5.39 |
| 2008 | 36.57 | 28.33 | 2.62 | 3.23 | 2.46 | 2.02 | 1.96 | 2.21 | 1.75 | 1.71 | 4.61 | 15.27 | 8.51 |
| 2009 | 8.06 | 38.57 | 17.70 | 3.37 | 3.68 | 1.27 | 2.67 | 3.06 | 2.00 | 13.69 | 0.88 | 7.59 | 8.37 |
| 2010 | 36.69 | 29.10 | 43.34 | 29.04 | 5.60 | 3.94 | 3.91 | 3.21 | 2.11 | 2.88 | 12.10 | 23.84 | 16.26 |
| 2011 | 19.67 | 32.63 | 75.77 | 9.46 | 5.21 | 4.59 | 3.72 | 2.91 | 2.28 | 7.79 | 7.70 | 1.24 | 14.36 |
| 2012 | 10.27 | 3.37 | 17.86 | 17.07 | 2.38 | 3.13 | 2.34 | 3.61 | 1.44 | 1.57 | 9.76 | 45.75 | 9.94 |
| 2013 | 15.27 | 3.62 | 2.68 | 2.08 | 1.52 | 1.47 | 1.56 | 1.63 | 1.08 | 0.96 | 1.41 | 1.38 | 2.90 |
| 2014 | 1.40 | 13.37 | 10.57 | 4.60 | 1.23 | 1.23 | 1.33 | | | | | | 4.72 |
| **Grand Total** | **19.93** | **20.79** | **24.70** | **14.32** | **4.02** | **3.00** | **2.85** | **2.84** | **2.21** | **4.61** | **5.20** | **18.41** | **10.11** |
| | | | | | | | | | | | | | |
| Average | 19.9 | 20.8 | 24.7 | 14.3 | 4.0 | 3.0 | 2.9 | 2.8 | 2.2 | 4.6 | 5.2 | 18.4 | 9.8 |
| Minimum | 1.4 | 3.4 | 2.6 | 2.1 | 1.2 | 1.1 | 1.3 | 0.9 | 1.1 | 0.8 | 0.9 | 1.2 | 2.9 |
| Maximum | 46.8 | 38.6 | 75.8 | 67.9 | 8.6 | 5.8 | 5.5 | 4.0 | 3.4 | 14.9 | 12.1 | 45.8 | 17.1 |

**Table B-3: Reclamation Ditch - Scaled Flows at Davis Road and at Castroville Pump Station (Tembladero Slough)**

Scaled flow at Davis Rd. (AF/mo)

| Davis Rd | Month | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **Grand Total** |
| 2002 | | | | | | 63.5 | 73.7 | 101.9 | 110.6 | 96.5 | 451.1 | 1,963.7 | 2,861.0 |
| 2003 | 701.5 | 297.3 | 347.6 | 502.9 | 147.9 | 110.2 | 74.5 | 53.7 | 86.0 | 47.4 | 162.9 | 1,398.4 | 3,930.4 |
| 2004 | 989.3 | 2,077.6 | 370.0 | 179.9 | 159.3 | 200.2 | 169.7 | 178.2 | 133.8 | 857.0 | 114.3 | 1,739.6 | 7,168.9 |
| 2005 | 2,699.1 | 1,755.2 | 3,393.8 | 920.1 | 430.8 | 322.8 | 319.7 | 228.8 | 177.1 | 174.5 | 178.6 | 1,021.0 | 11,621.6 |
| 2006 | 1,748.5 | 226.0 | 2,863.4 | 3,786.9 | 496.2 | 289.9 | 285.5 | 229.7 | 187.9 | 129.0 | 392.7 | 769.6 | 11,405.3 |
| 2007 | 270.6 | 930.7 | 278.6 | 355.2 | 270.0 | 202.6 | 205.6 | 215.4 | 190.9 | 238.2 | 144.0 | 356.8 | 3,658.5 |
| 2008 | 2,106.9 | 1,526.8 | 150.9 | 180.3 | 141.8 | 112.4 | 112.9 | 127.1 | 97.4 | 98.3 | 257.3 | 879.9 | 5,792.0 |
| 2009 | 464.6 | 2,007.1 | 1,020.0 | 188.1 | 212.1 | 71.0 | 154.1 | 176.2 | 111.5 | 788.5 | 48.8 | 437.1 | 5,678.9 |
| 2010 | 2,114.1 | 1,514.1 | 2,497.1 | 1,619.0 | 322.8 | 219.9 | 225.4 | 184.7 | 117.6 | 166.7 | 674.9 | 1,373.6 | 11,029.4 |
| 2011 | 1,133.2 | 1,697.8 | 4,365.3 | 527.4 | 300.1 | 256.1 | 214.1 | 167.5 | 127.1 | 448.8 | 429.2 | 71.6 | 9,738.3 |
| 2012 | 591.8 | 181.5 | 1,029.2 | 951.7 | 137.0 | 174.3 | 134.7 | 207.8 | 80.1 | 90.2 | 543.9 | 2,636.1 | 6,758.5 |
| 2013 | 880.0 | 188.6 | 154.4 | 115.8 | 87.6 | 81.7 | 90.0 | 94.0 | 60.0 | 55.5 | 78.4 | 79.3 | 1,965.3 |
| 2014 | 80.6 | 695.6 | 609.1 | 256.5 | 71.1 | 68.6 | 76.8 | | | | | | 1,858.4 |
| **Grand Total** | **13,780.2** | **13,098.3** | **17,079.5** | **9,583.8** | **2,776.9** | **2,173.2** | **2,136.6** | **1,965.1** | **1,480.1** | **3,190.2** | **3,476.2** | **12,726.8** | **83,466.8** |
| | | | | | | | | | | | | | |
| Average | 1,148.4 | 1,091.5 | 1,423.3 | 798.6 | 231.4 | 167.2 | 164.4 | 163.8 | 123.3 | 265.9 | 289.7 | 1,060.6 | 6,420.5 |
| Minimum | 80.6 | 181.5 | 150.9 | 115.8 | 71.1 | 63.5 | 73.7 | 53.7 | 60.0 | 47.4 | 48.8 | 71.6 | 1,858.4 |
| Maximum | 2,699.1 | 2,077.6 | 4,365.3 | 3,786.9 | 496.2 | 322.8 | 319.7 | 229.7 | 190.9 | 857.0 | 674.9 | 2,636.1 | 11,621.6 |

Scaled flow at Castroville (AF/mo)

| Castroville | Month | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **Grand Total** |
| 2002 | | | | | | 72.4 | 78.9 | 92.8 | 95.7 | 90.1 | 574.7 | 2,807.0 | 3,811.5 |
| 2003 | 955.8 | 397.3 | 478.7 | 642.8 | 188.1 | 95.5 | 79.2 | 66.8 | 83.6 | 60.8 | 190.0 | 1,980.7 | 5,219.3 |
| 2004 | 1,403.9 | 2,992.6 | 485.3 | 207.9 | 200.7 | 155.3 | 126.9 | 133.7 | 107.2 | 1,150.8 | 124.6 | 2,538.8 | 9,627.6 |
| 2005 | 3,870.9 | 2,509.4 | 4,901.9 | 1,198.1 | 467.6 | 304.4 | 293.8 | 177.1 | 134.6 | 141.7 | 173.5 | 1,422.9 | 15,595.9 |
| 2006 | 2,471.0 | 285.8 | 4,095.6 | 5,481.0 | 568.3 | 255.3 | 242.7 | 168.6 | 145.7 | 109.6 | 479.1 | 1,057.2 | 15,359.9 |
| 2007 | 359.5 | 1,310.3 | 343.9 | 441.0 | 275.1 | 143.9 | 150.2 | 157.7 | 173.1 | 271.4 | 155.7 | 485.6 | 4,267.5 |
| 2008 | 2,976.8 | 2,167.2 | 204.0 | 214.0 | 187.3 | 96.6 | 102.4 | 105.2 | 89.2 | 105.4 | 307.4 | 1,215.3 | 7,770.9 |
| 2009 | 647.2 | 2,868.0 | 1,429.0 | 214.7 | 246.8 | 75.6 | 120.3 | 157.2 | 98.5 | 1,116.0 | 61.9 | 570.0 | 7,605.2 |
| 2010 | 3,049.6 | 2,171.0 | 3,551.1 | 2,268.4 | 368.8 | 167.5 | 171.0 | 136.7 | 99.2 | 156.8 | 914.4 | 1,952.2 | 15,006.6 |
| 2011 | 1,627.9 | 2,451.6 | 6,404.4 | 638.0 | 342.8 | 210.1 | 156.8 | 125.2 | 103.9 | 579.9 | 525.1 | 102.8 | 13,268.6 |
| 2012 | 847.1 | 245.6 | 1,451.4 | 1,339.4 | 180.6 | 148.2 | 109.0 | 164.6 | 80.6 | 94.5 | 737.8 | 3,790.9 | 9,189.7 |
| 2013 | 1,243.1 | 256.3 | 212.0 | 160.0 | 129.8 | 81.4 | 86.9 | 88.9 | 68.9 | 67.1 | 104.0 | 111.7 | 2,610.2 |
| 2014 | 115.8 | 969.9 | 854.8 | 342.3 | 106.3 | 75.0 | 80.2 | | | | | | 2,544.3 |
| **Grand Total** | **19,568.6** | **18,625.0** | **24,412.2** | **13,147.7** | **3,262.2** | **1,881.2** | **1,798.2** | **1,574.4** | **1,280.2** | **3,944.0** | **4,348.2** | **18,035.2** | **111,877.1** |
| | | | | | | | | | | | | | |
| Average | 1,630.7 | 1,552.1 | 2,034.4 | 1,095.6 | 271.8 | 144.7 | 138.3 | 131.2 | 106.7 | 328.7 | 362.4 | 1,502.9 | 8,605.9 |
| Minimum | 115.8 | 245.6 | 204.0 | 160.0 | 106.3 | 72.4 | 78.9 | 66.8 | 68.9 | 60.8 | 61.9 | 102.8 | 2,544.3 |
| Maximum | 3,870.9 | 2,992.6 | 6,404.4 | 5,481.0 | 568.3 | 304.4 | 293.8 | 177.1 | 173.1 | 1,150.8 | 914.4 | 3,790.9 | 15,595.9 |

USGS Gage at San Jon Rd (AF/mo)

| Flow at Gage | Month | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **Grand Total** |
| 2002 | | | | | | 67.8 | 78.7 | 108.7 | 118.0 | 103.0 | 481.4 | 2,095.7 | 3,053.4 |
| 2003 | 748.7 | 317.3 | 371.0 | 536.7 | 157.9 | 117.6 | 79.5 | 57.4 | 91.8 | 50.6 | 173.8 | 1,492.4 | 4,194.7 |
| 2004 | 1,055.8 | 2,217.3 | 394.9 | 192.0 | 170.0 | 213.6 | 181.1 | 190.2 | 142.8 | 914.6 | 122.0 | 1,856.6 | 7,650.9 |
| 2005 | 2,880.6 | 1,873.2 | 3,622.0 | 982.0 | 459.8 | 344.5 | 341.2 | 244.2 | 189.0 | 186.2 | 190.6 | 1,089.7 | 12,403.0 |
| 2006 | 1,866.0 | 241.2 | 3,055.9 | 4,041.5 | 529.6 | 309.4 | 304.7 | 245.2 | 200.5 | 137.7 | 419.1 | 821.4 | 12,172.2 |
| 2007 | 288.8 | 993.3 | 297.3 | 379.0 | 288.2 | 216.2 | 219.4 | 229.9 | 203.7 | 254.3 | 153.6 | 380.7 | 3,904.5 |
| 2008 | 2,248.6 | 1,629.4 | 161.1 | 192.4 | 151.3 | 120.0 | 120.5 | 135.7 | 103.9 | 104.9 | 274.6 | 939.1 | 6,181.5 |
| 2009 | 495.8 | 2,142.0 | 1,088.5 | 200.7 | 226.3 | 75.8 | 164.4 | 188.0 | 119.0 | 841.5 | 52.1 | 466.5 | 6,060.8 |
| 2010 | 2,256.2 | 1,615.9 | 2,665.0 | 1,727.8 | 344.5 | 234.6 | 240.6 | 197.2 | 125.6 | 177.3 | 720.3 | 1,466.0 | 11,771.0 |
| 2011 | 1,209.4 | 1,811.9 | 4,658.8 | 562.9 | 320.3 | 273.3 | 228.5 | 178.7 | 135.7 | 479.0 | 458.1 | 76.5 | 10,393.1 |
| 2012 | 631.5 | 193.7 | 1,098.4 | 1,015.7 | 146.2 | 186.0 | 143.8 | 221.8 | 85.5 | 96.3 | 580.5 | 2,813.4 | 7,212.9 |
| 2013 | 939.2 | 201.3 | 164.8 | 123.6 | 93.5 | 87.2 | 96.0 | 100.4 | 64.0 | 59.2 | 83.7 | 84.7 | 2,097.5 |
| 2014 | 86.1 | 742.3 | 650.1 | 273.7 | 75.9 | 73.2 | 82.0 | | | | | | 1,983.4 |
| **Grand Total** | **14,706.7** | **13,978.9** | **18,227.8** | **10,228.2** | **2,963.6** | **2,319.3** | **2,280.3** | **2,097.2** | **1,579.6** | **3,404.7** | **3,709.9** | **13,582.5** | **89,078.7** |
| | | | | | | | | | | | | | |
| Average | 1,225.6 | 1,164.9 | 1,519.0 | 852.3 | 247.0 | 178.4 | 175.4 | 174.8 | 131.6 | 283.7 | 309.2 | 1,131.9 | 6,852.2 |
| Minimum | 86.1 | 193.7 | 161.1 | 123.6 | 75.9 | 67.8 | 78.7 | 57.4 | 64.0 | 50.6 | 52.1 | 76.5 | 1,983.4 |
| Maximum | 2,880.6 | 2,217.3 | 4,658.8 | 4,041.5 | 529.6 | 344.5 | 341.2 | 245.2 | 203.7 | 914.6 | 720.3 | 2,813.4 | 12,403.0 |

**Table B-4, Average Monthly Yields, Reclamation Ditch at Davis Road**

| Reclamation Ditch at Davis Rd | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ac-ft | January | February | March | April | May | June | July | August | September | October | November | December | Total |
| Bypass 1 cfs, Max Diversion 1 cfs | 46.4 | 41.9 | 51.8 | 57.2 | 55.2 | 46.3 | 47.8 | 50.4 | 41.5 | 32.7 | 30.5 | 39.5 | 541.2 |
| Bypass 1 cfs, Max Diversion 2 cfs | 81.5 | 72.5 | 90.4 | 103.7 | 94.9 | 78.3 | 79.9 | 83.3 | 56.9 | 46.9 | 47.5 | 70.3 | 906.2 |
| Bypass 1 cfs, Max Diversion 2.9 cfs | 108.8 | 95.9 | 118.0 | 133.0 | 118.3 | 97.6 | 97.9 | 97.3 | 60.6 | 54.6 | 58.4 | 94.3 | 1134.7 |
| Bypass 1 cfs, Max Diversion 2.99 cfs | 111.3 | 98.1 | 120.6 | 135.5 | 120.2 | 99.0 | 99.1 | 97.9 | 60.8 | 55.3 | 59.4 | 96.6 | 1153.8 |
| Bypass 1 cfs, Max Diversion 3 cfs | 111.6 | 98.4 | 120.9 | 135.7 | 120.4 | 99.2 | 99.2 | 98.0 | 60.8 | 55.4 | 59.5 | 96.8 | 1155.9 |
| Bypass 1 cfs, Max Diversion 4 cfs | 139.0 | 121.7 | 147.7 | 160.2 | 136.0 | 108.9 | 107.0 | 101.3 | 62.0 | 62.6 | 69.7 | 121.5 | 1337.5 |
| Bypass 1 cfs, Max Diversion 5 cfs | 163.9 | 143.7 | 172.2 | 181.8 | 144.8 | 112.7 | 109.2 | 102.1 | 62.4 | 68.2 | 78.1 | 144.8 | 1484.0 |
| Bypass 1 cfs, Max Diversion 6 cfs | 186.9 | 164.4 | 195.0 | 201.4 | 149.3 | 114.2 | 110.1 | 102.3 | 62.6 | 73.0 | 85.6 | 165.9 | 1610.6 |
| Bypass 1 cfs, Max Diversion 7 cfs | 208.5 | 184.4 | 216.5 | 219.1 | 152.5 | 114.8 | 110.4 | 102.5 | 62.8 | 77.1 | 92.6 | 185.8 | 1645.1 |
| Bypass 1 cfs, Max Diversion 8 cfs | 229.0 | 203.5 | 237.0 | 234.6 | 155.1 | 115.3 | 110.5 | 102.7 | 62.9 | 81.1 | 99.0 | 205.1 | 1747.4 |
| Bypass 2 cfs, Max Diversion 2.99 cfs | 92.4 | 79.7 | 95.6 | 102.8 | 80.6 | 62.5 | 59.1 | 50.9 | 20.5 | 29.9 | 39.1 | 81.7 | 794.7 |
| Bypass 2 cfs, Max Diversion 6 cfs | 162.1 | 142.6 | 164.6 | 161.9 | 97.3 | 68.5 | 62.6 | 52.1 | 21.2 | 44.4 | 62.1 | 146.3 | 1185.7 |
| Bypass 0.7 cfs, Max Diversion 2 cfs | 89.0 | 80.2 | 98.1 | 109.5 | 103.1 | 86.8 | 89.7 | 93.0 | 71.3 | 59.0 | 57.1 | 77.6 | 1014.3 |
| Bypass 0.7 cfs, Max Diversion 2.99 cfs | 120.4 | 107.0 | 130.5 | 145.1 | 132.4 | 111.5 | 113.3 | 113.5 | 77.6 | 68.5 | 70.5 | 105.3 | 1295.6 |
| Bypass 0.7 cfs, Max Diversion 6 cfs | 198.0 | 174.8 | 206.9 | 214.0 | 167.1 | 131.7 | 128.7 | 120.6 | 80.1 | 87.3 | 97.9 | 176.2 | 1783.2 |

Notes:
Assumed 1 cfs must be bypassed for environmental flows. 0.7 cfs bypass shown for comparison
Available PDWF capacity in Salinas gravity sewer estimated at 6 cfs. Assumes limiting pipe segment slope at 0.0003.
Does not account for future growth in Salinas. Per 2004 Salinas WWMP, this pipeline will approach full capacity at build-out.
Minimum flow in Reclamation Ditch occurs in September. Summer months carry irrigation return flows.

**Table B-5, Average Monthly Yields, Tembladero Slough at Castroville**

| Tembladero Slough at Castroville | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ac-ft | January | February | March | April | May | June | July | August | September | October | November | December | Total |
| Bypass 1 cfs, Max Diversion 2.2 cfs | 106.0 | 96.4 | 116.6 | 126.1 | 122.7 | 105.2 | 109.2 | 113.0 | 95.3 | 78.4 | 73.2 | 92.3 | 1234.5 |
| Bypass 1 cfs, Max Diversion 2.5 cfs | 117.0 | 106.2 | 129.1 | 141.5 | 136.0 | 115.5 | 119.7 | 124.2 | 101.5 | 83.5 | 78.9 | 102.1 | 1355.1 |
| Bypass 1 cfs, Max Diversion 2.9 cfs | 131.1 | 118.4 | 144.5 | 160.4 | 151.9 | 128.3 | 132.7 | 137.6 | 107.5 | 89.0 | 85.5 | 114.6 | 1501.7 |
| Bypass 1 cfs, Max Diversion 2.99 cfs | 134.2 | 121.0 | 147.8 | 164.3 | 155.3 | 131.1 | 135.4 | 140.4 | 108.6 | 90.1 | 86.9 | 117.2 | 1532.5 |
| Bypass 1 cfs, Max Diversion 3 cfs | 134.6 | 121.3 | 148.2 | 164.8 | 155.6 | 131.4 | 135.7 | 140.7 | 108.8 | 90.2 | 87.1 | 117.5 | 1535.9 |
| Bypass 1 cfs, Max Diversion 3.5 cfs | 151.1 | 135.4 | 165.7 | 185.1 | 172.6 | 145.8 | 149.8 | 154.1 | 113.2 | 95.5 | 94.4 | 131.7 | 1694.4 |
| Bypass 0.7 cfs, Max Diversion 2.2 cfs | 112.8 | 102.6 | 121.9 | 128.0 | 127.0 | 112.1 | 116.5 | 119.1 | 105.3 | 89.3 | 82.9 | 100.1 | 1317.5 |

Notes:
2.2 cfs = 1.2 MGD, which is the available excess PWWF capacity at the MRWPCA Castroville Pump Station
Available excess PDWF is 2.0 MGD = 3.1 cfs.
Flow at Castroville scaled from the Reclamation Ditch gage at San Jon Road.

**Table B-6, Average Monthly Yields, Reclamation Ditch at Davis Road and Tembladero Slough at Castroville**

| **Divert at both Davis Road and Castroville** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ac-ft | January | February | March | April | May | June | July | August | September | October | November | December | Total |
| Bypass 1 cfs, Max Diversion 2 cfs | 166.7 | 148.7 | 181.9 | 202.7 | 187.3 | 158.0 | 162.0 | 164.5 | 115.8 | 99.9 | 101.1 | 145.4 | 1834.1 |
| Bypass 1 cfs, Max Diversion 2.9 cfs | 218.6 | 193.1 | 233.1 | 253.0 | 224.4 | 186.1 | 186.2 | 179.3 | 120.2 | 114.4 | 120.7 | 191.3 | 2220.5 |
| Bypass 1 cfs, Max Diversion 2.99 cfs | 223.5 | 197.3 | 237.9 | 257.4 | 226.9 | 187.7 | 187.4 | 179.8 | 120.4 | 115.6 | 122.5 | 195.7 | 2252.0 |
| Bypass 1 cfs, Max Diversion 3 cfs | 224.0 | 197.7 | 238.4 | 257.8 | 227.2 | 187.8 | 187.6 | 179.9 | 120.4 | 115.7 | 122.7 | 196.2 | 2255.5 |
| Bypass 2 cfs, Max Diversion 3 cfs | 194.9 | 169.8 | 205.3 | 221.3 | 178.8 | 138.8 | 133.4 | 123.9 | 67.4 | 75.7 | 89.8 | 171.4 | 1770.5 |
| Bypass 1 cfs, Div 6 cfs RD, 2.99 cfs TS | 297.2 | 262.5 | 310.7 | 321.1 | 251.2 | 198.4 | 194.0 | 182.1 | 121.5 | 132.0 | 147.6 | 264.2 | 2562.3 |
| Bypass 2 cfs, Div 6 cfs RD, 2.99 cfs TS | 263.7 | 231.9 | 273.6 | 279.6 | 194.1 | 144.0 | 136.2 | 124.8 | 68.0 | 89.8 | 112.4 | 235.2 | 2049.6 |
| Seasonal Bypass, Div 2.99 both sites | 223.1 | 197.0 | 237.5 | 256.8 | 225.9 | 187.7 | 187.4 | 179.8 | 120.4 | 115.6 | 122.5 | 196.2 | 2249.9 |
| Seasonal Bypass, Div 6 cfs RD, 2.99 cfs TS | 292.8 | 259.9 | 306.6 | 316.0 | 242.5 | 198.6 | 194.1 | 182.1 | 121.5 | 132.2 | 147.7 | 260.7 | 2654.8 |

Notes:
Assume the same diversion target at Davis Rd (Rec Ditch) and Castroville (Tembladero Slough), except where noted
Seasonal Bypass Targets: 0.69 cfs at Davis Rd (JUN-NOV), 2 cfs at Davis Rd (DEC-MAY), 1 cfs at Castroville (JAN-DEC)

### Table B-7: In-Stream Flows Comparison

**Reclamation Ditch at Davis Road**
**In-Stream Flows Comparrison**

| | |
|---|---|
| Target Diversion: | 6 cfs |
| By-Pass First: | 1 cfs |

**Table A: In-stream flow without diversion**

| Flow (AF/month) | Month | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **Grand Total** |
| 2002 | | | | | | 63.5 | 73.7 | 101.9 | 110.6 | 96.5 | 451.1 | 1,963.7 | 2,861.0 |
| 2003 | 701.5 | 297.3 | 347.6 | 502.9 | 147.9 | 110.2 | 74.5 | 53.7 | 86.0 | 47.4 | 162.9 | 1,398.4 | 3,930.4 |
| 2004 | 989.3 | 2,077.6 | 370.0 | 179.9 | 159.3 | 200.2 | 169.7 | 178.2 | 133.8 | 857.0 | 114.3 | 1,739.6 | 7,168.9 |
| 2005 | 2,699.1 | 1,755.2 | 3,393.8 | 920.1 | 430.8 | 322.8 | 319.7 | 228.8 | 177.1 | 174.5 | 178.6 | 1,021.0 | 11,621.6 |
| 2006 | 1,748.5 | 226.0 | 2,863.4 | 3,786.9 | 496.2 | 289.9 | 285.5 | 229.7 | 187.9 | 129.0 | 392.7 | 769.6 | 11,405.3 |
| 2007 | 270.6 | 930.7 | 278.6 | 355.2 | 270.0 | 202.6 | 205.6 | 215.4 | 190.9 | 238.2 | 144.0 | 356.8 | 3,658.5 |
| 2008 | 2,106.9 | 1,526.8 | 150.9 | 180.3 | 141.8 | 112.4 | 112.9 | 127.1 | 97.4 | 98.3 | 257.3 | 879.9 | 5,792.0 |
| 2009 | 464.6 | 2,007.1 | 1,020.0 | 188.1 | 212.1 | 71.0 | 154.1 | 176.2 | 111.5 | 788.5 | 48.8 | 437.1 | 5,678.9 |
| 2010 | 2,114.1 | 1,514.1 | 2,497.1 | 1,619.0 | 322.8 | 219.9 | 225.4 | 184.7 | 117.6 | 166.2 | 674.9 | 1,373.6 | 11,029.4 |
| 2011 | 1,133.2 | 1,697.8 | 4,365.3 | 527.4 | 300.1 | 256.1 | 214.1 | 167.5 | 127.1 | 448.8 | 429.2 | 71.6 | 9,738.3 |
| 2012 | 591.8 | 181.5 | 1,029.2 | 951.7 | 137.0 | 174.3 | 134.7 | 207.8 | 80.1 | 90.2 | 543.9 | 2,636.1 | 6,758.5 |
| 2013 | 880.0 | 188.6 | 154.4 | 115.8 | 87.6 | 81.7 | 90.0 | 94.0 | 60.0 | 55.5 | 78.4 | 73.8 | 1,959.8 |
| **Grand Total** | **13,699.6** | **12,402.7** | **16,470.3** | **9,327.3** | **2,705.7** | **2,104.6** | **2,059.8** | **1,965.1** | **1,480.1** | **3,190.2** | **3,476.2** | **12,721.3** | **81,602.8** |

**Table B: In-stream flow after diversion**

| Flow (AF/Month) | Month | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Year** | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **Grand Total** |
| 2002 | | | | | | 56.5 | 60.3 | 61.2 | 59.5 | 60.6 | 333.6 | 1,709.9 | 2,341.7 |
| 2003 | 520.8 | 208.0 | 256.1 | 285.2 | 61.9 | 59.5 | 59.1 | 50.5 | 58.4 | 33.6 | 94.9 | 1,175.7 | 2,863.8 |
| 2004 | 834.2 | 1,853.9 | 229.5 | 59.5 | 61.5 | 59.5 | 61.5 | 61.5 | 59.5 | 672.5 | 62.7 | 1,616.9 | 5,632.7 |
| 2005 | 2,386.0 | 1,524.2 | 3,067.6 | 582.0 | 148.1 | 74.4 | 65.9 | 61.5 | 59.5 | 61.5 | 80.9 | 818.1 | 8,929.7 |
| 2006 | 1,473.2 | 116.1 | 2,499.6 | 3,441.7 | 220.8 | 59.7 | 61.5 | 61.5 | 59.5 | 61.5 | 263.3 | 582.7 | 8,901.1 |
| 2007 | 151.0 | 758.7 | 127.3 | 181.9 | 71.8 | 59.5 | 61.5 | 61.5 | 86.5 | 143.9 | 90.5 | 246.4 | 2,040.4 |
| 2008 | 1,787.8 | 1,292.0 | 71.8 | 61.4 | 61.5 | 59.5 | 61.2 | 61.5 | 59.5 | 63.6 | 168.1 | 679.8 | 4,427.7 |
| 2009 | 362.5 | 1,748.2 | 828.2 | 59.5 | 71.3 | 54.5 | 61.5 | 71.8 | 59.4 | 701.5 | 45.5 | 279.9 | 4,343.6 |
| 2010 | 1,891.5 | 1,333.5 | 2,170.2 | 1,349.0 | 127.7 | 59.5 | 61.5 | 61.5 | 59.5 | 73.7 | 534.5 | 1,167.4 | 8,889.5 |
| 2011 | 989.7 | 1,513.3 | 4,123.2 | 260.3 | 117.1 | 64.2 | 61.5 | 61.5 | 59.5 | 335.3 | 276.0 | 52.2 | 7,913.8 |
| 2012 | 515.0 | 118.5 | 849.9 | 771.5 | 61.5 | 67.9 | 61.5 | 61.5 | 58.7 | 58.0 | 444.5 | 2,344.3 | 5,412.7 |
| 2013 | 732.6 | 127.8 | 102.0 | 60.3 | 60.6 | 59.3 | 61.5 | 61.5 | 49.5 | 49.1 | 54.2 | 57.2 | 1,475.6 |
| **Grand Total** | **11,644.2** | **10,594.2** | **14,325.4** | **7,112.4** | **1,063.8** | **734.1** | **738.5** | **736.9** | **729.0** | **2,314.8** | **2,448.7** | **10,730.3** | **63,172.1** |
| | | | | | | | | | | | | | |
| % Reduction | 15% | 15% | 13% | 24% | 61% | 65% | 64% | 63% | 51% | 27% | 30% | 16% | 23% |

Flows from USGS Gage 11152650, Reclamation Ditch at San Jon Road
Scaled to basin size at Davis Road (93.7%)
Assumes diversion structure will include low-flow bypass channel to prevent captureing 100% of daily flow.

**Table B-8: In-Stream Flows Comparison**

**Reclamation Ditch at Davis Road**
**In-Stream Flows Comparrison**

| | | |
|---|---|---|
| Target Diversion: | 6 | cfs |
| By-Pass First: | 2 | cfs |

**Table A: In-stream flow without diversion**

| Flow (AF/month) | Month | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | Grand Total |
| 2002 | | | | | | 63.5 | 73.7 | 101.9 | 110.6 | 96.5 | 451.1 | 1,963.7 | 2,861.0 |
| 2003 | 701.5 | 297.3 | 347.6 | 502.9 | 147.9 | 110.2 | 74.5 | 53.7 | 86.0 | 47.4 | 162.9 | 1,398.4 | 3,930.4 |
| 2004 | 989.3 | 2,077.6 | 370.0 | 179.9 | 159.3 | 200.2 | 169.7 | 178.2 | 133.8 | 857.0 | 114.3 | 1,739.6 | 7,168.9 |
| 2005 | 2,699.1 | 1,755.2 | 3,393.8 | 920.1 | 430.8 | 322.8 | 319.7 | 228.8 | 177.1 | 174.5 | 178.6 | 1,021.0 | 11,621.6 |
| 2006 | 1,748.5 | 226.0 | 2,863.4 | 3,786.9 | 496.2 | 289.9 | 285.5 | 229.7 | 187.9 | 129.0 | 392.7 | 769.6 | 11,405.3 |
| 2007 | 270.6 | 930.7 | 278.6 | 355.2 | 270.0 | 202.6 | 205.6 | 215.4 | 190.9 | 238.2 | 144.0 | 356.8 | 3,658.5 |
| 2008 | 2,106.9 | 1,526.8 | 150.9 | 180.3 | 141.8 | 112.4 | 112.9 | 127.1 | 97.4 | 98.3 | 257.3 | 879.9 | 5,792.0 |
| 2009 | 464.6 | 2,007.1 | 1,020.0 | 188.1 | 212.1 | 71.0 | 154.1 | 176.2 | 111.5 | 788.5 | 48.8 | 437.1 | 5,678.9 |
| 2010 | 2,114.1 | 1,514.1 | 2,497.1 | 1,619.0 | 322.8 | 219.9 | 225.4 | 184.7 | 117.6 | 166.2 | 674.9 | 1,373.6 | 11,029.4 |
| 2011 | 1,133.2 | 1,697.8 | 4,365.3 | 527.4 | 300.1 | 256.1 | 214.1 | 167.5 | 127.1 | 448.8 | 429.2 | 71.6 | 9,738.3 |
| 2012 | 591.8 | 181.5 | 1,029.2 | 951.7 | 137.0 | 174.3 | 134.7 | 207.8 | 80.1 | 90.2 | 543.9 | 2,636.1 | 6,758.5 |
| 2013 | 880.0 | 188.6 | 154.4 | 115.8 | 87.6 | 81.7 | 90.0 | 94.0 | 60.0 | 55.5 | 78.4 | 73.8 | 1,959.8 |
| **Grand Total** | **13,699.6** | **12,402.7** | **16,470.3** | **9,327.3** | **2,705.7** | **2,104.6** | **2,059.8** | **1,965.1** | **1,480.1** | **3,190.2** | **3,476.2** | **12,721.3** | **81,602.8** |

**Table B: In-stream flow after diversion**

| Flow (AF/Month) | Month | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | Grand Total |
| 2002 | | | | | | 63.5 | 73.7 | 99.0 | 107.3 | 91.9 | 370.5 | 1,726.5 | 2,532.4 |
| 2003 | 549.4 | 230.9 | 281.9 | 322.2 | 107.0 | 107.7 | 74.5 | 53.7 | 85.6 | 35.5 | 109.2 | 1,199.4 | 3,157.1 |
| 2004 | 859.5 | 1,866.2 | 257.5 | 119.0 | 122.0 | 119.0 | 122.7 | 122.0 | 115.1 | 707.2 | 78.7 | 1,625.5 | 6,114.3 |
| 2005 | 2,403.9 | 1,549.6 | 3,085.0 | 603.3 | 201.8 | 131.0 | 124.0 | 123.0 | 119.0 | 122.7 | 127.6 | 834.7 | 9,425.6 |
| 2006 | 1,505.7 | 152.1 | 2,501.6 | 3,452.6 | 273.0 | 119.0 | 123.0 | 123.0 | 117.3 | 113.3 | 303.2 | 609.8 | 9,393.6 |
| 2007 | 196.0 | 784.7 | 179.1 | 230.0 | 131.3 | 119.0 | 123.0 | 123.0 | 142.0 | 178.1 | 115.0 | 274.3 | 2,595.5 |
| 2008 | 1,809.4 | 1,318.2 | 123.4 | 119.0 | 117.3 | 107.1 | 100.6 | 111.3 | 90.4 | 77.9 | 192.9 | 705.7 | 4,873.3 |
| 2009 | 390.4 | 1,756.9 | 874.3 | 118.0 | 129.4 | 71.0 | 115.0 | 127.1 | 98.4 | 712.8 | 48.8 | 307.3 | 4,749.4 |
| 2010 | 1,902.8 | 1,357.4 | 2,196.6 | 1,378.8 | 183.2 | 119.0 | 123.0 | 122.4 | 106.1 | 120.0 | 553.4 | 1,191.5 | 9,354.1 |
| 2011 | 1,008.3 | 1,539.2 | 4,152.7 | 296.0 | 172.0 | 121.7 | 123.0 | 122.7 | 110.6 | 366.9 | 310.6 | 67.4 | 8,391.1 |
| 2012 | 524.8 | 134.1 | 883.4 | 809.4 | 112.2 | 123.1 | 117.0 | 119.3 | 75.8 | 75.9 | 465.1 | 2,363.0 | 5,803.2 |
| 2013 | 766.2 | 145.2 | 123.8 | 98.0 | 86.5 | 81.4 | 89.7 | 93.2 | 57.7 | 54.8 | 56.0 | 61.2 | 1,713.7 |
| **Grand Total** | **11,916.4** | **10,834.6** | **14,659.3** | **7,546.2** | **1,635.6** | **1,282.6** | **1,309.2** | **1,339.6** | **1,225.3** | **2,656.9** | **2,731.2** | **10,966.4** | **68,103.3** |
| | | | | | | | | | | | | | |
| % Reduction | 13% | 13% | 11% | 19% | 40% | 39% | 36% | 32% | 17% | 17% | 21% | 14% | 17% |

Flows from USGS Gage 11152650, Reclamation Ditch at San Jon Road
Scaled to basin size at Davis Road (93.7%)
Assumes diversion structure will include low-flow bypass channel to prevent captureing 100% of daily flow.

**Table B-9: Water Rights Database GIS Capture, PODs near Salinas**

| Application ID | No. | Permit ID | License ID | DB ID | Water Right Type | Water Right Type ID | Status | Holder Name | Date | Face Amt | County | Watershed | Source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A013225 | 1 | 11043 | 0 | 3413 | Appropriative | 84 | Permitted | MONTEREY COUNTY WATER RESOURCES AGENCY | 7/11/1949 | 168,538.0 | Monterey | SALINAS,<br>SALIN | SALINAS RIVER |
| A016124 | 2 | 10137 | 7543 | 4833 | Appropriative | 84 | Licensed | MONTEREY COUNTY WATER RESOURCES AGENCY | 11/4/1954 | 350,000.0 | Monterey, San L | SALINAS,<br>SALIN | NACIMIENTO RIVER, Salinas River |
| A016761 | 2 | 12261 | 12624 | 5163 | Appropriative | 84 | Licensed | MONTEREY COUNTY WATER RESOURCES AGENCY | 12/2/1955 | 220,000.0 | Monterey | SALINAS,<br>SALIN | SAN ANTONIO RIVER, Salinas River |
| A021587 | 1 | 15371 | 10722 | 8216 | Appropriative | 84 | Licensed | GABILAN CATTLE COMPANY | 1/3/1964 | 11.2 | Monterey | SALINAS,<br>SALIN | SWAMP CREEK, UNST |
| A021587 | 2 | 15371 | 10722 | 8216 | Appropriative | 84 | Licensed | GABILAN CATTLE COMPANY | 1/3/1964 | 11.2 | Monterey | SALINAS,<br>SALIN | SWAMP CREEK, UNST |
| A021587 | 3 | 15371 | 10722 | 8216 | Appropriative | 84 | Licensed | GABILAN CATTLE COMPANY | 1/3/1964 | 11.2 | Monterey | SALINAS,<br>SALIN | SWAMP CREEK, UNST |
| A021588 | 2 | 15372 | 10699 | 8217 | Appropriative | 84 | Licensed | GABILAN CATTLE COMPANY | 1/3/1964 | 31.4 | Monterey | SALINAS,<br>SALIN | SWAMP CREEK, UNST |
| A021589 | 1 | 15373 | 10709 | 8218 | Appropriative | 84 | Licensed | GABILAN CATTLE COMPANY | 1/3/1964 | 2.1 | Monterey | SALINAS | GABILAN CREEK |
| A021590 | 1 | 15374 | 10686 | 8219 | Appropriative | 84 | Licensed | GABILAN CATTLE COMPANY | 1/3/1964 | 1.7 | Monterey | SALINAS | GABILAN CREEK |
| A022489 | 1 | 15237 | 10978 | 8726 | Appropriative | 84 | Licensed | TERRY M BENGARD | 6/9/1966 | 42.0 | Monterey | SALINAS | HARTNELL CREEK |
| A022706 | 1 | 15445 | 10023 | 8849 | Appropriative | 84 | Licensed | ROBERT SWANSON | 2/20/1967 | 8.7 | Monterey | SALINAS,<br>SALIN | BARN CANYON CREEK, HOUSE CANYON CREEK |
| A022706 | 2 | 15445 | 10023 | 8849 | Appropriative | 84 | Licensed | ROBERT SWANSON | 2/20/1967 | 8.7 | Monterey | SALINAS,<br>SALIN | BARN CANYON CREEK, HOUSE CANYON CREEK |
| A024074 | 1 | 16780 | 11056 | 9737 | Appropriative | 84 | Licensed | GABILAN CATTLE COMPANY | 5/23/1972 | 59.4 | Monterey | SALINAS,<br>SALIN | SWAMP CREEK, UNST |
| A024075 | 1 | 16781 | 10929 | 9738 | Appropriative | 84 | Licensed | GABILAN CATTLE COMPANY | 5/23/1972 | 7.3 | Monterey | SALINAS,<br>SALIN | SWAMP CREEK |
| A024075 | 2 | 16781 | 10929 | 9738 | Appropriative | 84 | Licensed | GABILAN CATTLE COMPANY | 5/23/1972 | 7.3 | Monterey | SALINAS,<br>SALIN | SWAMP CREEK |
| A024075 | 3 | 16781 | 10929 | 9738 | Appropriative | 84 | Licensed | GABILAN CATTLE COMPANY | 5/23/1972 | 7.3 | Monterey | SALINAS,<br>SALIN | SWAMP CREEK |
| A030532 | 2 | 21089 | 0 | 14037 | Appropriative | 84 | Permitted | MONTEREY COUNTY WATER RESOURCES AGENCY | 3/25/1996 | 27,900.0 | Monterey, San L | SALINAS,<br>SALIN | NACIMIENTO RIVER, Salinas River |
| A031310 | 1 | 0 | 0 | 14453 | Appropriative | 84 | Pending | CLIFFORD G SILACCI | 3/26/2002 | 34.7 | Monterey | SALINAS,<br>SALIN | ALISAL CREEK, DUNN CANYON, UNST |
| A031310 | 2 | 0 | 0 | 14453 | Appropriative | 84 | Pending | CLIFFORD G SILACCI | 3/26/2002 | 34.7 | Monterey | SALINAS,<br>SALIN | ALISAL CREEK, DUNN CANYON, UNST |
| A031310 | 3 | 0 | 0 | 14453 | Appropriative | 84 | Pending | CLIFFORD G SILACCI | 3/26/2002 | 34.7 | Monterey | SALINAS,<br>SALIN | ALISAL CREEK, DUNN CANYON, UNST |
| A031310 | 4 | 0 | 0 | 14453 | Appropriative | 84 | Pending | CLIFFORD G SILACCI | 3/26/2002 | 34.7 | Monterey | SALINAS,<br>SALIN | ALISAL CREEK, DUNN CANYON, UNST |
| A031310 | 5 | 0 | 0 | 14453 | Appropriative | 84 | Pending | CLIFFORD G SILACCI | 3/26/2002 | 34.7 | Monterey | SALINAS,<br>SALIN | ALISAL CREEK, DUNN CANYON, UNST |
| A031310 | 6 | 0 | 0 | 14453 | Appropriative | 84 | Pending | CLIFFORD G SILACCI | 3/26/2002 | 34.7 | Monterey | SALINAS,<br>SALIN | ALISAL CREEK, DUNN CANYON, UNST |
| A031400 | 1 | 0 | 0 | 14494 | Appropriative | 84 | Pending | TERRY M BENGARD | 3/10/2003 | 48.0 | Monterey | SALINAS,<br>SALIN | ALISAL CREEK |
| A031400 | 2 | 0 | 0 | 14494 | Appropriative | 84 | Pending | TERRY M BENGARD | 3/10/2003 | 48.0 | Monterey | SALINAS,<br>SALIN | ALISAL CREEK |
| A031402 | 2 | 0 | 0 | 14496 | Appropriative | 84 | Pending | CLIFFORD G SILACCI | 3/19/2003 | 104.2 | Monterey | SALINAS,<br>SALIN | ALISAL SLOUGH, UNST |
| A031402 | 3 | 0 | 0 | 14496 | Appropriative | 84 | Pending | CLIFFORD G SILACCI | 3/19/2003 | 104.2 | Monterey | SALINAS,<br>SALIN | ALISAL SLOUGH, UNST |
| A031402 | 4 | 0 | 0 | 14496 | Appropriative | 84 | Pending | CLIFFORD G SILACCI | 3/19/2003 | 104.2 | Monterey | SALINAS,<br>SALIN | ALISAL SLOUGH, UNST |
| C002415 | 1 | 0 | 2415 | 17004 | Stockpond | 85 | Certified | CLIFFORD G SILACCI | 1/3/1978 | - | Monterey | SALINAS | UNST |
| C002416 | 1 | 0 | 2416 | 17005 | Stockpond | 85 | Certified | CLIFFORD G SILACCI | 1/3/1978 | - | Monterey | SALINAS | UNST |
| C002417 | 1 | 0 | 2417 | 17006 | Stockpond | 85 | Certified | CLIFFORD G SILACCI | 1/3/1978 | - | Monterey | SALINAS | UNST |
| C002418 | 1 | 0 | 2418 | 17007 | Stockpond | 85 | Certified | CLIFFORD G SILACCI | 1/3/1978 | - | Monterey | SALINAS | UNST |
| C002419 | 1 | 0 | 2419 | 17008 | Stockpond | 85 | Certified | CLIFFORD G SILACCI | 1/3/1978 | - | Monterey | SALINAS | UNST |
| C002420 | 1 | 0 | 2420 | 17009 | Stockpond | 85 | Certified | CLIFFORD G SILACCI | 1/3/1978 | - | Monterey | SALINAS | UNST |
| C002421 | 1 | 0 | 2421 | 17010 | Stockpond | 85 | Certified | CLIFFORD G SILACCI | 1/3/1978 | - | Monterey | SALINAS | UNST |
| C002422 | 1 | 0 | 2422 | 17011 | Stockpond | 85 | Certified | CLIFFORD G SILACCI | 1/3/1978 | - | Monterey | SALINAS | UNST |
| C002423 | 1 | 0 | 2423 | 17012 | Stockpond | 85 | Certified | CLIFFORD G SILACCI | 1/3/1978 | - | Monterey | SALINAS | UNST |
| C002425 | 1 | 0 | 2425 | 17014 | Stockpond | 85 | Certified | CLIFFORD G SILACCI | 1/3/1978 | - | Monterey | SALINAS | UNST |
| C002426 | 1 | 0 | 2426 | 17015 | Stockpond | 85 | Certified | CLIFFORD G SILACCI | 1/3/1978 | - | Monterey | SALINAS | UNST |
| C002427 | 1 | 0 | 2427 | 17016 | Stockpond | 85 | Certified | CLIFFORD G SILACCI | 1/3/1978 | - | Monterey | SALINAS | UNST |
| C002428 | 1 | 0 | 2428 | 17017 | Stockpond | 85 | Certified | CLIFFORD G SILACCI | 1/3/1978 | - | Monterey | SALINAS | UNST |
| C002429 | 1 | 0 | 2429 | 17018 | Stockpond | 85 | Certified | CLIFFORD G SILACCI | 1/3/1978 | - | Monterey | SALINAS | UNST |
| C002430 | 1 | 0 | 2430 | 17019 | Stockpond | 85 | Certified | CLIFFORD G SILACCI | 1/3/1978 | - | Monterey | SALINAS | UNST |
| C002431 | 1 | 0 | 2431 | 17020 | Stockpond | 85 | Certified | CLIFFORD G SILACCI | 1/3/1978 | - | Monterey | SALINAS | UNST |
| C002432 | 1 | 0 | 2432 | 17021 | Stockpond | 85 | Certified | CLIFFORD G SILACCI | 1/3/1978 | - | Monterey | SALINAS | UNST |
| C002433 | 1 | 0 | 2433 | 17022 | Stockpond | 85 | Certified | CLIFFORD G SILACCI | 1/3/1978 | - | Monterey | SALINAS | UNST |
| C002434 | 1 | 0 | 2434 | 17023 | Stockpond | 85 | Certified | CLIFFORD G SILACCI | 1/3/1978 | - | Monterey | SALINAS | UNST |
| S001895 | 1 | 0 | 0 | 29154 | Statement of Div and Use | 92 | Claimed | EDWARD A PORTER | 1/1/1975 | - | Monterey | SALINAS | GABILAN CREEK |
| S002860 | 1 | 0 | 0 | 29959 | Statement of Div and Use | 92 | Claimed | ROLLING HILLS RANCHOS WATER ASSOCIATION | 1/1/1975 | - | Monterey | SALINAS | UNSP |

| Application ID | No. | Permit ID | License ID | DB ID | Water Right Type | Water Right Type ID | Status | Holder Name | Date | Face Amt | County | Watershed | Source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| S009251 | 1 | 0 | 0 | 32660 | Statement of Div and Use | 92 | Claimed | PETE SILACCI | 4/26/1977 | - | Monterey | SALINAS | ALISAL CREEK |
| S014817 | 1 | 0 | 0 | 37657 | Statement of Div and Use | 92 | Inactive | STEPHEN JENSEN | 7/5/2000 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014826 | 1 | 0 | 0 | 37666 | Statement of Div and Use | 92 | Claimed | ELMER N JENSEN & ELSIE R JENSEN LIVING TRUST | 5/28/1997 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014867 | 1 | 0 | 0 | 37707 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014868 | 1 | 0 | 0 | 37708 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014869 | 1 | 0 | 0 | 37709 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014870 | 1 | 0 | 0 | 37710 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014872 | 1 | 0 | 0 | 37712 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014873 | 1 | 0 | 0 | 37713 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014874 | 1 | 0 | 0 | 37714 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014875 | 1 | 0 | 0 | 37715 | Statement of Div and Use | 92 | Inactive | TANIMURA & ANTLE INC | 6/28/2013 | - | Monterey | SALINAS | GROUNDWATER USE |
| S014876 | 1 | 0 | 0 | 37716 | Statement of Div and Use | 92 | Inactive | TANIMURA & ANTLE INC | 6/28/2013 | - | Monterey | SALINAS | GROUNDWATER USE |
| S014877 | 1 | 0 | 0 | 37717 | Statement of Div and Use | 92 | Inactive | TANIMURA & ANTLE INC | 6/28/2013 | - | Monterey | SALINAS | GROUNDWATER USE |
| S014878 | 1 | 0 | 0 | 37718 | Statement of Div and Use | 92 | Claimed | T. Yuki Farms, LPII | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014879 | 1 | 0 | 0 | 37719 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014880 | 1 | 0 | 0 | 37720 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014881 | 1 | 0 | 0 | 37721 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014882 | 1 | 0 | 0 | 37722 | Statement of Div and Use | 92 | Claimed | Robert Tanimura 1980 IrrevocableTrust; et al | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014883 | 1 | 0 | 0 | 37723 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014884 | 1 | 0 | 0 | 37724 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 5/30/2013 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014885 | 1 | 0 | 0 | 37725 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014886 | 1 | 0 | 0 | 37726 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014887 | 1 | 0 | 0 | 37727 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014888 | 1 | 0 | 0 | 37728 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014889 | 1 | 0 | 0 | 37729 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014890 | 1 | 0 | 0 | 37730 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014892 | 1 | 0 | 0 | 37732 | Statement of Div and Use | 92 | Claimed | Tanimura & Antle Partnership; et al | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014893 | 1 | 0 | 0 | 37733 | Statement of Div and Use | 92 | Claimed | Tanimura & Antle Partnership; et al | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014894 | 1 | 0 | 0 | 37734 | Statement of Div and Use | 92 | Claimed | Tanimura & Antle Partnership; et al | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014895 | 1 | 0 | 0 | 37735 | Statement of Div and Use | 92 | Claimed | Tanimura & Antle Partnership; et al | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014896 | 1 | 0 | 0 | 37736 | Statement of Div and Use | 92 | Claimed | Tanimura & Antle Partnership; et al | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S015877 | 1 | 0 | 0 | 38601 | Statement of Div and Use | 92 | Claimed | TERRY M BENGARD | 7/6/2005 | - | Monterey | SALINAS | ALISAL CREEK |
| S016592 | 1 | 0 | 0 | 51867 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 7/6/2010 | 192.4 | Monterey | SALINAS | Salinas River Underflow |
| S018218 | 1 | 0 | 0 | 52422 | Statement of Div and Use | 92 | Claimed | TERRY M BENGARD | 7/6/2010 | 150.0 | Monterey | SALINAS | Alisal Creek |
| S018221 | 1 | 0 | 0 | 52424 | Statement of Div and Use | 92 | Claimed | TERRY M BENGARD | 7/6/2010 | 120.0 | Monterey | SALINAS | Hartnell Creek |
| S020341 | 1 | 0 | 0 | 51426 | Statement of Div and Use | 92 | Inactive | PETE SILACCI | 8/7/2012 | 1,500.0 | Monterey | SALINAS | Alisal Creek |
| S021637 | 1 | 0 | 0 | 53889 | Statement of Div and Use | 92 | Claimed | PORTER FAMILY PARTNERSHIP, LP | 7/6/2010 | 136,339.0 | Monterey | SALINAS | Salinas River Underflow |
| S021638 | 1 | 0 | 0 | 53890 | Statement of Div and Use | 92 | Claimed | PORTER FAMILY PARTNERSHIP, LP | 7/6/2010 | 107,448.0 | Monterey | SALINAS | Salinas River Underflow |
| S021639 | 1 | 0 | 0 | 53891 | Statement of Div and Use | 92 | Claimed | M.B.T. FAMILY PARTNERSHIP | 7/6/2010 | 202,417.0 | Monterey | SALINAS | Salinas River Underflow |
| S021641 | 1 | 0 | 0 | 53893 | Statement of Div and Use | 92 | Claimed | THE HARDY FAMILY TRUST, ET AL. | 7/6/2010 | 262.5 | Monterey | SALINAS | Salinas River Underflow |
| S021642 | 1 | 0 | 0 | 53900 | Statement of Div and Use | 92 | Claimed | THE HARDY FAMILY TRUST, ET AL. | 7/6/2010 | 333.8 | Monterey | SALINAS | Salinas River Underflow |
| S023945 | 1 | 0 | 0 | | Statement of Div and Use | 92 | Claimed | TANIMURA & ANTLE | 7/2/2013 | - | Monterey | SALINAS | Salinas Valley Basin |
| S023947 | 1 | 0 | 0 | | Statement of Div and Use | 92 | Claimed | TANIMURA & ANTLE | 7/2/2013 | - | Monterey | SALINAS | Salinas Valley Basin |

**Table B-10: Surface Water Rights and Claims in the Reclamation Ditch Basin**

| Water Right ID | Source | Direct Diversion Rate (cfs) | Direct Diversion Season | Face Value Direct Diversion Amount Oct. 1-Mar. 31 (af) | Face Value Storage Amount (af) | Storage Season | Reported Use 2011 (Diverted) | Reported Use 2012 (Diverted) | Purpose of Use Code** |
|---|---|---|---|---|---|---|---|---|---|
| A021587 | Swamp Creek, trib to Gabilan Creek | | | 11.2 | 11.2 | 01NOV-30APR | 4.5 | 8.5 | S, R |
| A021588 | Swamp Creek, trib to Gabilan Creek | | | 31.4 | 31.4 | 01NOV-30APR | 9.25 | 15 | S, R |
| A021589 | Alisal Slough (map location Gabilan Creek) | | | 2.1 | | 01NOV-30APR | 1.5 | 2 | S |
| A021590 | Alisal Slough (map location Gabilan Creek) | | | 1.7 | | 01NOV-30APR | 0.8 | 1.7 | S |
| A022489 | Hartnell Creek, trib to Alisal Creek | 10 | 15NOV-15MAR | 42 | | 15NOV-15MAR | 5 | 0 | I, S, R |
| A022706 | Barn Canyon Creek, trib to Natividad Creek | | | 8.7 | 8.7 | 01DEC-01MAY | | | S, R |
| A024074 | Swamp Creek, trib to Gabilan Creek | | | 59.4 | 59.4 | 01NOV-30APR | 1.1 | 28 | I, S, R |
| A024075 | Swamp Creek, trib to Gabilan Creek | | | 7.3 | 7.3 | 01NOV-30APR | 1.5 | 5.5 | S, R |
| A031310 | Dunn Canyon Creek, trib to Alisal Creek | | | 34.7 | | | | | Pending |
| A031400 | Alisal Creek | | | 48.0 | | | | | Pending |
| A031402 | Alisal Creek | | | 104.2 | | | | | Pending |
| S001895 | Gabilan Creek | | | 0.1 | | | 0 | | S |
| S009251/ S020341 | Alisal Creek | | | 1500.0 | | | 1500 | | I, S |
| S015877 | Alisal Creek | Note | | 34.2 | | | 0 | 0 | I, S |
| S018218 | Alisal Creek | | | 150.0 | | | 0 | 0.0 | I, S |
| S018221 | Hartnell Creek | | | 120.0 | | | 5 | 0.0 | I, S |
| | | | | | | | | | |
| Totals | | | | 2155 | 118 | | 1528.65 | 60.7 | |

Blank fields indicate no data/ no report

**B-Mining, C-Milling, D-Domestic, E-Fire Protection, G-Dust Control, H-Fish Culture, I-Irrigation, J-Industrial, K-Incidental Power, L-Heat Protection, M-Municipal, N-Frost Protection, P-Power, R-Recreational, S-Stockwatering, T-Snow Making, W-Fish and Wildlife Protection and/or Enhancement, Z-Other.

Value of S015877 is based on sum of reported monthly use.

**Table B-11: Identified Uses of Inland Surface Waters, Lower Salinas Hydrologic Unit (Extract from CC RWQCB 2011 Basin Plan)**

| Waterbody Names | MUN | AGR | PRO | IND | GWR | REC1 | REC2 | WILD | COLD | WARM | MIGR | SPWN | BIOL | RARE | EST | FRESH | NAV | POW | COMM | AQUA | SAL | SHELL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | | | | | | | | | | | |
| **SALINAS HYDROLOGIC UNIT** | | | | | | | | | | | | | | | | | | | | | | |
| Moro Cojo Slough | | | | | X | X | X | X | X | X | | X | X | X | X | | | | X | | | X |
| Old Salinas River Estuary | | | | | | X | X | X | X | X | X | X | X | X | X | | | | X | | | X |
| Tembldero Slough | | | | | | X | X | X | | X | | X | | X | X | | | | X | | | X |
| Espinosa Lake | | | | | | X | X | X | | X | | | | | | | | | X | | | |
| Espinosa Slough | | | | | | X | X | X | | X | | | | | | | | | X | | | |
| Salinas Reclamation Canal | | | | | | X | X | X | | X | | | | | | | | | X | | | |
| Gabilan Creek | X | X | | | X | X | X | X | | X | | X | | | | | | | X | | | |
| Alisal Creek | X | X | | | X | X | X | X | X | X | | X | | | | | | | X | | | |
| Blanco Drain | | | | | | X | X | X | | X | | | | | | | | | X | | | |
| Salinas River Refuge Lagoon (South) | | | | | | X | X | X | X | X | X | | X | X | | | | | X | | | X |
| Marina Pond #1 | | | | | X | X | X | X | X | | | X | X | X | | | | | X | | | |
| Marina Pond #2 | | | | | X | X | X | X | X | | | | X | X | | | | | X | | | |
| Marina Pond #3 | | | | | X | X | X | X | X | | | | X | X | | | | | X | | | |
| Marina Pond #4/5 | | | | | X | X | X | X | X | | | | X | X | | | | | X | | | |
| Marina Pond #6 | | | | | X | X | X | X | X | | | | X | X | | | | | X | | | |
| Marina Pond #7 | | | | | X | X | X | X | X | | | X | X | X | | | | | X | | | |
| Laguna Grande/Roberts Lake | X | | | | | X | X | X | X | X | | | | | | | | | X | | | |
| Del Monte Lake | X | | | | | X | X | X | | X | | | | | | | | | X | | | |
| El Estero Lake | X | | | | X | X | X | X | X | X | | X | | | | | | | X | | | |
| Salinas River Lagoon (North) | | | | | | X | X | X | X | X | X | X | X | X | X | | | | X | | | X |
| Salinas River, dnstr of Spreckels Gage | X | X | | | | | X | X | X | X | X | | | | | X | | | X | | | |

**Use Codes**

Municipal and Domestic Supply (MUN)
Agricultural Supply (AGR)
Industrial Process Supply (PRO)
Industrial Service Supply (IND)
Ground Water Recharge (GWR)
Water Contact Recreation (REC1)
Non-Contact Water Recreation (REC2)
Wildlife Habitat (WILD)
Cold Fresh Water Habitat (COLD)
Warm Fresh Water Habitat (WARM)
Migration of Aquatic Organisms (MIGR)
Spawning, Reproduction, and/or Early Development (SPWN)
Preservation of Biological Habitats of Special Significance (BIOL)
Rare, Threatened, or Endangered Species (RARE)
Estuarine Habitat (EST)
Freshwater Replenishment (FRESH)
Navigation (NAV)
Hydropower Generation (POW)
Commercial and Sport Fishing (COMM)
Aquaculture (AQUA)
Inland Saline Water Habitat (SAL)
Shellfish Harvesting (SHELL)
Marine Habitat (MAR)
Areas of Special Biological Significance (ASBS)

**Table B-12: Stream Water Quality, Reclamation Ditch Watershed**
Note: Location above or below indicates multiple sampling locations

| Stream | Location | Analyte Name | No. Samples | Units | Mean | Min | Max |
|---|---|---|---|---|---|---|---|
| Reclamation Ditch | below Carr Lake | Ammonia as N, Unionized | 81 | mg/L | 0.029 | 0.0004 | 0.25 |
| Reclamation Ditch | below Carr Lake | Ammonia as NH3 | 111 | mg/L | 0.61 | 0.00 | 6.00 |
| Reclamation Ditch | below Carr Lake | Chloride | 29 | mg/L | 106.41 | 8.90 | 200.00 |
| Reclamation Ditch | below Carr Lake | Chlorophyll a, water column | 95 | mg/L | 0.016 | 0.00015 | 0.15 |
| Reclamation Ditch | below Carr Lake | Chlorpyrifos | 41 | mg/L | 0.0016 | 0.000045 | 0.055 |
| Reclamation Ditch | below Carr Lake | Coliform, Fecal | 29 | MPN/100 ml | 17,954.00 | 110.00 | 160,001.00 |
| Reclamation Ditch | below Carr Lake | Coliform, Total | 29 | MPN/100 ml | 53,966.00 | 1,600.00 | 160,001.00 |
| Reclamation Ditch | below Carr Lake | Diazinon | 46 | mg/L | 0.10 | 0.000086 | 3.16 |
| Reclamation Ditch | below Carr Lake | Dissolved Solids, Total | 101 | mg/L | 641.83 | 14.90 | 1,080.00 |
| Reclamation Ditch | below Carr Lake | Nitrate as N | 216 | mg/L | 13.00 | 0.00 | 69.10 |
| Reclamation Ditch | below Carr Lake | OrthoPhosphate as P | 214 | mg/L | 0.65 | 0.00 | 12.90 |
| Reclamation Ditch | below Carr Lake | Oxygen, Dissolved | 94 | mg/L | 0.93 | 0.00 | 6.58 |
| Reclamation Ditch | below Carr Lake | Suspended Solids, Total | 29 | mg/L | 69.46 | 5.00 | 385.00 |
| Reclamation Ditch | below Carr Lake | Turbidity | 119 | NTU | 141.51 | 2.90 | 1,454.00 |
| | | | | | | | |
| Tembladero Slough | below Hwy 183 | Ammonia as N, Unionized | 157 | mg/L | 0.010 | 0.0004 | 0.074 |
| Tembladero Slough | below Hwy 183 | Ammonia as NH3 | 2 | mg/L | 0.030 | 0.00 | 0.060 |
| Tembladero Slough | below Hwy 183 | Chloride | 111 | mg/L | 876.41 | 42.00 | 9,600.00 |
| Tembladero Slough | below Hwy 183 | Chlorophyll a, water column | 169 | mg/L | 0.037 | 0.00039 | 0.66 |
| Tembladero Slough | below Hwy 183 | Chlorpyrifos | 9 | mg/L | 0.011 | 0.00005 | 0.070 |
| Tembladero Slough | below Hwy 183 | Coliform, Fecal | 111 | MPN/100 ml | 2,310.14 | 30.00 | 54,000.00 |
| Tembladero Slough | below Hwy 183 | Coliform, Total | 111 | MPN/100 ml | 29,306.78 | 240.00 | 240,001.00 |
| Tembladero Slough | below Hwy 183 | Diazinon | 7 | mg/L | 0.20 | 0.00029 | 0.52 |
| Tembladero Slough | below Hwy 183 | Dissolved Solids, Total | 178 | mg/L | 2,024.71 | 276.00 | 18,000.00 |
| Tembladero Slough | below Hwy 183 | Nitrate as N | 180 | mg/L | 28.59 | 0.002 | 107.00 |
| Tembladero Slough | below Hwy 183 | OrthoPhosphate as P | 180 | mg/L | 0.43 | 0.00 | 1.20 |
| Tembladero Slough | below Hwy 183 | Oxygen, Dissolved | 172 | mg/L | 0.60 | 0.00 | 8.98 |
| Tembladero Slough | below Hwy 183 | Suspended Solids, Total | 116 | mg/L | 133.85 | 21.00 | 1,600.00 |
| Tembladero Slough | below Hwy 183 | Turbidity | 175 | NTU | 211.18 | 8.90 | 2,663.00 |
| | | | | | | | |
| Old Salinas River | above Potrero Rd | Ammonia as N, Unionized | 96 | mg/L | 0.0075 | 0.0002 | 0.027 |
| Old Salinas River | above Potrero Rd | Ammonia as NH3 | 22 | mg/L | 0.24 | 0.00 | 1.17 |
| Old Salinas River | above Potrero Rd | Chloride | 109 | mg/L | 2,504.48 | 79.00 | 17,000.00 |
| Old Salinas River | above Potrero Rd | Chlorophyll a, water column | 134 | mg/L | 0.029 | 0.00045 | 0.24 |
| Old Salinas River | above Potrero Rd | Chlorpyrifos | 33 | mg/L | 0.00022 | 0.000044 | 0.0010 |
| Old Salinas River | above Potrero Rd | Coliform, Fecal | 106 | MPN/100 ml | 3,222.87 | 23.00 | 92,000.00 |
| Old Salinas River | above Potrero Rd | Coliform, Total | 106 | MPN/100 ml | 19,573.45 | 260.00 | 240,000.00 |
| Old Salinas River | above Potrero Rd | Diazinon | 31 | mg/L | 0.011 | 0.00 | 0.21 |
| Old Salinas River | above Potrero Rd | Dissolved Solids, Total | 116 | mg/L | 5,964.12 | 193.00 | 59,000.00 |
| Old Salinas River | above Potrero Rd | Nitrate as N | 138 | mg/L | 19.50 | 0.00 | 64.00 |
| Old Salinas River | above Potrero Rd | OrthoPhosphate as P | 138 | mg/L | 0.42 | 0.00 | 2.40 |
| Old Salinas River | above Potrero Rd | Oxygen, Dissolved | 138 | mg/L | 1.02 | 0.00 | 18.03 |
| Old Salinas River | above Potrero Rd | Suspended Solids, Total | 114 | mg/L | 113.33 | 5.00 | 578.00 |
| Old Salinas River | above Potrero Rd | Turbidity | 158 | NTU | 183.41 | 0.10 | 4,869.00 |
| | | | | | | | |

**Table B-12: Stream Water Quality, Reclamation Ditch Watershed**
Note: Location above or below indicates multiple sampling locations

| Stream | Location | Analyte Name | No. Samples | Units | Mean | Min | Max |
|---|---|---|---|---|---|---|---|
| **Tributary Streams** | | | | | | | |
| Alisal Creek | above Carr Lake | Ammonia as N, Unionized | 11 | mg/L | 0.041 | 0.001 | 0.19 |
| Alisal Creek | above Carr Lake | Chloride | 6 | mg/L | 110.00 | 95.00 | 128.00 |
| Alisal Creek | above Carr Lake | Chlorophyll a, water column | 17 | mg/L | 0.040 | 0.00021 | 0.33 |
| Alisal Creek | above Carr Lake | Coliform, Fecal | 6 | MPN/100 ml | 5,267.00 | 2.00 | 17,000.00 |
| Alisal Creek | above Carr Lake | Coliform, Total | 6 | MPN/100 ml | 20,000.00 | 2.00 | 50,000.00 |
| Alisal Creek | above Carr Lake | Dissolved Solids, Total | 17 | mg/L | 623.95 | 185.00 | 940.00 |
| Alisal Creek | above Carr Lake | Nitrate as N | 17 | mg/L | 25.08 | 6.07 | 44.90 |
| Alisal Creek | above Carr Lake | OrthoPhosphate as P | 17 | mg/L | 0.75 | 0.30 | 1.39 |
| Alisal Creek | above Carr Lake | Oxygen, Dissolved | 16 | mg/L | 0.089 | 0.00 | 1.27 |
| Alisal Creek | above Carr Lake | Suspended Solids, Total | 6 | mg/L | 160.83 | 66.00 | 356.00 |
| Alisal Creek | above Carr Lake | Turbidity | 17 | NTU | 861.45 | 44.00 | 3,000.00 |
| | | | | | | | |
| Alisal Slough | White Barn | Ammonia as N, Unionized | 53 | mg/L | 0.011 | 0.0008 | 0.044 |
| Alisal Slough | White Barn | Chlorophyll a, water column | 54 | mg/L | 0.0023 | 0.00001 | 0.035 |
| Alisal Slough | White Barn | Chlorpyrifos | 5 | mg/L | 0.001 | 0.001 | 0.001 |
| Alisal Slough | White Barn | Diazinon | 5 | mg/L | 0.11 | 0.002 | 0.20 |
| Alisal Slough | White Barn | Dissolved Solids, Total | 60 | mg/L | 1,957.80 | 535.00 | 3,150.00 |
| Alisal Slough | White Barn | Nitrate as N | 60 | mg/L | 43.03 | 0.002 | 109.00 |
| Alisal Slough | White Barn | OrthoPhosphate as P | 60 | mg/L | 0.44 | 0.0075 | 0.88 |
| Alisal Slough | White Barn | Oxygen, Dissolved | 55 | mg/L | 0.16 | 0.00 | 1.97 |
| Alisal Slough | White Barn | Turbidity | 56 | NTU | 87.80 | 2.30 | 715.00 |
| | | | | | | | |
| Espinosa Slough | above Recl. Ditch | Ammonia as N, Unionized | 54 | mg/L | 0.017 | 0.0007 | 0.21 |
| Espinosa Slough | above Recl. Ditch | Chlorophyll a, water column | 54 | mg/L | 0.011 | 0.00 | 0.13 |
| Espinosa Slough | above Recl. Ditch | Chlorpyrifos | 5 | mg/L | 0.014 | 0.001 | 0.068 |
| Espinosa Slough | above Recl. Ditch | Diazinon | 5 | mg/L | 0.66 | 0.16 | 1.96 |
| Espinosa Slough | above Recl. Ditch | Dissolved Solids, Total | 60 | mg/L | 1,253.90 | 333.00 | 2,170.00 |
| Espinosa Slough | above Recl. Ditch | Nitrate as N | 60 | mg/L | 34.96 | 0.009 | 103.00 |
| Espinosa Slough | above Recl. Ditch | OrthoPhosphate as P | 60 | mg/L | 0.40 | 0.0075 | 1.30 |
| Espinosa Slough | above Recl. Ditch | Oxygen, Dissolved | 55 | mg/L | 0.99 | 0.00 | 8.85 |
| Espinosa Slough | above Recl. Ditch | Turbidity | 55 | NTU | 321.70 | 0.10 | 1,819.00 |
| | | | | | | | |
| Gabilan Creek | above Carr Lake | Ammonia as N, Unionized | 19 | mg/L | 0.033 | 0.0001 | 0.27 |
| Gabilan Creek | above Carr Lake | Ammonia as NH3 | 94 | mg/L | 0.049 | 0.00 | 0.43 |
| Gabilan Creek | above Carr Lake | Chloride | 13 | mg/L | 56.43 | 6.60 | 160.00 |
| Gabilan Creek | above Carr Lake | Chlorophyll a, water column | 27 | mg/L | 0.0069 | 0.00072 | 0.050 |
| Gabilan Creek | above Carr Lake | Coliform, Fecal | 13 | MPN/100 ml | 2,524.00 | 70.00 | 17,000.00 |
| Gabilan Creek | above Carr Lake | Coliform, Total | 13 | MPN/100 ml | 37,131.00 | 1,100.00 | 160,000.00 |
| Gabilan Creek | above Carr Lake | Dissolved Solids, Total | 27 | mg/L | 451.20 | 96.90 | 930.00 |
| Gabilan Creek | above Carr Lake | Nitrate as N | 120 | mg/L | 5.96 | 0.00 | 78.40 |
| Gabilan Creek | above Carr Lake | OrthoPhosphate as P | 121 | mg/L | 0.37 | 0.00 | 2.30 |
| Gabilan Creek | above Carr Lake | Oxygen, Dissolved | 27 | mg/L | 0.25 | 0.00 | 2.06 |
| Gabilan Creek | above Carr Lake | Suspended Solids, Total | 13 | mg/L | 669.46 | 12.00 | 2,010.00 |
| Gabilan Creek | above Carr Lake | Turbidity | 27 | NTU | 1,002.90 | 3.00 | 3,000.00 |

**Table B-12: Stream Water Quality, Reclamation Ditch Watershed**
Note: Location above or below indicates multiple sampling locations

| Stream | Location | Analyte Name | No. Samples | Units | Mean | Min | Max |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
| Merritt Ditch | Hwy 183 | Ammonia as N, Unionized | 54 | mg/L | 0.026 | 0.0002 | 0.32 |
| Merritt Ditch | Hwy 183 | Chlorophyll a, water column | 54 | mg/L | 0.0055 | 0.00017 | 0.036 |
| Merritt Ditch | Hwy 183 | Chlorpyrifos | 5 | mg/L | 0.001 | 0.001 | 0.0010 |
| Merritt Ditch | Hwy 183 | Diazinon | 5 | mg/L | 0.084 | 0.026 | 0.19 |
| Merritt Ditch | Hwy 183 | Dissolved Solids, Total | 60 | mg/L | 1,271.70 | 429.00 | 2,060.00 |
| Merritt Ditch | Hwy 183 | Nitrate as N | 60 | mg/L | 21.76 | 0.002 | 64.80 |
| Merritt Ditch | Hwy 183 | OrthoPhosphate as P | 60 | mg/L | 0.24 | 0.0075 | 1.67 |
| Merritt Ditch | Hwy 183 | Oxygen, Dissolved | 55 | mg/L | 0.59 | 0.00 | 6.54 |
| Merritt Ditch | Hwy 183 | Turbidity | 54 | NTU | 216.30 | 5.60 | 1,650.00 |
| | | | | | | | |
| Natividad Creek | above Carr Lake | Ammonia as N, Unionized | 46 | mg/L | 0.043 | 0.0001 | 0.89 |
| Natividad Creek | above Carr Lake | Ammonia as NH3 | 2 | mg/L | 7.40 | 6.50 | 8.30 |
| Natividad Creek | above Carr Lake | Chlorophyll a, water column | 46 | mg/L | 0.0030 | 0.00 | 0.032 |
| Natividad Creek | above Carr Lake | Chlorpyrifos | 4 | mg/L | 0.04 | 0.001 | 0.16 |
| Natividad Creek | above Carr Lake | Diazinon | 4 | mg/L | 0.97 | 0.018 | 3.55 |
| Natividad Creek | above Carr Lake | Dissolved Solids, Total | 51 | mg/L | 754.00 | 220.00 | 1,430.00 |
| Natividad Creek | above Carr Lake | Nitrate as N | 52 | mg/L | 32.13 | 0.014 | 150.00 |
| Natividad Creek | above Carr Lake | OrthoPhosphate as P | 55 | mg/L | 0.66 | 0.0075 | 3.96 |
| Natividad Creek | above Carr Lake | Oxygen, Dissolved | 47 | mg/L | 0.56 | 0.00 | 5.61 |
| Natividad Creek | above Carr Lake | Turbidity | 46 | NTU | 460.80 | 12.50 | 3,000.00 |
| | | | | | | | |
| Santa Rita Creek | above Hwy 101 | Ammonia as N, Unionized | 14 | mg/L | 0.026 | 0.000 | 0.278 |
| Santa Rita Creek | above Hwy 101 | Chloride | 14 | mg/L | 89.93 | 18.00 | 170.00 |
| Santa Rita Creek | above Hwy 101 | Chlorophyll a, water column | 14 | mg/L | 0.021 | 0.007 | 0.047 |
| Santa Rita Creek | above Hwy 101 | Coliform, Fecal | 14 | MPN/100 ml | 1,171.00 | 70.00 | 5,000.00 |
| Santa Rita Creek | above Hwy 101 | Coliform, Total | 14 | MPN/100 ml | 45,086.00 | 2,200.00 | 160,001.00 |
| Santa Rita Creek | above Hwy 101 | Dissolved Solids, Total | 14 | mg/L | 516.40 | 290.00 | 800.00 |
| Santa Rita Creek | above Hwy 101 | Nitrate as N | 14 | mg/L | 8.63 | 0.05 | 64.00 |
| Santa Rita Creek | above Hwy 101 | OrthoPhosphate as P | 14 | mg/L | 0.52 | 0.20 | 1.40 |
| Santa Rita Creek | above Hwy 101 | Oxygen, Dissolved | 14 | mg/L | 1.02 | 0.00 | 3.79 |
| Santa Rita Creek | above Hwy 101 | Suspended Solids, Total | 14 | mg/L | 131.98 | 8.20 | 610.00 |
| Santa Rita Creek | above Hwy 101 | Turbidity | 14 | NTU | 362.00 | 11.80 | 1,266.00 |

Highlighted cells exceed TMDL / standards. See table B-13.
Min value of 0.00 = Not Detected.

**Table B-13: Total Maximum Daily Loads**

| Analyte Name | Units | Standard | Reference |
|---|---|---|---|
| Ammonia as N, Unionized | mg/L | 0.025 | Board Order R3-2013-0008 |
| Ammonia as NH3 | mg/L | 0.025 | CCAMP Proposed |
| Chloride | mg/L | 150 | Basin Plan |
| Chlorophyll a, water column | mg/L | 0.015 | Board Order R3-2013-0008 |
| Chlorpyrifos | mg/L | CMC 0.00025<br>CCC 0.00015 | Board Decision 2011 |
| Coliform, Fecal | MPN/100 ml | 400 | Basin Plan, Water Body Contact |
| Coliform, Total | MPN/100 ml | 10,000 | US EPA |
| Diazinon | mg/L | CMC 0.00016<br>CCC 0.00010 | CC RWQCB Decision 2011 |
| Dissolved Solids, Total | mg/L | 1000 | CCAMP Proposed |
| Nitrate as N (all streams with MUN use) | mg/L | 10 | Board Order R3-2013-0008 |
| Nitrate as N (Salinas River) | mg/L | 1.4 (dry season)<br>8.0 (wet season) | Board Order R3-2013-0008 |
| Nitrate as N (Rec. Ditch, Tembladero, Blanco Drain, Alisal Slough, Espinosa Slough, Merritt Ditch, Santa Rita Creek) | mg/L | 6.4 (dry season)<br>8.0 (wet season) | Board Order R3-2013-0008 |
| Nitrate as N (OSR) | mg/L | 3.1 (dry season)<br>8.0 (wet season) | Board Order R3-2013-0008 |
| OrthoPhosphate as P (Salinas River) | mg/L | 0.07 (dry season)<br>0.30 (wet season) | Board Order R3-2013-0008 |
| Orthophosphate as P (Rec. Ditch, Tembladero, Blanco Drain, Alisal Slough, Espinosa Slough, Merritt Ditch, Santa Rita Creek) | mg/L | 0.13 (dry season)<br>0.30 (wet season) | Board Order R3-2013-0008 |
| Oxygen, Dissolved | mg/L | >7.0 and <13.0 (Cold)<br>>5.0 and <13.0 (Warm) | Board Order R3-2013-0008 |
| Suspended Solids, Total | mg/L | 500 | CCAMP Proposed |
| Turbidity | NTU | 10 | CCAMP Proposed |

CMC = Criterion Maximum Concentration (1-hr average)
CCC = Criterion Continuous Concentration (96-hour average)
Order R3-2013-0008: Lower Salinas River Watershed Nutrient TMDL
Seasonal targets for nitrate and orthophosphate

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**Appendix C: Conceptual Diversion Facility**

Figure C-1: Conceptual Pump Station, Profile View
Figure C-2: Conceptual Pump Station, Plan View
Figure C-3: Davis Road Pump Station Location
Figure C-4: Castroville Pump Station Location
Table C-1: Davis Road Pump Station, Option 1, System Head Calculations
Table C-2: Davis Road Pump Station, Option 2, System Head Calculations
Table C-3: Castroville Pump Station, System Head Calculations
Table C-4: Estimated Construction Cost, 6 cfs Pump Station at Davis Road
Table C-5: Estimated Construction Cost, 3 cfs Pump Station at Davis Road
Table C-6: Estimated Construction Cost, 3 cfs Pump Station at Castroville

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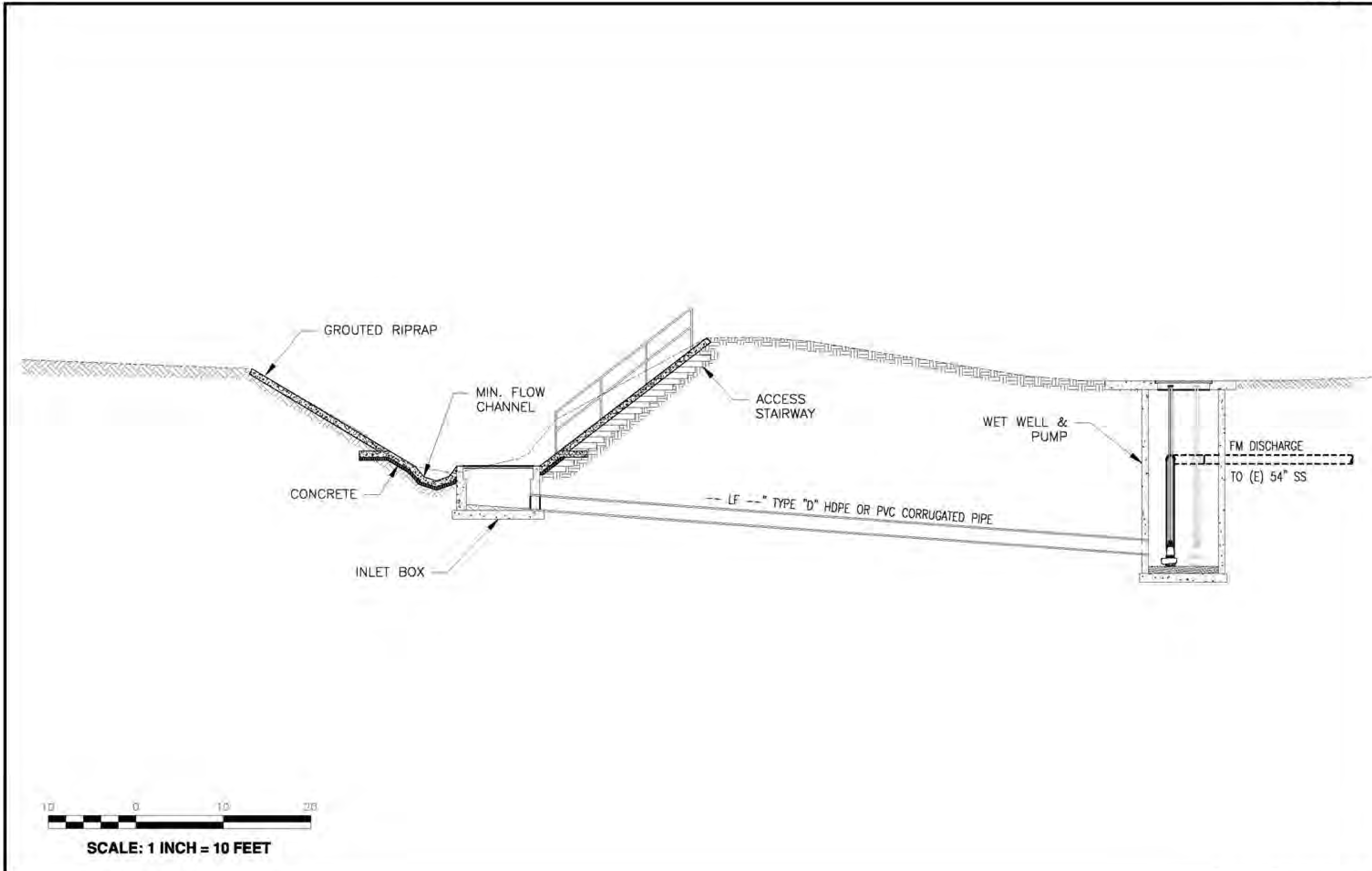
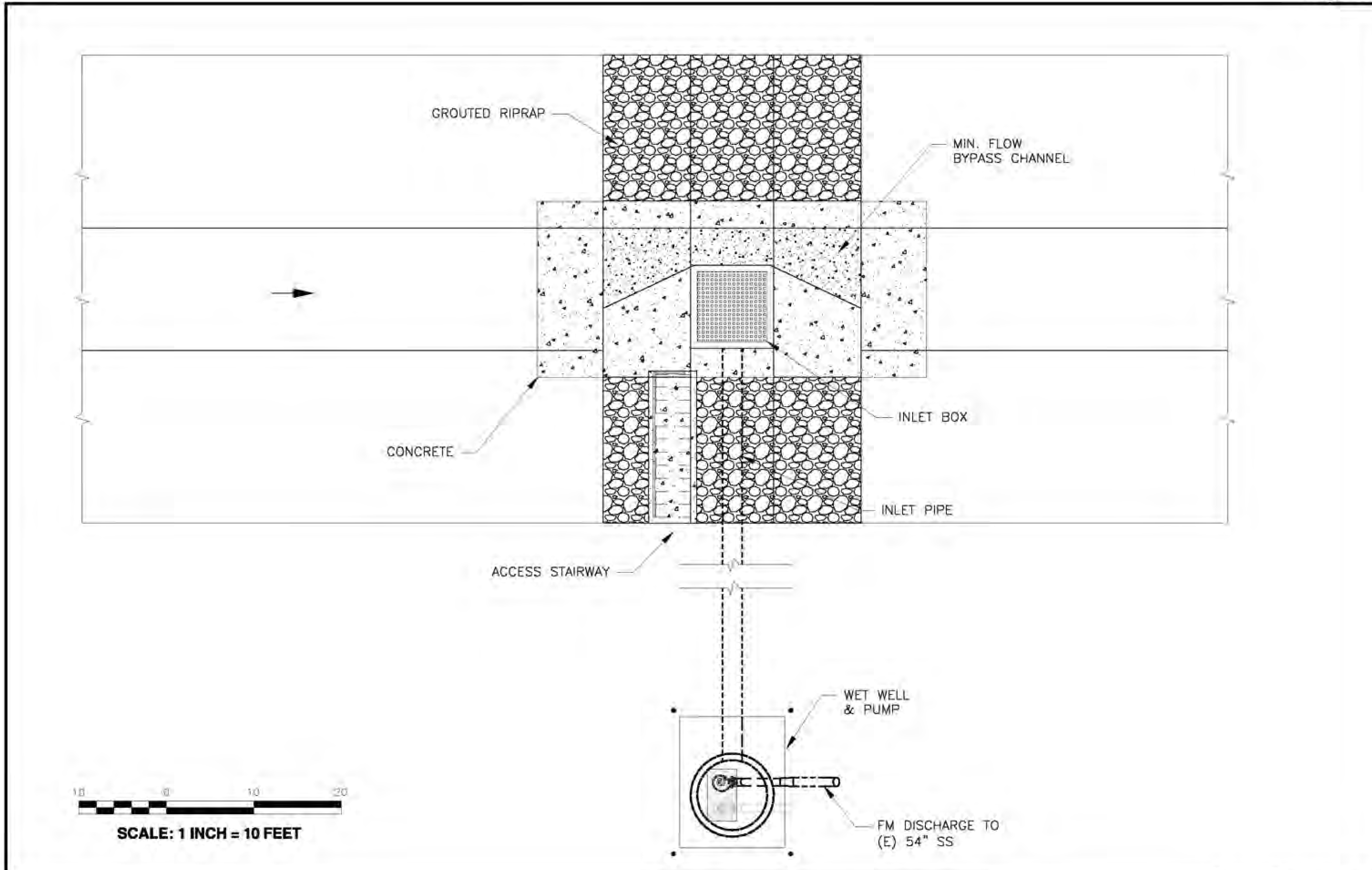
Figure 1




Schaaf & Wheeler

Figure 2




Schaaf & Wheeler

## Davis Road Location


Schaaf & Wheeler

Castroville Location


Schaaf & Wheeler

**Table C-1:** **Reclamation Ditch Diversion Pump Station, Davis Rd, Option 1**

**System Head Calculations**

**Sizing**
Target Q = 6 cfs = 2700 gpm
Use a single 6 cfs pump

| | |
|---|---|
| Number of Pumps in Parallel | **1** |
| Pump Discharge Diameter (inches) | **12** |
| Length of Pump Discharge (feet) | **25** |
| Discharge Hazen-Williams Coefficient (C) | **130** |
| Force Main Diameter in PS#2 (inches) | **16** |
| Force Main Length in PS#2 (feet) | **0** |
| Force Main Diameter from PS#2 to MH (inches) | **16** |
| Force Main Length from PS#2 to MH (feet) | **100** |
| Force Main Hazen-Williams Coefficient (C) | **120** |
| Outfall Elevation (feet) | **20.00** |
| Wetwell Pumping Level (feet) | **5.00** |
| Static Lift (feet) | 15.00 |

PS1 Flow - gpm

| **Fitting** | **K Value** |
|---|---|
| 45 Elbow | 0.2 |
| 90 Elbow | 0.3 |
| 22.5 Elbow | 0.075 |
| 11.25 Elbow | 0 |
| GV | 0.3 |
| CV | 2.5 |
| Reducer | 0.03 |
| FR Elbow | 0.3 |
| Tee branch | 0.75 |

| Pump Discharge Piping | | | | | | | | | | | | Force Main in PS | | | | | Force Main from PS to MH | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Minor Losses | | | | | | | | | | | | | | | | | | | | | |
| Flow (gpm) | Velocity (fps) | Velocity Head (ft) | Friction Loss (ft) | K: | Flare Elbow **0** (ft) | Suction Elbow **0** (ft) | Discharge Elbows **0.8** (ft) | Tee Branch **0** (ft) | Gate Valve **0.3** (ft) | Check Valve **2.5** (ft) | Total Minor Losses (ft) | Flow (gpm) | Velocity (fps) | Velocity Head (ft) | Friction Loss (ft) | **0.0** Minor Losses (ft) | Flow (gpm) | Velocity (fps) | Velocity Head (ft) | Friction Loss (ft) | **0.3** Minor Losses (ft) | Total Loss (ft) | TDH (ft) | Pump Flow (gpm) | HP at 75% eff. HP |
| **0** | 0.00 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.00 | **0** | **0** |
| **100** | 0.28 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 100 | 0.16 | 0.00 | 0.00 | 0.00 | 100 | 0.16 | 0.00 | 0.00 | 0.00 | 0.01 | 15.01 | **100** | **1** |
| **200** | 0.57 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.02 | 200 | 0.32 | 0.00 | 0.00 | 0.00 | 200 | 0.32 | 0.00 | 0.00 | 0.00 | 0.03 | 15.03 | **200** | **1** |
| **300** | 0.85 | 0.01 | 0.01 | | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.03 | 0.04 | 300 | 0.48 | 0.00 | 0.00 | 0.00 | 300 | 0.48 | 0.00 | 0.01 | 0.00 | 0.06 | 15.06 | **300** | **2** |
| **400** | 1.13 | 0.02 | 0.01 | | 0.00 | 0.00 | 0.02 | 0.00 | 0.01 | 0.05 | 0.07 | 400 | 0.64 | 0.01 | 0.00 | 0.00 | 400 | 0.64 | 0.01 | 0.01 | 0.00 | 0.10 | 15.10 | **400** | **2** |
| **500** | 1.42 | 0.03 | 0.02 | | 0.00 | 0.00 | 0.02 | 0.00 | 0.01 | 0.08 | 0.11 | 500 | 0.80 | 0.01 | 0.00 | 0.00 | 500 | 0.80 | 0.01 | 0.02 | 0.00 | 0.15 | 15.15 | **500** | **3** |
| **600** | 1.70 | 0.04 | 0.02 | | 0.00 | 0.00 | 0.04 | 0.00 | 0.01 | 0.11 | 0.16 | 600 | 0.96 | 0.01 | 0.00 | 0.00 | 600 | 0.96 | 0.01 | 0.03 | 0.00 | 0.22 | 15.22 | **600** | **3** |
| **700** | 1.99 | 0.06 | 0.03 | | 0.00 | 0.00 | 0.05 | 0.00 | 0.02 | 0.15 | 0.22 | 700 | 1.12 | 0.02 | 0.00 | 0.00 | 700 | 1.12 | 0.02 | 0.04 | 0.01 | 0.30 | 15.30 | **700** | **4** |
| **800** | 2.27 | 0.08 | 0.04 | | 0.00 | 0.00 | 0.06 | 0.00 | 0.02 | 0.20 | 0.29 | 800 | 1.28 | 0.03 | 0.00 | 0.00 | 800 | 1.28 | 0.03 | 0.05 | 0.01 | 0.39 | 15.39 | **800** | **4** |
| **900** | 2.55 | 0.10 | 0.05 | | 0.00 | 0.00 | 0.08 | 0.00 | 0.03 | 0.25 | 0.36 | 900 | 1.44 | 0.03 | 0.00 | 0.00 | 900 | 1.44 | 0.03 | 0.06 | 0.01 | 0.49 | 15.49 | **900** | **5** |
| **1,000** | 2.84 | 0.12 | 0.06 | | 0.00 | 0.00 | 0.10 | 0.00 | 0.04 | 0.31 | 0.45 | 1,000 | 1.60 | 0.04 | 0.00 | 0.00 | 1,000 | 1.60 | 0.04 | 0.07 | 0.01 | 0.60 | 15.60 | **1,000** | **5** |
| **1,100** | 3.12 | 0.15 | 0.08 | | 0.00 | 0.00 | 0.12 | 0.00 | 0.05 | 0.38 | 0.54 | 1,100 | 1.76 | 0.05 | 0.00 | 0.00 | 1,100 | 1.76 | 0.05 | 0.09 | 0.01 | 0.72 | 15.72 | **1,100** | **6** |
| **1,200** | 3.40 | 0.18 | 0.09 | | 0.00 | 0.00 | 0.14 | 0.00 | 0.05 | 0.45 | 0.65 | 1,200 | 1.91 | 0.06 | 0.00 | 0.00 | 1,200 | 1.91 | 0.06 | 0.10 | 0.02 | 0.86 | 15.86 | **1,200** | **6** |
| **1,300** | 3.69 | 0.21 | 0.10 | | 0.00 | 0.00 | 0.17 | 0.00 | 0.06 | 0.53 | 0.76 | 1,300 | 2.07 | 0.07 | 0.00 | 0.00 | 1,300 | 2.07 | 0.07 | 0.12 | 0.02 | 1.00 | 16.00 | **1,300** | **7** |
| **1,400** | 3.97 | 0.24 | 0.12 | | 0.00 | 0.00 | 0.20 | 0.00 | 0.07 | 0.61 | 0.88 | 1,400 | 2.23 | 0.08 | 0.00 | 0.00 | 1,400 | 2.23 | 0.08 | 0.14 | 0.02 | 1.16 | 16.16 | **1,400** | **8** |
| **1,500** | 4.26 | 0.28 | 0.14 | | 0.00 | 0.00 | 0.22 | 0.00 | 0.08 | 0.70 | 1.01 | 1,500 | 2.39 | 0.09 | 0.00 | 0.00 | 1,500 | 2.39 | 0.09 | 0.15 | 0.03 | 1.33 | 16.33 | **1,500** | **8** |
| **1,600** | 4.54 | 0.32 | 0.15 | | 0.00 | 0.00 | 0.26 | 0.00 | 0.10 | 0.80 | 1.15 | 1,600 | 2.55 | 0.10 | 0.00 | 0.00 | 1,600 | 2.55 | 0.10 | 0.17 | 0.03 | 1.51 | 16.51 | **1,600** | **9** |
| **1,700** | 4.82 | 0.36 | 0.17 | | 0.00 | 0.00 | 0.29 | 0.00 | 0.11 | 0.90 | 1.30 | 1,700 | 2.71 | 0.11 | 0.00 | 0.00 | 1,700 | 2.71 | 0.11 | 0.19 | 0.03 | 1.70 | 16.70 | **1,700** | **10** |
| **1,800** | 5.11 | 0.40 | 0.19 | | 0.00 | 0.00 | 0.32 | 0.00 | 0.12 | 1.01 | 1.46 | 1,800 | 2.87 | 0.13 | 0.00 | 0.00 | 1,800 | 2.87 | 0.13 | 0.22 | 0.04 | 1.90 | 16.90 | **1,800** | **10** |
| **1,900** | 5.39 | 0.45 | 0.21 | | 0.00 | 0.00 | 0.36 | 0.00 | 0.14 | 1.13 | 1.62 | 1,900 | 3.03 | 0.14 | 0.00 | 0.00 | 1,900 | 3.03 | 0.14 | 0.24 | 0.04 | 2.12 | 17.12 | **1,900** | **11** |
| **2,000** | 5.67 | 0.50 | 0.23 | | 0.00 | 0.00 | 0.40 | 0.00 | 0.15 | 1.25 | 1.80 | 2,000 | 3.19 | 0.16 | 0.00 | 0.00 | 2,000 | 3.19 | 0.16 | 0.26 | 0.05 | 2.34 | 17.34 | **2,000** | **12** |
| **2,100** | 5.96 | 0.55 | 0.25 | | 0.00 | 0.00 | 0.44 | 0.00 | 0.17 | 1.38 | 1.98 | 2,100 | 3.35 | 0.17 | 0.00 | 0.00 | 2,100 | 3.35 | 0.17 | 0.29 | 0.05 | 2.58 | 17.58 | **2,100** | **12** |
| **2,200** | 6.24 | 0.60 | 0.27 | | 0.00 | 0.00 | 0.48 | 0.00 | 0.18 | 1.51 | 2.18 | 2,200 | 3.51 | 0.19 | 0.00 | 0.00 | 2,200 | 3.51 | 0.19 | 0.31 | 0.06 | 2.82 | 17.82 | **2,200** | **13** |
| **2,300** | 6.53 | 0.66 | 0.30 | | 0.00 | 0.00 | 0.53 | 0.00 | 0.20 | 1.65 | 2.38 | 2,300 | 3.67 | 0.21 | 0.00 | 0.00 | 2,300 | 3.67 | 0.21 | 0.34 | 0.06 | 3.08 | 18.08 | **2,300** | **14** |
| **2,400** | 6.81 | 0.72 | 0.32 | | 0.00 | 0.00 | 0.58 | 0.00 | 0.22 | 1.80 | 2.59 | 2,400 | 3.83 | 0.23 | 0.00 | 0.00 | 2,400 | 3.83 | 0.23 | 0.37 | 0.07 | 3.35 | 18.35 | **2,400** | **15** |
| **2,500** | 7.09 | 0.78 | 0.35 | | 0.00 | 0.00 | 0.62 | 0.00 | 0.23 | 1.95 | 2.81 | 2,500 | 3.99 | 0.25 | 0.00 | 0.00 | 2,500 | 3.99 | 0.25 | 0.40 | 0.07 | 3.63 | 18.63 | **2,500** | **16** |
| **2,600** | 7.38 | 0.84 | 0.37 | | 0.00 | 0.00 | 0.68 | 0.00 | 0.25 | 2.11 | 3.04 | 2,600 | 4.15 | 0.27 | 0.00 | 0.00 | 2,600 | 4.15 | 0.27 | 0.43 | 0.08 | 3.92 | 18.92 | **2,600** | **17** |
| **2,700** | 7.66 | 0.91 | 0.40 | | 0.00 | 0.00 | 0.73 | 0.00 | 0.27 | 2.28 | 3.28 | 2,700 | 4.31 | 0.29 | 0.00 | 0.00 | 2,700 | 4.31 | 0.29 | 0.46 | 0.09 | 4.23 | 19.23 | **2,700** | **17** |
| **2,800** | 7.94 | 0.98 | 0.43 | | 0.00 | 0.00 | 0.78 | 0.00 | 0.29 | 2.45 | 3.53 | 2,800 | 4.47 | 0.31 | 0.00 | 0.00 | 2,800 | 4.47 | 0.31 | 0.49 | 0.09 | 4.54 | 19.54 | **2,800** | **18** |
| **2,900** | 8.23 | 1.05 | 0.46 | | 0.00 | 0.00 | 0.84 | 0.00 | 0.32 | 2.63 | 3.78 | 2,900 | 4.63 | 0.33 | 0.00 | 0.00 | 2,900 | 4.63 | 0.33 | 0.52 | 0.10 | 4.86 | 19.86 | **2,900** | **19** |
| **3,000** | 8.51 | 1.12 | 0.49 | | 0.00 | 0.00 | 0.90 | 0.00 | 0.34 | 2.81 | 4.05 | 3,000 | 4.79 | 0.36 | 0.00 | 0.00 | 3,000 | 4.79 | 0.36 | 0.56 | 0.11 | 5.20 | 20.20 | **3,000** | **20** |
| **3,100** | 8.79 | 1.20 | 0.52 | | 0.00 | 0.00 | 0.96 | 0.00 | 0.36 | 3.00 | 4.32 | 3,100 | 4.95 | 0.38 | 0.00 | 0.00 | 3,100 | 4.95 | 0.38 | 0.59 | 0.11 | 5.55 | 20.55 | **3,100** | **21** |
| **3,200** | 9.08 | 1.28 | 0.55 | | 0.00 | 0.00 | 1.02 | 0.00 | 0.38 | 3.20 | 4.61 | 3,200 | 5.11 | 0.40 | 0.00 | 0.00 | 3,200 | 5.11 | 0.40 | 0.63 | 0.12 | 5.91 | 20.91 | **3,200** | **23** |
| **3,300** | 9.36 | 1.36 | 0.58 | | 0.00 | 0.00 | 1.09 | 0.00 | 0.41 | 3.40 | 4.90 | 3,300 | 5.27 | 0.43 | 0.00 | 0.00 | 3,300 | 5.27 | 0.43 | 0.66 | 0.13 | 6.27 | 21.27 | **3,300** | **24** |
| **3,400** | 9.65 | 1.44 | 0.61 | | 0.00 | 0.00 | 1.16 | 0.00 | 0.43 | 3.61 | 5.20 | 3,400 | 5.43 | 0.46 | 0.00 | 0.00 | 3,400 | 5.43 | 0.46 | 0.70 | 0.14 | 6.65 | 21.65 | **3,400** | **25** |
| **3,500** | 9.93 | 1.53 | 0.65 | | 0.00 | 0.00 | 1.22 | 0.00 | 0.46 | 3.83 | 5.51 | 3,500 | 5.59 | 0.48 | 0.00 | 0.00 | 3,500 | 5.59 | 0.48 | 0.74 | 0.15 | 7.05 | 22.05 | **3,500** | **26** |
| **3,600** | 10.21 | 1.62 | 0.68 | | 0.00 | 0.00 | 1.30 | 0.00 | 0.49 | 4.05 | 5.83 | 3,600 | 5.74 | 0.51 | 0.00 | 0.00 | 3,600 | 5.74 | 0.51 | 0.78 | 0.15 | 7.45 | 22.45 | **3,600** | **27** |
| **3,700** | 10.50 | 1.71 | 0.72 | | 0.00 | 0.00 | 1.37 | 0.00 | 0.51 | 4.28 | 6.16 | 3,700 | 5.90 | 0.54 | 0.00 | 0.00 | 3,700 | 5.90 | 0.54 | 0.82 | 0.16 | 7.86 | 22.86 | **3,700** | **28** |
| **3,800** | 10.78 | 1.80 | 0.75 | | 0.00 | 0.00 | 1.44 | 0.00 | 0.54 | 4.51 | 6.50 | 3,800 | 6.06 | 0.57 | 0.00 | 0.00 | 3,800 | 6.06 | 0.57 | 0.86 | 0.17 | 8.29 | 23.29 | **3,800** | **30** |
| **3,900** | 11.06 | 1.90 | 0.79 | | 0.00 | 0.00 | 1.52 | 0.00 | 0.57 | 4.75 | 6.84 | 3,900 | 6.22 | 0.60 | 0.00 | 0.00 | 3,900 | 6.22 | 0.60 | 0.91 | 0.18 | 8.72 | 23.72 | **3,900** | **31** |
| **4,000** | 11.35 | 2.00 | 0.83 | | 0.00 | 0.00 | 1.60 | 0.00 | 0.60 | 5.00 | 7.20 | 4,000 | 6.38 | 0.63 | 0.00 | 0.00 | 4,000 | 6.38 | 0.63 | 0.95 | 0.19 | 9.17 | 24.17 | **4,000** | **33** |

**Table C-2:** **Reclamation Ditch Diversion Pump Station, Davis Rd, Option 2**

**System Head Calculations**

**Sizing**
Target Q = 6 cfs = 2700 gpm
Install two each 3 cfs pumps (plus spare)
Q = 1350 cfs

| Parameter | Value |
|---|---|
| Number of Pumps in Parallel | **1** |
| Pump Discharge Diameter (inches) | **10** |
| Length of Pump Discharge (feet) | **25** |
| Discharge Hazen-Williams Coefficient (C) | **130** |
| Force Main Diameter in PS#2 (inches) | **12** |
| Force Main Length in PS#2 (feet) | **0** |
| Force Main Diameter from PS#2 to MH (inches) | **12** |
| Force Main Length from PS#2 to MH (feet) | **100** |
| Force Main Hazen-Williams Coefficient (C) | **120** |
| Outfall Elevation (feet) | **20.00** |
| Wetwell Pumping Level (feet) | **5.00** |
| Static Lift (feet) | 15.00 |

PS1 Flow - gpm

| **Fitting** | **K Value** |
|---|---|
| 45 Elbow | 0.2 |
| 90 Elbow | 0.3 |
| 22.5 Elbow | 0.075 |
| 11.25 Elbow | 0 |
| GV | 0.3 |
| CV | 2.5 |
| Reducer | 0.03 |
| FR Elbow | 0.3 |
| Tee branch | 0.75 |

| Pump Discharge Piping | | | | | | | | | | | | Force Main in PS | | | | | Force Main from PS to MH | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Minor Losses | | | | | | | | | | | | | | | | | | | | | |
| Flow (gpm) | Velocity (fps) | Velocity Head (ft) | Friction Loss (ft) | K: | Flare Elbow **0** (ft) | Suction Elbow **0** (ft) | Discharge Elbows **0.8** (ft) | Tee Branch **0** (ft) | Gate Valve **0.3** (ft) | Check Valve **2.5** (ft) | Total Minor Losses (ft) | Flow (gpm) | Velocity (fps) | Velocity Head (ft) | Friction Loss (ft) | **0.0** Minor Losses (ft) | Flow (gpm) | Velocity (fps) | Velocity Head (ft) | Friction Loss (ft) | **0.3** Minor Losses (ft) | Total Loss (ft) | TDH (ft) | Pump Flow (gpm) | HP at 75% eff. HP |
| **0** | 0.00 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 15.00 | **0** | **0** |
| **100** | 0.41 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 100 | 0.28 | 0.00 | 0.00 | 0.00 | 100 | 0.28 | 0.00 | 0.00 | 0.00 | 0.02 | 15.02 | **100** | **1** |
| **200** | 0.82 | 0.01 | 0.01 | | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.03 | 0.04 | 200 | 0.57 | 0.00 | 0.00 | 0.00 | 200 | 0.57 | 0.00 | 0.02 | 0.00 | 0.06 | 15.06 | **200** | **1** |
| **300** | 1.23 | 0.02 | 0.02 | | 0.00 | 0.00 | 0.02 | 0.00 | 0.01 | 0.06 | 0.08 | 300 | 0.85 | 0.01 | 0.00 | 0.00 | 300 | 0.85 | 0.01 | 0.03 | 0.00 | 0.14 | 15.14 | **300** | **2** |
| **400** | 1.63 | 0.04 | 0.03 | | 0.00 | 0.00 | 0.03 | 0.00 | 0.01 | 0.10 | 0.15 | 400 | 1.13 | 0.02 | 0.00 | 0.00 | 400 | 1.13 | 0.02 | 0.05 | 0.01 | 0.24 | 15.24 | **400** | **2** |
| **500** | 2.04 | 0.06 | 0.04 | | 0.00 | 0.00 | 0.05 | 0.00 | 0.02 | 0.16 | 0.23 | 500 | 1.42 | 0.03 | 0.00 | 0.00 | 500 | 1.42 | 0.03 | 0.08 | 0.01 | 0.37 | 15.37 | **500** | **3** |
| **600** | 2.45 | 0.09 | 0.06 | | 0.00 | 0.00 | 0.07 | 0.00 | 0.03 | 0.23 | 0.34 | 600 | 1.70 | 0.04 | 0.00 | 0.00 | 600 | 1.70 | 0.04 | 0.12 | 0.01 | 0.52 | 15.52 | **600** | **3** |
| **700** | 2.86 | 0.13 | 0.08 | | 0.00 | 0.00 | 0.10 | 0.00 | 0.04 | 0.32 | 0.46 | 700 | 1.99 | 0.06 | 0.00 | 0.00 | 700 | 1.99 | 0.06 | 0.15 | 0.02 | 0.71 | 15.71 | **700** | **4** |
| **800** | 3.27 | 0.17 | 0.10 | | 0.00 | 0.00 | 0.13 | 0.00 | 0.05 | 0.41 | 0.60 | 800 | 2.27 | 0.08 | 0.00 | 0.00 | 800 | 2.27 | 0.08 | 0.20 | 0.02 | 0.92 | 15.92 | **800** | **4** |
| **900** | 3.68 | 0.21 | 0.13 | | 0.00 | 0.00 | 0.17 | 0.00 | 0.06 | 0.52 | 0.76 | 900 | 2.55 | 0.10 | 0.00 | 0.00 | 900 | 2.55 | 0.10 | 0.24 | 0.03 | 1.16 | 16.16 | **900** | **5** |
| **1,000** | 4.09 | 0.26 | 0.15 | | 0.00 | 0.00 | 0.21 | 0.00 | 0.08 | 0.65 | 0.93 | 1,000 | 2.84 | 0.12 | 0.00 | 0.00 | 1,000 | 2.84 | 0.12 | 0.30 | 0.04 | 1.42 | 16.42 | **1,000** | **6** |
| **1,100** | 4.49 | 0.31 | 0.18 | | 0.00 | 0.00 | 0.25 | 0.00 | 0.09 | 0.78 | 1.13 | 1,100 | 3.12 | 0.15 | 0.00 | 0.00 | 1,100 | 3.12 | 0.15 | 0.35 | 0.05 | 1.71 | 16.71 | **1,100** | **6** |
| **1,200** | 4.90 | 0.37 | 0.22 | | 0.00 | 0.00 | 0.30 | 0.00 | 0.11 | 0.93 | 1.34 | 1,200 | 3.40 | 0.18 | 0.00 | 0.00 | 1,200 | 3.40 | 0.18 | 0.41 | 0.05 | 2.03 | 17.03 | **1,200** | **7** |
| **1,300** | 5.31 | 0.44 | 0.25 | | 0.00 | 0.00 | 0.35 | 0.00 | 0.13 | 1.09 | 1.58 | 1,300 | 3.69 | 0.21 | 0.00 | 0.00 | 1,300 | 3.69 | 0.21 | 0.48 | 0.06 | 2.37 | 17.37 | **1,300** | **8** |
| **1,400** | 5.72 | 0.51 | 0.29 | | 0.00 | 0.00 | 0.41 | 0.00 | 0.15 | 1.27 | 1.83 | 1,400 | 3.97 | 0.24 | 0.00 | 0.00 | 1,400 | 3.97 | 0.24 | 0.55 | 0.07 | 2.74 | 17.74 | **1,400** | **8** |
| **1,500** | 6.13 | 0.58 | 0.33 | | 0.00 | 0.00 | 0.47 | 0.00 | 0.17 | 1.46 | 2.10 | 1,500 | 4.26 | 0.28 | 0.00 | 0.00 | 1,500 | 4.26 | 0.28 | 0.63 | 0.08 | 3.14 | 18.14 | **1,500** | **9** |
| **1,600** | 6.54 | 0.66 | 0.37 | | 0.00 | 0.00 | 0.53 | 0.00 | 0.20 | 1.66 | 2.39 | 1,600 | 4.54 | 0.32 | 0.00 | 0.00 | 1,600 | 4.54 | 0.32 | 0.71 | 0.10 | 3.56 | 18.56 | **1,600** | **10** |
| **1,700** | 6.94 | 0.75 | 0.41 | | 0.00 | 0.00 | 0.60 | 0.00 | 0.22 | 1.87 | 2.70 | 1,700 | 4.82 | 0.36 | 0.00 | 0.00 | 1,700 | 4.82 | 0.36 | 0.79 | 0.11 | 4.01 | 19.01 | **1,700** | **11** |
| **1,800** | 7.35 | 0.84 | 0.46 | | 0.00 | 0.00 | 0.67 | 0.00 | 0.25 | 2.10 | 3.02 | 1,800 | 5.11 | 0.40 | 0.00 | 0.00 | 1,800 | 5.11 | 0.40 | 0.88 | 0.12 | 4.48 | 19.48 | **1,800** | **12** |
| **1,900** | 7.76 | 0.94 | 0.51 | | 0.00 | 0.00 | 0.75 | 0.00 | 0.28 | 2.34 | 3.37 | 1,900 | 5.39 | 0.45 | 0.00 | 0.00 | 1,900 | 5.39 | 0.45 | 0.97 | 0.14 | 4.98 | 19.98 | **1,900** | **13** |
| **2,000** | 8.17 | 1.04 | 0.56 | | 0.00 | 0.00 | 0.83 | 0.00 | 0.31 | 2.59 | 3.73 | 2,000 | 5.67 | 0.50 | 0.00 | 0.00 | 2,000 | 5.67 | 0.50 | 1.07 | 0.15 | 5.51 | 20.51 | **2,000** | **14** |
| **2,100** | 8.58 | 1.14 | 0.61 | | 0.00 | 0.00 | 0.91 | 0.00 | 0.34 | 2.86 | 4.11 | 2,100 | 5.96 | 0.55 | 0.00 | 0.00 | 2,100 | 5.96 | 0.55 | 1.17 | 0.17 | 6.06 | 21.06 | **2,100** | **15** |
| **2,200** | 8.99 | 1.25 | 0.67 | | 0.00 | 0.00 | 1.00 | 0.00 | 0.38 | 3.14 | 4.52 | 2,200 | 6.24 | 0.60 | 0.00 | 0.00 | 2,200 | 6.24 | 0.60 | 1.27 | 0.18 | 6.64 | 21.64 | **2,200** | **16** |
| **2,300** | 9.40 | 1.37 | 0.72 | | 0.00 | 0.00 | 1.10 | 0.00 | 0.41 | 3.43 | 4.94 | 2,300 | 6.53 | 0.66 | 0.00 | 0.00 | 2,300 | 6.53 | 0.66 | 1.38 | 0.20 | 7.24 | 22.24 | **2,300** | **17** |
| **2,400** | 9.80 | 1.49 | 0.78 | | 0.00 | 0.00 | 1.19 | 0.00 | 0.45 | 3.73 | 5.37 | 2,400 | 6.81 | 0.72 | 0.00 | 0.00 | 2,400 | 6.81 | 0.72 | 1.49 | 0.22 | 7.87 | 22.87 | **2,400** | **18** |
| **2,500** | 10.21 | 1.62 | 0.84 | | 0.00 | 0.00 | 1.30 | 0.00 | 0.49 | 4.05 | 5.83 | 2,500 | 7.09 | 0.78 | 0.00 | 0.00 | 2,500 | 7.09 | 0.78 | 1.61 | 0.23 | 8.52 | 23.52 | **2,500** | **20** |
| **2,600** | 10.62 | 1.75 | 0.91 | | 0.00 | 0.00 | 1.40 | 0.00 | 0.53 | 4.38 | 6.31 | 2,600 | 7.38 | 0.84 | 0.00 | 0.00 | 2,600 | 7.38 | 0.84 | 1.73 | 0.25 | 9.20 | 24.20 | **2,600** | **21** |
| **2,700** | 11.03 | 1.89 | 0.97 | | 0.00 | 0.00 | 1.51 | 0.00 | 0.57 | 4.72 | 6.80 | 2,700 | 7.66 | 0.91 | 0.00 | 0.00 | 2,700 | 7.66 | 0.91 | 1.86 | 0.27 | 9.91 | 24.91 | **2,700** | **23** |
| **2,800** | 11.44 | 2.03 | 1.04 | | 0.00 | 0.00 | 1.63 | 0.00 | 0.61 | 5.08 | 7.31 | 2,800 | 7.94 | 0.98 | 0.00 | 0.00 | 2,800 | 7.94 | 0.98 | 1.99 | 0.29 | 10.64 | 25.64 | **2,800** | **24** |
| **2,900** | 11.85 | 2.18 | 1.11 | | 0.00 | 0.00 | 1.74 | 0.00 | 0.65 | 5.45 | 7.85 | 2,900 | 8.23 | 1.05 | 0.00 | 0.00 | 2,900 | 8.23 | 1.05 | 2.12 | 0.32 | 11.39 | 26.39 | **2,900** | **26** |
| **3,000** | 12.26 | 2.33 | 1.18 | | 0.00 | 0.00 | 1.87 | 0.00 | 0.70 | 5.83 | 8.40 | 3,000 | 8.51 | 1.12 | 0.00 | 0.00 | 3,000 | 8.51 | 1.12 | 2.26 | 0.34 | 12.18 | 27.18 | **3,000** | **27** |
| **3,100** | 12.66 | 2.49 | 1.26 | | 0.00 | 0.00 | 1.99 | 0.00 | 0.75 | 6.23 | 8.97 | 3,100 | 8.79 | 1.20 | 0.00 | 0.00 | 3,100 | 8.79 | 1.20 | 2.40 | 0.36 | 12.98 | 27.98 | **3,100** | **29** |
| **3,200** | 13.07 | 2.65 | 1.33 | | 0.00 | 0.00 | 2.12 | 0.00 | 0.80 | 6.63 | 9.55 | 3,200 | 9.08 | 1.28 | 0.00 | 0.00 | 3,200 | 9.08 | 1.28 | 2.55 | 0.38 | 13.82 | 28.82 | **3,200** | **31** |
| **3,300** | 13.48 | 2.82 | 1.41 | | 0.00 | 0.00 | 2.26 | 0.00 | 0.85 | 7.06 | 10.16 | 3,300 | 9.36 | 1.36 | 0.00 | 0.00 | 3,300 | 9.36 | 1.36 | 2.69 | 0.41 | 14.67 | 29.67 | **3,300** | **33** |
| **3,400** | 13.89 | 3.00 | 1.49 | | 0.00 | 0.00 | 2.40 | 0.00 | 0.90 | 7.49 | 10.78 | 3,400 | 9.65 | 1.44 | 0.00 | 0.00 | 3,400 | 9.65 | 1.44 | 2.85 | 0.43 | 15.56 | 30.56 | **3,400** | **35** |
| **3,500** | 14.30 | 3.17 | 1.57 | | 0.00 | 0.00 | 2.54 | 0.00 | 0.95 | 7.94 | 11.43 | 3,500 | 9.93 | 1.53 | 0.00 | 0.00 | 3,500 | 9.93 | 1.53 | 3.00 | 0.46 | 16.46 | 31.46 | **3,500** | **37** |
| **3,600** | 14.71 | 3.36 | 1.66 | | 0.00 | 0.00 | 2.69 | 0.00 | 1.01 | 8.40 | 12.09 | 3,600 | 10.21 | 1.62 | 0.00 | 0.00 | 3,600 | 10.21 | 1.62 | 3.17 | 0.49 | 17.40 | 32.40 | **3,600** | **39** |
| **3,700** | 15.12 | 3.55 | 1.74 | | 0.00 | 0.00 | 2.84 | 0.00 | 1.06 | 8.87 | 12.77 | 3,700 | 10.50 | 1.71 | 0.00 | 0.00 | 3,700 | 10.50 | 1.71 | 3.33 | 0.51 | 18.36 | 33.36 | **3,700** | **42** |
| **3,800** | 15.52 | 3.74 | 1.83 | | 0.00 | 0.00 | 2.99 | 0.00 | 1.12 | 9.36 | 13.47 | 3,800 | 10.78 | 1.80 | 0.00 | 0.00 | 3,800 | 10.78 | 1.80 | 3.50 | 0.54 | 19.34 | 34.34 | **3,800** | **44** |
| **3,900** | 15.93 | 3.94 | 1.92 | | 0.00 | 0.00 | 3.15 | 0.00 | 1.18 | 9.85 | 14.19 | 3,900 | 11.06 | 1.90 | 0.00 | 0.00 | 3,900 | 11.06 | 1.90 | 3.67 | 0.57 | 20.35 | 35.35 | **3,900** | **46** |
| **4,000** | 16.34 | 4.15 | 2.01 | | 0.00 | 0.00 | 3.32 | 0.00 | 1.24 | 10.37 | 14.93 | 4,000 | 11.35 | 2.00 | 0.00 | 0.00 | 4,000 | 11.35 | 2.00 | 3.85 | 0.60 | 21.39 | 36.39 | **4,000** | **49** |

**Table C-3:** **Reclamation Ditch Diversion Pump Station, Castroville**

**System Head Calculations**

**Sizing**
Target Q = 3 cfs = 1350 gpm

| Parameter | Value |
|---|---|
| Number of Pumps in Parallel | **1** |
| Pump Discharge Diameter (inches) | **10** |
| Length of Pump Discharge (feet) | **25** |
| Discharge Hazen-Williams Coefficient (C) | **130** |
| Force Main Diameter in PS#2 (inches) | **12** |
| Force Main Length in PS#2 (feet) | **0** |
| Force Main Diameter from PS#2 to MH (inches) | **12** |
| Force Main Length from PS#2 to MH (feet) | **300** |
| Force Main Hazen-Williams Coefficient (C) | **120** |
| Outfall Elevation (feet) | **5.00** |
| Wetwell Pumping Level (feet) | **-13.00** |
| Static Lift (feet) | 18.00 |

PS1 Flow - gpm

| **Fitting** | **K Value** |
|---|---|
| 45 Elbow | 0.2 |
| 90 Elbow | 0.3 |
| 22.5 Elbow | 0.075 |
| 11.25 Elbow | 0 |
| GV | 0.3 |
| CV | 2.5 |
| Reducer | 0.03 |
| FR Elbow | 0.3 |
| Tee branch | 0.75 |

| Pump Discharge Piping | | | | | | | | | | | | Force Main in PS | | | | | Force Main from PS to MH | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Minor Losses | | | | | | | | | | | | | | | | | | | | | |
| Flow (gpm) | Velocity (fps) | Velocity Head (ft) | Friction Loss (ft) | K: | Flare Elbow **0** (ft) | Suction Elbow **0** (ft) | Discharge Elbows **0.8** (ft) | Tee Branch **0** (ft) | Gate Valve **0.3** (ft) | Check Valve **2.5** (ft) | Total Minor Losses (ft) | Flow (gpm) | Velocity (fps) | Velocity Head (ft) | Friction Loss (ft) | **0.0** Minor Losses (ft) | Flow (gpm) | Velocity (fps) | Velocity Head (ft) | Friction Loss (ft) | **0.3** Minor Losses (ft) | Total Loss (ft) | TDH (ft) | Pump Flow (gpm) | HP at 75% eff. HP |
| **0** | 0.00 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 18.00 | **0** | **0** |
| **100** | 0.41 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 100 | 0.28 | 0.00 | 0.00 | 0.00 | 100 | 0.28 | 0.00 | 0.01 | 0.00 | 0.02 | 18.02 | **100** | **1** |
| **200** | 0.82 | 0.01 | 0.01 | | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.03 | 0.04 | 200 | 0.57 | 0.00 | 0.00 | 0.00 | 200 | 0.57 | 0.00 | 0.05 | 0.00 | 0.09 | 18.09 | **200** | **1** |
| **300** | 1.23 | 0.02 | 0.02 | | 0.00 | 0.00 | 0.02 | 0.00 | 0.01 | 0.06 | 0.08 | 300 | 0.85 | 0.01 | 0.00 | 0.00 | 300 | 0.85 | 0.01 | 0.10 | 0.00 | 0.20 | 18.20 | **300** | **2** |
| **400** | 1.63 | 0.04 | 0.03 | | 0.00 | 0.00 | 0.03 | 0.00 | 0.01 | 0.10 | 0.15 | 400 | 1.13 | 0.02 | 0.00 | 0.00 | 400 | 1.13 | 0.02 | 0.16 | 0.01 | 0.35 | 18.35 | **400** | **2** |
| **500** | 2.04 | 0.06 | 0.04 | | 0.00 | 0.00 | 0.05 | 0.00 | 0.02 | 0.16 | 0.23 | 500 | 1.42 | 0.03 | 0.00 | 0.00 | 500 | 1.42 | 0.03 | 0.25 | 0.01 | 0.53 | 18.53 | **500** | **3** |
| **600** | 2.45 | 0.09 | 0.06 | | 0.00 | 0.00 | 0.07 | 0.00 | 0.03 | 0.23 | 0.34 | 600 | 1.70 | 0.04 | 0.00 | 0.00 | 600 | 1.70 | 0.04 | 0.35 | 0.01 | 0.75 | 18.75 | **600** | **4** |
| **700** | 2.86 | 0.13 | 0.08 | | 0.00 | 0.00 | 0.10 | 0.00 | 0.04 | 0.32 | 0.46 | 700 | 1.99 | 0.06 | 0.00 | 0.00 | 700 | 1.99 | 0.06 | 0.46 | 0.02 | 1.01 | 19.01 | **700** | **4** |
| **800** | 3.27 | 0.17 | 0.10 | | 0.00 | 0.00 | 0.13 | 0.00 | 0.05 | 0.41 | 0.60 | 800 | 2.27 | 0.08 | 0.00 | 0.00 | 800 | 2.27 | 0.08 | 0.59 | 0.02 | 1.31 | 19.31 | **800** | **5** |
| **900** | 3.68 | 0.21 | 0.13 | | 0.00 | 0.00 | 0.17 | 0.00 | 0.06 | 0.52 | 0.76 | 900 | 2.55 | 0.10 | 0.00 | 0.00 | 900 | 2.55 | 0.10 | 0.73 | 0.03 | 1.64 | 19.64 | **900** | **6** |
| **1,000** | 4.09 | 0.26 | 0.15 | | 0.00 | 0.00 | 0.21 | 0.00 | 0.08 | 0.65 | 0.93 | 1,000 | 2.84 | 0.12 | 0.00 | 0.00 | 1,000 | 2.84 | 0.12 | 0.89 | 0.04 | 2.01 | 20.01 | **1,000** | **7** |
| **1,100** | 4.49 | 0.31 | 0.18 | | 0.00 | 0.00 | 0.25 | 0.00 | 0.09 | 0.78 | 1.13 | 1,100 | 3.12 | 0.15 | 0.00 | 0.00 | 1,100 | 3.12 | 0.15 | 1.06 | 0.05 | 2.42 | 20.42 | **1,100** | **8** |
| **1,200** | 4.90 | 0.37 | 0.22 | | 0.00 | 0.00 | 0.30 | 0.00 | 0.11 | 0.93 | 1.34 | 1,200 | 3.40 | 0.18 | 0.00 | 0.00 | 1,200 | 3.40 | 0.18 | 1.24 | 0.05 | 2.86 | 20.86 | **1,200** | **8** |
| **1,300** | 5.31 | 0.44 | 0.25 | | 0.00 | 0.00 | 0.35 | 0.00 | 0.13 | 1.09 | 1.58 | 1,300 | 3.69 | 0.21 | 0.00 | 0.00 | 1,300 | 3.69 | 0.21 | 1.44 | 0.06 | 3.33 | 21.33 | **1,300** | **9** |
| **1,400** | 5.72 | 0.51 | 0.29 | | 0.00 | 0.00 | 0.41 | 0.00 | 0.15 | 1.27 | 1.83 | 1,400 | 3.97 | 0.24 | 0.00 | 0.00 | 1,400 | 3.97 | 0.24 | 1.65 | 0.07 | 3.85 | 21.85 | **1,400** | **10** |
| **1,500** | 6.13 | 0.58 | 0.33 | | 0.00 | 0.00 | 0.47 | 0.00 | 0.17 | 1.46 | 2.10 | 1,500 | 4.26 | 0.28 | 0.00 | 0.00 | 1,500 | 4.26 | 0.28 | 1.88 | 0.08 | 4.39 | 22.39 | **1,500** | **11** |
| **1,600** | 6.54 | 0.66 | 0.37 | | 0.00 | 0.00 | 0.53 | 0.00 | 0.20 | 1.66 | 2.39 | 1,600 | 4.54 | 0.32 | 0.00 | 0.00 | 1,600 | 4.54 | 0.32 | 2.12 | 0.10 | 4.97 | 22.97 | **1,600** | **12** |
| **1,700** | 6.94 | 0.75 | 0.41 | | 0.00 | 0.00 | 0.60 | 0.00 | 0.22 | 1.87 | 2.70 | 1,700 | 4.82 | 0.36 | 0.00 | 0.00 | 1,700 | 4.82 | 0.36 | 2.37 | 0.11 | 5.59 | 23.59 | **1,700** | **14** |
| **1,800** | 7.35 | 0.84 | 0.46 | | 0.00 | 0.00 | 0.67 | 0.00 | 0.25 | 2.10 | 3.02 | 1,800 | 5.11 | 0.40 | 0.00 | 0.00 | 1,800 | 5.11 | 0.40 | 2.63 | 0.12 | 6.24 | 24.24 | **1,800** | **15** |
| **1,900** | 7.76 | 0.94 | 0.51 | | 0.00 | 0.00 | 0.75 | 0.00 | 0.28 | 2.34 | 3.37 | 1,900 | 5.39 | 0.45 | 0.00 | 0.00 | 1,900 | 5.39 | 0.45 | 2.91 | 0.14 | 6.92 | 24.92 | **1,900** | **16** |
| **2,000** | 8.17 | 1.04 | 0.56 | | 0.00 | 0.00 | 0.83 | 0.00 | 0.31 | 2.59 | 3.73 | 2,000 | 5.67 | 0.50 | 0.00 | 0.00 | 2,000 | 5.67 | 0.50 | 3.20 | 0.15 | 7.64 | 25.64 | **2,000** | **17** |
| **2,100** | 8.58 | 1.14 | 0.61 | | 0.00 | 0.00 | 0.91 | 0.00 | 0.34 | 2.86 | 4.11 | 2,100 | 5.96 | 0.55 | 0.00 | 0.00 | 2,100 | 5.96 | 0.55 | 3.50 | 0.17 | 8.39 | 26.39 | **2,100** | **19** |
| **2,200** | 8.99 | 1.25 | 0.67 | | 0.00 | 0.00 | 1.00 | 0.00 | 0.38 | 3.14 | 4.52 | 2,200 | 6.24 | 0.60 | 0.00 | 0.00 | 2,200 | 6.24 | 0.60 | 3.82 | 0.18 | 9.18 | 27.18 | **2,200** | **20** |
| **2,300** | 9.40 | 1.37 | 0.72 | | 0.00 | 0.00 | 1.10 | 0.00 | 0.41 | 3.43 | 4.94 | 2,300 | 6.53 | 0.66 | 0.00 | 0.00 | 2,300 | 6.53 | 0.66 | 4.15 | 0.20 | 10.00 | 28.00 | **2,300** | **22** |
| **2,400** | 9.80 | 1.49 | 0.78 | | 0.00 | 0.00 | 1.19 | 0.00 | 0.45 | 3.73 | 5.37 | 2,400 | 6.81 | 0.72 | 0.00 | 0.00 | 2,400 | 6.81 | 0.72 | 4.48 | 0.22 | 10.86 | 28.86 | **2,400** | **23** |
| **2,500** | 10.21 | 1.62 | 0.84 | | 0.00 | 0.00 | 1.30 | 0.00 | 0.49 | 4.05 | 5.83 | 2,500 | 7.09 | 0.78 | 0.00 | 0.00 | 2,500 | 7.09 | 0.78 | 4.84 | 0.23 | 11.75 | 29.75 | **2,500** | **25** |
| **2,600** | 10.62 | 1.75 | 0.91 | | 0.00 | 0.00 | 1.40 | 0.00 | 0.53 | 4.38 | 6.31 | 2,600 | 7.38 | 0.84 | 0.00 | 0.00 | 2,600 | 7.38 | 0.84 | 5.20 | 0.25 | 12.67 | 30.67 | **2,600** | **27** |
| **2,700** | 11.03 | 1.89 | 0.97 | | 0.00 | 0.00 | 1.51 | 0.00 | 0.57 | 4.72 | 6.80 | 2,700 | 7.66 | 0.91 | 0.00 | 0.00 | 2,700 | 7.66 | 0.91 | 5.58 | 0.27 | 13.62 | 31.62 | **2,700** | **29** |
| **2,800** | 11.44 | 2.03 | 1.04 | | 0.00 | 0.00 | 1.63 | 0.00 | 0.61 | 5.08 | 7.31 | 2,800 | 7.94 | 0.98 | 0.00 | 0.00 | 2,800 | 7.94 | 0.98 | 5.96 | 0.29 | 14.61 | 32.61 | **2,800** | **31** |
| **2,900** | 11.85 | 2.18 | 1.11 | | 0.00 | 0.00 | 1.74 | 0.00 | 0.65 | 5.45 | 7.85 | 2,900 | 8.23 | 1.05 | 0.00 | 0.00 | 2,900 | 8.23 | 1.05 | 6.36 | 0.32 | 15.64 | 33.64 | **2,900** | **33** |
| **3,000** | 12.26 | 2.33 | 1.18 | | 0.00 | 0.00 | 1.87 | 0.00 | 0.70 | 5.83 | 8.40 | 3,000 | 8.51 | 1.12 | 0.00 | 0.00 | 3,000 | 8.51 | 1.12 | 6.78 | 0.34 | 16.69 | 34.69 | **3,000** | **35** |
| **3,100** | 12.66 | 2.49 | 1.26 | | 0.00 | 0.00 | 1.99 | 0.00 | 0.75 | 6.23 | 8.97 | 3,100 | 8.79 | 1.20 | 0.00 | 0.00 | 3,100 | 8.79 | 1.20 | 7.20 | 0.36 | 17.78 | 35.78 | **3,100** | **37** |
| **3,200** | 13.07 | 2.65 | 1.33 | | 0.00 | 0.00 | 2.12 | 0.00 | 0.80 | 6.63 | 9.55 | 3,200 | 9.08 | 1.28 | 0.00 | 0.00 | 3,200 | 9.08 | 1.28 | 7.64 | 0.38 | 18.91 | 36.91 | **3,200** | **40** |
| **3,300** | 13.48 | 2.82 | 1.41 | | 0.00 | 0.00 | 2.26 | 0.00 | 0.85 | 7.06 | 10.16 | 3,300 | 9.36 | 1.36 | 0.00 | 0.00 | 3,300 | 9.36 | 1.36 | 8.08 | 0.41 | 20.06 | 38.06 | **3,300** | **42** |
| **3,400** | 13.89 | 3.00 | 1.49 | | 0.00 | 0.00 | 2.40 | 0.00 | 0.90 | 7.49 | 10.78 | 3,400 | 9.65 | 1.44 | 0.00 | 0.00 | 3,400 | 9.65 | 1.44 | 8.54 | 0.43 | 21.25 | 39.25 | **3,400** | **45** |
| **3,500** | 14.30 | 3.17 | 1.57 | | 0.00 | 0.00 | 2.54 | 0.00 | 0.95 | 7.94 | 11.43 | 3,500 | 9.93 | 1.53 | 0.00 | 0.00 | 3,500 | 9.93 | 1.53 | 9.01 | 0.46 | 22.47 | 40.47 | **3,500** | **48** |
| **3,600** | 14.71 | 3.36 | 1.66 | | 0.00 | 0.00 | 2.69 | 0.00 | 1.01 | 8.40 | 12.09 | 3,600 | 10.21 | 1.62 | 0.00 | 0.00 | 3,600 | 10.21 | 1.62 | 9.50 | 0.49 | 23.73 | 41.73 | **3,600** | **51** |
| **3,700** | 15.12 | 3.55 | 1.74 | | 0.00 | 0.00 | 2.84 | 0.00 | 1.06 | 8.87 | 12.77 | 3,700 | 10.50 | 1.71 | 0.00 | 0.00 | 3,700 | 10.50 | 1.71 | 9.99 | 0.51 | 25.02 | 43.02 | **3,700** | **54** |
| **3,800** | 15.52 | 3.74 | 1.83 | | 0.00 | 0.00 | 2.99 | 0.00 | 1.12 | 9.36 | 13.47 | 3,800 | 10.78 | 1.80 | 0.00 | 0.00 | 3,800 | 10.78 | 1.80 | 10.49 | 0.54 | 26.34 | 44.34 | **3,800** | **57** |
| **3,900** | 15.93 | 3.94 | 1.92 | | 0.00 | 0.00 | 3.15 | 0.00 | 1.18 | 9.85 | 14.19 | 3,900 | 11.06 | 1.90 | 0.00 | 0.00 | 3,900 | 11.06 | 1.90 | 11.01 | 0.57 | 27.69 | 45.69 | **3,900** | **60** |
| **4,000** | 16.34 | 4.15 | 2.01 | | 0.00 | 0.00 | 3.32 | 0.00 | 1.24 | 10.37 | 14.93 | 4,000 | 11.35 | 2.00 | 0.00 | 0.00 | 4,000 | 11.35 | 2.00 | 11.54 | 0.60 | 29.08 | 47.08 | **4,000** | **63** |

**Table C-4: Estimated Cost of Construction of the Reclamation Ditch Diversion Structure**
**Davis Road - Option 1**
Preliminary Design Cost Estimate

31-Mar-14
By: Josh Tabije

| Item of Work | Unit | Unit Cost | Quantity | Subtotal |
|---|---|---|---|---|
| ***Mobilization / Demobilization*** | | | | |
| ~ 5% of of project cost. This cost includes permits, fees, temporary structures, equipment rental and various misc. items | | | | ***$17,000*** |
| ***Clearing and Demolition*** | | | | |
| Demolition of Existing Facilities | LS | $10,000 | 1 | $10,000 |
| (By Department of Water Resources) | | | | ***$10,000*** |
| ***Structures*** | | | | |
| 96" Precast Manhole | EA | $30,000 | 1 | $30,000 |
| Cast-In-Place Concrete | CY | $1,000 | 40 | $40,000 |
| Concrete Dowel Inserts | EA | $300 | 30 | $9,000 |
| Wetwell Inlet Pipe | LF | $300 | 80 | $24,000 |
| | | | | ***$79,000*** |
| ***Miscellaneous Exterior Site Work*** | | | | |
| Excavation | CY | $140 | 180 | $25,200 |
| Site Shoring | SF | $3 | 1200 | $3,600 |
| Concrete Channel Lining | CY | $410 | 20 | $8,200 |
| Concrete Seal Slab | CY | $340 | 4 | $1,360 |
| Concrete Stairs | CY | $420 | 4 | $1,680 |
| Grouted RipRap | CY | $160 | 38 | $6,080 |
| | | | | ***$46,120*** |
| ***Pump Station/Channel Ammenities*** | | | | |
| 17 hp Pump | EA | $34,000 | 2 | $68,000 |
| Pump Installation | LS | $12,000 | 1 | $12,000 |
| Pump Discharge Pipe | LF | $200 | 50 | $10,000 |
| Aluminum Pump Access Hatch | EA | $17,900 | 1 | $17,900 |
| Fiberglass Railing | LS | $12,000 | 1 | $12,000 |
| | | | | ***$119,900*** |
| ***Site Piping*** | | | | |
| 16-Inch C900 PVC with Trench and Backfill | LF | $100 | 100 | $10,000 |
| | | | | ***$10,000*** |
| ***Electrical Equipment*** | | | | |
| Electrical Equipment (Including Installation) | LS | $60,000 | 1 | $60,000 |
| Electrical Conduit Run | LF | $100 | 100 | $10,000 |
| | | | | ***$70,000*** |
| **ESTIMATED CONSTRUCTION COST** | | | | **$352,020** |
| **INSPECTION AND TESTING (15%)** | | | | **$53,000** |
| **CONSTRUCTION CONTINGENCY (20%)** | | | | **$70,000** |
| **ESTIMATED TOTAL CONSTRUCTION COST** | | | | **$475,000** |

**This estimate of construction cost is a professional opinion, based upon the engineer's experience with the design and construction of similar projects. It is prepared only as a guide and is subject to change. Schaaf & Wheeler and its subconsultants make no warranty, whether expressed or implied, that the actual costs will not vary from these estimated costs, and assumes no liability for such variances. This estimate specifically excludes any costs associated with designing for handling and disposal of hazardous wastes and contaminated materials. Costs associated with land, right-of-way, or easement purchase are not included in this estimate.**

**Table C-5: Estimated Cost of Construction of the Reclamation Ditch Diversion Structure**
**Davis Road - Option 2**
Preliminary Design Cost Estimate

31-Mar-14
By: Josh Tabije

| Item of Work | Unit | Unit Cost | Quantity | Subtotal |
|---|---|---|---|---|
| ***Mobilization / Demobilization*** | | | | |
| ~ 5% of of project cost. This cost includes permits, fees, temporary structures, equipment rental and various misc. items | | | | ***$17,000*** |
| ***Clearing and Demolition*** | | | | |
| Demolition of Existing Facilities | LS | $10,000 | 1 | $10,000 |
| (By Department of Water Resources) | | | | ***$10,000*** |
| ***Structures*** | | | | |
| 96" Precast Manhole | EA | $30,000 | 1 | $30,000 |
| Cast-In-Place Concrete | CY | $1,000 | 40 | $40,000 |
| Concrete Dowel Inserts | EA | $300 | 30 | $9,000 |
| Wetwell Inlet Pipe | LF | $300 | 80 | $24,000 |
| | | | | ***$79,000*** |
| ***Miscellaneous Exterior Site Work*** | | | | |
| Excavation | CY | $140 | 180 | $25,200 |
| Site Shoring | SF | $3 | 1200 | $3,600 |
| Concrete Channel Lining | CY | $410 | 20 | $8,200 |
| Concrete Seal Slab | CY | $340 | 4 | $1,360 |
| Concrete Stairs | CY | $420 | 4 | $1,680 |
| Grouted RipRap | CY | $160 | 38 | $6,080 |
| | | | | ***$46,120*** |
| ***Pump Station/Channel Ammenities*** | | | | |
| 8 hp Pump | EA | $16,000 | 3 | $48,000 |
| Pump Installation | LS | $12,000 | 1 | $12,000 |
| Pump Discharge Pipe | LF | $200 | 50 | $10,000 |
| Aluminum Pump Access Hatch | EA | $17,900 | 1 | $17,900 |
| Fiberglass Railing | LS | $12,000 | 1 | $12,000 |
| | | | | ***$99,900*** |
| ***Site Piping*** | | | | |
| 12-Inch C900 PVC with Trench and Backfill | LF | $80 | 300 | $24,000 |
| | | | | ***$24,000*** |
| ***Electrical Equipment*** | | | | |
| Electrical Equipment (Including Installation) | LS | $60,000 | 1 | $60,000 |
| Electrical Conduit Run | LF | $100 | 100 | $10,000 |
| | | | | ***$70,000*** |
| **ESTIMATED CONSTRUCTION COST** | | | | **$346,020** |
| **INSPECTION AND TESTING (15%)** | | | | **$52,000** |
| **CONSTRUCTION CONTINGENCY (20%)** | | | | **$69,000** |
| **ESTIMATED TOTAL CONSTRUCTION COST** | | | | **$467,000** |

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**Table C-6: Estimated Cost of Construction of the Reclamation Ditch Diversion Structure**
**Castroville Pump Station**
Preliminary Design Cost Estimate

31-Mar-14
By: Josh Tabije

| Item of Work | Unit | Unit Cost | Quantity | Subtotal |
|---|---|---|---|---|
| ***Mobilization / Demobilization*** | | | | |
| ~ 5% of of project cost. This cost includes permits, fees, temporary structures, equipment rental and various misc. items | | | | ***$16,000*** |
| ***Site Preparation*** | | | | |
| Site Preparation | LS | $10,000 | 1 | $10,000 |
| (By Department of Water Resources) | | | | ***$10,000*** |
| ***Structures*** | | | | |
| 96" Precast Manhole | EA | $30,000 | 1 | $30,000 |
| Cast-In-Place Concrete | CY | $1,000 | 40 | $40,000 |
| Concrete Dowel Inserts | EA | $300 | 30 | $9,000 |
| Wetwell Inlet Pipe | LF | $300 | 80 | $24,000 |
| | | | | ***$79,000*** |
| ***Miscellaneous Exterior Site Work*** | | | | |
| Excavation | CY | $140 | 180 | $25,200 |
| Site Shoring | SF | $3 | 1200 | $3,600 |
| Concrete Channel Lining | CY | $410 | 20 | $8,200 |
| Concrete Seal Slab | CY | $340 | 4 | $1,360 |
| Concrete Stairs | CY | $420 | 4 | $1,680 |
| Grouted RipRap | CY | $160 | 38 | $6,080 |
| | | | | ***$46,120*** |
| ***Pump Station/Channel Ammenities*** | | | | |
| 10 hp Pump | EA | $20,000 | 2 | $40,000 |
| Pump Installation | LS | $12,000 | 1 | $12,000 |
| Pump Discharge Pipe | LF | $200 | 50 | $10,000 |
| Aluminum Pump Access Hatch | EA | $17,900 | 1 | $17,900 |
| Fiberglass Railing | LS | $12,000 | 1 | $12,000 |
| | | | | ***$91,900*** |
| ***Site Piping*** | | | | |
| 10-Inch C900 PVC with Trench and Backfill | LF | $60 | 300 | $18,000 |
| | | | | ***$18,000*** |
| ***Electrical Equipment*** | | | | |
| Electrical Equipment (Including Installation) | LS | $60,000 | 1 | $60,000 |
| Electrical Conduit Run | LF | $100 | 100 | $10,000 |
| | | | | ***$70,000*** |
| **ESTIMATED CONSTRUCTION COST** | | | | **$331,020** |
| **INSPECTION AND TESTING (15%)** | | | | **$50,000** |
| **CONSTRUCTION CONTINGENCY (20%)** | | | | **$66,000** |
| **ESTIMATED TOTAL CONSTRUCTION COST** | | | | **$447,000** |

**This estimate of construction cost is a professional opinion, based upon the engineer's experience with the design and construction of similar projects. It is prepared only as a guide and is subject to change. Schaaf & Wheeler and its subconsultants make no warranty, whether expressed or implied, that the actual costs will not vary from these estimated costs, and assumes no liability for such variances. This estimate specifically excludes any costs associated with designing for handling and disposal of hazardous wastes and contaminated materials. Costs associated with land, right-of-way, or easement purchase are not included in this estimate.**

**Appendix D: Analysis Statistical Outputs**

Reclamation Ditch at Davis Road, Percentile Flows by Month
Tembladero Slough at Castroville, Percentile Flows by Month

**Scenario Notes:**

**Reclamation Ditch at Davis Road**

| | |
|---|---|
| **Case 0:** | Base Condition: Flow = USGS San Jon Road gage (11152650),<br>scaled down by a factor of 0.937 for Davis Rd. location |
| **Case 1:** | Divert up to 2.99 cfs of available flow from Reclamation Ditch at Davis Rd;<br>Leave a minimum base flow of 2 cfs Dec-May, or 0.69 cfs Jun-Nov |
| **Case 2:** | Divert up to 6.0 cfs of available flow from Reclamation Ditch at Davis Rd;<br>Leave a minimum base flow of 2 cfs Dec-May, or 0.69 cfs Jun-Nov |
| **Case 3:** | Divert up to 2.99 cfs of available flow from Reclamation Ditch at Davis Rd;<br>Leave a minimum base flow of 1.0 cfs year-round. |
| **Case 4:** | Divert up to 6 cfs of available flow from Reclamation Ditch at Davis Rd;<br>Leave a minimum base flow of 1.0 cfs year-round. |

**Tembladero Slough at Castroville**

| | |
|---|---|
| **Case 0:** | Base Condition: Flow = USGS San Jon Road gage (11152650),<br>scaled up by a factor of 1.4 for Castroville location |
| **Case 1:** | Divert up to 2.99 cfs of available flow from Reclamation Ditch at Davis Rd and<br>up to 2.99 cfs of available flow from Tembladero Slough at Catroville;<br>Leave minimum base flows of 2 cfs Dec-May, or 0.69 cfs Jun-Nov, in Reclamation Ditch;<br>Leave constant minimum base flow of 1 cfs in Tembladero Slough. |
| **Case 2:** | Divert up to 6.0 cfs of available flow from Reclamation Ditch at Davis Rd and<br>up to 2.99 cfs of available flow from Tembladero Slough at Catroville;<br>Leave minimum base flows of 2 cfs Dec-May, or 0.69 cfs Jun-Nov<br>Leave constant minimum base flow of 1 cfs in Tembladero Slough. |
| **Case 3:** | Divert up to 2.99 cfs of available flow from Reclamation Ditch at Davis Rd and<br>up to 2.99 cfs of available flow from Tembladero Slough at Catroville;<br>Leave minimum base flows of 1.0 cfs year-round in both Tembladero Slough and Rec Ditch. |
| **Case 4:** | Divert up to 6.0 cfs of available flow from Reclamation Ditch at Davis Rd and<br>up to 2.99 cfs of available flow from Tembladero Slough at Catroville;<br>Leave minimum base flows of 1.0 cfs year-round in both Tembladero Slough and Rec Ditch. |
| **Percentile Results:** | The flow with the nth percentile rank.<br>The 1.0 percetile flow is the highest daily flow.<br>The 0.50 percentile flow is the median daily flow.<br>The 0.01 percentile flow is exceeded 99% of the time (blank if 0.0 cfs). |

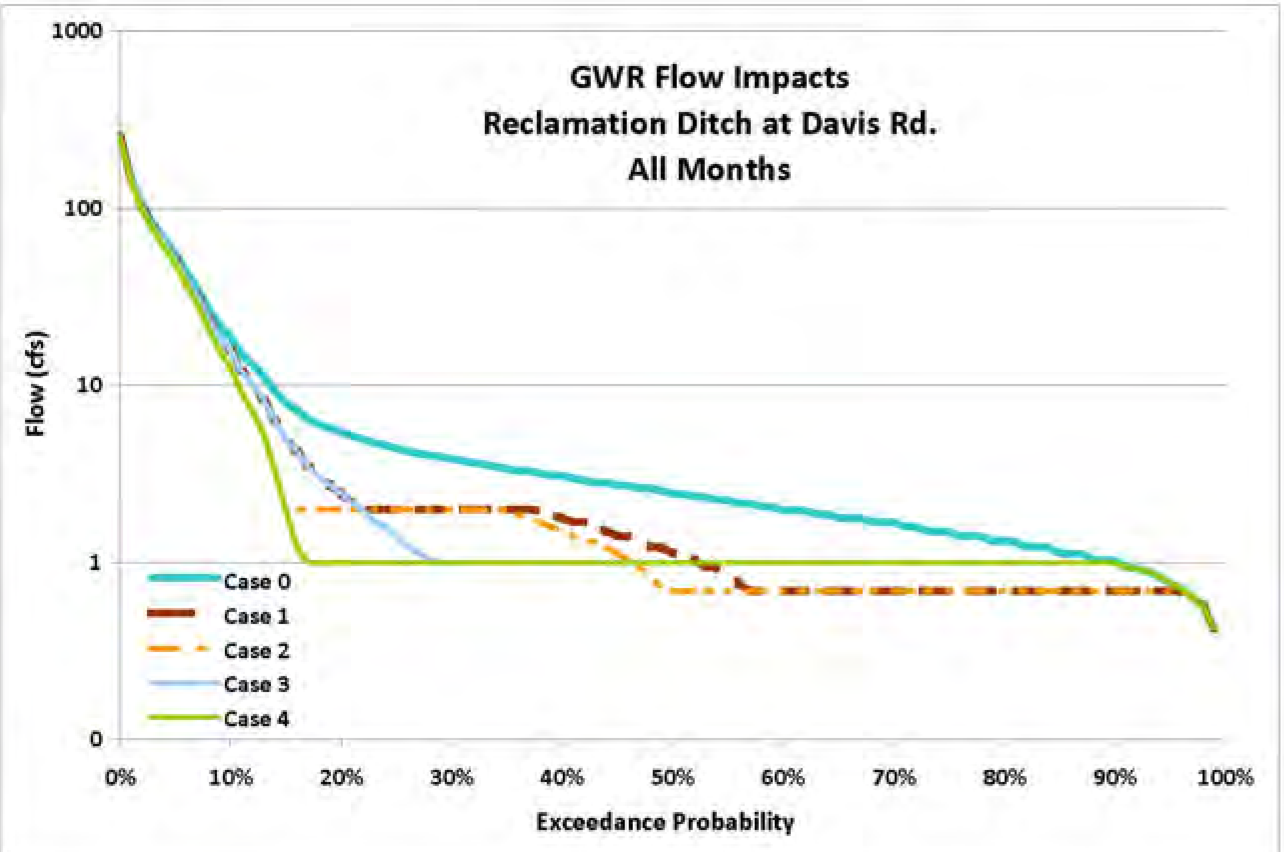
**Reclamation Ditch at Davis Rd, Annual Percentile Flows (cfs)**

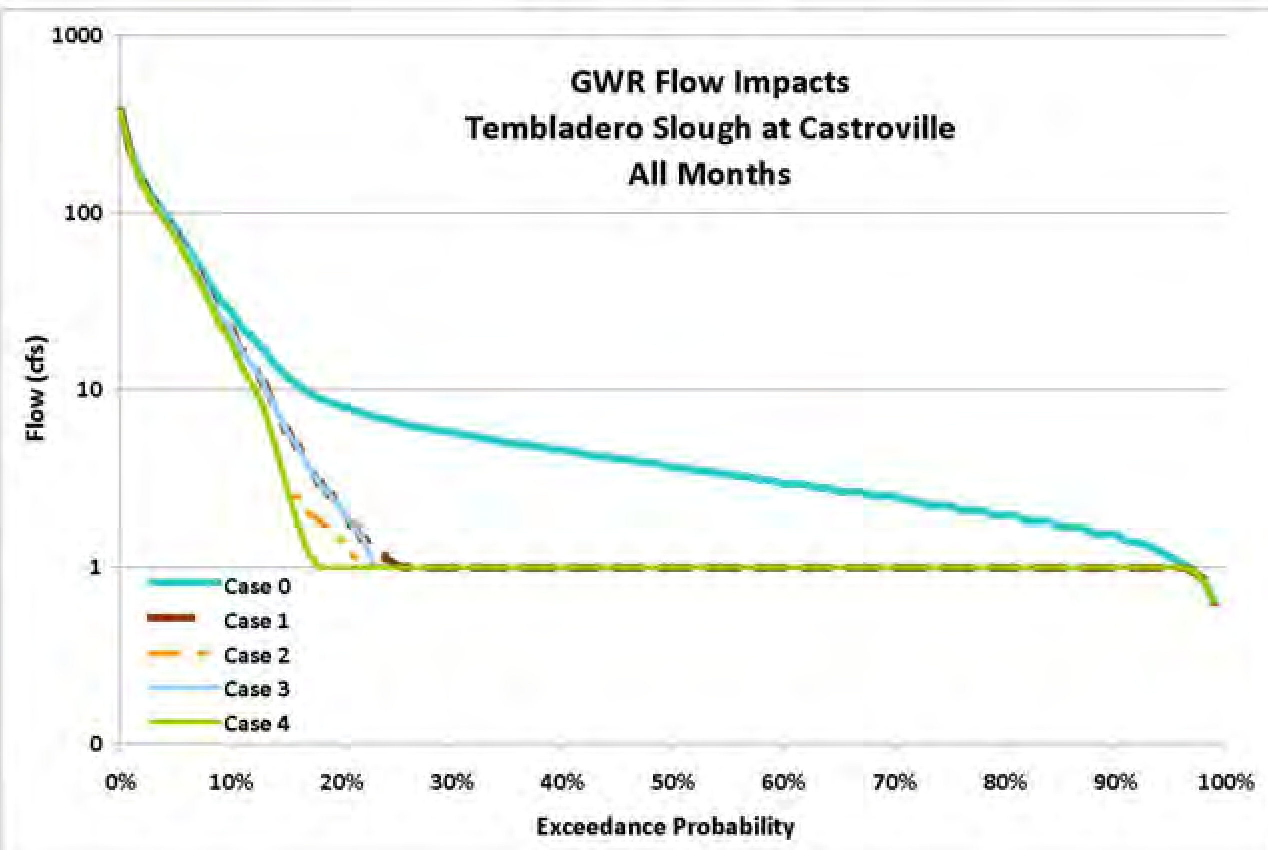
| Annual Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 252.99 | 250.00 | 246.99 | 250.00 | 246.99 |
| 0.99 | 144.94 | 141.95 | 138.94 | 141.95 | 138.94 |
| 0.98 | 103.07 | 100.08 | 97.07 | 100.08 | 97.07 |
| 0.97 | 80.58 | 77.59 | 74.58 | 77.59 | 74.58 |
| 0.96 | 66.30 | 63.31 | 60.30 | 63.31 | 60.30 |
| 0.95 | 54.35 | 51.36 | 48.35 | 51.36 | 48.35 |
| 0.94 | 43.10 | 40.11 | 37.10 | 40.11 | 37.10 |
| 0.93 | 34.67 | 31.68 | 28.67 | 31.68 | 28.67 |
| 0.92 | 27.17 | 24.18 | 21.17 | 24.18 | 21.17 |
| 0.91 | 21.55 | 18.56 | 15.55 | 18.56 | 15.55 |
| 0.90 | 18.74 | 15.75 | 12.74 | 15.75 | 12.74 |
| 0.89 | 14.99 | 12.00 | 8.99 | 12.00 | 8.99 |
| 0.88 | 13.12 | 10.13 | 7.12 | 10.13 | 7.12 |
| 0.87 | 11.24 | 8.25 | 5.24 | 8.25 | 5.24 |
| 0.86 | 9.28 | 6.29 | 3.28 | 6.29 | 3.28 |
| 0.85 | 7.96 | 4.97 | 2.00 | 4.97 | 1.96 |
| 0.84 | 7.21 | 4.22 | 2.00 | 4.22 | 1.21 |
| 0.83 | 6.47 | 3.48 | 2.00 | 3.48 | 1.00 |
| 0.82 | 6.00 | 3.01 | 2.00 | 3.01 | 1.00 |
| 0.81 | 5.72 | 2.73 | 2.00 | 2.73 | 1.00 |
| 0.80 | 5.43 | 2.44 | 2.00 | 2.44 | 1.00 |
| 0.79 | 5.15 | 2.16 | 2.00 | 2.16 | 1.00 |
| 0.78 | 4.97 | 2.00 | 2.00 | 1.98 | 1.00 |
| 0.77 | 4.69 | 2.00 | 2.00 | 1.70 | 1.00 |
| 0.76 | 4.59 | 2.00 | 2.00 | 1.60 | 1.00 |
| 0.75 | 4.40 | 2.00 | 2.00 | 1.41 | 1.00 |
| 0.74 | 4.22 | 2.00 | 2.00 | 1.23 | 1.00 |
| 0.73 | 4.12 | 2.00 | 2.00 | 1.13 | 1.00 |
| 0.72 | 4.03 | 2.00 | 2.00 | 1.04 | 1.00 |
| 0.71 | 3.94 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.70 | 3.84 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.69 | 3.75 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.68 | 3.65 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.67 | 3.56 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.66 | 3.47 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.65 | 3.37 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.64 | 3.28 | 2.00 | 1.87 | 1.00 | 1.00 |
| 0.63 | 3.28 | 2.00 | 1.78 | 1.00 | 1.00 |
| 0.62 | 3.19 | 1.97 | 1.69 | 1.00 | 1.00 |
| 0.61 | 3.09 | 1.87 | 1.59 | 1.00 | 1.00 |
| 0.60 | 3.09 | 1.78 | 1.50 | 1.00 | 1.00 |
| 0.59 | 3.00 | 1.70 | 1.41 | 1.00 | 1.00 |
| 0.58 | 2.90 | 1.69 | 1.31 | 1.00 | 1.00 |
| 0.57 | 2.81 | 1.59 | 1.31 | 1.00 | 1.00 |
| 0.56 | 2.81 | 1.50 | 1.22 | 1.00 | 1.00 |
| 0.55 | 2.72 | 1.41 | 1.12 | 1.00 | 1.00 |
| 0.54 | 2.72 | 1.41 | 1.03 | 1.00 | 1.00 |
| 0.53 | 2.62 | 1.31 | 0.94 | 1.00 | 1.00 |
| 0.52 | 2.62 | 1.23 | 0.86 | 1.00 | 1.00 |
| 0.51 | 2.53 | 1.22 | 0.70 | 1.00 | 1.00 |
| 0.50 | 2.44 | 1.12 | 0.69 | 1.00 | 1.00 |
| 0.49 | 2.44 | 1.12 | 0.69 | 1.00 | 1.00 |
| 0.48 | 2.34 | 1.03 | 0.69 | 1.00 | 1.00 |
| 0.47 | 2.34 | 0.95 | 0.69 | 1.00 | 1.00 |
| 0.46 | 2.25 | 0.94 | 0.69 | 1.00 | 1.00 |
| 0.45 | 2.25 | 0.85 | 0.69 | 1.00 | 1.00 |
| 0.44 | 2.16 | 0.76 | 0.69 | 1.00 | 1.00 |
| 0.43 | 2.16 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.42 | 2.06 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.41 | 2.06 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.40 | 1.97 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.39 | 1.97 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.38 | 1.97 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.37 | 1.87 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.36 | 1.87 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.35 | 1.78 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.34 | 1.78 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.33 | 1.78 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.32 | 1.69 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.31 | 1.69 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.30 | 1.69 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.29 | 1.59 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.28 | 1.59 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.27 | 1.50 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.26 | 1.50 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.25 | 1.50 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.24 | 1.41 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.23 | 1.41 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.22 | 1.41 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.21 | 1.31 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.20 | 1.31 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.19 | 1.31 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.18 | 1.22 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.17 | 1.22 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.16 | 1.22 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.15 | 1.12 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.14 | 1.12 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.13 | 1.12 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.12 | 1.03 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.11 | 1.03 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.10 | 1.03 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.09 | 0.94 | 0.69 | 0.69 | 0.94 | 0.94 |
| 0.08 | 0.92 | 0.69 | 0.69 | 0.92 | 0.92 |
| 0.07 | 0.89 | 0.69 | 0.69 | 0.89 | 0.89 |
| 0.06 | 0.83 | 0.69 | 0.69 | 0.83 | 0.83 |
| 0.05 | 0.77 | 0.69 | 0.69 | 0.77 | 0.77 |
| 0.04 | 0.71 | 0.69 | 0.69 | 0.71 | 0.71 |
| 0.03 | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 |
| 0.02 | 0.56 | 0.56 | 0.56 | 0.56 | 0.56 |
| 0.01 | 0.42 | 0.42 | 0.42 | 0.42 | 0.42 |

**Tembladero Slough at Castroville, Annual Percentile Flows (cfs)**

| Annual Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 378.00 | 372.02 | 369.01 | 372.02 | 369.01 |
| 0.99 | 216.57 | 210.59 | 207.58 | 210.59 | 207.58 |
| 0.98 | 154.00 | 148.02 | 145.01 | 148.02 | 145.01 |
| 0.97 | 120.40 | 114.42 | 111.41 | 114.42 | 111.41 |
| 0.96 | 99.06 | 93.08 | 90.07 | 93.08 | 90.07 |
| 0.95 | 81.20 | 75.22 | 72.21 | 75.22 | 72.21 |
| 0.94 | 64.40 | 58.42 | 55.41 | 58.42 | 55.41 |
| 0.93 | 51.80 | 45.82 | 42.81 | 45.82 | 42.81 |
| 0.92 | 40.60 | 34.62 | 31.61 | 34.62 | 31.61 |
| 0.91 | 32.20 | 26.22 | 23.21 | 26.22 | 23.21 |
| 0.90 | 28.00 | 22.02 | 19.01 | 22.02 | 19.01 |
| 0.89 | 22.40 | 16.42 | 13.41 | 16.42 | 13.41 |
| 0.88 | 19.60 | 13.62 | 10.61 | 13.62 | 10.61 |
| 0.87 | 16.80 | 10.82 | 7.81 | 10.82 | 7.81 |
| 0.86 | 13.86 | 7.88 | 4.87 | 7.88 | 4.87 |
| 0.85 | 11.90 | 5.92 | 2.95 | 5.92 | 2.91 |
| 0.84 | 10.78 | 4.80 | 2.48 | 4.80 | 1.79 |
| 0.83 | 9.66 | 3.68 | 2.07 | 3.68 | 1.20 |
| 0.82 | 8.96 | 2.98 | 1.83 | 2.98 | 1.00 |
| 0.81 | 8.54 | 2.56 | 1.65 | 2.56 | 1.00 |
| 0.80 | 8.12 | 2.14 | 1.42 | 2.14 | 1.00 |
| 0.79 | 7.70 | 1.72 | 1.19 | 1.72 | 1.00 |
| 0.78 | 7.42 | 1.44 | 1.05 | 1.44 | 1.00 |
| 0.77 | 7.00 | 1.23 | 1.00 | 1.02 | 1.00 |
| 0.76 | 6.86 | 1.14 | 1.00 | 1.00 | 1.00 |
| 0.75 | 6.58 | 1.02 | 1.00 | 1.00 | 1.00 |
| 0.74 | 6.30 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.73 | 6.16 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.72 | 6.02 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.71 | 5.88 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.70 | 5.74 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.69 | 5.60 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.68 | 5.46 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.67 | 5.32 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.66 | 5.18 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.65 | 5.04 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.64 | 4.90 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.63 | 4.90 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.62 | 4.76 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.61 | 4.62 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.60 | 4.62 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.59 | 4.48 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.58 | 4.34 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.57 | 4.20 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.56 | 4.20 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.55 | 4.06 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.54 | 4.06 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.53 | 3.92 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.52 | 3.92 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.51 | 3.78 | 1.00 | 1.00 | 1.00 | 1.00 |

| Annual Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 0.50 | 3.64 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.49 | 3.64 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.48 | 3.50 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.47 | 3.50 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.46 | 3.36 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.45 | 3.36 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.44 | 3.22 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.43 | 3.22 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.42 | 3.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.41 | 3.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.40 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.39 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.38 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.37 | 2.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.36 | 2.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.35 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.34 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.33 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.32 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.31 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.30 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.29 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.28 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.27 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.26 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.25 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.24 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.23 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.22 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.21 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.20 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.19 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.18 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.17 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.16 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.15 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.14 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.13 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.12 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.11 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.10 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.09 | 1.40 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.08 | 1.37 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.07 | 1.32 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.06 | 1.23 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.05 | 1.13 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.04 | 1.05 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.03 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| 0.02 | 0.84 | 0.84 | 0.84 | 0.84 | 0.84 |
| 0.01 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 |


GWR Flow Impacts
Reclamation Ditch at Davis Rd.
All Months
Flow (cfs)
1000
100
10
1
0
Case 0
Case 1
Case 2
Case 3
Case 4
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability


GWR Flow Impacts
Tembladero Slough at Castroville
All Months
Flow (cfs)
1000
100
10
1
0
Case 0
Case 1
Case 2
Case 3
Case 4
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability

**Reclamation Ditch at Davis Rd, Percentile Flows by Month (cfs)**

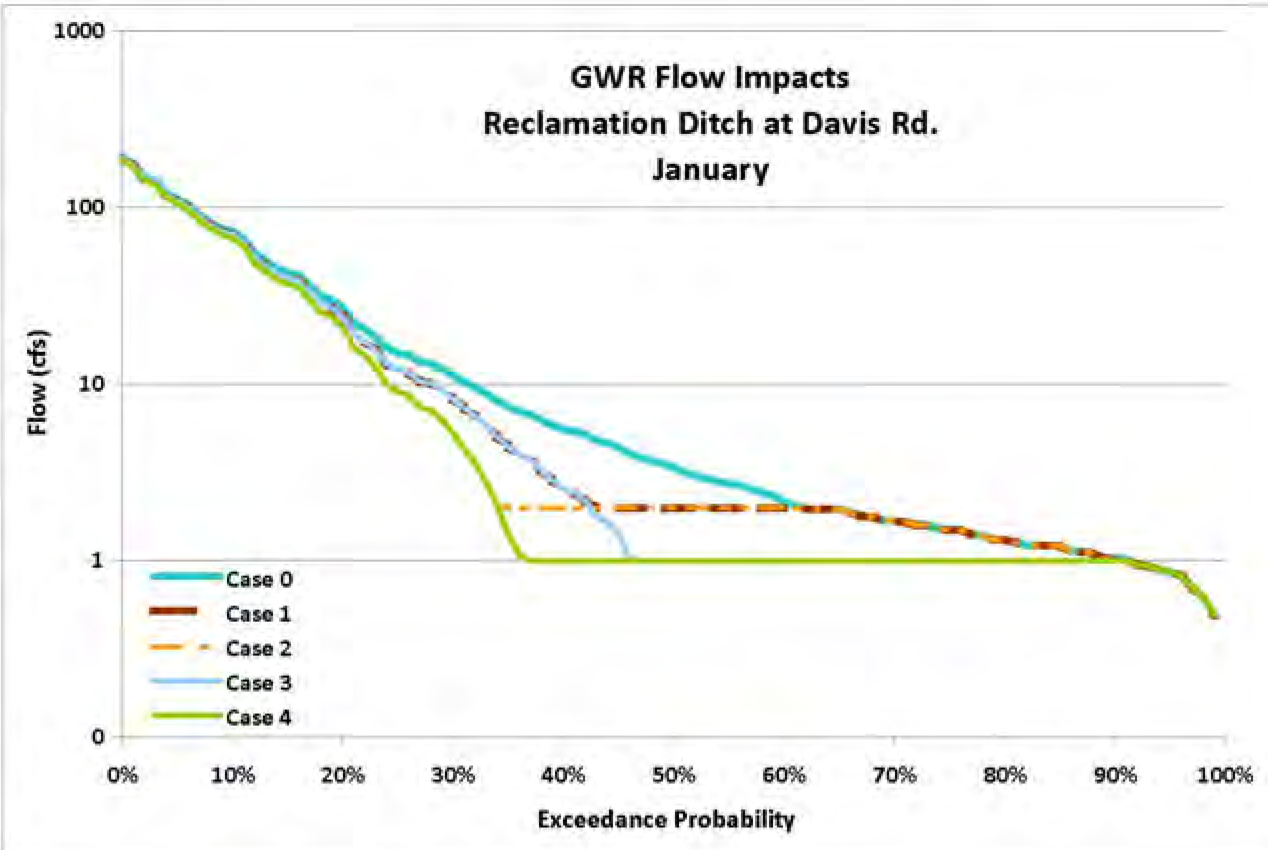
| January Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 193.02 | 190.03 | 187.02 | 190.03 | 187.02 |
| 0.99 | 175.41 | 172.42 | 169.41 | 172.42 | 169.41 |
| 0.98 | 148.61 | 145.62 | 142.61 | 145.62 | 142.61 |
| 0.97 | 141.30 | 138.31 | 135.30 | 138.31 | 135.30 |
| 0.96 | 121.06 | 118.07 | 115.06 | 118.07 | 115.06 |
| 0.95 | 111.50 | 108.51 | 105.50 | 108.51 | 105.50 |
| 0.94 | 102.88 | 99.89 | 96.88 | 99.89 | 96.88 |
| 0.93 | 90.14 | 87.15 | 84.14 | 87.15 | 84.14 |
| 0.92 | 82.27 | 79.28 | 76.27 | 79.28 | 76.27 |
| 0.91 | 76.27 | 73.28 | 70.27 | 73.28 | 70.27 |
| 0.90 | 73.09 | 70.10 | 67.09 | 70.10 | 67.09 |
| 0.89 | 66.34 | 63.35 | 60.34 | 63.35 | 60.34 |
| 0.88 | 54.53 | 51.54 | 48.53 | 51.54 | 48.53 |
| 0.87 | 49.66 | 46.67 | 43.66 | 46.67 | 43.66 |
| 0.86 | 44.79 | 41.80 | 38.79 | 41.80 | 38.79 |
| 0.85 | 43.10 | 40.11 | 37.10 | 40.11 | 37.10 |
| 0.84 | 41.42 | 38.43 | 35.42 | 38.43 | 35.42 |
| 0.83 | 35.79 | 32.80 | 29.79 | 32.80 | 29.79 |
| 0.82 | 31.67 | 28.68 | 25.67 | 28.68 | 25.67 |
| 0.81 | 29.98 | 26.99 | 23.98 | 26.99 | 23.98 |
| 0.80 | 27.17 | 24.18 | 21.17 | 24.18 | 21.17 |
| 0.79 | 22.11 | 19.12 | 16.11 | 19.12 | 16.11 |
| 0.78 | 20.61 | 17.62 | 14.61 | 17.62 | 14.61 |
| 0.77 | 18.37 | 15.38 | 12.37 | 15.38 | 12.37 |
| 0.76 | 15.93 | 12.94 | 9.93 | 12.94 | 9.93 |
| 0.75 | 14.99 | 12.00 | 8.99 | 12.00 | 8.99 |
| 0.74 | 14.62 | 11.63 | 8.62 | 11.63 | 8.62 |
| 0.73 | 13.31 | 10.32 | 7.31 | 10.32 | 7.31 |
| 0.72 | 13.12 | 10.13 | 7.12 | 10.13 | 7.12 |
| 0.71 | 12.18 | 9.19 | 6.18 | 9.19 | 6.18 |
| 0.70 | 11.24 | 8.25 | 5.24 | 8.25 | 5.24 |
| 0.69 | 10.31 | 7.32 | 4.31 | 7.32 | 4.31 |
| 0.68 | 9.56 | 6.57 | 3.56 | 6.57 | 3.56 |
| 0.67 | 8.77 | 5.78 | 2.77 | 5.78 | 2.77 |
| 0.66 | 8.04 | 5.05 | 2.06 | 5.05 | 2.04 |
| 0.65 | 7.40 | 4.41 | 2.00 | 4.41 | 1.40 |
| 0.64 | 7.01 | 4.02 | 2.00 | 4.02 | 1.07 |
| 0.63 | 6.75 | 3.76 | 2.00 | 3.76 | 1.00 |
| 0.62 | 6.22 | 3.23 | 2.00 | 3.23 | 1.00 |
| 0.61 | 5.85 | 2.86 | 2.00 | 2.86 | 1.00 |
| 0.60 | 5.53 | 2.54 | 2.00 | 2.54 | 1.00 |
| 0.59 | 5.40 | 2.41 | 2.00 | 2.41 | 1.00 |
| 0.58 | 5.17 | 2.18 | 2.00 | 2.18 | 1.00 |
| 0.57 | 4.78 | 2.00 | 2.00 | 1.79 | 1.00 |
| 0.56 | 4.63 | 2.00 | 2.00 | 1.64 | 1.00 |
| 0.55 | 4.40 | 2.00 | 2.00 | 1.41 | 1.00 |
| 0.54 | 4.03 | 2.00 | 2.00 | 1.04 | 1.00 |
| 0.53 | 3.84 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.52 | 3.65 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.51 | 3.56 | 2.00 | 2.00 | 1.00 | 1.00 |

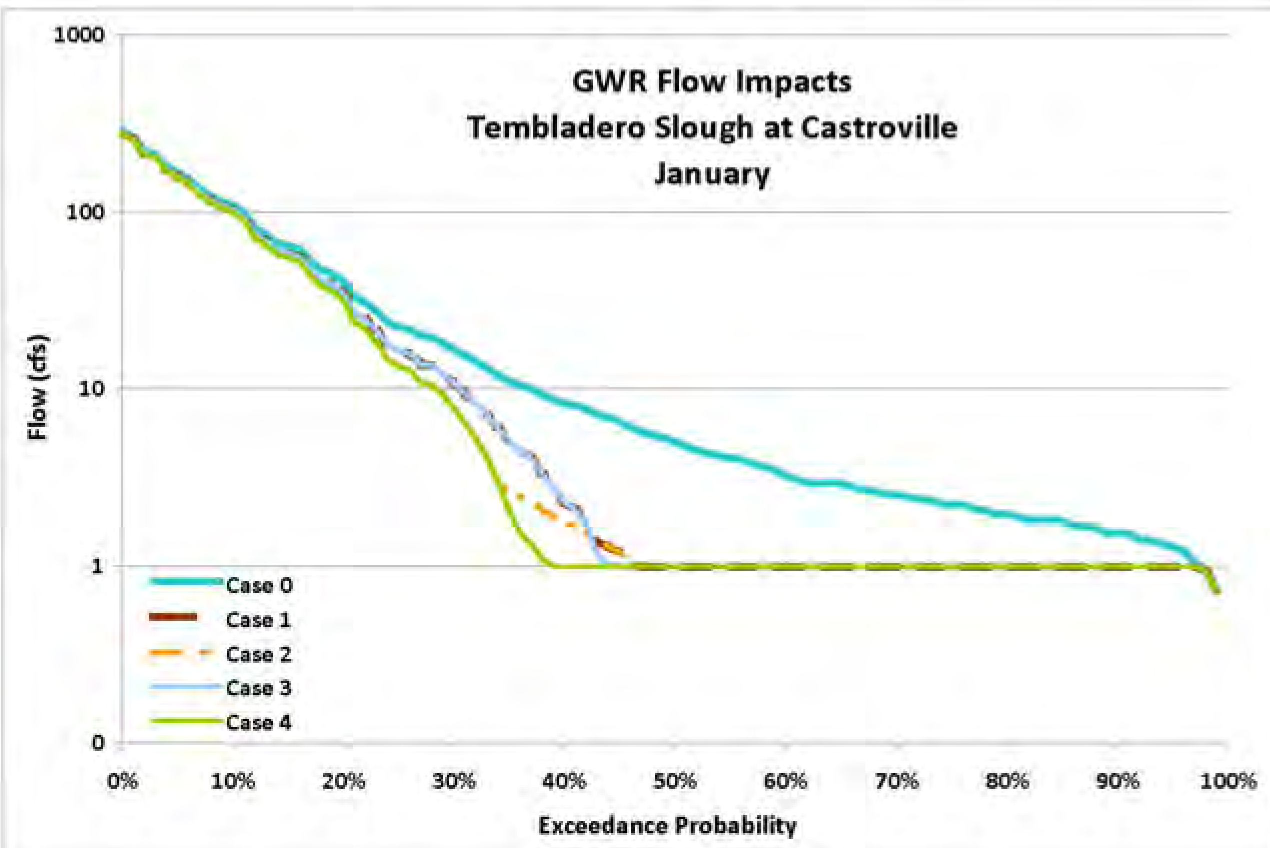
| January Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 0.50 | 3.37 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.49 | 3.15 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.48 | 3.02 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.47 | 2.90 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.46 | 2.81 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.45 | 2.72 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.44 | 2.68 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.43 | 2.53 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.42 | 2.44 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.41 | 2.34 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.40 | 2.16 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.39 | 2.06 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.38 | 1.97 | 1.97 | 1.97 | 1.00 | 1.00 |
| 0.37 | 1.97 | 1.97 | 1.97 | 1.00 | 1.00 |
| 0.36 | 1.97 | 1.97 | 1.97 | 1.00 | 1.00 |
| 0.35 | 1.97 | 1.97 | 1.97 | 1.00 | 1.00 |
| 0.34 | 1.87 | 1.87 | 1.87 | 1.00 | 1.00 |
| 0.33 | 1.78 | 1.78 | 1.78 | 1.00 | 1.00 |
| 0.32 | 1.78 | 1.78 | 1.78 | 1.00 | 1.00 |
| 0.31 | 1.69 | 1.69 | 1.69 | 1.00 | 1.00 |
| 0.30 | 1.69 | 1.69 | 1.69 | 1.00 | 1.00 |
| 0.29 | 1.65 | 1.65 | 1.65 | 1.00 | 1.00 |
| 0.28 | 1.59 | 1.59 | 1.59 | 1.00 | 1.00 |
| 0.27 | 1.59 | 1.59 | 1.59 | 1.00 | 1.00 |
| 0.26 | 1.50 | 1.50 | 1.50 | 1.00 | 1.00 |
| 0.25 | 1.50 | 1.50 | 1.50 | 1.00 | 1.00 |
| 0.24 | 1.50 | 1.50 | 1.50 | 1.00 | 1.00 |
| 0.23 | 1.41 | 1.41 | 1.41 | 1.00 | 1.00 |
| 0.22 | 1.39 | 1.39 | 1.39 | 1.00 | 1.00 |
| 0.21 | 1.31 | 1.31 | 1.31 | 1.00 | 1.00 |
| 0.20 | 1.31 | 1.31 | 1.31 | 1.00 | 1.00 |
| 0.19 | 1.27 | 1.27 | 1.27 | 1.00 | 1.00 |
| 0.18 | 1.22 | 1.22 | 1.22 | 1.00 | 1.00 |
| 0.17 | 1.22 | 1.22 | 1.22 | 1.00 | 1.00 |
| 0.16 | 1.22 | 1.22 | 1.22 | 1.00 | 1.00 |
| 0.15 | 1.22 | 1.22 | 1.22 | 1.00 | 1.00 |
| 0.14 | 1.12 | 1.12 | 1.12 | 1.00 | 1.00 |
| 0.13 | 1.12 | 1.12 | 1.12 | 1.00 | 1.00 |
| 0.12 | 1.11 | 1.11 | 1.11 | 1.00 | 1.00 |
| 0.11 | 1.03 | 1.03 | 1.03 | 1.00 | 1.00 |
| 0.10 | 1.03 | 1.03 | 1.03 | 1.00 | 1.00 |
| 0.09 | 1.03 | 1.03 | 1.03 | 1.00 | 1.00 |
| 0.08 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| 0.07 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| 0.06 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 |
| 0.05 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 |
| 0.04 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 |
| 0.03 | 0.70 | 0.70 | 0.70 | 0.70 | 0.70 |
| 0.02 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 |
| 0.01 | 0.49 | 0.49 | 0.49 | 0.49 | 0.49 |

**Tembladero Slough at Castroville, Percentile Flows by Month (cfs)**

| January Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 288.40 | 282.42 | 279.41 | 282.42 | 279.41 |
| 0.99 | 262.08 | 256.10 | 253.09 | 256.10 | 253.09 |
| 0.98 | 222.04 | 216.06 | 213.05 | 216.06 | 213.05 |
| 0.97 | 211.12 | 205.14 | 202.13 | 205.14 | 202.13 |
| 0.96 | 180.88 | 174.90 | 171.89 | 174.90 | 171.89 |
| 0.95 | 166.60 | 160.62 | 157.61 | 160.62 | 157.61 |
| 0.94 | 153.72 | 147.74 | 144.73 | 147.74 | 144.73 |
| 0.93 | 134.68 | 128.70 | 125.69 | 128.70 | 125.69 |
| 0.92 | 122.92 | 116.94 | 113.93 | 116.94 | 113.93 |
| 0.91 | 113.96 | 107.98 | 104.97 | 107.98 | 104.97 |
| 0.90 | 109.20 | 103.22 | 100.21 | 103.22 | 100.21 |
| 0.89 | 99.12 | 93.14 | 90.13 | 93.14 | 90.13 |
| 0.88 | 81.48 | 75.50 | 72.49 | 75.50 | 72.49 |
| 0.87 | 74.20 | 68.22 | 65.21 | 68.22 | 65.21 |
| 0.86 | 66.92 | 60.94 | 57.93 | 60.94 | 57.93 |
| 0.85 | 64.40 | 58.42 | 55.41 | 58.42 | 55.41 |
| 0.84 | 61.88 | 55.90 | 52.89 | 55.90 | 52.89 |
| 0.83 | 53.48 | 47.50 | 44.49 | 47.50 | 44.49 |
| 0.82 | 47.32 | 41.34 | 38.33 | 41.34 | 38.33 |
| 0.81 | 44.80 | 38.82 | 35.81 | 38.82 | 35.81 |
| 0.80 | 40.60 | 34.62 | 31.61 | 34.62 | 31.61 |
| 0.79 | 33.04 | 27.06 | 24.05 | 27.06 | 24.05 |
| 0.78 | 30.80 | 24.82 | 21.81 | 24.82 | 21.81 |
| 0.77 | 27.44 | 21.46 | 18.45 | 21.46 | 18.45 |
| 0.76 | 23.80 | 17.82 | 14.81 | 17.82 | 14.81 |
| 0.75 | 22.40 | 16.42 | 13.41 | 16.42 | 13.41 |
| 0.74 | 21.84 | 15.86 | 12.85 | 15.86 | 12.85 |
| 0.73 | 19.88 | 13.90 | 10.89 | 13.90 | 10.89 |
| 0.72 | 19.60 | 13.62 | 10.61 | 13.62 | 10.61 |
| 0.71 | 18.20 | 12.22 | 9.21 | 12.22 | 9.21 |
| 0.70 | 16.80 | 10.82 | 7.81 | 10.82 | 7.81 |
| 0.69 | 15.40 | 9.42 | 6.41 | 9.42 | 6.41 |
| 0.68 | 14.28 | 8.30 | 5.29 | 8.30 | 5.29 |
| 0.67 | 13.10 | 7.12 | 4.11 | 7.12 | 4.11 |
| 0.66 | 12.01 | 6.03 | 3.04 | 6.03 | 3.02 |
| 0.65 | 11.06 | 5.08 | 2.67 | 5.08 | 2.07 |
| 0.64 | 10.47 | 4.49 | 2.47 | 4.49 | 1.55 |
| 0.63 | 10.08 | 4.10 | 2.34 | 4.10 | 1.34 |
| 0.62 | 9.30 | 3.32 | 2.08 | 3.32 | 1.09 |
| 0.61 | 8.74 | 2.76 | 1.90 | 2.76 | 1.00 |
| 0.60 | 8.26 | 2.28 | 1.74 | 2.28 | 1.00 |
| 0.59 | 8.06 | 2.08 | 1.68 | 2.08 | 1.00 |
| 0.58 | 7.73 | 1.75 | 1.57 | 1.75 | 1.00 |
| 0.57 | 7.14 | 1.37 | 1.37 | 1.16 | 1.00 |
| 0.56 | 6.92 | 1.30 | 1.30 | 1.01 | 1.00 |
| 0.55 | 6.58 | 1.19 | 1.19 | 1.00 | 1.00 |
| 0.54 | 6.02 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.53 | 5.74 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.52 | 5.46 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.51 | 5.32 | 1.00 | 1.00 | 1.00 | 1.00 |

| January Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 0.50 | 5.04 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.49 | 4.70 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.48 | 4.51 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.47 | 4.34 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.46 | 4.20 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.45 | 4.06 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.44 | 4.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.43 | 3.78 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.42 | 3.64 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.41 | 3.50 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.40 | 3.22 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.39 | 3.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.38 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.37 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.36 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.35 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.34 | 2.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.33 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.32 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.31 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.30 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.29 | 2.46 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.28 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.27 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.26 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.25 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.24 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.23 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.22 | 2.07 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.21 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.20 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.19 | 1.90 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.18 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.17 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.16 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.15 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.14 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.13 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.12 | 1.65 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.11 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.10 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.09 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.08 | 1.40 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.07 | 1.40 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.06 | 1.34 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.05 | 1.29 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.04 | 1.23 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.03 | 1.05 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.02 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| 0.01 | 0.73 | 0.73 | 0.73 | 0.73 | 0.73 |


GWR Flow Impacts
Reclamation Ditch at Davis Rd.
January
Flow (cfs)
1000
100
10
1
0
Case 0
Case 1
Case 2
Case 3
Case 4
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability


GWR Flow Impacts
Tembladero Slough at Castroville
January
Flow (cfs)
1000
100
10
1
0
Case 0
Case 1
Case 2
Case 3
Case 4
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability

Reclamation Ditch at Davis Rd, Percentile Flows by Month (cfs)

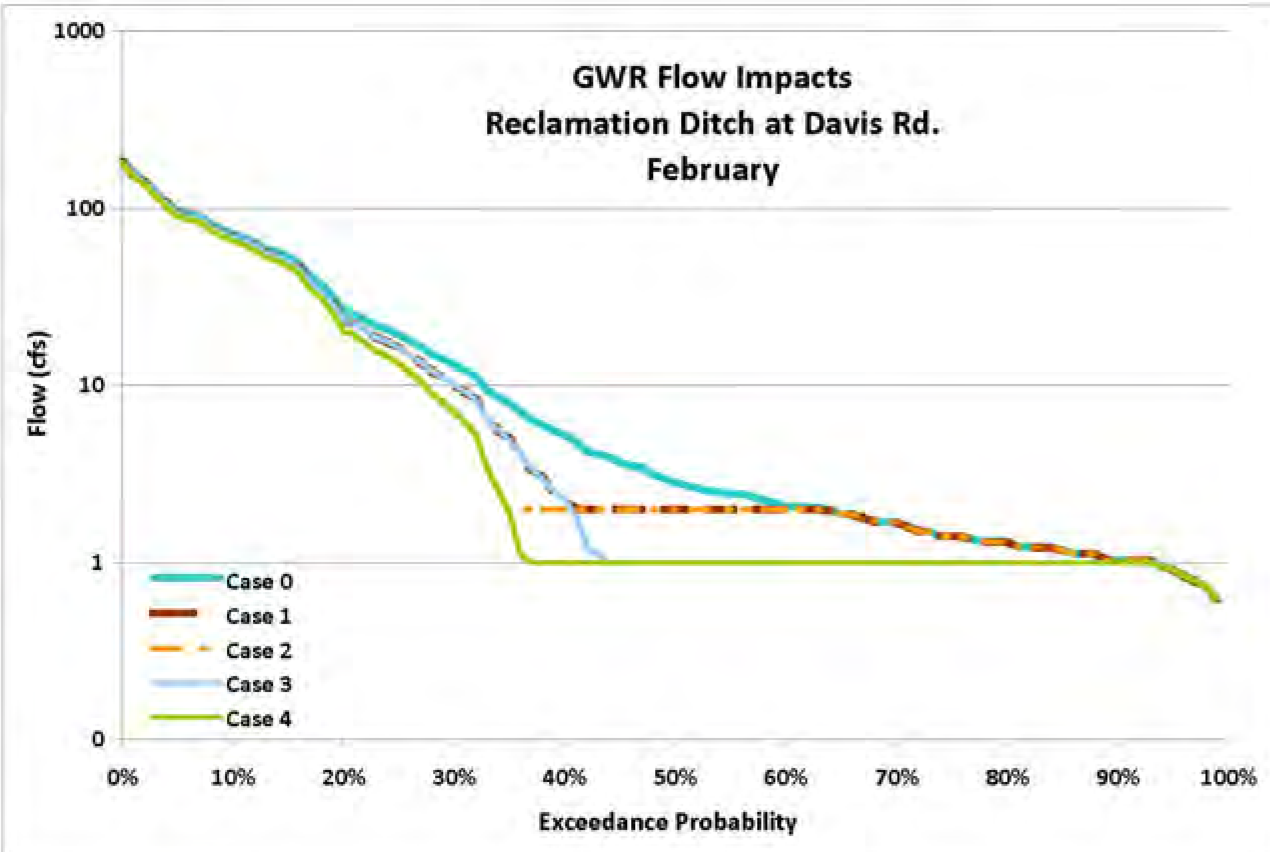
| February Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 184.59 | 181.60 | 178.59 | 181.60 | 178.59 |
| 0.99 | 156.85 | 153.86 | 150.85 | 153.86 | 150.85 |
| 0.98 | 142.42 | 139.43 | 136.42 | 139.43 | 136.42 |
| 0.97 | 122.93 | 119.94 | 116.93 | 119.94 | 116.93 |
| 0.96 | 108.50 | 105.51 | 102.50 | 105.51 | 102.50 |
| 0.95 | 95.11 | 92.12 | 89.11 | 92.12 | 89.11 |
| 0.94 | 92.76 | 89.77 | 86.76 | 89.77 | 86.76 |
| 0.93 | 90.23 | 87.24 | 84.23 | 87.24 | 84.23 |
| 0.92 | 80.58 | 77.59 | 74.58 | 77.59 | 74.58 |
| 0.91 | 76.18 | 73.19 | 70.18 | 73.19 | 70.18 |
| 0.90 | 71.21 | 68.22 | 65.21 | 68.22 | 65.21 |
| 0.89 | 68.12 | 65.13 | 62.12 | 65.13 | 62.12 |
| 0.88 | 64.47 | 61.48 | 58.47 | 61.48 | 58.47 |
| 0.87 | 58.47 | 55.48 | 52.47 | 55.48 | 52.47 |
| 0.86 | 56.78 | 53.79 | 50.78 | 53.79 | 50.78 |
| 0.85 | 52.94 | 49.95 | 46.94 | 49.95 | 46.94 |
| 0.84 | 48.54 | 45.55 | 42.54 | 45.55 | 42.54 |
| 0.83 | 40.85 | 37.86 | 34.85 | 37.86 | 34.85 |
| 0.82 | 37.11 | 34.12 | 31.11 | 34.12 | 31.11 |
| 0.81 | 31.95 | 28.96 | 25.95 | 28.96 | 25.95 |
| 0.80 | 26.24 | 23.25 | 20.24 | 23.25 | 20.24 |
| 0.79 | 25.21 | 22.22 | 19.21 | 22.22 | 19.21 |
| 0.78 | 23.24 | 20.25 | 17.24 | 20.25 | 17.24 |
| 0.77 | 21.55 | 18.56 | 15.55 | 18.56 | 15.55 |
| 0.76 | 20.61 | 17.62 | 14.61 | 17.62 | 14.61 |
| 0.75 | 19.21 | 16.22 | 13.21 | 16.22 | 13.21 |
| 0.74 | 17.80 | 14.81 | 11.80 | 14.81 | 11.80 |
| 0.73 | 16.49 | 13.50 | 10.49 | 13.50 | 10.49 |
| 0.72 | 14.99 | 12.00 | 8.99 | 12.00 | 8.99 |
| 0.71 | 14.06 | 11.07 | 8.06 | 11.07 | 8.06 |
| 0.70 | 13.12 | 10.13 | 7.12 | 10.13 | 7.12 |
| 0.69 | 12.18 | 9.19 | 6.18 | 9.19 | 6.18 |
| 0.68 | 11.24 | 8.25 | 5.24 | 8.25 | 5.24 |
| 0.67 | 9.37 | 6.38 | 3.37 | 6.38 | 3.37 |
| 0.66 | 8.56 | 5.57 | 2.56 | 5.57 | 2.56 |
| 0.65 | 7.92 | 4.93 | 2.00 | 4.93 | 1.92 |
| 0.64 | 7.08 | 4.09 | 2.00 | 4.09 | 1.12 |
| 0.63 | 6.40 | 3.41 | 2.00 | 3.41 | 1.00 |
| 0.62 | 5.96 | 2.97 | 2.00 | 2.97 | 1.00 |
| 0.61 | 5.53 | 2.54 | 2.00 | 2.54 | 1.00 |
| 0.60 | 5.25 | 2.26 | 2.00 | 2.26 | 1.00 |
| 0.59 | 4.85 | 2.00 | 2.00 | 1.86 | 1.00 |
| 0.58 | 4.22 | 2.00 | 2.00 | 1.23 | 1.00 |
| 0.57 | 4.09 | 2.00 | 2.00 | 1.10 | 1.00 |
| 0.56 | 3.94 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.55 | 3.65 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.54 | 3.50 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.53 | 3.47 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.52 | 3.11 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.51 | 3.00 | 2.00 | 2.00 | 1.00 | 1.00 |

| February Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 0.50 | 2.81 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.49 | 2.72 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.48 | 2.62 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.47 | 2.53 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.46 | 2.49 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.45 | 2.44 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.44 | 2.44 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.43 | 2.34 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.42 | 2.25 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.41 | 2.16 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.40 | 2.06 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.39 | 2.06 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.38 | 2.06 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.37 | 2.03 | 1.99 | 1.99 | 1.00 | 1.00 |
| 0.36 | 1.97 | 1.97 | 1.97 | 1.00 | 1.00 |
| 0.35 | 1.87 | 1.87 | 1.87 | 1.00 | 1.00 |
| 0.34 | 1.87 | 1.87 | 1.87 | 1.00 | 1.00 |
| 0.33 | 1.78 | 1.78 | 1.78 | 1.00 | 1.00 |
| 0.32 | 1.71 | 1.71 | 1.71 | 1.00 | 1.00 |
| 0.31 | 1.69 | 1.69 | 1.69 | 1.00 | 1.00 |
| 0.30 | 1.69 | 1.69 | 1.69 | 1.00 | 1.00 |
| 0.29 | 1.59 | 1.59 | 1.59 | 1.00 | 1.00 |
| 0.28 | 1.50 | 1.50 | 1.50 | 1.00 | 1.00 |
| 0.27 | 1.50 | 1.50 | 1.50 | 1.00 | 1.00 |
| 0.26 | 1.41 | 1.41 | 1.41 | 1.00 | 1.00 |
| 0.25 | 1.41 | 1.41 | 1.41 | 1.00 | 1.00 |
| 0.24 | 1.41 | 1.41 | 1.41 | 1.00 | 1.00 |
| 0.23 | 1.34 | 1.34 | 1.34 | 1.00 | 1.00 |
| 0.22 | 1.31 | 1.31 | 1.31 | 1.00 | 1.00 |
| 0.21 | 1.31 | 1.31 | 1.31 | 1.00 | 1.00 |
| 0.20 | 1.31 | 1.31 | 1.31 | 1.00 | 1.00 |
| 0.19 | 1.22 | 1.22 | 1.22 | 1.00 | 1.00 |
| 0.18 | 1.22 | 1.22 | 1.22 | 1.00 | 1.00 |
| 0.17 | 1.22 | 1.22 | 1.22 | 1.00 | 1.00 |
| 0.16 | 1.22 | 1.22 | 1.22 | 1.00 | 1.00 |
| 0.15 | 1.17 | 1.17 | 1.17 | 1.00 | 1.00 |
| 0.14 | 1.12 | 1.12 | 1.12 | 1.00 | 1.00 |
| 0.13 | 1.12 | 1.12 | 1.12 | 1.00 | 1.00 |
| 0.12 | 1.12 | 1.12 | 1.12 | 1.00 | 1.00 |
| 0.11 | 1.03 | 1.03 | 1.03 | 1.00 | 1.00 |
| 0.10 | 1.03 | 1.03 | 1.03 | 1.00 | 1.00 |
| 0.09 | 1.03 | 1.03 | 1.03 | 1.00 | 1.00 |
| 0.08 | 1.03 | 1.03 | 1.03 | 1.00 | 1.00 |
| 0.07 | 1.03 | 1.03 | 1.03 | 1.00 | 1.00 |
| 0.06 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| 0.05 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| 0.04 | 0.84 | 0.84 | 0.84 | 0.84 | 0.84 |
| 0.03 | 0.79 | 0.79 | 0.79 | 0.79 | 0.79 |
| 0.02 | 0.73 | 0.73 | 0.73 | 0.73 | 0.73 |
| 0.01 | 0.62 | 0.62 | 0.62 | 0.62 | 0.62 |

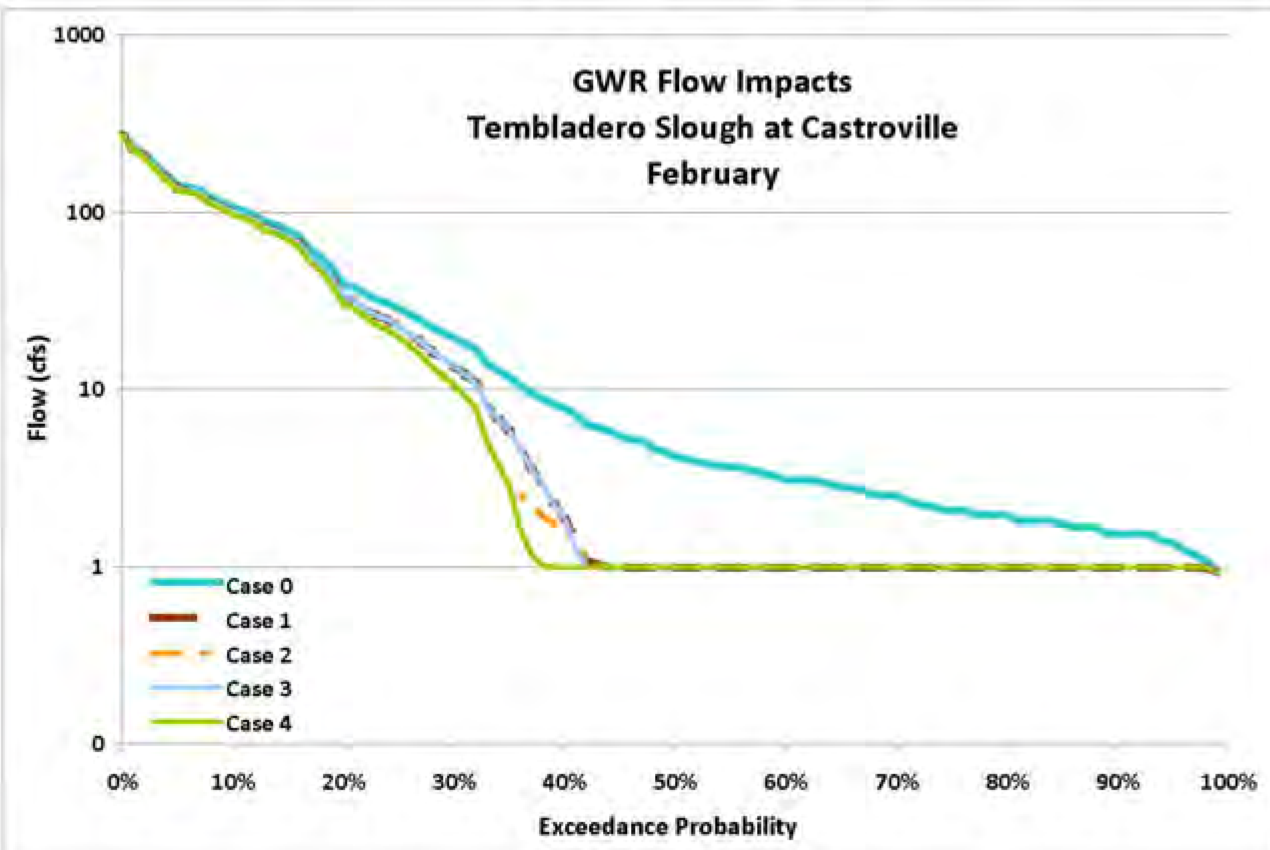
Tembladero Slough at Castroville, Percentile Flows by Month (cfs)

| February Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 275.80 | 269.82 | 266.81 | 269.82 | 266.81 |
| 0.99 | 234.36 | 228.38 | 225.37 | 228.38 | 225.37 |
| 0.98 | 212.80 | 206.82 | 203.81 | 206.82 | 203.81 |
| 0.97 | 183.68 | 177.70 | 174.69 | 177.70 | 174.69 |
| 0.96 | 162.12 | 156.14 | 153.13 | 156.14 | 153.13 |
| 0.95 | 142.10 | 136.12 | 133.11 | 136.12 | 133.11 |
| 0.94 | 138.60 | 132.62 | 129.61 | 132.62 | 129.61 |
| 0.93 | 134.82 | 128.84 | 125.83 | 128.84 | 125.83 |
| 0.92 | 120.40 | 114.42 | 111.41 | 114.42 | 111.41 |
| 0.91 | 113.82 | 107.84 | 104.83 | 107.84 | 104.83 |
| 0.90 | 106.40 | 100.42 | 97.41 | 100.42 | 97.41 |
| 0.89 | 101.78 | 95.80 | 92.79 | 95.80 | 92.79 |
| 0.88 | 96.32 | 90.34 | 87.33 | 90.34 | 87.33 |
| 0.87 | 87.36 | 81.38 | 78.37 | 81.38 | 78.37 |
| 0.86 | 84.84 | 78.86 | 75.85 | 78.86 | 75.85 |
| 0.85 | 79.10 | 73.12 | 70.11 | 73.12 | 70.11 |
| 0.84 | 72.52 | 66.54 | 63.53 | 66.54 | 63.53 |
| 0.83 | 61.04 | 55.06 | 52.05 | 55.06 | 52.05 |
| 0.82 | 55.44 | 49.46 | 46.45 | 49.46 | 46.45 |
| 0.81 | 47.74 | 41.76 | 38.75 | 41.76 | 38.75 |
| 0.80 | 39.20 | 33.22 | 30.21 | 33.22 | 30.21 |
| 0.79 | 37.66 | 31.68 | 28.67 | 31.68 | 28.67 |
| 0.78 | 34.72 | 28.74 | 25.73 | 28.74 | 25.73 |
| 0.77 | 32.20 | 26.22 | 23.21 | 26.22 | 23.21 |
| 0.76 | 30.80 | 24.82 | 21.81 | 24.82 | 21.81 |
| 0.75 | 28.70 | 22.72 | 19.71 | 22.72 | 19.71 |
| 0.74 | 26.60 | 20.62 | 17.61 | 20.62 | 17.61 |
| 0.73 | 24.64 | 18.66 | 15.65 | 18.66 | 15.65 |
| 0.72 | 22.40 | 16.42 | 13.41 | 16.42 | 13.41 |
| 0.71 | 21.00 | 15.02 | 12.01 | 15.02 | 12.01 |
| 0.70 | 19.60 | 13.62 | 10.61 | 13.62 | 10.61 |
| 0.69 | 18.20 | 12.22 | 9.21 | 12.22 | 9.21 |
| 0.68 | 16.80 | 10.82 | 7.81 | 10.82 | 7.81 |
| 0.67 | 14.00 | 8.02 | 5.01 | 8.02 | 5.01 |
| 0.66 | 12.80 | 6.82 | 3.81 | 6.82 | 3.81 |
| 0.65 | 11.83 | 5.85 | 2.92 | 5.85 | 2.84 |
| 0.64 | 10.58 | 4.60 | 2.51 | 4.60 | 1.63 |
| 0.63 | 9.56 | 3.58 | 2.17 | 3.58 | 1.17 |
| 0.62 | 8.90 | 2.92 | 1.95 | 2.92 | 1.01 |
| 0.61 | 8.26 | 2.28 | 1.74 | 2.28 | 1.00 |
| 0.60 | 7.84 | 1.86 | 1.60 | 1.86 | 1.00 |
| 0.59 | 7.25 | 1.41 | 1.41 | 1.27 | 1.00 |
| 0.58 | 6.30 | 1.09 | 1.09 | 1.00 | 1.00 |
| 0.57 | 6.12 | 1.03 | 1.03 | 1.00 | 1.00 |
| 0.56 | 5.88 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.55 | 5.46 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.54 | 5.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.53 | 5.18 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.52 | 4.65 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.51 | 4.48 | 1.00 | 1.00 | 1.00 | 1.00 |

| February Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 0.50 | 4.20 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.49 | 4.06 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.48 | 3.92 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.47 | 3.78 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.46 | 3.72 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.45 | 3.64 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.44 | 3.64 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.43 | 3.50 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.42 | 3.36 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.41 | 3.23 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.40 | 3.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.39 | 3.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.38 | 3.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.37 | 3.04 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.36 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.35 | 2.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.34 | 2.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.33 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.32 | 2.55 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.31 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.30 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.29 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.28 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.27 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.26 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.25 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.24 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.23 | 2.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.22 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.21 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.20 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.19 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.18 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.17 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.16 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.15 | 1.75 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.14 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.13 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.12 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.11 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.10 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.09 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.08 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.07 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.06 | 1.40 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.05 | 1.37 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.04 | 1.25 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.03 | 1.18 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.02 | 1.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.01 | 0.93 | 0.93 | 0.93 | 0.93 | 0.93 |



GWR Flow Impacts
Reclamation Ditch at Davis Rd.
February
Flow (cfs)
1000
100
10
1
0
Case 0
Case 1
Case 2
Case 3
Case 4
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability

GWR Flow Impacts
Tembladero Slough at Castroville
February
Flow (cfs)
1000
100
10
1
0
Case 0
Case 1
Case 2
Case 3
Case 4
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability

**Reclamation Ditch at Davis Rd, Percentile Flows by Month (cfs)**

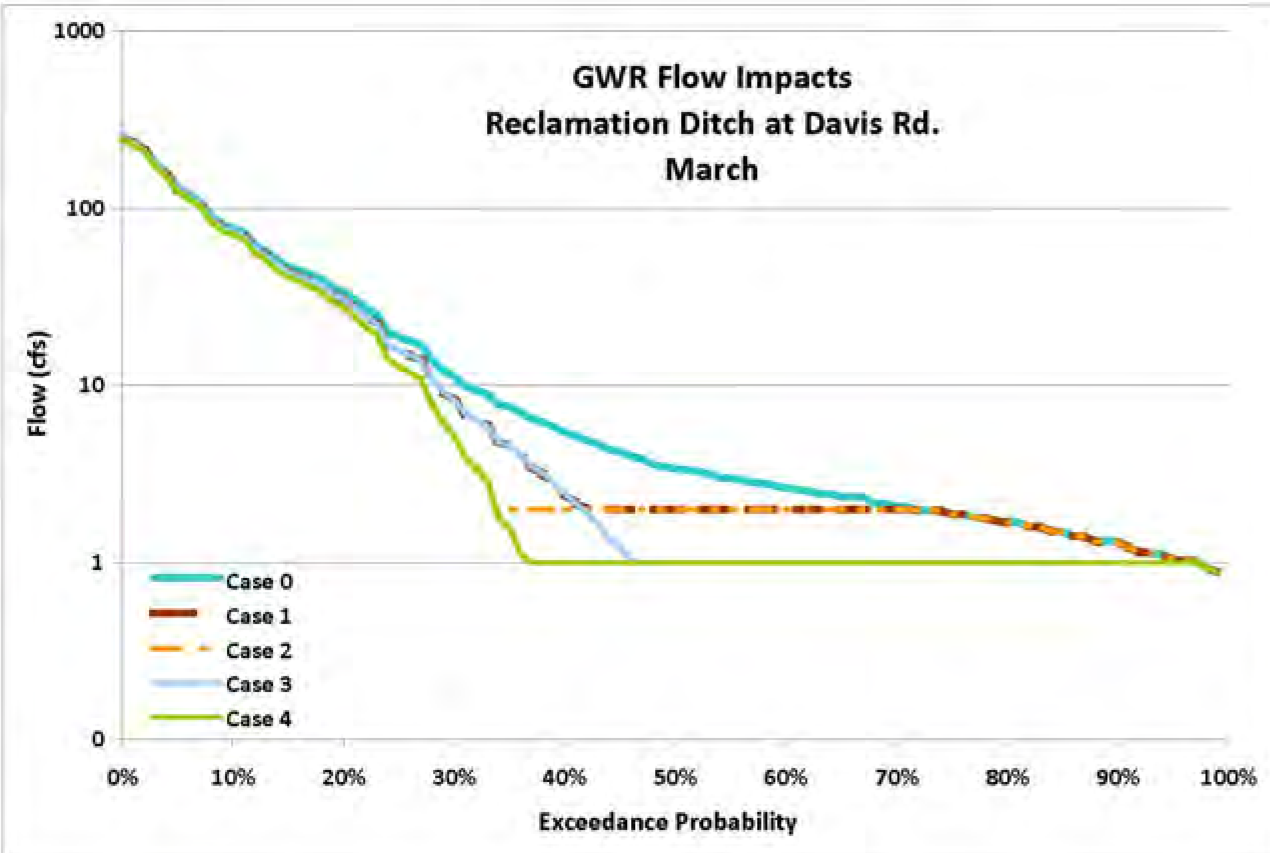
| March Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 252.99 | 250.00 | 246.99 | 250.00 | 246.99 |
| 0.99 | 235.75 | 232.76 | 229.75 | 232.76 | 229.75 |
| 0.98 | 214.76 | 211.77 | 208.76 | 211.77 | 208.76 |
| 0.97 | 177.66 | 174.67 | 171.66 | 174.67 | 171.66 |
| 0.96 | 155.92 | 152.93 | 149.92 | 152.93 | 149.92 |
| 0.95 | 130.24 | 127.25 | 124.24 | 127.25 | 124.24 |
| 0.94 | 119.19 | 116.20 | 113.19 | 116.20 | 113.19 |
| 0.93 | 108.88 | 105.89 | 102.88 | 105.89 | 102.88 |
| 0.92 | 90.89 | 87.90 | 84.89 | 87.90 | 84.89 |
| 0.91 | 80.58 | 77.59 | 74.58 | 77.59 | 74.58 |
| 0.90 | 76.83 | 73.84 | 70.83 | 73.84 | 70.83 |
| 0.89 | 72.71 | 69.72 | 66.71 | 69.72 | 66.71 |
| 0.88 | 62.22 | 59.23 | 56.22 | 59.23 | 56.22 |
| 0.87 | 56.97 | 53.98 | 50.97 | 53.98 | 50.97 |
| 0.86 | 50.97 | 47.98 | 44.97 | 47.98 | 44.97 |
| 0.85 | 46.85 | 43.86 | 40.85 | 43.86 | 40.85 |
| 0.84 | 44.60 | 41.61 | 38.60 | 41.61 | 38.60 |
| 0.83 | 42.17 | 39.18 | 36.17 | 39.18 | 36.17 |
| 0.82 | 39.73 | 36.74 | 33.73 | 36.74 | 33.73 |
| 0.81 | 35.61 | 32.62 | 29.61 | 32.62 | 29.61 |
| 0.80 | 33.73 | 30.74 | 27.73 | 30.74 | 27.73 |
| 0.79 | 30.55 | 27.56 | 24.55 | 27.56 | 24.55 |
| 0.78 | 27.36 | 24.37 | 21.36 | 24.37 | 21.36 |
| 0.77 | 25.30 | 22.31 | 19.30 | 22.31 | 19.30 |
| 0.76 | 20.05 | 17.06 | 14.05 | 17.06 | 14.05 |
| 0.75 | 18.74 | 15.75 | 12.74 | 15.75 | 12.74 |
| 0.74 | 17.80 | 14.81 | 11.80 | 14.81 | 11.80 |
| 0.73 | 16.87 | 13.88 | 10.87 | 13.88 | 10.87 |
| 0.72 | 13.87 | 10.88 | 7.87 | 10.88 | 7.87 |
| 0.71 | 12.18 | 9.19 | 6.18 | 9.19 | 6.18 |
| 0.70 | 11.24 | 8.25 | 5.24 | 8.25 | 5.24 |
| 0.69 | 9.93 | 6.94 | 3.93 | 6.94 | 3.93 |
| 0.68 | 9.37 | 6.38 | 3.37 | 6.38 | 3.37 |
| 0.67 | 8.92 | 5.93 | 2.92 | 5.93 | 2.92 |
| 0.66 | 7.78 | 4.79 | 2.00 | 4.79 | 1.78 |
| 0.65 | 7.59 | 4.60 | 2.00 | 4.60 | 1.59 |
| 0.64 | 7.03 | 4.04 | 2.00 | 4.04 | 1.13 |
| 0.63 | 6.47 | 3.48 | 2.00 | 3.48 | 1.00 |
| 0.62 | 6.17 | 3.18 | 2.00 | 3.18 | 1.00 |
| 0.61 | 5.83 | 2.84 | 2.00 | 2.84 | 1.00 |
| 0.60 | 5.43 | 2.44 | 2.00 | 2.44 | 1.00 |
| 0.59 | 5.15 | 2.16 | 2.00 | 2.16 | 1.00 |
| 0.58 | 4.89 | 2.00 | 2.00 | 1.90 | 1.00 |
| 0.57 | 4.65 | 2.00 | 2.00 | 1.66 | 1.00 |
| 0.56 | 4.35 | 2.00 | 2.00 | 1.36 | 1.00 |
| 0.55 | 4.22 | 2.00 | 2.00 | 1.23 | 1.00 |
| 0.54 | 3.99 | 2.00 | 2.00 | 1.02 | 1.00 |
| 0.53 | 3.84 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.52 | 3.56 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.51 | 3.47 | 2.00 | 2.00 | 1.00 | 1.00 |

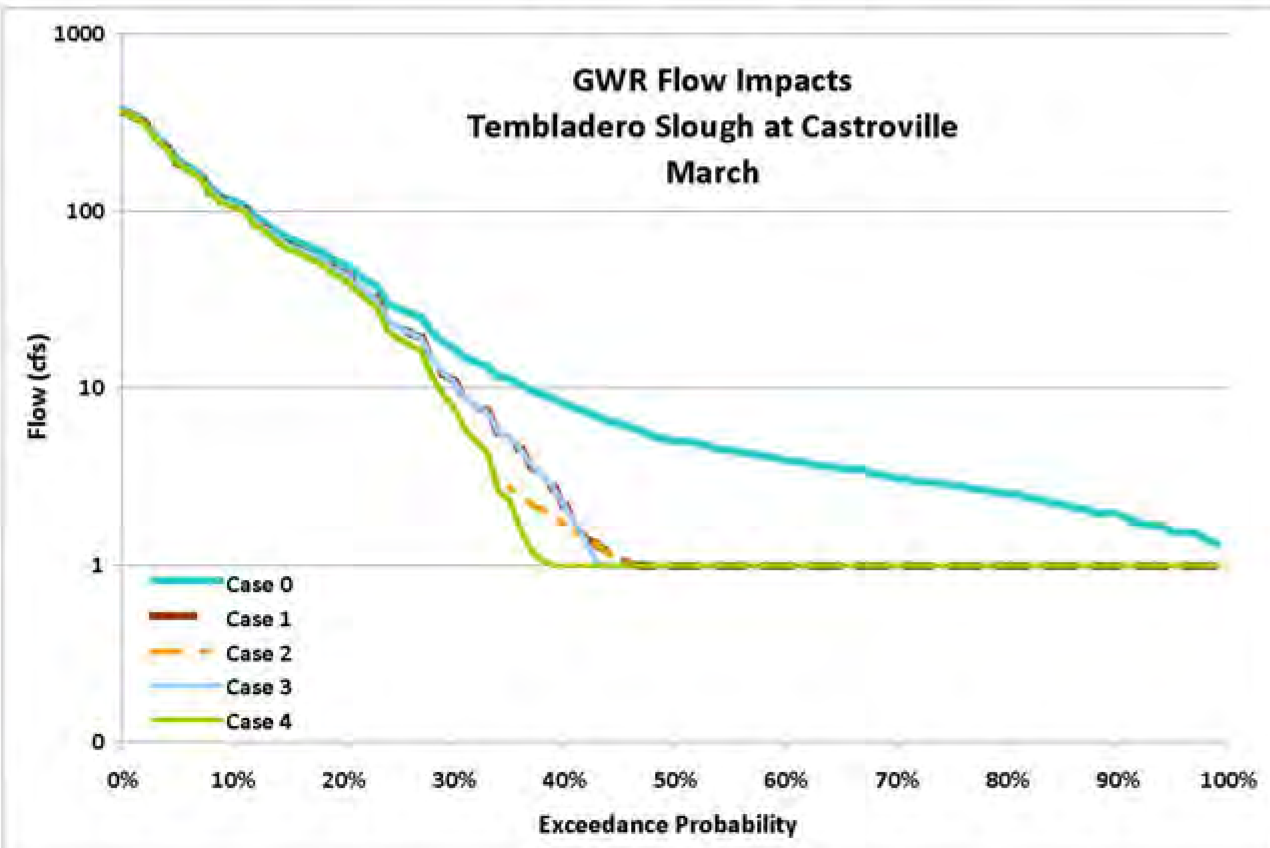
| March Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 0.50 | 3.37 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.49 | 3.34 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.48 | 3.28 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.47 | 3.17 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.46 | 3.00 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.45 | 3.00 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.44 | 2.90 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.43 | 2.83 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.42 | 2.79 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.41 | 2.72 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.40 | 2.62 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.39 | 2.59 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.38 | 2.53 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.37 | 2.44 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.36 | 2.44 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.35 | 2.34 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.34 | 2.34 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.33 | 2.34 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.32 | 2.16 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.31 | 2.16 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.30 | 2.06 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.29 | 2.06 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.28 | 1.97 | 1.97 | 1.97 | 1.00 | 1.00 |
| 0.27 | 1.97 | 1.97 | 1.97 | 1.00 | 1.00 |
| 0.26 | 1.97 | 1.97 | 1.97 | 1.00 | 1.00 |
| 0.25 | 1.87 | 1.87 | 1.87 | 1.00 | 1.00 |
| 0.24 | 1.87 | 1.87 | 1.87 | 1.00 | 1.00 |
| 0.23 | 1.80 | 1.80 | 1.80 | 1.00 | 1.00 |
| 0.22 | 1.78 | 1.78 | 1.78 | 1.00 | 1.00 |
| 0.21 | 1.72 | 1.72 | 1.72 | 1.00 | 1.00 |
| 0.20 | 1.69 | 1.69 | 1.69 | 1.00 | 1.00 |
| 0.19 | 1.69 | 1.69 | 1.69 | 1.00 | 1.00 |
| 0.18 | 1.59 | 1.59 | 1.59 | 1.00 | 1.00 |
| 0.17 | 1.59 | 1.59 | 1.59 | 1.00 | 1.00 |
| 0.16 | 1.50 | 1.50 | 1.50 | 1.00 | 1.00 |
| 0.15 | 1.50 | 1.50 | 1.50 | 1.00 | 1.00 |
| 0.14 | 1.41 | 1.41 | 1.41 | 1.00 | 1.00 |
| 0.13 | 1.41 | 1.41 | 1.41 | 1.00 | 1.00 |
| 0.12 | 1.31 | 1.31 | 1.31 | 1.00 | 1.00 |
| 0.11 | 1.31 | 1.31 | 1.31 | 1.00 | 1.00 |
| 0.10 | 1.31 | 1.31 | 1.31 | 1.00 | 1.00 |
| 0.09 | 1.22 | 1.22 | 1.22 | 1.00 | 1.00 |
| 0.08 | 1.14 | 1.14 | 1.14 | 1.00 | 1.00 |
| 0.07 | 1.12 | 1.12 | 1.12 | 1.00 | 1.00 |
| 0.06 | 1.12 | 1.12 | 1.12 | 1.00 | 1.00 |
| 0.05 | 1.03 | 1.03 | 1.03 | 1.00 | 1.00 |
| 0.04 | 1.03 | 1.03 | 1.03 | 1.00 | 1.00 |
| 0.03 | 1.03 | 1.03 | 1.03 | 1.00 | 1.00 |
| 0.02 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| 0.01 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |

**Tembladero Slough at Castroville, Percentile Flows by Month (cfs)**

| March Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 378.00 | 372.02 | 369.01 | 372.02 | 369.01 |
| 0.99 | 352.24 | 346.26 | 343.25 | 346.26 | 343.25 |
| 0.98 | 320.88 | 314.90 | 311.89 | 314.90 | 311.89 |
| 0.97 | 265.44 | 259.46 | 256.45 | 259.46 | 256.45 |
| 0.96 | 232.96 | 226.98 | 223.97 | 226.98 | 223.97 |
| 0.95 | 194.60 | 188.62 | 185.61 | 188.62 | 185.61 |
| 0.94 | 178.08 | 172.10 | 169.09 | 172.10 | 169.09 |
| 0.93 | 162.68 | 156.70 | 153.69 | 156.70 | 153.69 |
| 0.92 | 135.80 | 129.82 | 126.81 | 129.82 | 126.81 |
| 0.91 | 120.40 | 114.42 | 111.41 | 114.42 | 111.41 |
| 0.90 | 114.80 | 108.82 | 105.81 | 108.82 | 105.81 |
| 0.89 | 108.64 | 102.66 | 99.65 | 102.66 | 99.65 |
| 0.88 | 92.96 | 86.98 | 83.97 | 86.98 | 83.97 |
| 0.87 | 85.12 | 79.14 | 76.13 | 79.14 | 76.13 |
| 0.86 | 76.16 | 70.18 | 67.17 | 70.18 | 67.17 |
| 0.85 | 70.00 | 64.02 | 61.01 | 64.02 | 61.01 |
| 0.84 | 66.64 | 60.66 | 57.65 | 60.66 | 57.65 |
| 0.83 | 63.00 | 57.02 | 54.01 | 57.02 | 54.01 |
| 0.82 | 59.36 | 53.38 | 50.37 | 53.38 | 50.37 |
| 0.81 | 53.20 | 47.22 | 44.21 | 47.22 | 44.21 |
| 0.80 | 50.40 | 44.42 | 41.41 | 44.42 | 41.41 |
| 0.79 | 45.64 | 39.66 | 36.65 | 39.66 | 36.65 |
| 0.78 | 40.88 | 34.90 | 31.89 | 34.90 | 31.89 |
| 0.77 | 37.80 | 31.82 | 28.81 | 31.82 | 28.81 |
| 0.76 | 29.96 | 23.98 | 20.97 | 23.98 | 20.97 |
| 0.75 | 28.00 | 22.02 | 19.01 | 22.02 | 19.01 |
| 0.74 | 26.60 | 20.62 | 17.61 | 20.62 | 17.61 |
| 0.73 | 25.20 | 19.22 | 16.21 | 19.22 | 16.21 |
| 0.72 | 20.72 | 14.74 | 11.73 | 14.74 | 11.73 |
| 0.71 | 18.20 | 12.22 | 9.21 | 12.22 | 9.21 |
| 0.70 | 16.80 | 10.82 | 7.81 | 10.82 | 7.81 |
| 0.69 | 14.84 | 8.86 | 5.85 | 8.86 | 5.85 |
| 0.68 | 14.00 | 8.02 | 5.01 | 8.02 | 5.01 |
| 0.67 | 13.33 | 7.35 | 4.34 | 7.35 | 4.34 |
| 0.66 | 11.62 | 5.64 | 2.85 | 5.64 | 2.63 |
| 0.65 | 11.34 | 5.36 | 2.76 | 5.36 | 2.35 |
| 0.64 | 10.50 | 4.52 | 2.48 | 4.52 | 1.61 |
| 0.63 | 9.66 | 3.68 | 2.20 | 3.68 | 1.20 |
| 0.62 | 9.21 | 3.23 | 2.06 | 3.23 | 1.06 |
| 0.61 | 8.71 | 2.73 | 1.89 | 2.73 | 1.00 |
| 0.60 | 8.12 | 2.14 | 1.70 | 2.14 | 1.00 |
| 0.59 | 7.70 | 1.72 | 1.56 | 1.72 | 1.00 |
| 0.58 | 7.31 | 1.43 | 1.43 | 1.33 | 1.00 |
| 0.57 | 6.94 | 1.31 | 1.31 | 1.02 | 1.00 |
| 0.56 | 6.50 | 1.16 | 1.16 | 1.00 | 1.00 |
| 0.55 | 6.30 | 1.09 | 1.09 | 1.00 | 1.00 |
| 0.54 | 5.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.53 | 5.74 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.52 | 5.32 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.51 | 5.18 | 1.00 | 1.00 | 1.00 | 1.00 |

| March Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 0.50 | 5.04 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.49 | 4.98 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.48 | 4.90 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.47 | 4.73 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.46 | 4.48 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.45 | 4.48 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.44 | 4.34 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.43 | 4.23 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.42 | 4.17 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.41 | 4.06 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.40 | 3.92 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.39 | 3.86 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.38 | 3.78 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.37 | 3.64 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.36 | 3.64 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.35 | 3.50 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.34 | 3.50 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.33 | 3.50 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.32 | 3.22 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.31 | 3.22 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.30 | 3.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.29 | 3.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.28 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.27 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.26 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.25 | 2.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.24 | 2.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.23 | 2.69 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.22 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.21 | 2.58 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.20 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.19 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.18 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.17 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.16 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.15 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.14 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.13 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.12 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.11 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.10 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.09 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.08 | 1.71 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.07 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.06 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.05 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.04 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.03 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.02 | 1.40 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.01 | 1.32 | 1.00 | 1.00 | 1.00 | 1.00 |


GWR Flow Impacts
Reclamation Ditch at Davis Rd.
March
Flow (cfs)
1000
100
10
1
0
Case 0
Case 1
Case 2
Case 3
Case 4
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability


GWR Flow Impacts
Tembladero Slough at Castroville
March
Flow (cfs)
1000
100
10
1
0
Case 0
Case 1
Case 2
Case 3
Case 4
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability

**Reclamation Ditch at Davis Rd, Percentile Flows by Month (cfs)**

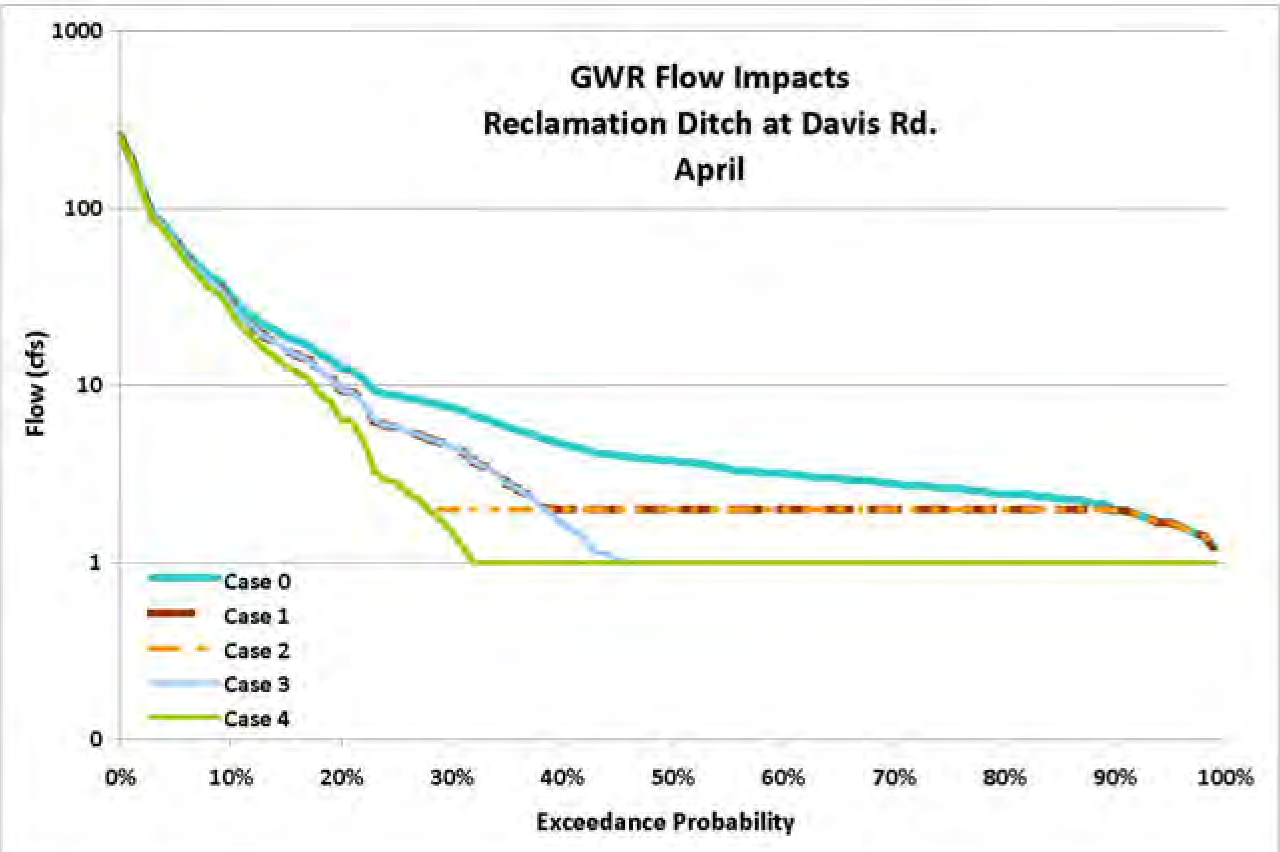
| April Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 252.99 | 250.00 | 246.99 | 250.00 | 246.99 |
| 0.99 | 190.41 | 187.42 | 184.41 | 187.42 | 184.41 |
| 0.98 | 126.83 | 123.84 | 120.83 | 123.84 | 120.83 |
| 0.97 | 91.83 | 88.84 | 85.83 | 88.84 | 85.83 |
| 0.96 | 80.47 | 77.48 | 74.47 | 77.48 | 74.47 |
| 0.95 | 66.48 | 63.49 | 60.48 | 63.49 | 60.48 |
| 0.94 | 55.28 | 52.29 | 49.28 | 52.29 | 49.28 |
| 0.93 | 47.76 | 44.77 | 41.76 | 44.77 | 41.76 |
| 0.92 | 41.57 | 38.58 | 35.57 | 38.58 | 35.57 |
| 0.91 | 38.42 | 35.43 | 32.42 | 35.43 | 32.42 |
| 0.90 | 31.86 | 28.87 | 25.86 | 28.87 | 25.86 |
| 0.89 | 26.99 | 24.00 | 20.99 | 24.00 | 20.99 |
| 0.88 | 24.40 | 21.41 | 18.40 | 21.41 | 18.40 |
| 0.87 | 21.98 | 18.99 | 15.98 | 18.99 | 15.98 |
| 0.86 | 20.56 | 17.57 | 14.56 | 17.57 | 14.56 |
| 0.85 | 18.74 | 15.75 | 12.74 | 15.75 | 12.74 |
| 0.84 | 17.80 | 14.81 | 11.80 | 14.81 | 11.80 |
| 0.83 | 16.87 | 13.88 | 10.87 | 13.88 | 10.87 |
| 0.82 | 14.99 | 12.00 | 8.99 | 12.00 | 8.99 |
| 0.81 | 14.06 | 11.07 | 8.06 | 11.07 | 8.06 |
| 0.80 | 12.37 | 9.38 | 6.37 | 9.38 | 6.37 |
| 0.79 | 12.10 | 9.11 | 6.10 | 9.11 | 6.10 |
| 0.78 | 10.89 | 7.90 | 4.89 | 7.90 | 4.89 |
| 0.77 | 9.31 | 6.32 | 3.31 | 6.32 | 3.31 |
| 0.76 | 8.91 | 5.92 | 2.91 | 5.92 | 2.91 |
| 0.75 | 8.81 | 5.82 | 2.81 | 5.82 | 2.81 |
| 0.74 | 8.48 | 5.49 | 2.48 | 5.49 | 2.48 |
| 0.73 | 8.26 | 5.27 | 2.26 | 5.27 | 2.26 |
| 0.72 | 7.95 | 4.96 | 2.00 | 4.96 | 1.95 |
| 0.71 | 7.74 | 4.75 | 2.00 | 4.75 | 1.74 |
| 0.70 | 7.50 | 4.51 | 2.00 | 4.51 | 1.50 |
| 0.69 | 7.21 | 4.22 | 2.00 | 4.22 | 1.21 |
| 0.68 | 6.69 | 3.70 | 2.00 | 3.70 | 1.00 |
| 0.67 | 6.47 | 3.48 | 2.00 | 3.48 | 1.00 |
| 0.66 | 6.18 | 3.19 | 2.00 | 3.19 | 1.00 |
| 0.65 | 5.80 | 2.81 | 2.00 | 2.81 | 1.00 |
| 0.64 | 5.58 | 2.59 | 2.00 | 2.59 | 1.00 |
| 0.63 | 5.37 | 2.38 | 2.00 | 2.38 | 1.00 |
| 0.62 | 5.06 | 2.07 | 2.00 | 2.07 | 1.00 |
| 0.61 | 4.87 | 2.00 | 2.00 | 1.88 | 1.00 |
| 0.60 | 4.63 | 2.00 | 2.00 | 1.64 | 1.00 |
| 0.59 | 4.51 | 2.00 | 2.00 | 1.52 | 1.00 |
| 0.58 | 4.37 | 2.00 | 2.00 | 1.38 | 1.00 |
| 0.57 | 4.12 | 2.00 | 2.00 | 1.13 | 1.00 |
| 0.56 | 4.12 | 2.00 | 2.00 | 1.13 | 1.00 |
| 0.55 | 4.03 | 2.00 | 2.00 | 1.04 | 1.00 |
| 0.54 | 3.94 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.53 | 3.88 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.52 | 3.84 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.51 | 3.75 | 2.00 | 2.00 | 1.00 | 1.00 |

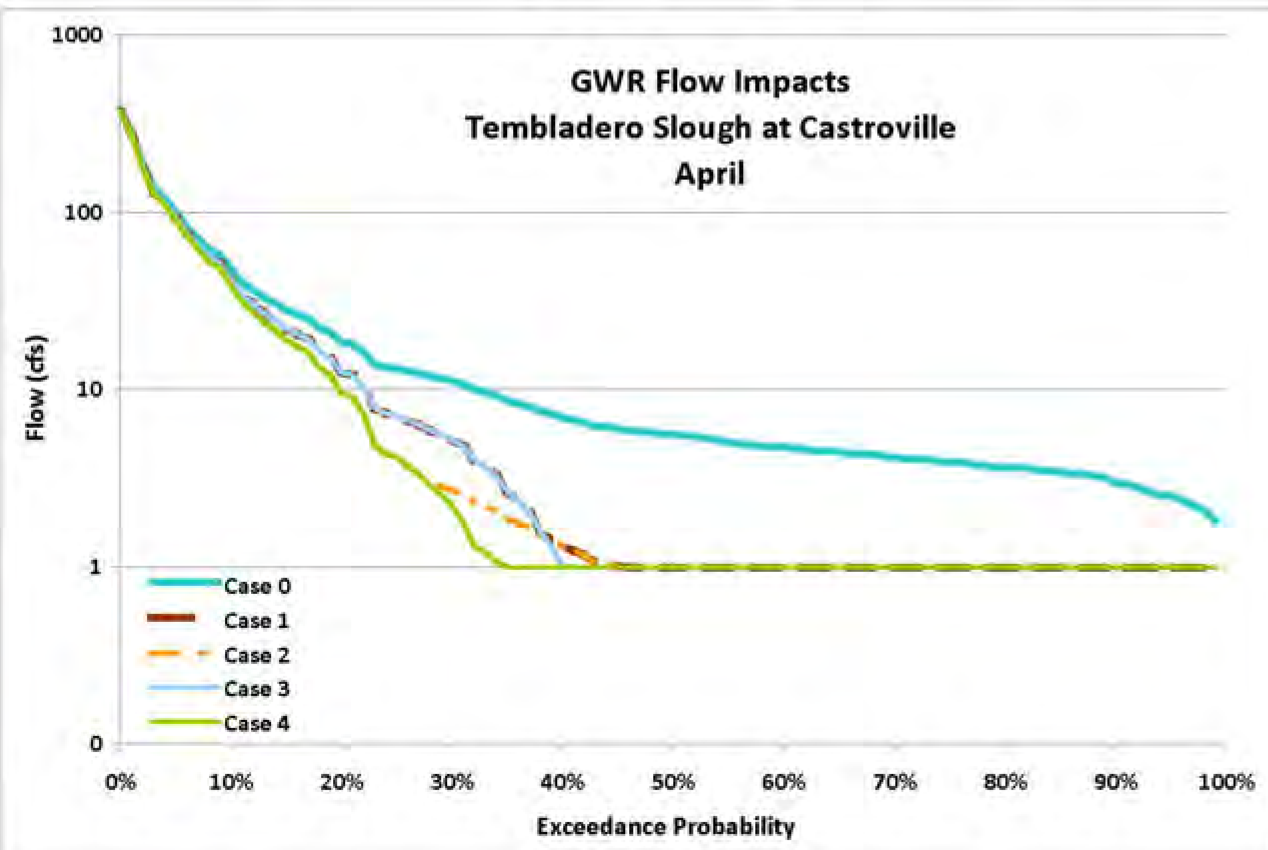
| April Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 0.50 | 3.75 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.49 | 3.65 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.48 | 3.65 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.47 | 3.56 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.46 | 3.47 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.45 | 3.38 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.44 | 3.28 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.43 | 3.28 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.42 | 3.20 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.41 | 3.19 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.40 | 3.19 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.39 | 3.12 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.38 | 3.09 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.37 | 3.00 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.36 | 3.00 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.35 | 3.00 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.34 | 2.90 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.33 | 2.90 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.32 | 2.90 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.31 | 2.81 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.30 | 2.78 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.29 | 2.72 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.28 | 2.72 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.27 | 2.70 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.26 | 2.62 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.25 | 2.62 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.24 | 2.62 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.23 | 2.53 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.22 | 2.53 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.21 | 2.44 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.20 | 2.44 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.19 | 2.44 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.18 | 2.44 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.17 | 2.34 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.16 | 2.34 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.15 | 2.28 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.14 | 2.25 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.13 | 2.25 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.12 | 2.16 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.11 | 2.16 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.10 | 1.97 | 1.97 | 1.97 | 1.00 | 1.00 |
| 0.09 | 1.97 | 1.97 | 1.97 | 1.00 | 1.00 |
| 0.08 | 1.87 | 1.87 | 1.87 | 1.00 | 1.00 |
| 0.07 | 1.78 | 1.78 | 1.78 | 1.00 | 1.00 |
| 0.06 | 1.69 | 1.69 | 1.69 | 1.00 | 1.00 |
| 0.05 | 1.69 | 1.69 | 1.69 | 1.00 | 1.00 |
| 0.04 | 1.59 | 1.59 | 1.59 | 1.00 | 1.00 |
| 0.03 | 1.49 | 1.49 | 1.49 | 1.00 | 1.00 |
| 0.02 | 1.41 | 1.41 | 1.41 | 1.00 | 1.00 |
| 0.01 | 1.22 | 1.22 | 1.22 | 1.00 | 1.00 |

**Tembladero Slough at Castroville, Percentile Flows by Month (cfs)**

| April Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 378.00 | 372.02 | 369.01 | 372.02 | 369.01 |
| 0.99 | 284.49 | 278.51 | 275.50 | 278.51 | 275.50 |
| 0.98 | 189.50 | 183.52 | 180.51 | 183.52 | 180.51 |
| 0.97 | 137.20 | 131.22 | 128.21 | 131.22 | 128.21 |
| 0.96 | 120.23 | 114.25 | 111.24 | 114.25 | 111.24 |
| 0.95 | 99.33 | 93.35 | 90.34 | 93.35 | 90.34 |
| 0.94 | 82.60 | 76.62 | 73.61 | 76.62 | 73.61 |
| 0.93 | 71.36 | 65.38 | 62.37 | 65.38 | 62.37 |
| 0.92 | 62.10 | 56.12 | 53.11 | 56.12 | 53.11 |
| 0.91 | 57.40 | 51.42 | 48.41 | 51.42 | 48.41 |
| 0.90 | 47.60 | 41.62 | 38.61 | 41.62 | 38.61 |
| 0.89 | 40.33 | 34.35 | 31.34 | 34.35 | 31.34 |
| 0.88 | 36.46 | 30.48 | 27.47 | 30.48 | 27.47 |
| 0.87 | 32.84 | 26.86 | 23.85 | 26.86 | 23.85 |
| 0.86 | 30.72 | 24.74 | 21.73 | 24.74 | 21.73 |
| 0.85 | 28.00 | 22.02 | 19.01 | 22.02 | 19.01 |
| 0.84 | 26.60 | 20.62 | 17.61 | 20.62 | 17.61 |
| 0.83 | 25.20 | 19.22 | 16.21 | 19.22 | 16.21 |
| 0.82 | 22.40 | 16.42 | 13.41 | 16.42 | 13.41 |
| 0.81 | 21.00 | 15.02 | 12.01 | 15.02 | 12.01 |
| 0.80 | 18.48 | 12.50 | 9.49 | 12.50 | 9.49 |
| 0.79 | 18.07 | 12.09 | 9.08 | 12.09 | 9.08 |
| 0.78 | 16.27 | 10.29 | 7.28 | 10.29 | 7.28 |
| 0.77 | 13.91 | 7.93 | 4.92 | 7.93 | 4.92 |
| 0.76 | 13.32 | 7.34 | 4.33 | 7.34 | 4.33 |
| 0.75 | 13.16 | 7.18 | 4.17 | 7.18 | 4.17 |
| 0.74 | 12.66 | 6.68 | 3.67 | 6.68 | 3.67 |
| 0.73 | 12.34 | 6.36 | 3.35 | 6.36 | 3.35 |
| 0.72 | 11.88 | 5.90 | 2.94 | 5.90 | 2.89 |
| 0.71 | 11.56 | 5.58 | 2.83 | 5.58 | 2.57 |
| 0.70 | 11.20 | 5.22 | 2.71 | 5.22 | 2.21 |
| 0.69 | 10.78 | 4.80 | 2.58 | 4.80 | 1.79 |
| 0.68 | 10.00 | 4.02 | 2.32 | 4.02 | 1.32 |
| 0.67 | 9.66 | 3.68 | 2.20 | 3.68 | 1.20 |
| 0.66 | 9.24 | 3.26 | 2.07 | 3.26 | 1.07 |
| 0.65 | 8.66 | 2.68 | 1.87 | 2.68 | 1.00 |
| 0.64 | 8.34 | 2.36 | 1.77 | 2.36 | 1.00 |
| 0.63 | 8.02 | 2.04 | 1.66 | 2.04 | 1.00 |
| 0.62 | 7.56 | 1.58 | 1.51 | 1.58 | 1.00 |
| 0.61 | 7.28 | 1.42 | 1.42 | 1.30 | 1.00 |
| 0.60 | 6.92 | 1.30 | 1.30 | 1.01 | 1.00 |
| 0.59 | 6.74 | 1.24 | 1.24 | 1.00 | 1.00 |
| 0.58 | 6.53 | 1.17 | 1.17 | 1.00 | 1.00 |
| 0.57 | 6.16 | 1.05 | 1.05 | 1.00 | 1.00 |
| 0.56 | 6.16 | 1.05 | 1.05 | 1.00 | 1.00 |
| 0.55 | 6.02 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.54 | 5.88 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.53 | 5.79 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.52 | 5.74 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.51 | 5.60 | 1.00 | 1.00 | 1.00 | 1.00 |

| April Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 0.50 | 5.60 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.49 | 5.46 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.48 | 5.45 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.47 | 5.32 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.46 | 5.18 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.45 | 5.05 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.44 | 4.90 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.43 | 4.90 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.42 | 4.79 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.41 | 4.76 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.40 | 4.76 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.39 | 4.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.38 | 4.62 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.37 | 4.48 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.36 | 4.48 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.35 | 4.48 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.34 | 4.34 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.33 | 4.34 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.32 | 4.34 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.31 | 4.20 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.30 | 4.16 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.29 | 4.06 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.28 | 4.06 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.27 | 4.04 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.26 | 3.92 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.25 | 3.92 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.24 | 3.92 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.23 | 3.78 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.22 | 3.78 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.21 | 3.64 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.20 | 3.64 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.19 | 3.64 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.18 | 3.64 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.17 | 3.50 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.16 | 3.50 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.15 | 3.41 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.14 | 3.36 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.13 | 3.36 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.12 | 3.22 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.11 | 3.22 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.10 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.09 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.08 | 2.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.07 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.06 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.05 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.04 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.03 | 2.22 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.02 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.01 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |


GWR Flow Impacts
Reclamation Ditch at Davis Rd.
April
1000
100
10
1
0
Flow (cfs)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability
Case 0
Case 1
Case 2
Case 3
Case 4


GWR Flow Impacts
Tembladero Slough at Castroville
April
1000
100
10
1
0
Flow (cfs)
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability
Case 0
Case 1
Case 2
Case 3
Case 4

Reclamation Ditch at Davis Rd, Percentile Flows by Month (cfs)

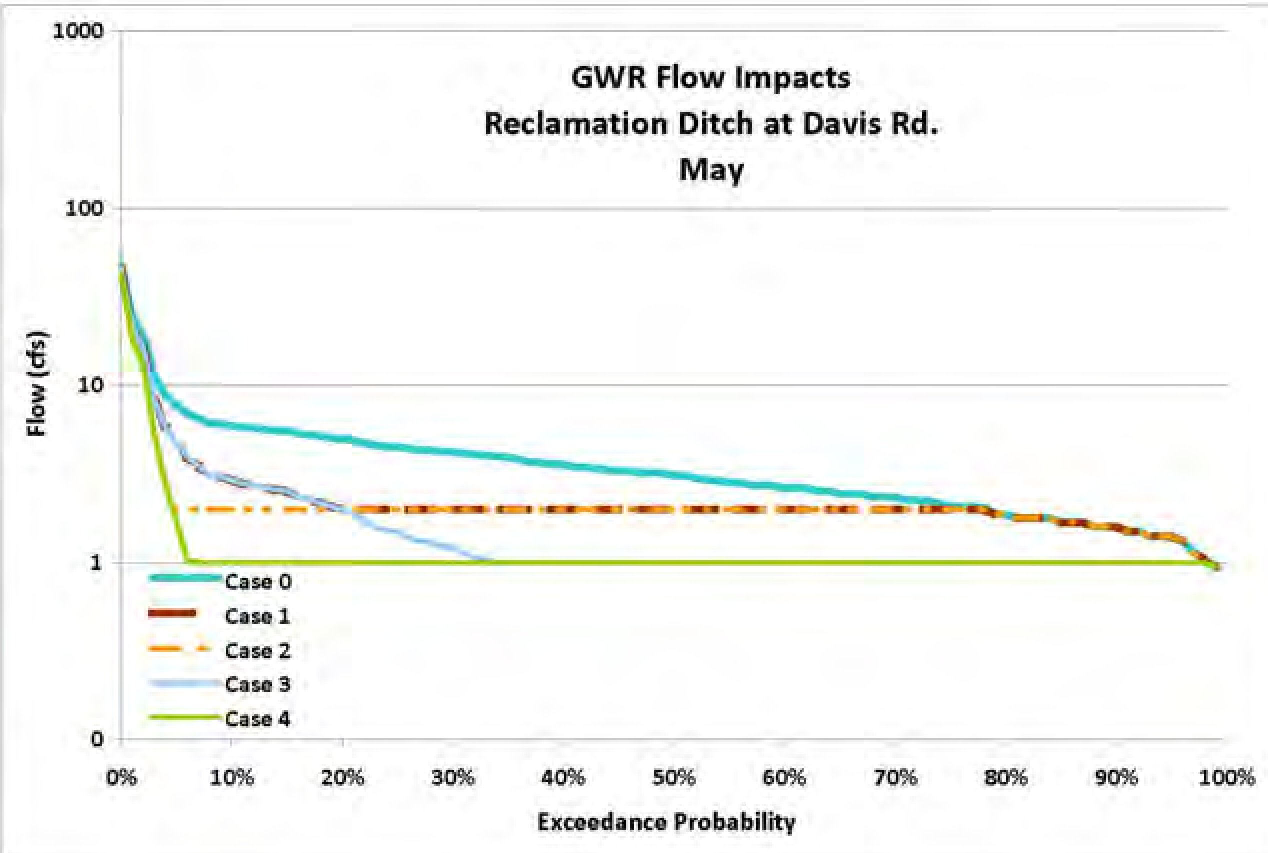
| May Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 47.79 | 44.80 | 41.79 | 44.80 | 41.79 |
| 0.99 | 23.99 | 21.00 | 17.99 | 21.00 | 17.99 |
| 0.98 | 19.11 | 16.12 | 13.11 | 16.12 | 13.11 |
| 0.97 | 11.24 | 8.25 | 5.24 | 8.25 | 5.24 |
| 0.96 | 8.75 | 5.76 | 2.75 | 5.76 | 2.75 |
| 0.95 | 7.68 | 4.69 | 2.00 | 4.69 | 1.68 |
| 0.94 | 6.92 | 3.93 | 2.00 | 3.93 | 1.02 |
| 0.93 | 6.48 | 3.49 | 2.00 | 3.49 | 1.00 |
| 0.92 | 6.09 | 3.10 | 2.00 | 3.10 | 1.00 |
| 0.91 | 6.03 | 3.04 | 2.00 | 3.04 | 1.00 |
| 0.90 | 5.90 | 2.91 | 2.00 | 2.91 | 1.00 |
| 0.89 | 5.77 | 2.78 | 2.00 | 2.78 | 1.00 |
| 0.88 | 5.72 | 2.73 | 2.00 | 2.73 | 1.00 |
| 0.87 | 5.62 | 2.63 | 2.00 | 2.63 | 1.00 |
| 0.86 | 5.57 | 2.58 | 2.00 | 2.58 | 1.00 |
| 0.85 | 5.53 | 2.54 | 2.00 | 2.54 | 1.00 |
| 0.84 | 5.34 | 2.35 | 2.00 | 2.35 | 1.00 |
| 0.83 | 5.25 | 2.26 | 2.00 | 2.26 | 1.00 |
| 0.82 | 5.15 | 2.16 | 2.00 | 2.16 | 1.00 |
| 0.81 | 5.06 | 2.07 | 2.00 | 2.07 | 1.00 |
| 0.80 | 4.97 | 2.00 | 2.00 | 1.98 | 1.00 |
| 0.79 | 4.87 | 2.00 | 2.00 | 1.88 | 1.00 |
| 0.78 | 4.70 | 2.00 | 2.00 | 1.71 | 1.00 |
| 0.77 | 4.57 | 2.00 | 2.00 | 1.58 | 1.00 |
| 0.76 | 4.50 | 2.00 | 2.00 | 1.51 | 1.00 |
| 0.75 | 4.50 | 2.00 | 2.00 | 1.51 | 1.00 |
| 0.74 | 4.37 | 2.00 | 2.00 | 1.38 | 1.00 |
| 0.73 | 4.31 | 2.00 | 2.00 | 1.32 | 1.00 |
| 0.72 | 4.29 | 2.00 | 2.00 | 1.30 | 1.00 |
| 0.71 | 4.22 | 2.00 | 2.00 | 1.23 | 1.00 |
| 0.70 | 4.22 | 2.00 | 2.00 | 1.23 | 1.00 |
| 0.69 | 4.12 | 2.00 | 2.00 | 1.13 | 1.00 |
| 0.68 | 4.05 | 2.00 | 2.00 | 1.06 | 1.00 |
| 0.67 | 4.01 | 2.00 | 2.00 | 1.03 | 1.00 |
| 0.66 | 3.94 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.65 | 3.94 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.64 | 3.80 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.63 | 3.67 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.62 | 3.65 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.61 | 3.56 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.60 | 3.56 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.59 | 3.47 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.58 | 3.47 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.57 | 3.37 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.56 | 3.32 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.55 | 3.28 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.54 | 3.28 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.53 | 3.19 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.52 | 3.19 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.51 | 3.19 | 2.00 | 2.00 | 1.00 | 1.00 |

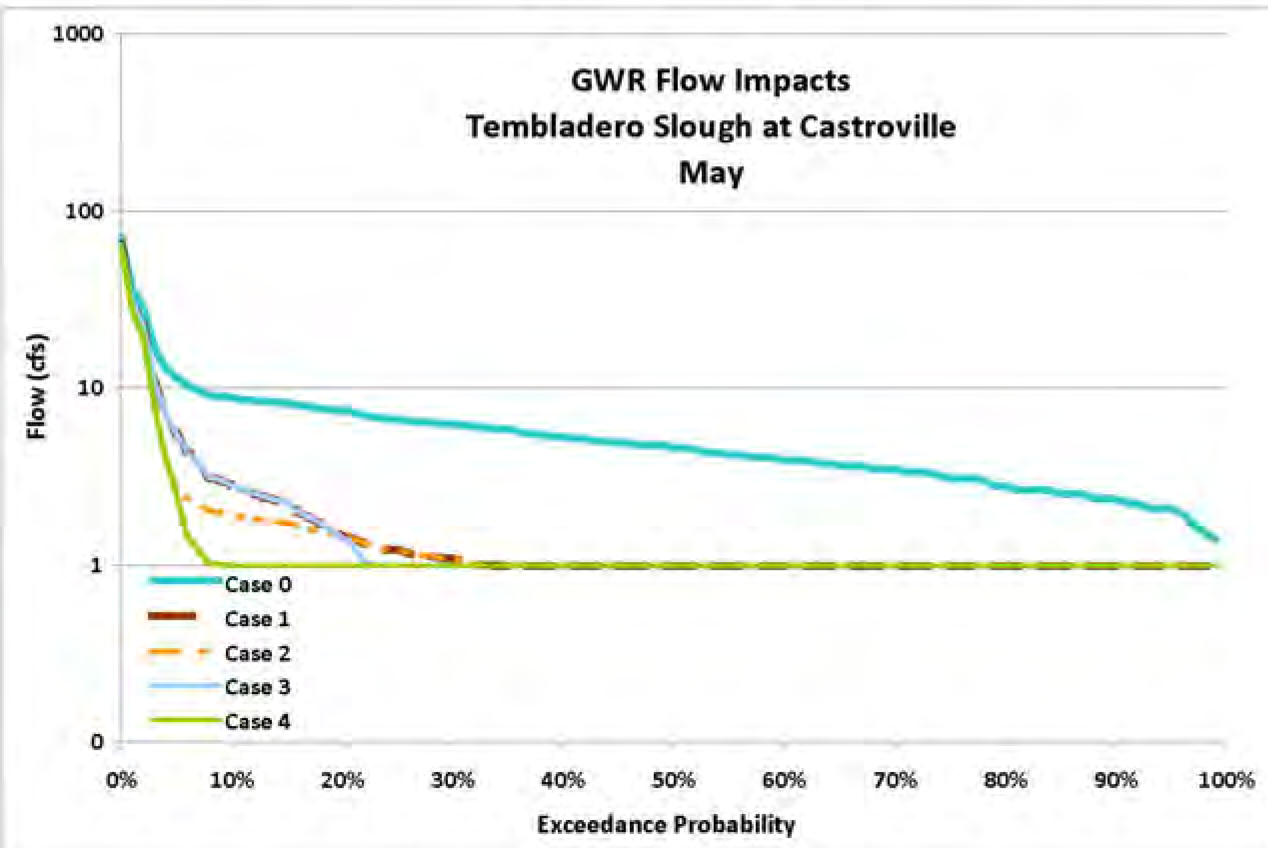
| May Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 0.50 | 3.09 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.49 | 3.09 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.48 | 3.00 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.47 | 2.90 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.46 | 2.90 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.45 | 2.81 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.44 | 2.81 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.43 | 2.74 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.42 | 2.72 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.41 | 2.72 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.40 | 2.62 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.39 | 2.62 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.38 | 2.62 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.37 | 2.53 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.36 | 2.53 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.35 | 2.44 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.34 | 2.44 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.33 | 2.44 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.32 | 2.34 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.31 | 2.34 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.30 | 2.34 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.29 | 2.25 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.28 | 2.25 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.27 | 2.23 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.26 | 2.16 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.25 | 2.06 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.24 | 2.06 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.23 | 2.06 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.22 | 2.04 | 1.99 | 1.99 | 1.00 | 1.00 |
| 0.21 | 1.87 | 1.87 | 1.87 | 1.00 | 1.00 |
| 0.20 | 1.87 | 1.87 | 1.87 | 1.00 | 1.00 |
| 0.19 | 1.78 | 1.78 | 1.78 | 1.00 | 1.00 |
| 0.18 | 1.78 | 1.78 | 1.78 | 1.00 | 1.00 |
| 0.17 | 1.78 | 1.78 | 1.78 | 1.00 | 1.00 |
| 0.16 | 1.78 | 1.78 | 1.78 | 1.00 | 1.00 |
| 0.15 | 1.69 | 1.69 | 1.69 | 1.00 | 1.00 |
| 0.14 | 1.69 | 1.69 | 1.69 | 1.00 | 1.00 |
| 0.13 | 1.69 | 1.69 | 1.69 | 1.00 | 1.00 |
| 0.12 | 1.59 | 1.59 | 1.59 | 1.00 | 1.00 |
| 0.11 | 1.59 | 1.59 | 1.59 | 1.00 | 1.00 |
| 0.10 | 1.59 | 1.59 | 1.59 | 1.00 | 1.00 |
| 0.09 | 1.50 | 1.50 | 1.50 | 1.00 | 1.00 |
| 0.08 | 1.50 | 1.50 | 1.50 | 1.00 | 1.00 |
| 0.07 | 1.41 | 1.41 | 1.41 | 1.00 | 1.00 |
| 0.06 | 1.41 | 1.41 | 1.41 | 1.00 | 1.00 |
| 0.05 | 1.41 | 1.41 | 1.41 | 1.00 | 1.00 |
| 0.04 | 1.31 | 1.31 | 1.31 | 1.00 | 1.00 |
| 0.03 | 1.14 | 1.14 | 1.14 | 1.00 | 1.00 |
| 0.02 | 1.03 | 1.03 | 1.03 | 1.00 | 1.00 |
| 0.01 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |

Tembladero Slough at Castroville, Percentile Flows by Month (cfs)

| May Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 71.40 | 65.42 | 62.41 | 65.42 | 62.41 |
| 0.99 | 35.84 | 29.86 | 26.85 | 29.86 | 26.85 |
| 0.98 | 28.56 | 22.58 | 19.57 | 22.58 | 19.57 |
| 0.97 | 16.80 | 10.82 | 7.81 | 10.82 | 7.81 |
| 0.96 | 13.08 | 7.10 | 4.09 | 7.10 | 4.09 |
| 0.95 | 11.48 | 5.50 | 2.81 | 5.50 | 2.49 |
| 0.94 | 10.33 | 4.35 | 2.43 | 4.35 | 1.44 |
| 0.93 | 9.69 | 3.71 | 2.21 | 3.71 | 1.21 |
| 0.92 | 9.10 | 3.12 | 2.02 | 3.12 | 1.02 |
| 0.91 | 9.02 | 3.04 | 1.99 | 3.04 | 1.01 |
| 0.90 | 8.82 | 2.84 | 1.93 | 2.84 | 1.00 |
| 0.89 | 8.62 | 2.64 | 1.86 | 2.64 | 1.00 |
| 0.88 | 8.54 | 2.56 | 1.83 | 2.56 | 1.00 |
| 0.87 | 8.40 | 2.42 | 1.79 | 2.42 | 1.00 |
| 0.86 | 8.32 | 2.34 | 1.76 | 2.34 | 1.00 |
| 0.85 | 8.26 | 2.28 | 1.74 | 2.28 | 1.00 |
| 0.84 | 7.98 | 2.00 | 1.65 | 2.00 | 1.00 |
| 0.83 | 7.84 | 1.86 | 1.60 | 1.86 | 1.00 |
| 0.82 | 7.70 | 1.72 | 1.56 | 1.72 | 1.00 |
| 0.81 | 7.56 | 1.58 | 1.51 | 1.58 | 1.00 |
| 0.80 | 7.42 | 1.46 | 1.46 | 1.44 | 1.00 |
| 0.79 | 7.28 | 1.42 | 1.42 | 1.30 | 1.00 |
| 0.78 | 7.03 | 1.33 | 1.33 | 1.05 | 1.00 |
| 0.77 | 6.83 | 1.27 | 1.27 | 1.00 | 1.00 |
| 0.76 | 6.72 | 1.23 | 1.23 | 1.00 | 1.00 |
| 0.75 | 6.72 | 1.23 | 1.23 | 1.00 | 1.00 |
| 0.74 | 6.52 | 1.17 | 1.17 | 1.00 | 1.00 |
| 0.73 | 6.44 | 1.14 | 1.14 | 1.00 | 1.00 |
| 0.72 | 6.41 | 1.13 | 1.13 | 1.00 | 1.00 |
| 0.71 | 6.30 | 1.09 | 1.09 | 1.00 | 1.00 |
| 0.70 | 6.30 | 1.09 | 1.09 | 1.00 | 1.00 |
| 0.69 | 6.16 | 1.05 | 1.05 | 1.00 | 1.00 |
| 0.68 | 6.05 | 1.01 | 1.01 | 1.00 | 1.00 |
| 0.67 | 5.99 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.66 | 5.88 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.65 | 5.88 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.64 | 5.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.63 | 5.49 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.62 | 5.46 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.61 | 5.32 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.60 | 5.32 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.59 | 5.18 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.58 | 5.18 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.57 | 5.04 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.56 | 4.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.55 | 4.90 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.54 | 4.90 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.53 | 4.76 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.52 | 4.76 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.51 | 4.76 | 1.00 | 1.00 | 1.00 | 1.00 |

| May Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 0.50 | 4.62 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.49 | 4.62 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.48 | 4.48 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.47 | 4.34 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.46 | 4.34 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.45 | 4.20 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.44 | 4.20 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.43 | 4.09 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.42 | 4.06 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.41 | 4.06 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.40 | 3.92 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.39 | 3.92 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.38 | 3.92 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.37 | 3.78 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.36 | 3.78 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.35 | 3.64 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.34 | 3.64 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.33 | 3.64 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.32 | 3.50 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.31 | 3.50 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.30 | 3.50 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.29 | 3.36 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.28 | 3.36 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.27 | 3.33 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.26 | 3.22 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.25 | 3.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.24 | 3.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.23 | 3.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.22 | 3.05 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.21 | 2.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.20 | 2.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.19 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.18 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.17 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.16 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.15 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.14 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.13 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.12 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.11 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.10 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.09 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.08 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.07 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.06 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.05 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.04 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.03 | 1.71 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.02 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.01 | 1.40 | 1.00 | 1.00 | 1.00 | 1.00 |


GWR Flow Impacts
Reclamation Ditch at Davis Rd.
May
1000
100
10
1
0
Flow (cfs)
Case 0
Case 1
Case 2
Case 3
Case 4
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability


GWR Flow Impacts
Tembladero Slough at Castroville
May
1000
100
10
1
0
Flow (cfs)
Case 0
Case 1
Case 2
Case 3
Case 4
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability

**Reclamation Ditch at Davis Rd, Percentile Flows by Month (cfs)**

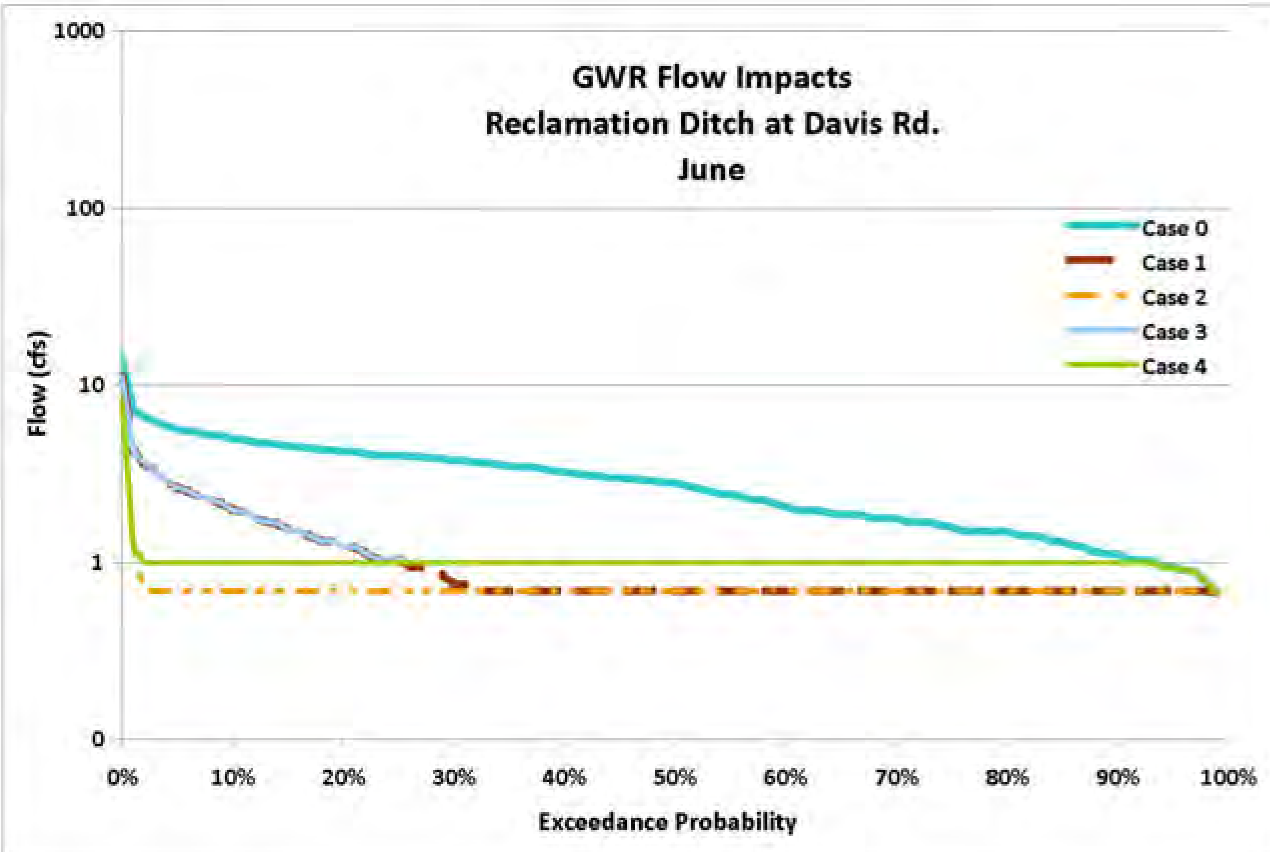
| June Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 14.06 | 11.07 | 8.06 | 11.07 | 8.06 |
| 0.99 | 7.21 | 4.22 | 1.21 | 4.22 | 1.21 |
| 0.98 | 6.64 | 3.65 | 0.69 | 3.65 | 1.00 |
| 0.97 | 6.25 | 3.26 | 0.69 | 3.26 | 1.00 |
| 0.96 | 5.87 | 2.88 | 0.69 | 2.88 | 1.00 |
| 0.95 | 5.62 | 2.63 | 0.69 | 2.63 | 1.00 |
| 0.94 | 5.53 | 2.54 | 0.69 | 2.54 | 1.00 |
| 0.93 | 5.34 | 2.35 | 0.69 | 2.35 | 1.00 |
| 0.92 | 5.25 | 2.26 | 0.69 | 2.26 | 1.00 |
| 0.91 | 5.15 | 2.16 | 0.69 | 2.16 | 1.00 |
| 0.90 | 4.97 | 1.98 | 0.69 | 1.98 | 1.00 |
| 0.89 | 4.92 | 1.93 | 0.69 | 1.93 | 1.00 |
| 0.88 | 4.78 | 1.79 | 0.69 | 1.79 | 1.00 |
| 0.87 | 4.69 | 1.70 | 0.69 | 1.70 | 1.00 |
| 0.86 | 4.66 | 1.67 | 0.69 | 1.67 | 1.00 |
| 0.85 | 4.51 | 1.52 | 0.69 | 1.52 | 1.00 |
| 0.84 | 4.50 | 1.51 | 0.69 | 1.51 | 1.00 |
| 0.83 | 4.40 | 1.41 | 0.69 | 1.41 | 1.00 |
| 0.82 | 4.31 | 1.32 | 0.69 | 1.32 | 1.00 |
| 0.81 | 4.31 | 1.32 | 0.69 | 1.32 | 1.00 |
| 0.80 | 4.22 | 1.23 | 0.69 | 1.23 | 1.00 |
| 0.79 | 4.22 | 1.23 | 0.69 | 1.23 | 1.00 |
| 0.78 | 4.12 | 1.13 | 0.69 | 1.13 | 1.00 |
| 0.77 | 4.03 | 1.04 | 0.69 | 1.04 | 1.00 |
| 0.76 | 4.03 | 1.04 | 0.69 | 1.04 | 1.00 |
| 0.75 | 4.03 | 1.04 | 0.69 | 1.04 | 1.00 |
| 0.74 | 3.94 | 0.95 | 0.69 | 1.00 | 1.00 |
| 0.73 | 3.94 | 0.95 | 0.69 | 1.00 | 1.00 |
| 0.72 | 3.89 | 0.90 | 0.69 | 1.00 | 1.00 |
| 0.71 | 3.84 | 0.85 | 0.69 | 1.00 | 1.00 |
| 0.70 | 3.75 | 0.76 | 0.69 | 1.00 | 1.00 |
| 0.69 | 3.75 | 0.76 | 0.69 | 1.00 | 1.00 |
| 0.68 | 3.65 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.67 | 3.65 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.66 | 3.56 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.65 | 3.50 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.64 | 3.47 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.63 | 3.47 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.62 | 3.37 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.61 | 3.28 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.60 | 3.22 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.59 | 3.19 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.58 | 3.09 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.57 | 3.09 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.56 | 3.00 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.55 | 3.00 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.54 | 2.99 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.53 | 2.90 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.52 | 2.90 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.51 | 2.81 | 0.69 | 0.69 | 1.00 | 1.00 |

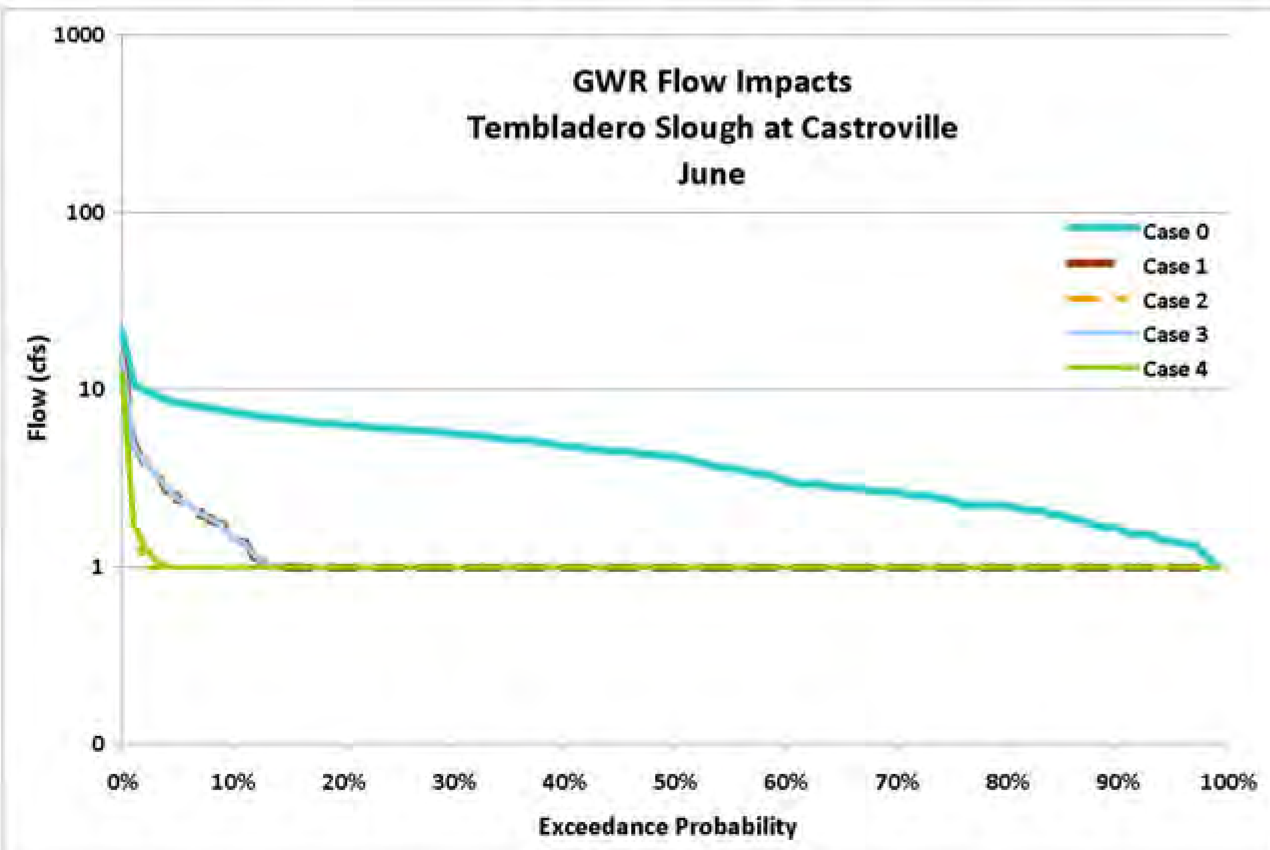
| June Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 0.50 | 2.81 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.49 | 2.72 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.48 | 2.62 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.47 | 2.53 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.46 | 2.44 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.45 | 2.44 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.44 | 2.34 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.43 | 2.25 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.42 | 2.25 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.41 | 2.16 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.40 | 2.06 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.39 | 1.97 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.38 | 1.97 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.37 | 1.97 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.36 | 1.90 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.35 | 1.87 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.34 | 1.87 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.33 | 1.82 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.32 | 1.78 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.31 | 1.78 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.30 | 1.78 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.29 | 1.69 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.28 | 1.69 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.27 | 1.69 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.26 | 1.62 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.25 | 1.59 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.24 | 1.50 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.23 | 1.50 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.22 | 1.50 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.21 | 1.50 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.20 | 1.50 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.19 | 1.43 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.18 | 1.41 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.17 | 1.41 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.16 | 1.31 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.15 | 1.31 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.14 | 1.24 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.13 | 1.22 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.12 | 1.13 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.11 | 1.12 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.10 | 1.12 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.09 | 1.03 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.08 | 1.03 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.07 | 1.03 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.06 | 0.94 | 0.69 | 0.69 | 0.94 | 0.94 |
| 0.05 | 0.94 | 0.69 | 0.69 | 0.94 | 0.94 |
| 0.04 | 0.90 | 0.69 | 0.69 | 0.90 | 0.90 |
| 0.03 | 0.89 | 0.69 | 0.69 | 0.89 | 0.89 |
| 0.02 | 0.78 | 0.69 | 0.69 | 0.78 | 0.78 |
| 0.01 | 0.67 | 0.67 | 0.67 | 0.67 | 0.67 |

**Tembladero Slough at Castroville, Percentile Flows by Month (cfs)**

| June Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 21.00 | 15.02 | 12.01 | 15.02 | 12.01 |
| 0.99 | 10.78 | 4.80 | 1.79 | 4.80 | 1.79 |
| 0.98 | 9.91 | 3.93 | 1.00 | 3.93 | 1.29 |
| 0.97 | 9.34 | 3.36 | 1.00 | 3.36 | 1.10 |
| 0.96 | 8.77 | 2.79 | 1.00 | 2.79 | 1.00 |
| 0.95 | 8.40 | 2.42 | 1.00 | 2.42 | 1.00 |
| 0.94 | 8.26 | 2.28 | 1.00 | 2.28 | 1.00 |
| 0.93 | 7.98 | 2.00 | 1.00 | 2.00 | 1.00 |
| 0.92 | 7.84 | 1.86 | 1.00 | 1.86 | 1.00 |
| 0.91 | 7.70 | 1.72 | 1.00 | 1.72 | 1.00 |
| 0.90 | 7.42 | 1.44 | 1.00 | 1.44 | 1.00 |
| 0.89 | 7.35 | 1.37 | 1.00 | 1.37 | 1.00 |
| 0.88 | 7.14 | 1.16 | 1.00 | 1.16 | 1.00 |
| 0.87 | 7.00 | 1.02 | 1.00 | 1.02 | 1.00 |
| 0.86 | 6.96 | 1.01 | 1.00 | 1.01 | 1.00 |
| 0.85 | 6.74 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.84 | 6.72 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.83 | 6.58 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.82 | 6.44 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.81 | 6.44 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.80 | 6.30 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.79 | 6.30 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.78 | 6.16 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.77 | 6.02 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.76 | 6.02 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.75 | 6.02 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.74 | 5.88 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.73 | 5.88 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.72 | 5.81 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.71 | 5.74 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.70 | 5.60 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.69 | 5.60 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.68 | 5.46 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.67 | 5.46 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.66 | 5.32 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.65 | 5.23 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.64 | 5.18 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.63 | 5.18 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.62 | 5.04 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.61 | 4.90 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.60 | 4.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.59 | 4.76 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.58 | 4.62 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.57 | 4.62 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.56 | 4.48 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.55 | 4.48 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.54 | 4.46 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.53 | 4.34 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.52 | 4.34 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.51 | 4.20 | 1.00 | 1.00 | 1.00 | 1.00 |

| June Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 0.50 | 4.20 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.49 | 4.06 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.48 | 3.92 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.47 | 3.78 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.46 | 3.64 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.45 | 3.64 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.44 | 3.50 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.43 | 3.36 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.42 | 3.36 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.41 | 3.22 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.40 | 3.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.39 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.38 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.37 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.36 | 2.83 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.35 | 2.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.34 | 2.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.33 | 2.73 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.32 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.31 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.30 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.29 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.28 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.27 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.26 | 2.43 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.25 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.24 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.23 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.22 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.21 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.20 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.19 | 2.13 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.18 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.17 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.16 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.15 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.14 | 1.86 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.13 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.12 | 1.69 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.11 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.10 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.09 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.08 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.07 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.06 | 1.40 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.05 | 1.40 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.04 | 1.35 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.03 | 1.33 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.02 | 1.16 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.01 | 1.01 | 0.99 | 0.99 | 0.99 | 0.99 |


GWR Flow Impacts
Reclamation Ditch at Davis Rd.
June
1000
100
10
1
0
Flow (cfs)
Case 0
Case 1
Case 2
Case 3
Case 4
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability


GWR Flow Impacts
Tembladero Slough at Castroville
June
1000
100
10
1
0
Flow (cfs)
Case 0
Case 1
Case 2
Case 3
Case 4
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability

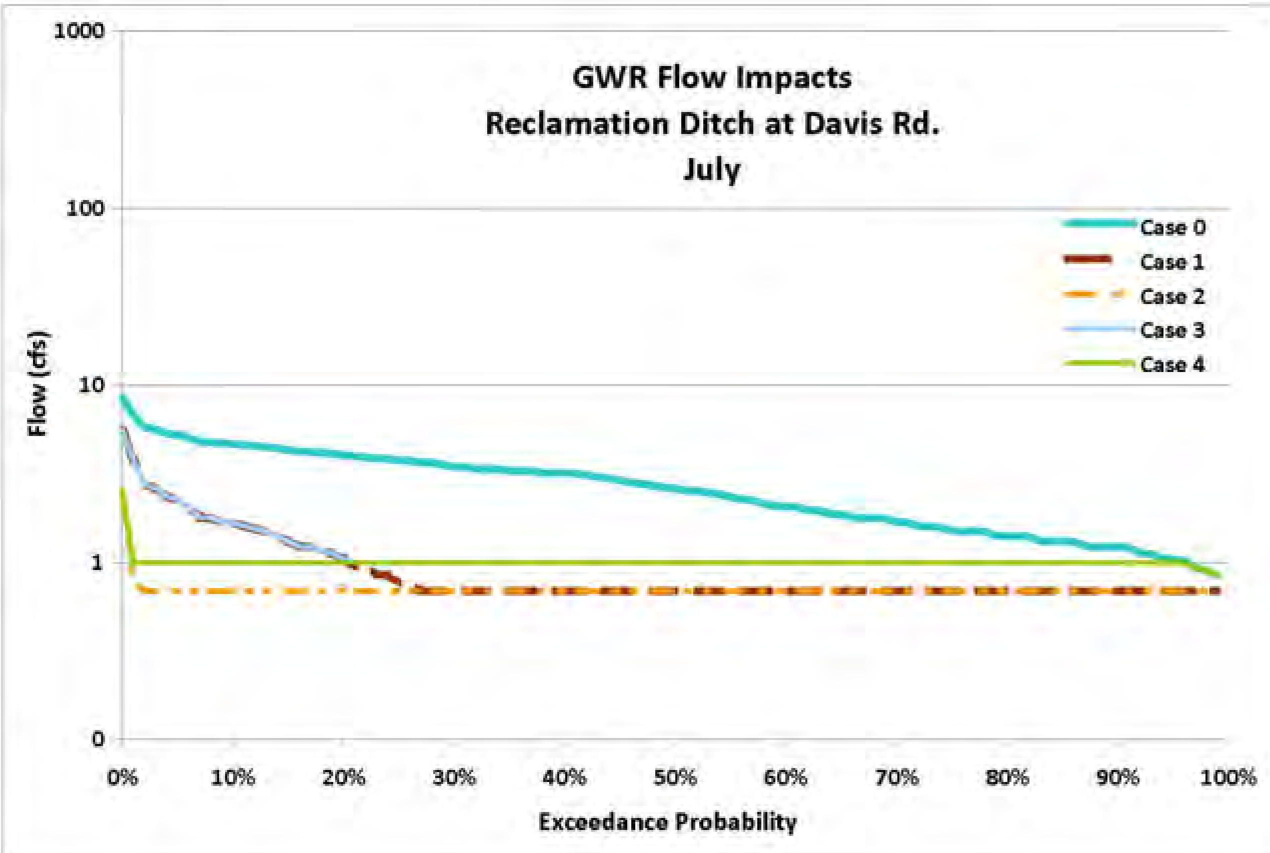
Reclamation Ditch at Davis Rd, Percentile Flows by Month (cfs)

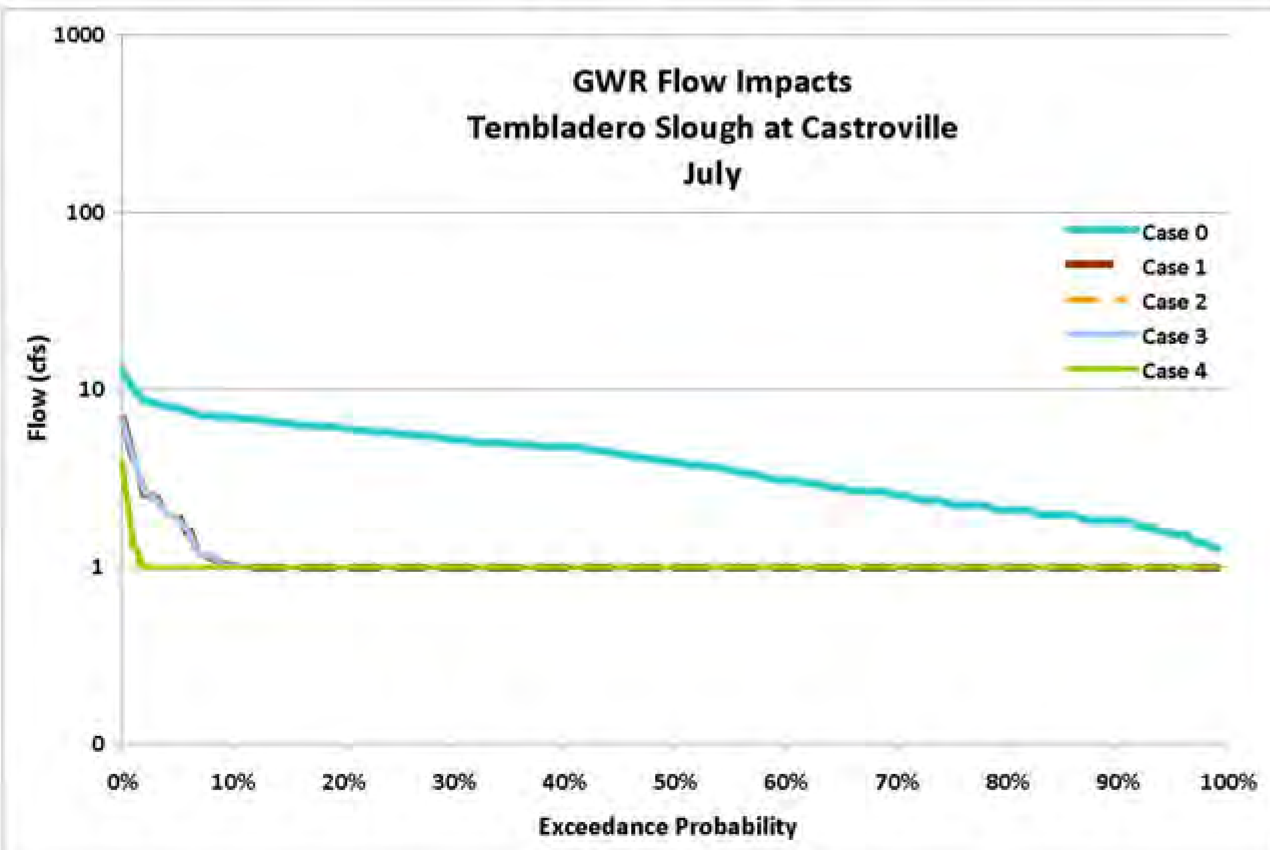
| July Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 8.53 | 5.54 | 2.53 | 5.54 | 2.53 |
| 0.99 | 6.77 | 3.78 | 0.77 | 3.78 | 1.00 |
| 0.98 | 5.77 | 2.78 | 0.69 | 2.78 | 1.00 |
| 0.97 | 5.62 | 2.63 | 0.69 | 2.63 | 1.00 |
| 0.96 | 5.34 | 2.35 | 0.69 | 2.35 | 1.00 |
| 0.95 | 5.25 | 2.26 | 0.69 | 2.26 | 1.00 |
| 0.94 | 5.06 | 2.07 | 0.69 | 2.07 | 1.00 |
| 0.93 | 4.78 | 1.79 | 0.69 | 1.79 | 1.00 |
| 0.92 | 4.78 | 1.79 | 0.69 | 1.79 | 1.00 |
| 0.91 | 4.69 | 1.70 | 0.69 | 1.70 | 1.00 |
| 0.90 | 4.68 | 1.69 | 0.69 | 1.69 | 1.00 |
| 0.89 | 4.59 | 1.60 | 0.69 | 1.60 | 1.00 |
| 0.88 | 4.54 | 1.55 | 0.69 | 1.55 | 1.00 |
| 0.87 | 4.48 | 1.49 | 0.69 | 1.49 | 1.00 |
| 0.86 | 4.40 | 1.41 | 0.69 | 1.41 | 1.00 |
| 0.85 | 4.31 | 1.32 | 0.69 | 1.32 | 1.00 |
| 0.84 | 4.22 | 1.23 | 0.69 | 1.23 | 1.00 |
| 0.83 | 4.22 | 1.23 | 0.69 | 1.23 | 1.00 |
| 0.82 | 4.14 | 1.15 | 0.69 | 1.15 | 1.00 |
| 0.81 | 4.12 | 1.13 | 0.69 | 1.13 | 1.00 |
| 0.80 | 4.03 | 1.04 | 0.69 | 1.04 | 1.00 |
| 0.79 | 3.94 | 0.95 | 0.69 | 1.00 | 1.00 |
| 0.78 | 3.94 | 0.95 | 0.69 | 1.00 | 1.00 |
| 0.77 | 3.84 | 0.85 | 0.69 | 1.00 | 1.00 |
| 0.76 | 3.84 | 0.85 | 0.69 | 1.00 | 1.00 |
| 0.75 | 3.75 | 0.76 | 0.69 | 1.00 | 1.00 |
| 0.74 | 3.75 | 0.76 | 0.69 | 1.00 | 1.00 |
| 0.73 | 3.65 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.72 | 3.65 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.71 | 3.56 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.70 | 3.47 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.69 | 3.47 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.68 | 3.37 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.67 | 3.37 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.66 | 3.37 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.65 | 3.29 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.64 | 3.28 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.63 | 3.28 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.62 | 3.19 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.61 | 3.19 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.60 | 3.19 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.59 | 3.19 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.58 | 3.09 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.57 | 3.04 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.56 | 2.98 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.55 | 2.90 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.54 | 2.81 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.53 | 2.78 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.52 | 2.72 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.51 | 2.64 | 0.69 | 0.69 | 1.00 | 1.00 |

| July Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 0.50 | 2.62 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.49 | 2.53 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.48 | 2.53 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.47 | 2.47 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.46 | 2.44 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.45 | 2.34 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.44 | 2.27 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.43 | 2.25 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.42 | 2.16 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.41 | 2.07 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.40 | 2.06 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.39 | 2.06 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.38 | 1.97 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.37 | 1.97 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.36 | 1.87 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.35 | 1.87 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.34 | 1.79 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.33 | 1.78 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.32 | 1.78 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.31 | 1.78 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.30 | 1.69 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.29 | 1.69 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.28 | 1.59 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.27 | 1.59 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.26 | 1.59 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.25 | 1.50 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.24 | 1.50 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.23 | 1.50 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.22 | 1.50 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.21 | 1.41 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.20 | 1.41 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.19 | 1.41 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.18 | 1.41 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.17 | 1.31 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.16 | 1.31 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.15 | 1.31 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.14 | 1.31 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.13 | 1.24 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.12 | 1.22 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.11 | 1.22 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.10 | 1.22 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.09 | 1.22 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.08 | 1.12 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.07 | 1.12 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.06 | 1.06 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.05 | 1.03 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.04 | 1.03 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.03 | 0.94 | 0.69 | 0.69 | 0.94 | 0.94 |
| 0.02 | 0.90 | 0.69 | 0.69 | 0.90 | 0.90 |
| 0.01 | 0.85 | 0.69 | 0.69 | 0.85 | 0.85 |

Tembladero Slough at Castroville, Percentile Flows by Month (cfs)

| July Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 12.74 | 6.76 | 3.75 | 6.76 | 3.75 |
| 0.99 | 10.12 | 4.14 | 1.13 | 4.14 | 1.36 |
| 0.98 | 8.62 | 2.64 | 1.00 | 2.64 | 1.00 |
| 0.97 | 8.40 | 2.42 | 1.00 | 2.42 | 1.00 |
| 0.96 | 7.98 | 2.00 | 1.00 | 2.00 | 1.00 |
| 0.95 | 7.84 | 1.86 | 1.00 | 1.86 | 1.00 |
| 0.94 | 7.56 | 1.58 | 1.00 | 1.58 | 1.00 |
| 0.93 | 7.15 | 1.17 | 1.00 | 1.17 | 1.00 |
| 0.92 | 7.14 | 1.16 | 1.00 | 1.16 | 1.00 |
| 0.91 | 7.00 | 1.02 | 1.00 | 1.02 | 1.00 |
| 0.90 | 6.99 | 1.02 | 1.00 | 1.02 | 1.00 |
| 0.89 | 6.86 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.88 | 6.79 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.87 | 6.69 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.86 | 6.58 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.85 | 6.44 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.84 | 6.30 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.83 | 6.30 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.82 | 6.19 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.81 | 6.16 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.80 | 6.02 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.79 | 5.88 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.78 | 5.88 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.77 | 5.74 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.76 | 5.74 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.75 | 5.60 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.74 | 5.60 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.73 | 5.46 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.72 | 5.46 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.71 | 5.32 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.70 | 5.18 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.69 | 5.18 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.68 | 5.04 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.67 | 5.04 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.66 | 5.04 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.65 | 4.92 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.64 | 4.90 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.63 | 4.90 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.62 | 4.76 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.61 | 4.76 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.60 | 4.76 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.59 | 4.76 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.58 | 4.62 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.57 | 4.55 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.56 | 4.45 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.55 | 4.34 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.54 | 4.20 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.53 | 4.15 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.52 | 4.06 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.51 | 3.95 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.50 | 3.92 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.49 | 3.78 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.48 | 3.78 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.47 | 3.69 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.46 | 3.64 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.45 | 3.50 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.44 | 3.39 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.43 | 3.36 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.42 | 3.22 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.41 | 3.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.40 | 3.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.39 | 3.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.38 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.37 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.36 | 2.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.35 | 2.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.34 | 2.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.33 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.32 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.31 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.30 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.29 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.28 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.27 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.26 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.25 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.24 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.23 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.22 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.21 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.20 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.19 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.18 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.17 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.16 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.15 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.14 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.13 | 1.85 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.12 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.11 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.10 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.09 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.08 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.07 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.06 | 1.58 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.05 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.04 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.03 | 1.40 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.02 | 1.35 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.01 | 1.27 | 1.00 | 1.00 | 1.00 | 1.00 |


GWR Flow Impacts
Reclamation Ditch at Davis Rd.
July
Flow (cfs)
1000
100
10
1
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability
Case 0
Case 1
Case 2
Case 3
Case 4


GWR Flow Impacts
Tembladero Slough at Castroville
July
Flow (cfs)
1000
100
10
1
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability
Case 0
Case 1
Case 2
Case 3
Case 4

Reclamation Ditch at Davis Rd, Percentile Flows by Month (cfs)

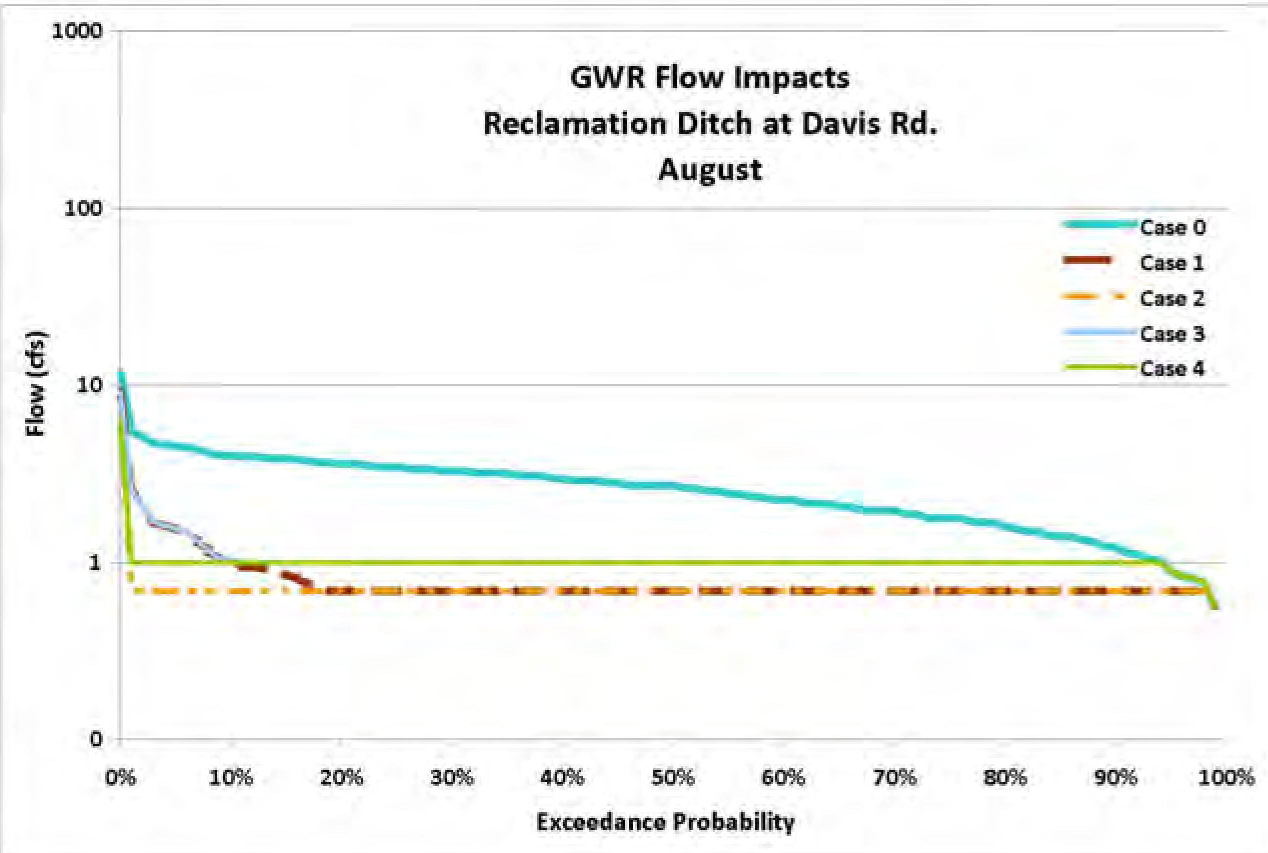
| August Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 12.18 | 9.19 | 6.18 | 9.19 | 6.18 |
| 0.99 | 5.52 | 2.53 | 0.69 | 2.53 | 1.00 |
| 0.98 | 5.09 | 2.10 | 0.69 | 2.10 | 1.00 |
| 0.97 | 4.69 | 1.70 | 0.69 | 1.70 | 1.00 |
| 0.96 | 4.61 | 1.62 | 0.69 | 1.62 | 1.00 |
| 0.95 | 4.54 | 1.55 | 0.69 | 1.55 | 1.00 |
| 0.94 | 4.47 | 1.48 | 0.69 | 1.48 | 1.00 |
| 0.93 | 4.31 | 1.32 | 0.69 | 1.32 | 1.00 |
| 0.92 | 4.15 | 1.16 | 0.69 | 1.16 | 1.00 |
| 0.91 | 4.03 | 1.04 | 0.69 | 1.04 | 1.00 |
| 0.90 | 4.03 | 1.04 | 0.69 | 1.04 | 1.00 |
| 0.89 | 3.94 | 0.95 | 0.69 | 1.00 | 1.00 |
| 0.88 | 3.94 | 0.95 | 0.69 | 1.00 | 1.00 |
| 0.87 | 3.91 | 0.92 | 0.69 | 1.00 | 1.00 |
| 0.86 | 3.84 | 0.85 | 0.69 | 1.00 | 1.00 |
| 0.85 | 3.84 | 0.85 | 0.69 | 1.00 | 1.00 |
| 0.84 | 3.81 | 0.82 | 0.69 | 1.00 | 1.00 |
| 0.83 | 3.74 | 0.75 | 0.69 | 1.00 | 1.00 |
| 0.82 | 3.65 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.81 | 3.65 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.80 | 3.56 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.79 | 3.56 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.78 | 3.56 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.77 | 3.47 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.76 | 3.47 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.75 | 3.47 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.74 | 3.37 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.73 | 3.37 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.72 | 3.37 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.71 | 3.28 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.70 | 3.28 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.69 | 3.28 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.68 | 3.21 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.67 | 3.19 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.66 | 3.19 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.65 | 3.19 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.64 | 3.09 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.63 | 3.09 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.62 | 3.09 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.61 | 3.00 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.60 | 2.96 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.59 | 2.90 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.58 | 2.90 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.57 | 2.90 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.56 | 2.81 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.55 | 2.81 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.54 | 2.72 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.53 | 2.72 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.52 | 2.72 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.51 | 2.72 | 0.69 | 0.69 | 1.00 | 1.00 |

| August Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 0.50 | 2.72 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.49 | 2.62 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.48 | 2.62 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.47 | 2.53 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.46 | 2.53 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.45 | 2.44 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.44 | 2.44 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.43 | 2.34 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.42 | 2.34 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.41 | 2.26 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.40 | 2.25 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.39 | 2.25 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.38 | 2.16 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.37 | 2.16 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.36 | 2.16 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.35 | 2.06 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.34 | 2.06 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.33 | 1.97 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.32 | 1.97 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.31 | 1.97 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.30 | 1.97 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.29 | 1.87 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.28 | 1.87 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.27 | 1.78 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.26 | 1.78 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.25 | 1.78 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.24 | 1.78 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.23 | 1.69 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.22 | 1.69 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.21 | 1.68 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.20 | 1.59 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.19 | 1.55 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.18 | 1.50 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.17 | 1.50 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.16 | 1.41 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.15 | 1.41 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.14 | 1.41 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.13 | 1.33 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.12 | 1.31 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.11 | 1.22 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.10 | 1.22 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.09 | 1.12 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.08 | 1.12 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.07 | 1.03 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.06 | 1.03 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.05 | 0.90 | 0.69 | 0.69 | 0.90 | 0.90 |
| 0.04 | 0.83 | 0.69 | 0.69 | 0.83 | 0.83 |
| 0.03 | 0.82 | 0.69 | 0.69 | 0.82 | 0.82 |
| 0.02 | 0.77 | 0.69 | 0.69 | 0.77 | 0.77 |
| 0.01 | 0.57 | 0.57 | 0.57 | 0.57 | 0.57 |

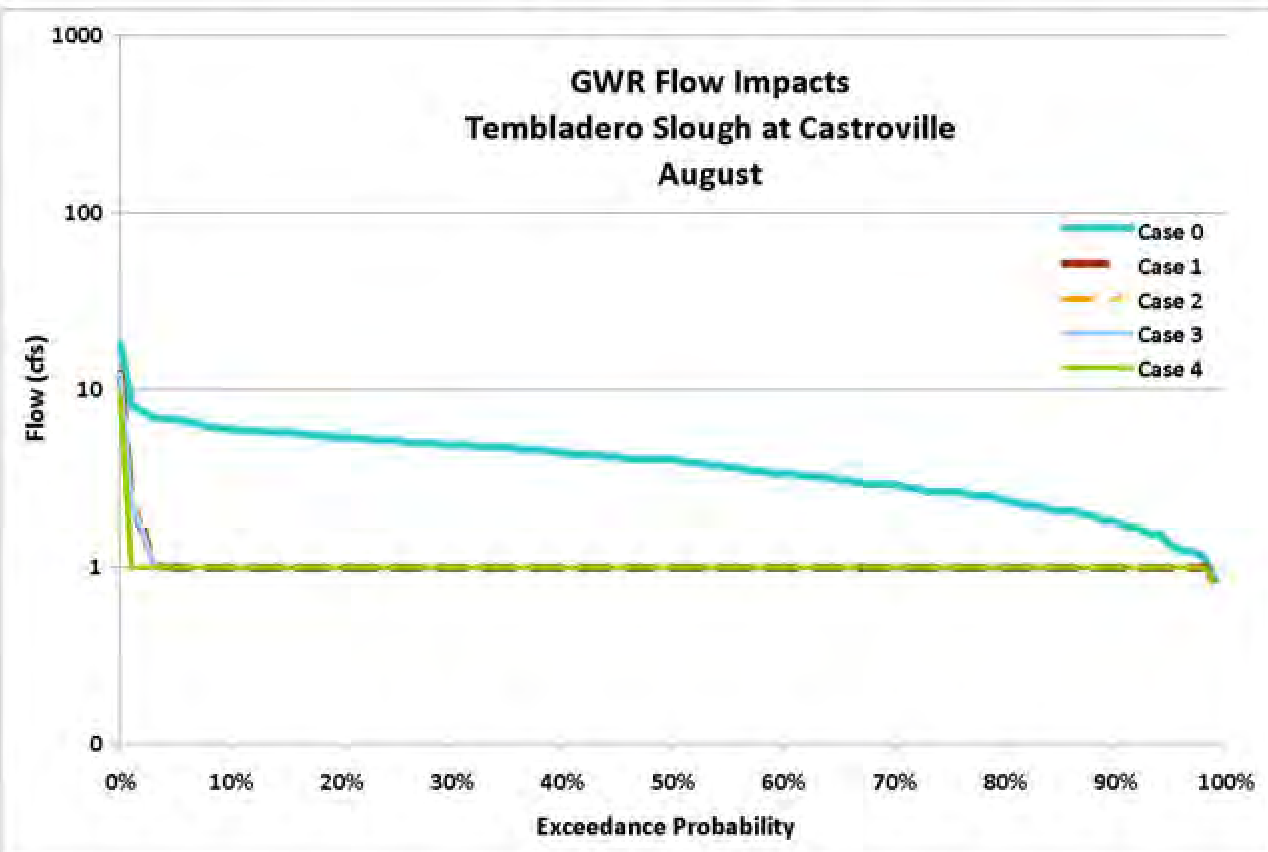
**Tembladero Slough at Castroville, Percentile Flows by Month (cfs)**

| August Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 18.20 | 12.22 | 9.21 | 12.22 | 9.21 |
| 0.99 | 8.24 | 2.26 | 1.00 | 2.26 | 1.00 |
| 0.98 | 7.60 | 1.62 | 1.00 | 1.62 | 1.00 |
| 0.97 | 7.00 | 1.02 | 1.00 | 1.02 | 1.00 |
| 0.96 | 6.88 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.95 | 6.78 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.94 | 6.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.93 | 6.44 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.92 | 6.20 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.91 | 6.02 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.90 | 6.02 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.89 | 5.88 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.88 | 5.88 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.87 | 5.85 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.86 | 5.74 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.85 | 5.74 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.84 | 5.69 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.83 | 5.59 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.82 | 5.46 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.81 | 5.46 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.80 | 5.32 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.79 | 5.32 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.78 | 5.32 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.77 | 5.18 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.76 | 5.18 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.75 | 5.18 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.74 | 5.04 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.73 | 5.04 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.72 | 5.04 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.71 | 4.90 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.70 | 4.90 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.69 | 4.90 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.68 | 4.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.67 | 4.76 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.66 | 4.76 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.65 | 4.76 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.64 | 4.62 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.63 | 4.62 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.62 | 4.62 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.61 | 4.48 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.60 | 4.42 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.59 | 4.34 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.58 | 4.34 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.57 | 4.34 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.56 | 4.20 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.55 | 4.20 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.54 | 4.06 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.53 | 4.06 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.52 | 4.06 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.51 | 4.06 | 1.00 | 1.00 | 1.00 | 1.00 |

| August Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 0.50 | 4.06 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.49 | 3.92 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.48 | 3.92 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.47 | 3.78 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.46 | 3.78 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.45 | 3.64 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.44 | 3.64 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.43 | 3.50 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.42 | 3.50 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.41 | 3.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.40 | 3.36 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.39 | 3.36 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.38 | 3.22 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.37 | 3.22 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.36 | 3.22 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.35 | 3.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.34 | 3.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.33 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.32 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.31 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.30 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.29 | 2.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.28 | 2.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.27 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.26 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.25 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.24 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.23 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.22 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.21 | 2.51 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.20 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.19 | 2.31 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.18 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.17 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.16 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.15 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.14 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.13 | 1.99 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.12 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.11 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.10 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.09 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.08 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.07 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.06 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.05 | 1.34 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.04 | 1.25 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.03 | 1.22 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.02 | 1.15 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.01 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |



GWR Flow Impacts
Reclamation Ditch at Davis Rd.
August
1000
100
10
1
0
Flow (cfs)
Case 0
Case 1
Case 2
Case 3
Case 4
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability

GWR Flow Impacts
Tembladero Slough at Castroville
August
1000
100
10
1
0
Flow (cfs)
Case 0
Case 1
Case 2
Case 3
Case 4
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability

Reclamation Ditch at Davis Rd, Percentile Flows by Month (cfs)

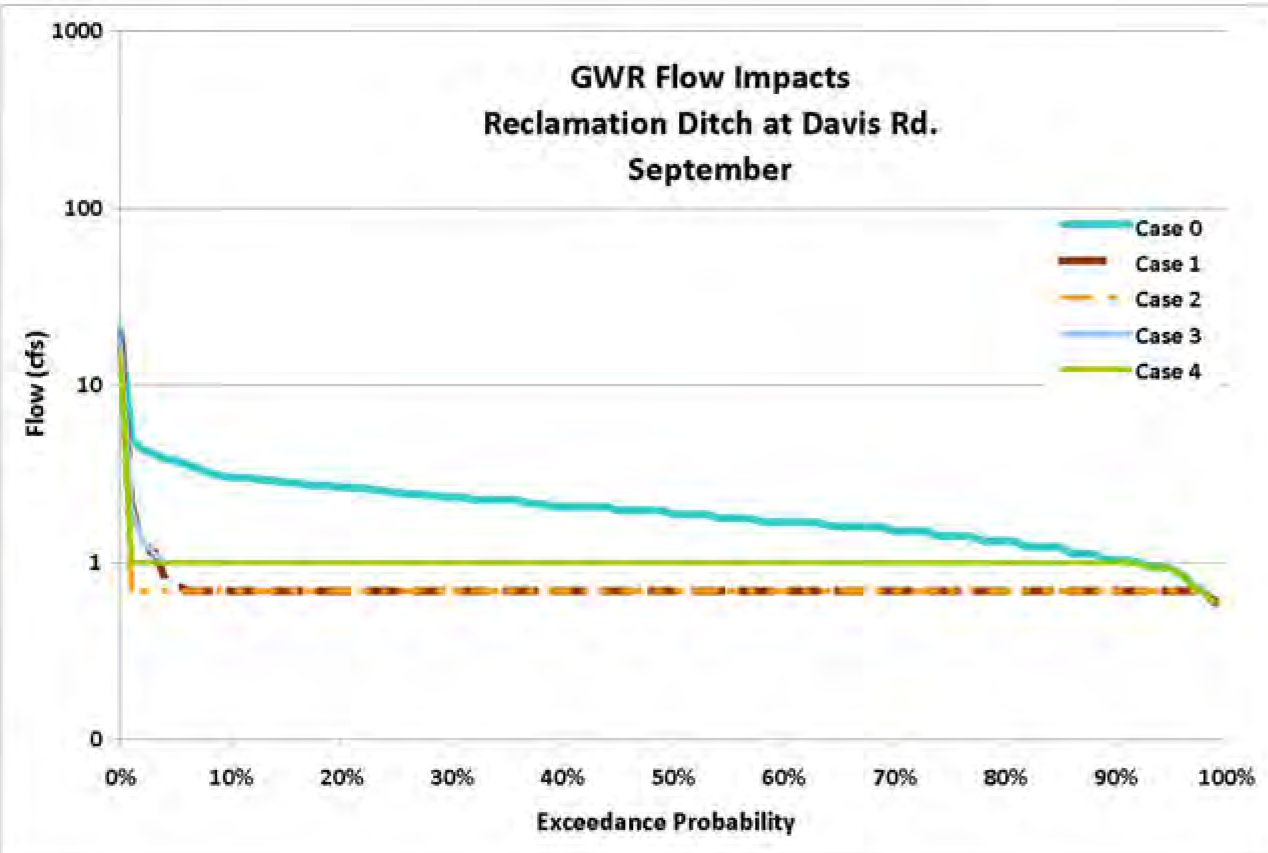
| September Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 20.61 | 17.62 | 14.61 | 17.62 | 14.61 |
| 0.99 | 4.99 | 2.00 | 0.69 | 2.00 | 1.00 |
| 0.98 | 4.31 | 1.32 | 0.69 | 1.32 | 1.00 |
| 0.97 | 4.12 | 1.13 | 0.69 | 1.13 | 1.00 |
| 0.96 | 3.84 | 0.85 | 0.69 | 1.00 | 1.00 |
| 0.95 | 3.75 | 0.76 | 0.69 | 1.00 | 1.00 |
| 0.94 | 3.60 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.93 | 3.37 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.92 | 3.21 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.91 | 3.09 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.90 | 3.01 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.89 | 3.00 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.88 | 3.00 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.87 | 2.90 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.86 | 2.88 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.85 | 2.81 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.84 | 2.81 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.83 | 2.72 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.82 | 2.72 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.81 | 2.72 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.80 | 2.64 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.79 | 2.62 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.78 | 2.62 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.77 | 2.57 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.76 | 2.53 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.75 | 2.46 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.74 | 2.44 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.73 | 2.44 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.72 | 2.39 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.71 | 2.34 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.70 | 2.34 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.69 | 2.34 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.68 | 2.25 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.67 | 2.25 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.66 | 2.25 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.65 | 2.25 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.64 | 2.25 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.63 | 2.16 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.62 | 2.16 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.61 | 2.06 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.60 | 2.06 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.59 | 2.06 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.58 | 2.06 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.57 | 2.06 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.56 | 2.06 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.55 | 1.97 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.54 | 1.97 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.53 | 1.97 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.52 | 1.97 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.51 | 1.97 | 0.69 | 0.69 | 1.00 | 1.00 |

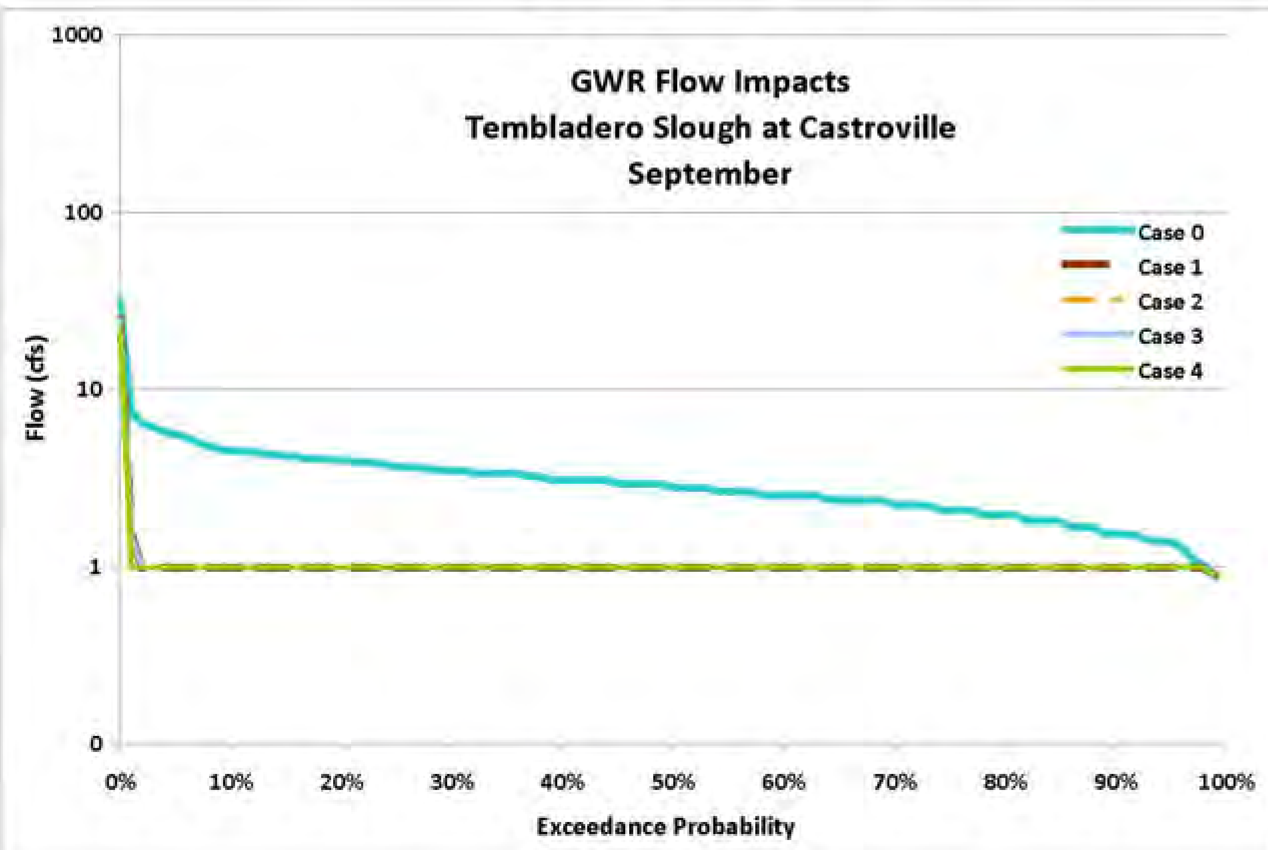
| September Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 0.50 | 1.87 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.49 | 1.87 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.48 | 1.87 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.47 | 1.87 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.46 | 1.78 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.45 | 1.78 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.44 | 1.78 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.43 | 1.78 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.42 | 1.69 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.41 | 1.69 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.40 | 1.69 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.39 | 1.69 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.38 | 1.69 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.37 | 1.69 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.36 | 1.62 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.35 | 1.59 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.34 | 1.59 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.33 | 1.59 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.32 | 1.59 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.31 | 1.59 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.30 | 1.50 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.29 | 1.50 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.28 | 1.50 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.27 | 1.49 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.26 | 1.41 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.25 | 1.41 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.24 | 1.41 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.23 | 1.41 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.22 | 1.31 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.21 | 1.31 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.20 | 1.31 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.19 | 1.31 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.18 | 1.22 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.17 | 1.22 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.16 | 1.22 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.15 | 1.22 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.14 | 1.12 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.13 | 1.12 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.12 | 1.12 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.11 | 1.03 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.10 | 1.03 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.09 | 1.03 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.08 | 1.00 | 0.69 | 0.69 | 0.98 | 0.98 |
| 0.07 | 0.94 | 0.69 | 0.69 | 0.94 | 0.94 |
| 0.06 | 0.94 | 0.69 | 0.69 | 0.94 | 0.94 |
| 0.05 | 0.93 | 0.69 | 0.69 | 0.93 | 0.93 |
| 0.04 | 0.86 | 0.69 | 0.69 | 0.86 | 0.86 |
| 0.03 | 0.74 | 0.69 | 0.69 | 0.74 | 0.74 |
| 0.02 | 0.68 | 0.68 | 0.68 | 0.68 | 0.68 |
| 0.01 | 0.59 | 0.59 | 0.59 | 0.59 | 0.59 |

**Tembladero Slough at Castroville, Percentile Flows by Month (cfs)**

| September Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 30.80 | 24.82 | 21.81 | 24.82 | 21.81 |
| 0.99 | 7.45 | 1.47 | 1.00 | 1.47 | 1.00 |
| 0.98 | 6.44 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.97 | 6.16 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.96 | 5.74 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.95 | 5.60 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.94 | 5.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.93 | 5.04 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.92 | 4.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.91 | 4.62 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.90 | 4.49 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.89 | 4.48 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.88 | 4.48 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.87 | 4.34 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.86 | 4.30 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.85 | 4.20 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.84 | 4.20 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.83 | 4.06 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.82 | 4.06 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.81 | 4.06 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.80 | 3.95 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.79 | 3.92 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.78 | 3.92 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.77 | 3.84 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.76 | 3.78 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.75 | 3.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.74 | 3.64 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.73 | 3.64 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.72 | 3.57 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.71 | 3.50 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.70 | 3.50 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.69 | 3.50 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.68 | 3.36 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.67 | 3.36 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.66 | 3.36 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.65 | 3.36 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.64 | 3.36 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.63 | 3.22 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.62 | 3.22 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.61 | 3.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.60 | 3.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.59 | 3.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.58 | 3.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.57 | 3.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.56 | 3.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.55 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.54 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.53 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.52 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.51 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |

| September Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 0.50 | 2.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.49 | 2.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.48 | 2.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.47 | 2.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.46 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.45 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.44 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.43 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.42 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.41 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.40 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.39 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.38 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.37 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.36 | 2.41 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.35 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.34 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.33 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.32 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.31 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.30 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.29 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.28 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.27 | 2.23 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.26 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.25 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.24 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.23 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.22 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.21 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.20 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.19 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.18 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.17 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.16 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.15 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.14 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.13 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.12 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.11 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.10 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.09 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.08 | 1.50 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.07 | 1.40 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.06 | 1.40 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.05 | 1.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.04 | 1.28 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.03 | 1.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.02 | 1.01 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.01 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 |


GWR Flow Impacts
Reclamation Ditch at Davis Rd.
September
1000
100
10
1
0
Flow (cfs)
Case 0
Case 1
Case 2
Case 3
Case 4
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability


GWR Flow Impacts
Tembladero Slough at Castroville
September
1000
100
10
1
0
Flow (cfs)
Case 0
Case 1
Case 2
Case 3
Case 4
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability

Reclamation Ditch at Davis Rd, Percentile Flows by Month (cfs)

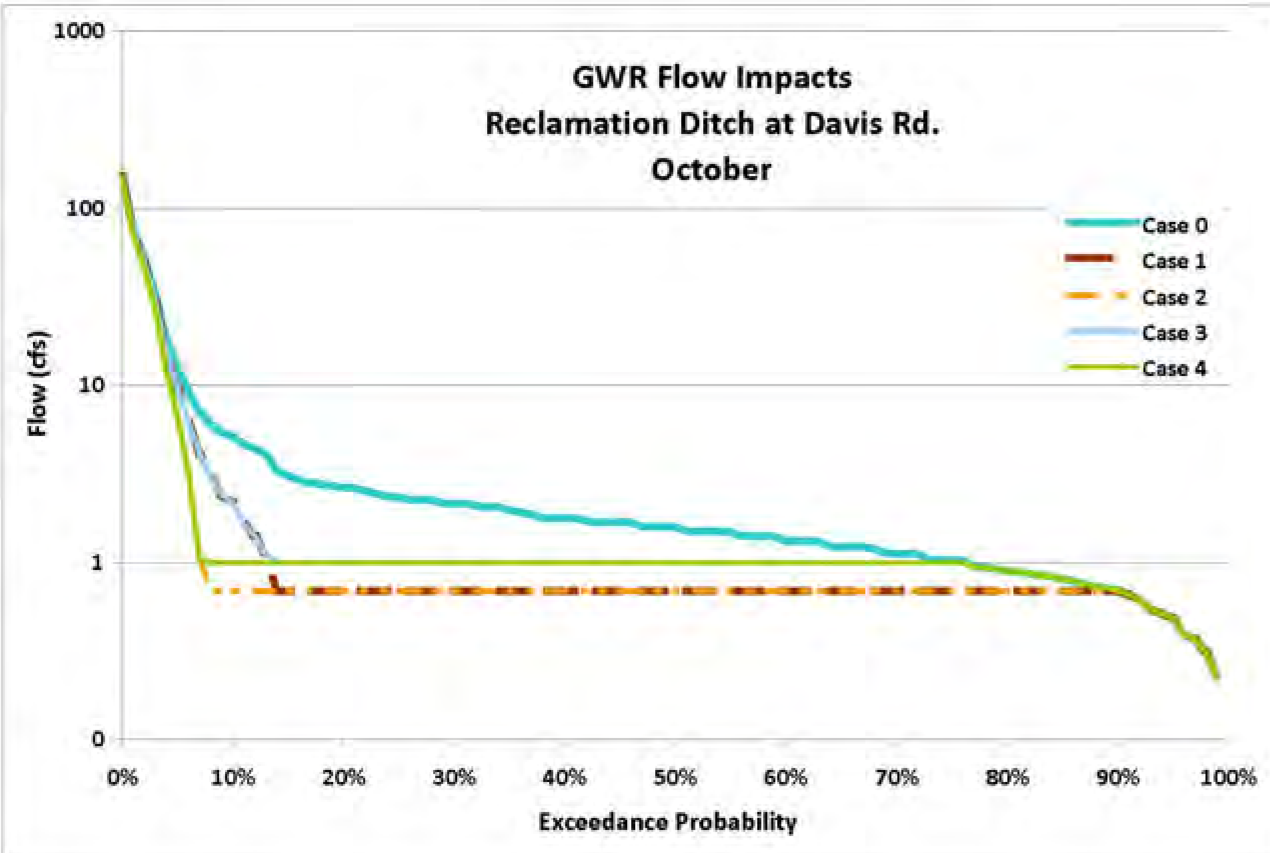
| October Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 152.73 | 149.74 | 146.73 | 149.74 | 146.73 |
| 0.99 | 75.23 | 72.24 | 69.23 | 72.24 | 69.23 |
| 0.98 | 51.65 | 48.66 | 45.65 | 48.66 | 45.65 |
| 0.97 | 32.31 | 29.32 | 26.31 | 29.32 | 26.31 |
| 0.96 | 18.10 | 15.11 | 12.10 | 15.11 | 12.10 |
| 0.95 | 12.60 | 9.61 | 6.60 | 9.61 | 6.60 |
| 0.94 | 9.20 | 6.21 | 3.20 | 6.21 | 3.20 |
| 0.93 | 7.03 | 4.04 | 1.03 | 4.04 | 1.03 |
| 0.92 | 6.02 | 3.03 | 0.69 | 3.03 | 1.00 |
| 0.91 | 5.40 | 2.41 | 0.69 | 2.41 | 1.00 |
| 0.90 | 5.14 | 2.15 | 0.69 | 2.15 | 1.00 |
| 0.89 | 4.63 | 1.64 | 0.69 | 1.64 | 1.00 |
| 0.88 | 4.40 | 1.41 | 0.69 | 1.41 | 1.00 |
| 0.87 | 4.08 | 1.09 | 0.69 | 1.10 | 1.00 |
| 0.86 | 3.28 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.85 | 3.09 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.84 | 2.90 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.83 | 2.81 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.82 | 2.74 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.81 | 2.72 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.80 | 2.62 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.79 | 2.62 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.78 | 2.53 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.77 | 2.44 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.76 | 2.34 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.75 | 2.34 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.74 | 2.25 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.73 | 2.25 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.72 | 2.25 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.71 | 2.16 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.70 | 2.16 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.69 | 2.16 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.68 | 2.09 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.67 | 2.06 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.66 | 2.06 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.65 | 1.97 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.64 | 1.92 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.63 | 1.87 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.62 | 1.78 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.61 | 1.78 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.60 | 1.78 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.59 | 1.78 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.58 | 1.70 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.57 | 1.69 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.56 | 1.69 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.55 | 1.69 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.54 | 1.69 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.53 | 1.59 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.52 | 1.59 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.51 | 1.59 | 0.69 | 0.69 | 1.00 | 1.00 |

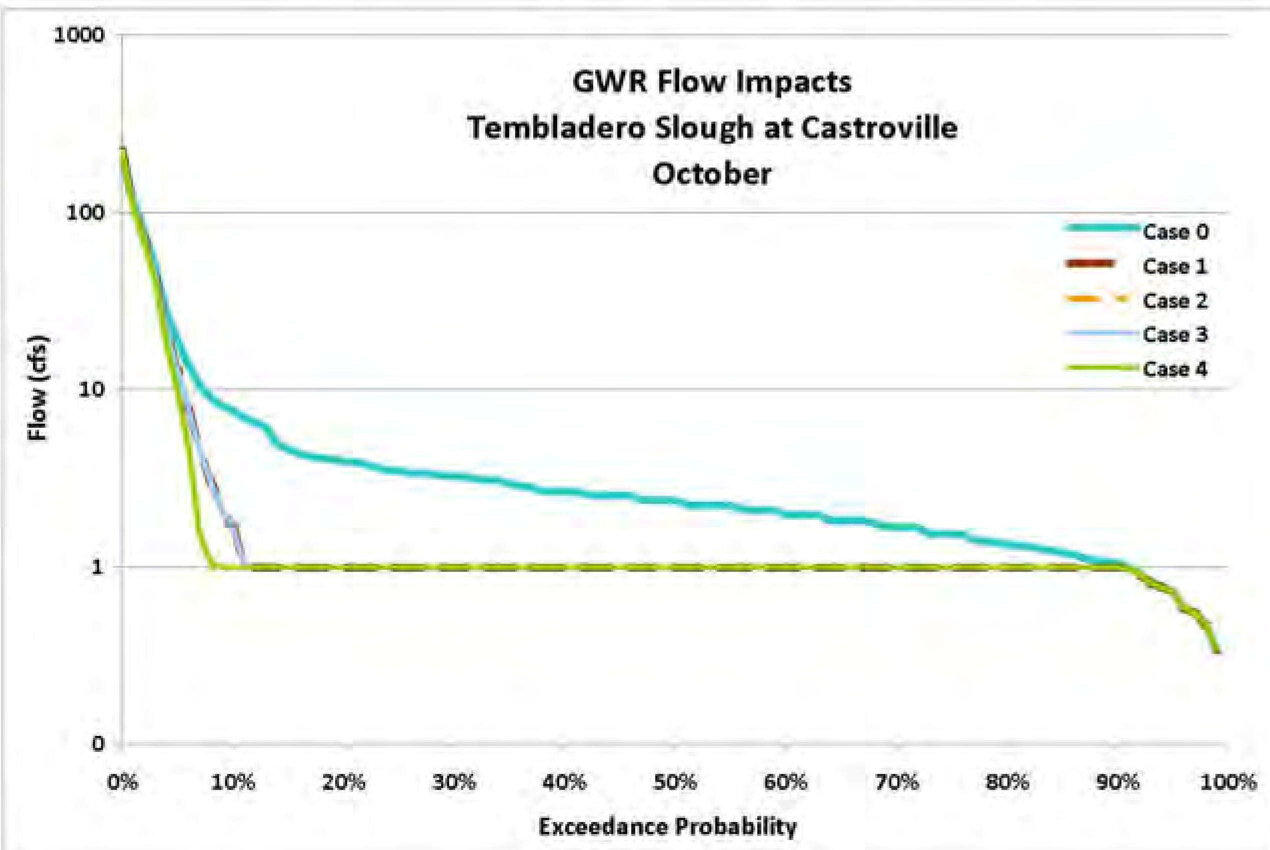
| October Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 0.50 | 1.59 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.49 | 1.50 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.48 | 1.50 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.47 | 1.50 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.46 | 1.50 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.45 | 1.49 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.44 | 1.41 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.43 | 1.41 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.42 | 1.41 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.41 | 1.41 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.40 | 1.31 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.39 | 1.31 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.38 | 1.31 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.37 | 1.31 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.36 | 1.22 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.35 | 1.22 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.34 | 1.22 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.33 | 1.22 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.32 | 1.19 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.31 | 1.12 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.30 | 1.12 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.29 | 1.12 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.28 | 1.11 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.27 | 1.03 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.26 | 1.03 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.25 | 1.03 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.24 | 1.03 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.23 | 0.94 | 0.69 | 0.69 | 0.94 | 0.94 |
| 0.22 | 0.94 | 0.69 | 0.69 | 0.94 | 0.94 |
| 0.21 | 0.92 | 0.69 | 0.69 | 0.92 | 0.92 |
| 0.20 | 0.89 | 0.69 | 0.69 | 0.89 | 0.89 |
| 0.19 | 0.89 | 0.69 | 0.69 | 0.89 | 0.89 |
| 0.18 | 0.87 | 0.69 | 0.69 | 0.87 | 0.87 |
| 0.17 | 0.84 | 0.69 | 0.69 | 0.84 | 0.84 |
| 0.16 | 0.83 | 0.69 | 0.69 | 0.83 | 0.83 |
| 0.15 | 0.80 | 0.69 | 0.69 | 0.80 | 0.80 |
| 0.14 | 0.79 | 0.69 | 0.69 | 0.79 | 0.79 |
| 0.13 | 0.75 | 0.69 | 0.69 | 0.75 | 0.75 |
| 0.12 | 0.73 | 0.69 | 0.69 | 0.73 | 0.73 |
| 0.11 | 0.71 | 0.69 | 0.69 | 0.71 | 0.71 |
| 0.10 | 0.70 | 0.69 | 0.69 | 0.70 | 0.70 |
| 0.09 | 0.66 | 0.66 | 0.66 | 0.66 | 0.66 |
| 0.08 | 0.62 | 0.62 | 0.62 | 0.62 | 0.62 |
| 0.07 | 0.54 | 0.54 | 0.54 | 0.54 | 0.54 |
| 0.06 | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 |
| 0.05 | 0.48 | 0.48 | 0.48 | 0.48 | 0.48 |
| 0.04 | 0.39 | 0.39 | 0.39 | 0.39 | 0.39 |
| 0.03 | 0.37 | 0.37 | 0.37 | 0.37 | 0.37 |
| 0.02 | 0.31 | 0.31 | 0.31 | 0.31 | 0.31 |
| 0.01 | 0.23 | 0.23 | 0.23 | 0.23 | 0.23 |

**Tembladero Slough at Castroville, Percentile Flows by Month (cfs)**

| October Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 228.20 | 222.22 | 219.21 | 222.22 | 219.21 |
| 0.99 | 112.41 | 106.43 | 103.42 | 106.43 | 103.42 |
| 0.98 | 77.17 | 71.19 | 68.18 | 71.19 | 68.18 |
| 0.97 | 48.27 | 42.29 | 39.28 | 42.29 | 39.28 |
| 0.96 | 27.05 | 21.07 | 18.06 | 21.07 | 18.06 |
| 0.95 | 18.83 | 12.85 | 9.84 | 12.85 | 9.84 |
| 0.94 | 13.75 | 7.77 | 4.76 | 7.77 | 4.76 |
| 0.93 | 10.51 | 4.53 | 1.52 | 4.53 | 1.52 |
| 0.92 | 8.99 | 3.01 | 1.00 | 3.01 | 1.07 |
| 0.91 | 8.07 | 2.09 | 1.00 | 2.09 | 1.00 |
| 0.90 | 7.69 | 1.71 | 1.00 | 1.71 | 1.00 |
| 0.89 | 6.91 | 1.03 | 1.00 | 1.03 | 1.00 |
| 0.88 | 6.57 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.87 | 6.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.86 | 4.90 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.85 | 4.62 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.84 | 4.34 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.83 | 4.20 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.82 | 4.09 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.81 | 4.06 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.80 | 3.92 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.79 | 3.92 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.78 | 3.78 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.77 | 3.64 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.76 | 3.50 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.75 | 3.50 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.74 | 3.36 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.73 | 3.36 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.72 | 3.36 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.71 | 3.22 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.70 | 3.22 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.69 | 3.22 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.68 | 3.12 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.67 | 3.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.66 | 3.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.65 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.64 | 2.86 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.63 | 2.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.62 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.61 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.60 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.59 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.58 | 2.55 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.57 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.56 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.55 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.54 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.53 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.52 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.51 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |

| October Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 0.50 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.49 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.48 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.47 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.46 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.45 | 2.23 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.44 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.43 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.42 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.41 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.40 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.39 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.38 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.37 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.36 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.35 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.34 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.33 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.32 | 1.78 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.31 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.30 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.29 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.28 | 1.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.27 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.26 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.25 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.24 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.23 | 1.40 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.22 | 1.40 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.21 | 1.37 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.20 | 1.33 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.19 | 1.32 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.18 | 1.30 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.17 | 1.26 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.16 | 1.25 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.15 | 1.20 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.14 | 1.18 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.13 | 1.12 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.12 | 1.09 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.11 | 1.06 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.10 | 1.05 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.09 | 0.99 | 0.99 | 0.99 | 0.99 | 0.99 |
| 0.08 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| 0.07 | 0.81 | 0.81 | 0.81 | 0.81 | 0.81 |
| 0.06 | 0.77 | 0.77 | 0.77 | 0.77 | 0.77 |
| 0.05 | 0.72 | 0.72 | 0.72 | 0.72 | 0.72 |
| 0.04 | 0.59 | 0.59 | 0.59 | 0.59 | 0.59 |
| 0.03 | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 |
| 0.02 | 0.47 | 0.47 | 0.47 | 0.47 | 0.47 |
| 0.01 | 0.34 | 0.34 | 0.34 | 0.34 | 0.34 |


GWR Flow Impacts
Reclamation Ditch at Davis Rd.
October
Flow (cfs)
1000
100
10
1
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability
Case 0
Case 1
Case 2
Case 3
Case 4


GWR Flow Impacts
Tembladero Slough at Castroville
October
Flow (cfs)
1000
100
10
1
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability
Case 0
Case 1
Case 2
Case 3
Case 4

Reclamation Ditch at Davis Rd, Percentile Flows by Month (cfs)

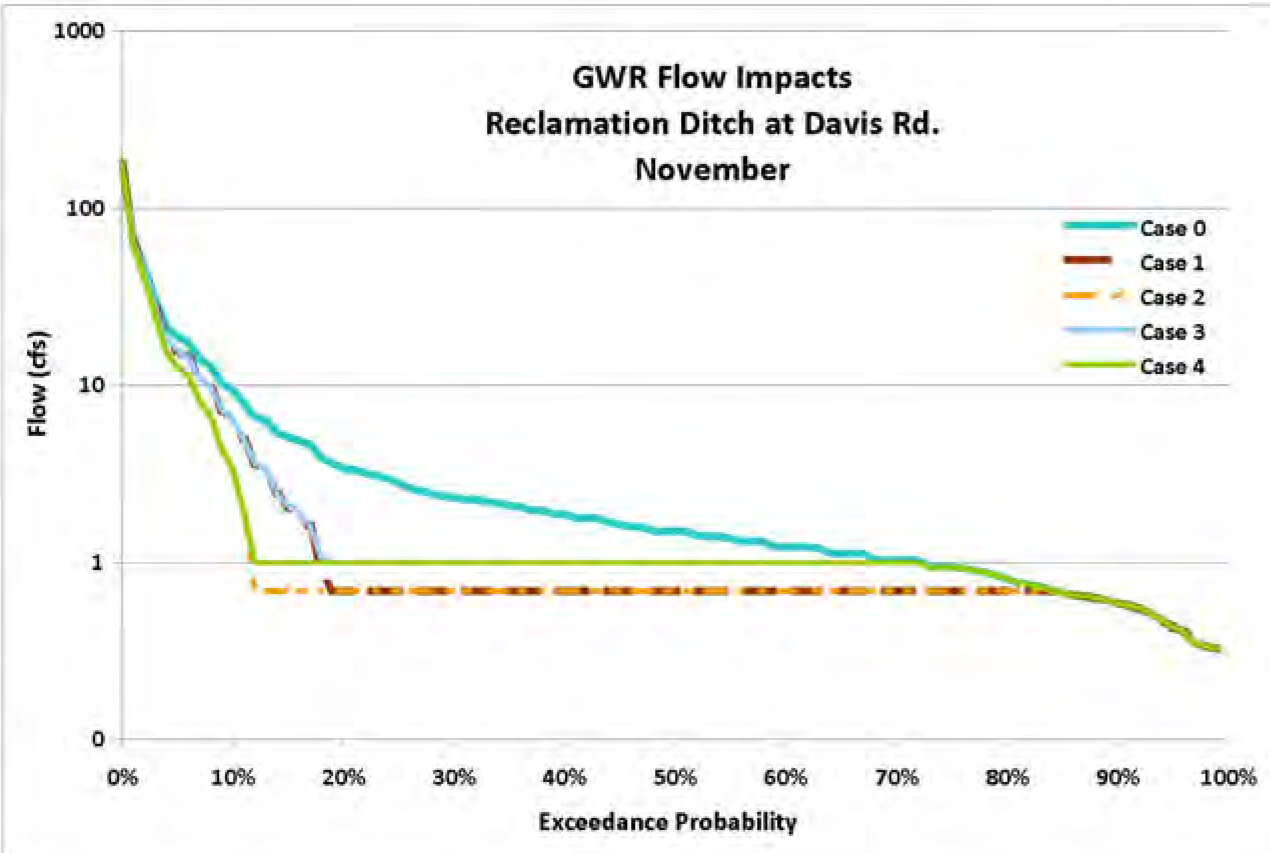
| November Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 178.03 | 175.04 | 172.03 | 175.04 | 172.03 |
| 0.99 | 67.00 | 64.01 | 61.00 | 64.01 | 61.00 |
| 0.98 | 46.10 | 43.11 | 40.10 | 43.11 | 40.10 |
| 0.97 | 30.12 | 27.13 | 24.12 | 27.13 | 24.12 |
| 0.96 | 21.21 | 18.22 | 15.21 | 18.22 | 15.21 |
| 0.95 | 18.74 | 15.75 | 12.74 | 15.75 | 12.74 |
| 0.94 | 17.30 | 14.31 | 11.30 | 14.31 | 11.30 |
| 0.93 | 14.06 | 11.07 | 8.06 | 11.07 | 8.06 |
| 0.92 | 12.71 | 9.72 | 6.71 | 9.72 | 6.71 |
| 0.91 | 10.31 | 7.32 | 4.31 | 7.32 | 4.31 |
| 0.90 | 9.37 | 6.38 | 3.37 | 6.38 | 3.37 |
| 0.89 | 7.92 | 4.93 | 1.92 | 4.93 | 1.92 |
| 0.88 | 6.64 | 3.65 | 0.69 | 3.65 | 1.00 |
| 0.87 | 6.34 | 3.35 | 0.69 | 3.35 | 1.00 |
| 0.86 | 5.41 | 2.42 | 0.69 | 2.42 | 1.00 |
| 0.85 | 5.07 | 2.08 | 0.69 | 2.08 | 1.00 |
| 0.84 | 4.88 | 1.89 | 0.69 | 1.89 | 1.00 |
| 0.83 | 4.59 | 1.60 | 0.69 | 1.60 | 1.00 |
| 0.82 | 3.89 | 0.90 | 0.69 | 1.05 | 1.00 |
| 0.81 | 3.63 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.80 | 3.37 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.79 | 3.34 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.78 | 3.19 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.77 | 3.09 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.76 | 2.97 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.75 | 2.81 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.74 | 2.62 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.73 | 2.54 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.72 | 2.44 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.71 | 2.34 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.70 | 2.34 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.69 | 2.25 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.68 | 2.25 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.67 | 2.20 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.66 | 2.16 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.65 | 2.09 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.64 | 2.06 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.63 | 1.97 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.62 | 1.97 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.61 | 1.87 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.60 | 1.87 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.59 | 1.78 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.58 | 1.78 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.57 | 1.78 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.56 | 1.69 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.55 | 1.64 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.54 | 1.59 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.53 | 1.59 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.52 | 1.50 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.51 | 1.50 | 0.69 | 0.69 | 1.00 | 1.00 |

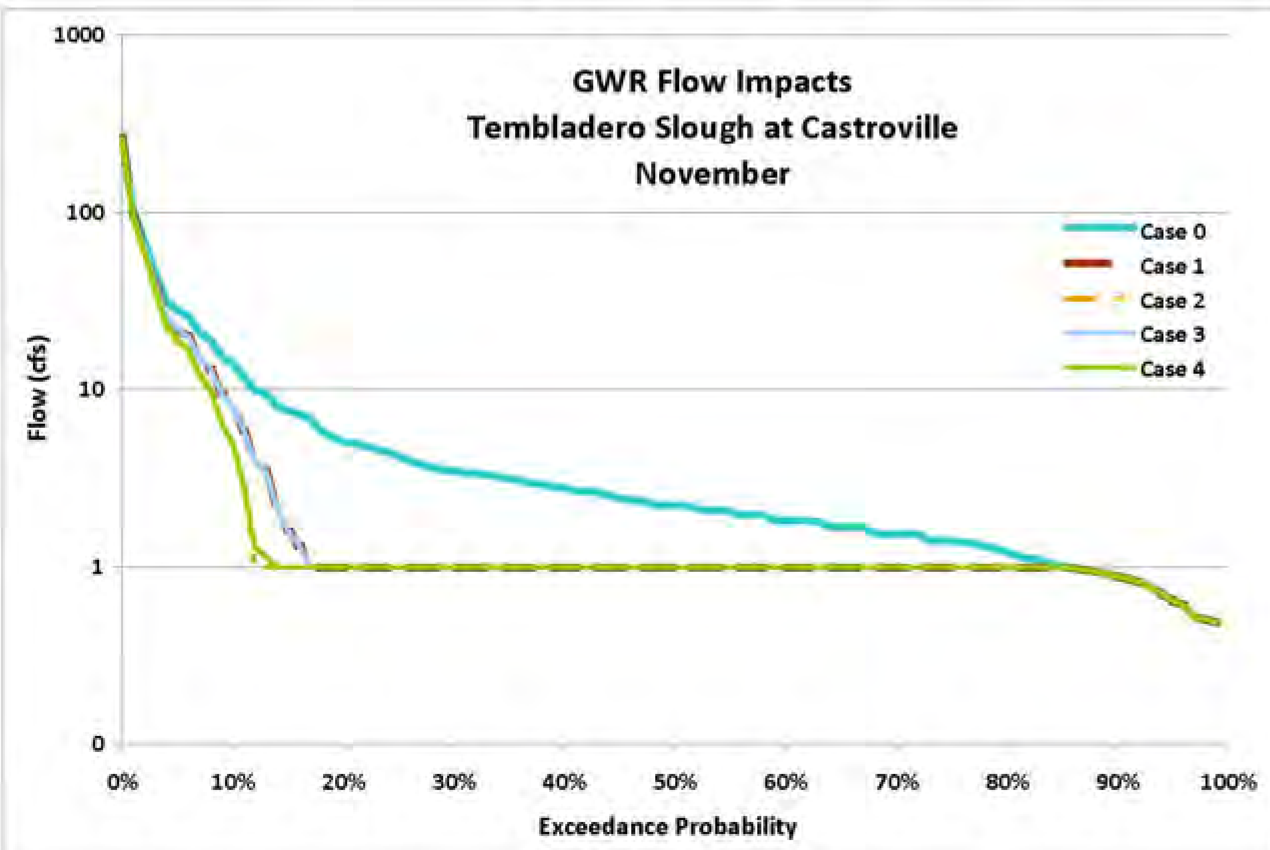
| November Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 0.50 | 1.50 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.49 | 1.50 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.48 | 1.41 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.47 | 1.41 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.46 | 1.41 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.45 | 1.36 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.44 | 1.31 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.43 | 1.31 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.42 | 1.31 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.41 | 1.22 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.40 | 1.22 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.39 | 1.22 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.38 | 1.22 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.37 | 1.20 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.36 | 1.12 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.35 | 1.12 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.34 | 1.12 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.33 | 1.12 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.32 | 1.03 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.31 | 1.03 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.30 | 1.03 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.29 | 1.03 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.28 | 1.03 | 0.69 | 0.69 | 1.00 | 1.00 |
| 0.27 | 0.94 | 0.69 | 0.69 | 0.94 | 0.94 |
| 0.26 | 0.94 | 0.69 | 0.69 | 0.94 | 0.94 |
| 0.25 | 0.94 | 0.69 | 0.69 | 0.94 | 0.94 |
| 0.24 | 0.93 | 0.69 | 0.69 | 0.93 | 0.93 |
| 0.23 | 0.90 | 0.69 | 0.69 | 0.90 | 0.90 |
| 0.22 | 0.88 | 0.69 | 0.69 | 0.88 | 0.88 |
| 0.21 | 0.84 | 0.69 | 0.69 | 0.84 | 0.84 |
| 0.20 | 0.81 | 0.69 | 0.69 | 0.81 | 0.81 |
| 0.19 | 0.76 | 0.69 | 0.69 | 0.76 | 0.76 |
| 0.18 | 0.75 | 0.69 | 0.69 | 0.75 | 0.75 |
| 0.17 | 0.73 | 0.69 | 0.69 | 0.73 | 0.73 |
| 0.16 | 0.70 | 0.69 | 0.69 | 0.70 | 0.70 |
| 0.15 | 0.67 | 0.67 | 0.67 | 0.67 | 0.67 |
| 0.14 | 0.66 | 0.66 | 0.66 | 0.66 | 0.66 |
| 0.13 | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 |
| 0.12 | 0.63 | 0.63 | 0.63 | 0.63 | 0.63 |
| 0.11 | 0.61 | 0.61 | 0.61 | 0.61 | 0.61 |
| 0.10 | 0.59 | 0.59 | 0.59 | 0.59 | 0.59 |
| 0.09 | 0.57 | 0.57 | 0.57 | 0.57 | 0.57 |
| 0.08 | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 |
| 0.07 | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 |
| 0.06 | 0.47 | 0.47 | 0.47 | 0.47 | 0.47 |
| 0.05 | 0.43 | 0.43 | 0.43 | 0.43 | 0.43 |
| 0.04 | 0.41 | 0.41 | 0.41 | 0.41 | 0.41 |
| 0.03 | 0.35 | 0.35 | 0.35 | 0.35 | 0.35 |
| 0.02 | 0.34 | 0.34 | 0.34 | 0.34 | 0.34 |
| 0.01 | 0.32 | 0.32 | 0.32 | 0.32 | 0.32 |

**Tembladero Slough at Castroville, Percentile Flows by Month (cfs)**

| November Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 266.00 | 260.02 | 257.01 | 260.02 | 257.01 |
| 0.99 | 100.11 | 94.13 | 91.12 | 94.13 | 91.12 |
| 0.98 | 68.88 | 62.90 | 59.89 | 62.90 | 59.89 |
| 0.97 | 45.01 | 39.03 | 36.02 | 39.03 | 36.02 |
| 0.96 | 31.70 | 25.72 | 22.71 | 25.72 | 22.71 |
| 0.95 | 28.00 | 22.02 | 19.01 | 22.02 | 19.01 |
| 0.94 | 25.84 | 19.86 | 16.85 | 19.86 | 16.85 |
| 0.93 | 21.00 | 15.02 | 12.01 | 15.02 | 12.01 |
| 0.92 | 18.98 | 13.00 | 9.99 | 13.00 | 9.99 |
| 0.91 | 15.40 | 9.42 | 6.41 | 9.42 | 6.41 |
| 0.90 | 14.00 | 8.02 | 5.01 | 8.02 | 5.01 |
| 0.89 | 11.83 | 5.85 | 2.84 | 5.85 | 2.84 |
| 0.88 | 9.92 | 3.94 | 1.00 | 3.94 | 1.29 |
| 0.87 | 9.47 | 3.49 | 1.00 | 3.49 | 1.14 |
| 0.86 | 8.08 | 2.10 | 1.00 | 2.10 | 1.00 |
| 0.85 | 7.58 | 1.60 | 1.00 | 1.60 | 1.00 |
| 0.84 | 7.30 | 1.32 | 1.00 | 1.32 | 1.00 |
| 0.83 | 6.86 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.82 | 5.81 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.81 | 5.43 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.80 | 5.04 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.79 | 4.99 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.78 | 4.76 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.77 | 4.62 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.76 | 4.44 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.75 | 4.20 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.74 | 3.92 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.73 | 3.79 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.72 | 3.64 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.71 | 3.50 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.70 | 3.50 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.69 | 3.36 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.68 | 3.36 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.67 | 3.29 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.66 | 3.22 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.65 | 3.13 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.64 | 3.08 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.63 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.62 | 2.94 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.61 | 2.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.60 | 2.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.59 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.58 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.57 | 2.66 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.56 | 2.52 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.55 | 2.44 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.54 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.53 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.52 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.51 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |

| November Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 0.50 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.49 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.48 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.47 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.46 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.45 | 2.04 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.44 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.43 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.42 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.41 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.40 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.39 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.38 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.37 | 1.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.36 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.35 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.34 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.33 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.32 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.31 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.30 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.29 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.28 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.27 | 1.40 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.26 | 1.40 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.25 | 1.40 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.24 | 1.39 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.23 | 1.34 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.22 | 1.32 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.21 | 1.26 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.20 | 1.22 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.19 | 1.14 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.18 | 1.12 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.17 | 1.09 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.16 | 1.04 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.15 | 1.01 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.14 | 0.98 | 0.98 | 0.98 | 0.98 | 0.98 |
| 0.13 | 0.97 | 0.97 | 0.97 | 0.97 | 0.97 |
| 0.12 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| 0.11 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| 0.10 | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 |
| 0.09 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 |
| 0.08 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 |
| 0.07 | 0.77 | 0.77 | 0.77 | 0.77 | 0.77 |
| 0.06 | 0.71 | 0.71 | 0.71 | 0.71 | 0.71 |
| 0.05 | 0.64 | 0.64 | 0.64 | 0.64 | 0.64 |
| 0.04 | 0.61 | 0.61 | 0.61 | 0.61 | 0.61 |
| 0.03 | 0.52 | 0.52 | 0.52 | 0.52 | 0.52 |
| 0.02 | 0.51 | 0.51 | 0.51 | 0.51 | 0.51 |
| 0.01 | 0.48 | 0.48 | 0.48 | 0.48 | 0.48 |


GWR Flow Impacts
Reclamation Ditch at Davis Rd.
November
Flow (cfs)
1000
100
10
1
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability
Case 0
Case 1
Case 2
Case 3
Case 4


GWR Flow Impacts
Tembladero Slough at Castroville
November
Flow (cfs)
1000
100
10
1
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability
Case 0
Case 1
Case 2
Case 3
Case 4

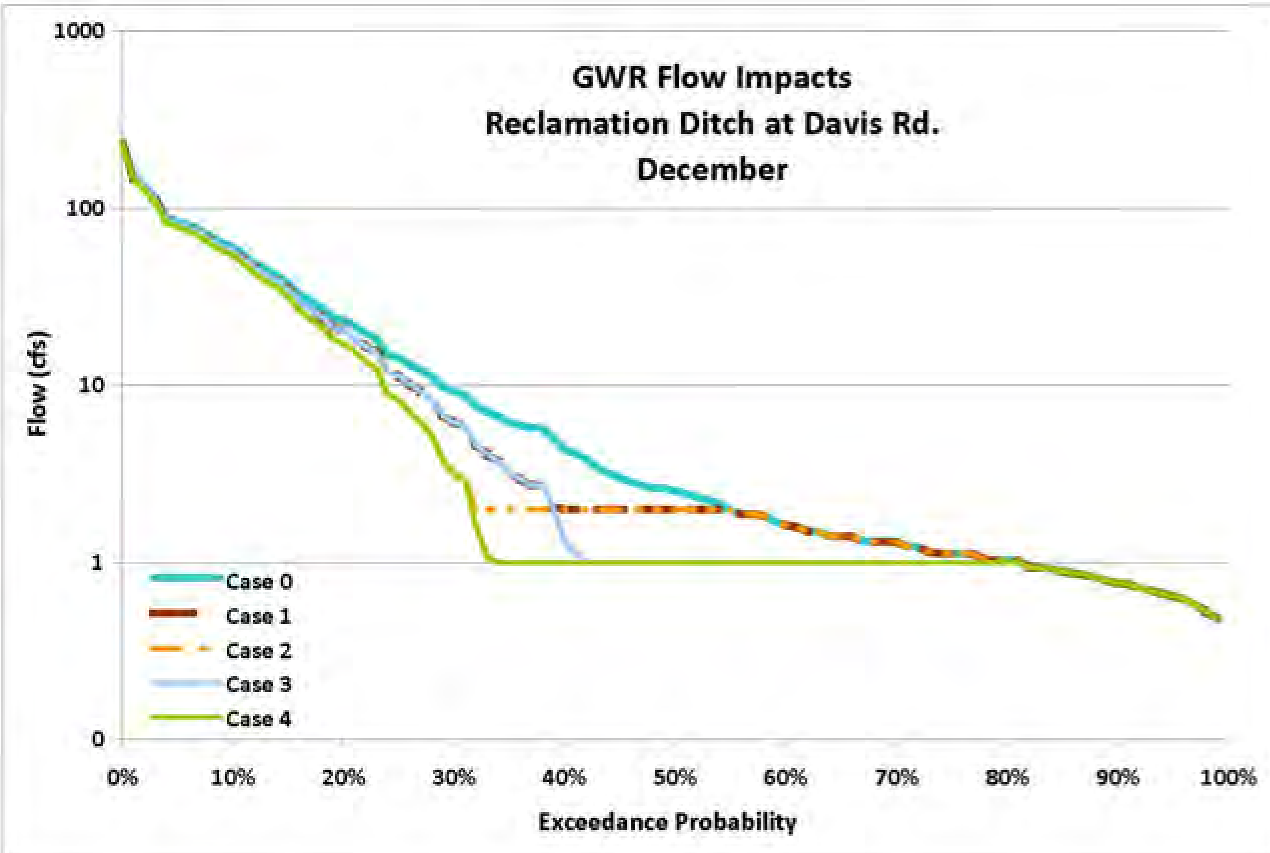
**Reclamation Ditch at Davis Rd, Percentile Flows by Month (cfs)**

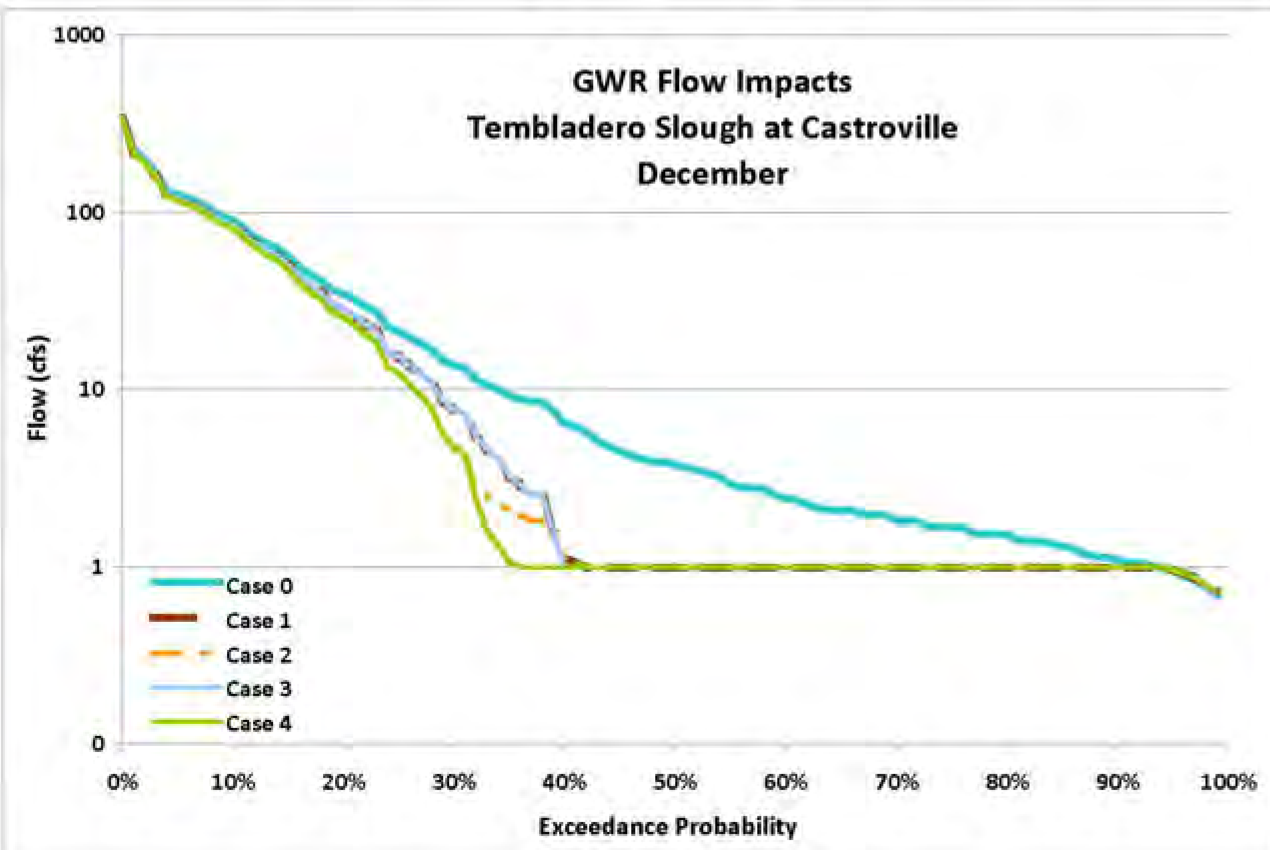
| December Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 231.44 | 228.45 | 225.44 | 228.45 | 225.44 |
| 0.99 | 151.54 | 148.55 | 145.54 | 148.55 | 145.54 |
| 0.98 | 133.65 | 130.66 | 127.65 | 130.66 | 127.65 |
| 0.97 | 112.89 | 109.90 | 106.89 | 109.90 | 106.89 |
| 0.96 | 88.83 | 85.84 | 82.83 | 85.84 | 82.83 |
| 0.95 | 84.24 | 81.25 | 78.24 | 81.25 | 78.24 |
| 0.94 | 80.09 | 77.10 | 74.09 | 77.10 | 74.09 |
| 0.93 | 75.90 | 72.91 | 69.90 | 72.91 | 69.90 |
| 0.92 | 69.00 | 66.01 | 63.00 | 66.01 | 63.00 |
| 0.91 | 63.35 | 60.36 | 57.35 | 60.36 | 57.35 |
| 0.90 | 60.72 | 57.73 | 54.72 | 57.73 | 54.72 |
| 0.89 | 54.52 | 51.53 | 48.52 | 51.53 | 48.52 |
| 0.88 | 48.72 | 45.73 | 42.72 | 45.73 | 42.72 |
| 0.87 | 44.76 | 41.77 | 38.76 | 41.77 | 38.76 |
| 0.86 | 42.17 | 39.18 | 36.17 | 39.18 | 36.17 |
| 0.85 | 37.81 | 34.82 | 31.81 | 34.82 | 31.81 |
| 0.84 | 32.80 | 29.81 | 26.80 | 29.81 | 26.80 |
| 0.83 | 29.98 | 26.99 | 23.98 | 26.99 | 23.98 |
| 0.82 | 27.59 | 24.60 | 21.59 | 24.60 | 21.59 |
| 0.81 | 24.36 | 21.37 | 18.36 | 21.37 | 18.36 |
| 0.80 | 23.24 | 20.25 | 17.24 | 20.25 | 17.24 |
| 0.79 | 21.55 | 18.56 | 15.55 | 18.56 | 15.55 |
| 0.78 | 19.68 | 16.69 | 13.68 | 16.69 | 13.68 |
| 0.77 | 18.43 | 15.44 | 12.43 | 15.44 | 12.43 |
| 0.76 | 14.99 | 12.00 | 8.99 | 12.00 | 8.99 |
| 0.75 | 14.29 | 11.30 | 8.29 | 11.30 | 8.29 |
| 0.74 | 13.12 | 10.13 | 7.12 | 10.13 | 7.12 |
| 0.73 | 12.18 | 9.19 | 6.18 | 9.19 | 6.18 |
| 0.72 | 11.24 | 8.25 | 5.24 | 8.25 | 5.24 |
| 0.71 | 9.75 | 6.76 | 3.75 | 6.76 | 3.75 |
| 0.70 | 9.18 | 6.19 | 3.18 | 6.19 | 3.18 |
| 0.69 | 8.90 | 5.91 | 2.90 | 5.91 | 2.90 |
| 0.68 | 7.62 | 4.63 | 2.00 | 4.63 | 1.62 |
| 0.67 | 7.08 | 4.09 | 2.00 | 4.09 | 1.08 |
| 0.66 | 6.71 | 3.72 | 2.00 | 3.72 | 1.00 |
| 0.65 | 6.18 | 3.19 | 2.00 | 3.19 | 1.00 |
| 0.64 | 5.94 | 2.95 | 2.00 | 2.95 | 1.00 |
| 0.63 | 5.72 | 2.73 | 2.00 | 2.73 | 1.00 |
| 0.62 | 5.72 | 2.73 | 2.00 | 2.73 | 1.00 |
| 0.61 | 5.02 | 2.05 | 2.00 | 2.03 | 1.00 |
| 0.60 | 4.31 | 2.00 | 2.00 | 1.32 | 1.00 |
| 0.59 | 4.12 | 2.00 | 2.00 | 1.13 | 1.00 |
| 0.58 | 3.84 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.57 | 3.42 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.56 | 3.19 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.55 | 3.01 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.54 | 2.84 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.53 | 2.72 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.52 | 2.62 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.51 | 2.62 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.50 | 2.53 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.49 | 2.44 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.48 | 2.34 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.47 | 2.25 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.46 | 2.16 | 2.00 | 2.00 | 1.00 | 1.00 |
| 0.45 | 1.96 | 1.96 | 1.96 | 1.00 | 1.00 |
| 0.44 | 1.87 | 1.87 | 1.87 | 1.00 | 1.00 |
| 0.43 | 1.87 | 1.87 | 1.87 | 1.00 | 1.00 |
| 0.42 | 1.86 | 1.86 | 1.86 | 1.00 | 1.00 |
| 0.41 | 1.70 | 1.70 | 1.70 | 1.00 | 1.00 |
| 0.40 | 1.63 | 1.63 | 1.63 | 1.00 | 1.00 |
| 0.39 | 1.59 | 1.59 | 1.59 | 1.00 | 1.00 |
| 0.38 | 1.50 | 1.50 | 1.50 | 1.00 | 1.00 |
| 0.37 | 1.50 | 1.50 | 1.50 | 1.00 | 1.00 |
| 0.36 | 1.41 | 1.41 | 1.41 | 1.00 | 1.00 |
| 0.35 | 1.41 | 1.41 | 1.41 | 1.00 | 1.00 |
| 0.34 | 1.41 | 1.41 | 1.41 | 1.00 | 1.00 |
| 0.33 | 1.31 | 1.31 | 1.31 | 1.00 | 1.00 |
| 0.32 | 1.31 | 1.31 | 1.31 | 1.00 | 1.00 |
| 0.31 | 1.31 | 1.31 | 1.31 | 1.00 | 1.00 |
| 0.30 | 1.31 | 1.31 | 1.31 | 1.00 | 1.00 |
| 0.29 | 1.22 | 1.22 | 1.22 | 1.00 | 1.00 |
| 0.28 | 1.22 | 1.22 | 1.22 | 1.00 | 1.00 |
| 0.27 | 1.14 | 1.14 | 1.14 | 1.00 | 1.00 |
| 0.26 | 1.12 | 1.12 | 1.12 | 1.00 | 1.00 |
| 0.25 | 1.12 | 1.12 | 1.12 | 1.00 | 1.00 |
| 0.24 | 1.12 | 1.12 | 1.12 | 1.00 | 1.00 |
| 0.23 | 1.12 | 1.12 | 1.12 | 1.00 | 1.00 |
| 0.22 | 1.03 | 1.03 | 1.03 | 1.00 | 1.00 |
| 0.21 | 1.03 | 1.03 | 1.03 | 1.00 | 1.00 |
| 0.20 | 1.03 | 1.03 | 1.03 | 1.00 | 1.00 |
| 0.19 | 1.03 | 1.03 | 1.03 | 1.00 | 1.00 |
| 0.18 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| 0.17 | 0.94 | 0.94 | 0.94 | 0.94 | 0.94 |
| 0.16 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| 0.15 | 0.89 | 0.89 | 0.89 | 0.89 | 0.89 |
| 0.14 | 0.86 | 0.86 | 0.86 | 0.86 | 0.86 |
| 0.13 | 0.85 | 0.85 | 0.85 | 0.85 | 0.85 |
| 0.12 | 0.82 | 0.82 | 0.82 | 0.82 | 0.82 |
| 0.11 | 0.79 | 0.79 | 0.79 | 0.79 | 0.79 |
| 0.10 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 |
| 0.09 | 0.76 | 0.76 | 0.76 | 0.76 | 0.76 |
| 0.08 | 0.72 | 0.72 | 0.72 | 0.72 | 0.72 |
| 0.07 | 0.69 | 0.69 | 0.69 | 0.69 | 0.69 |
| 0.06 | 0.67 | 0.67 | 0.67 | 0.67 | 0.67 |
| 0.05 | 0.65 | 0.65 | 0.65 | 0.65 | 0.65 |
| 0.04 | 0.62 | 0.62 | 0.62 | 0.62 | 0.62 |
| 0.03 | 0.58 | 0.58 | 0.58 | 0.58 | 0.58 |
| 0.02 | 0.53 | 0.53 | 0.53 | 0.53 | 0.53 |
| 0.01 | 0.48 | 0.48 | 0.48 | 0.48 | 0.48 |

Tembladero Slough at Castroville, Percentile Flows by Month (cfs)

| December Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 1.00 | 345.80 | 339.82 | 336.81 | 339.82 | 336.81 |
| 0.99 | 226.42 | 220.44 | 217.43 | 220.44 | 217.43 |
| 0.98 | 199.70 | 193.72 | 190.71 | 193.72 | 190.71 |
| 0.97 | 168.67 | 162.69 | 159.68 | 162.69 | 159.68 |
| 0.96 | 132.72 | 126.74 | 123.73 | 126.74 | 123.73 |
| 0.95 | 125.86 | 119.88 | 116.87 | 119.88 | 116.87 |
| 0.94 | 119.67 | 113.69 | 110.68 | 113.69 | 110.68 |
| 0.93 | 113.40 | 107.42 | 104.41 | 107.42 | 104.41 |
| 0.92 | 103.10 | 97.12 | 94.11 | 97.12 | 94.11 |
| 0.91 | 94.65 | 88.67 | 85.66 | 88.67 | 85.66 |
| 0.90 | 90.72 | 84.74 | 81.73 | 84.74 | 81.73 |
| 0.89 | 81.47 | 75.49 | 72.48 | 75.49 | 72.48 |
| 0.88 | 72.80 | 66.82 | 63.81 | 66.82 | 63.81 |
| 0.87 | 66.88 | 60.90 | 57.89 | 60.90 | 57.89 |
| 0.86 | 63.00 | 57.02 | 54.01 | 57.02 | 54.01 |
| 0.85 | 56.49 | 50.51 | 47.50 | 50.51 | 47.50 |
| 0.84 | 49.00 | 43.02 | 40.01 | 43.02 | 40.01 |
| 0.83 | 44.80 | 38.82 | 35.81 | 38.82 | 35.81 |
| 0.82 | 41.22 | 35.24 | 32.23 | 35.24 | 32.23 |
| 0.81 | 36.40 | 30.42 | 27.41 | 30.42 | 27.41 |
| 0.80 | 34.72 | 28.74 | 25.73 | 28.74 | 25.73 |
| 0.79 | 32.20 | 26.22 | 23.21 | 26.22 | 23.21 |
| 0.78 | 29.40 | 23.42 | 20.41 | 23.42 | 20.41 |
| 0.77 | 27.54 | 21.56 | 18.55 | 21.56 | 18.55 |
| 0.76 | 22.40 | 16.42 | 13.41 | 16.42 | 13.41 |
| 0.75 | 21.35 | 15.37 | 12.36 | 15.37 | 12.36 |
| 0.74 | 19.60 | 13.62 | 10.61 | 13.62 | 10.61 |
| 0.73 | 18.20 | 12.22 | 9.21 | 12.22 | 9.21 |
| 0.72 | 16.80 | 10.82 | 7.81 | 10.82 | 7.81 |
| 0.71 | 14.57 | 8.59 | 5.58 | 8.59 | 5.58 |
| 0.70 | 13.72 | 7.74 | 4.73 | 7.74 | 4.73 |
| 0.69 | 13.29 | 7.31 | 4.30 | 7.31 | 4.30 |
| 0.68 | 11.38 | 5.40 | 2.77 | 5.40 | 2.39 |
| 0.67 | 10.58 | 4.60 | 2.51 | 4.60 | 1.59 |
| 0.66 | 10.02 | 4.04 | 2.32 | 4.04 | 1.32 |
| 0.65 | 9.24 | 3.26 | 2.07 | 3.26 | 1.07 |
| 0.64 | 8.88 | 2.90 | 1.95 | 2.90 | 1.00 |
| 0.63 | 8.54 | 2.56 | 1.83 | 2.56 | 1.00 |
| 0.62 | 8.54 | 2.56 | 1.83 | 2.56 | 1.00 |
| 0.61 | 7.51 | 1.54 | 1.49 | 1.53 | 1.00 |
| 0.60 | 6.44 | 1.14 | 1.14 | 1.00 | 1.00 |
| 0.59 | 6.16 | 1.05 | 1.05 | 1.00 | 1.00 |
| 0.58 | 5.74 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.57 | 5.11 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.56 | 4.76 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.55 | 4.49 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.54 | 4.25 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.53 | 4.06 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.52 | 3.92 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.51 | 3.92 | 1.00 | 1.00 | 1.00 | 1.00 |

| December Percentile | Case 0: | Case 1: | Case 2: | Case 3: | Case 4: |
|---|---|---|---|---|---|
| 0.50 | 3.78 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.49 | 3.64 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.48 | 3.50 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.47 | 3.36 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.46 | 3.22 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.45 | 2.93 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.44 | 2.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.43 | 2.80 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.42 | 2.77 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.41 | 2.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.40 | 2.44 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.39 | 2.38 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.38 | 2.24 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.37 | 2.14 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.36 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.35 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.34 | 2.10 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.33 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.32 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.31 | 1.96 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.30 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.29 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.28 | 1.82 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.27 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.26 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.25 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.24 | 1.68 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.23 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.22 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.21 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.20 | 1.54 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.19 | 1.40 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.18 | 1.40 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.17 | 1.40 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.16 | 1.35 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.15 | 1.31 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.14 | 1.27 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.13 | 1.18 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.12 | 1.14 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.11 | 1.13 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.10 | 1.09 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.09 | 1.06 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.08 | 1.05 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.07 | 1.02 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.06 | 0.98 | 1.00 | 1.00 | 1.00 | 1.00 |
| 0.05 | 0.96 | 0.97 | 0.97 | 0.97 | 0.97 |
| 0.04 | 0.88 | 0.92 | 0.92 | 0.92 | 0.92 |
| 0.03 | 0.84 | 0.87 | 0.87 | 0.87 | 0.87 |
| 0.02 | 0.78 | 0.79 | 0.79 | 0.79 | 0.79 |
| 0.01 | 0.69 | 0.72 | 0.72 | 0.72 | 0.72 |


GWR Flow Impacts
Reclamation Ditch at Davis Rd.
December
1000
100
10
1
0
Flow (cfs)
Case 0
Case 1
Case 2
Case 3
Case 4
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability


GWR Flow Impacts
Tembladero Slough at Castroville
December
1000
100
10
1
0
Flow (cfs)
Case 0
Case 1
Case 2
Case 3
Case 4
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Exceedance Probability

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# Appendix Q <u>rev</u>

# Blanco Drain Yield Study

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# BLANCO DRAIN YIELD STUDY

**Prepared for**

## MONTEREY PENINSULA WATER MANAGEMENT DISTRICT

**Prepared by**


**Schaaf & Wheeler**
CONSULTING CIVIL ENGINEERS
3 QUAIL RUN CIRCLE, SUITE 101
SALINAS, CA 93907


**December 2014**

**Revised August 2015**

Cover Photos: Blanco Drain, December 2007

**Revision Note:** Updates were made to the following sections in response to a comment identifying that one of the referenced reports, Salinas Valley Water Project, Annual Flow Monitoring Report, Water Year 2012, had been revised in May 2014. The revisions did not affect the yield or impacts analysis results.

Section 2.1, text edit

Section 2.2, text edit and update of Table 2-3

Appendix B, update of table B-2

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C. Conceptual Diversion Facility
D. References

**Table i. Acronyms Used in this Report**

| Acronym | Description |
|---|---|
| AFY, ac-ft/yr | Acre-feet/year |
| cfs | Cubic foot per second |
| gpd | Gallons per day |
| mgd | Million gallons per day |
| mg/L | Milligrams per liter |
| µg/L | Micrograms per liter |
| MPN | Most Probable Number |
| ng/L | Nanogram per liter |
| ppb | Parts per billion |
| ppm | Parts per million |
| | |
| ASBS | Areas of Special Biological Significance |
| ASR | Aquifer Storage and Recovery |
| BMP | Best management practice |
| CAW, CalAm | California American Water Company |
| CCAMP | Central Coast Ambient Monitoring Program |
| CCoWS | Central Coast Watershed Studies Program |
| CCR | California Code of Regulations |
| CCRWQCB | Central Coast Regional Water Quality Control Board |
| CDPH | California Department of Public Health |
| CEQA | California Environmental Quality Act |
| CSIP | Castroville Seawater Intrusion Project |
| CWC | California Water Code |
| DWR | California Department of Water Resources |
| GWR | Groundwater Replenishment |
| MCWRA | Monterey County Water Resources Agency |
| MPWMD | Monterey Peninsula Water Management District |
| MRSWMP | Monterey Regional Stormwater Management Program |
| MRWPCA | Monterey Regional Water Pollution Control Agency |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic and Atmospheric Administration |
| NRCS | USDA Natural Resources Conservation Service |
| RTP | Regional Treatment Plant |
| SIWTF | Salinas Industrial Wastewater Treatment Facility |
| SRDF | Salinas River Diversion Facility |
| SRDP | Salinas River Diversion Project |
| SVRP | Salinas Valley Reclamation Plant |
| SVWP | Salinas Valley Water Project |
| SVGB | Salinas Valley Groundwater Basin |
| SWRCB | California State Water Resources Control Board |
| USACE | U.S. Army Corps of Engineers |
| USBR | U.S. Bureau of Reclamation |
| USGS | U.S. Geologic Survey |

**Table ii. Units of Measure Used in this Report**

| Unit | Equals |
|---|---|
| 1 acre-foot | = 43,560 cubic feet<br>= 325,851 gallons |
| 1 cubic foot | = 7.48 gallons |
| 1 cfs | = 448.8 gallons per minute |
| 1 MGD | = 1,000,000 gallons/day<br>= 1,120 acre-feet / year |
| 1 mg/L | = 1 ppm<br>= $1 / 10^6$ |
| 1 µg/L | = 0.001 mg/L<br>= 1 ppb<br>= $1 / 10^9$ |
| 1 ng/L | = 0.001 µg/L<br>= 1 part per trillion<br>= $1 / 10^{12}$ |

## Summary of Blanco Drain Yield Study

The Monterey Peninsula Water Management District (MPWMD) and the Monterey Regional Water Pollution Control Agency (MRWPCA) are jointly sponsoring the proposed Pure Water Monterey Groundwater Replenishment Project (Proposed Project), a water supply project that will serve northern Monterey County. The project will provide purified water for recharge of the Seaside Groundwater Basin that serves as drinking water supply, and recycled water to augment the existing Castroville Seawater Intrusion Project agricultural irrigation supply. One of the proposed sources of water supply to be developed for this project is tile drainage and stormwater runoff from the Blanco Drain, which currently contributes flow to the Salinas River. The purpose of this study was to (1) analyze water availability in the Blanco Drain, (2) provide an engineering analysis of the potential yields and the infrastructure required to capture and convey those flows to the Proposed Project, and (3) assess the potential project impacts on hydrology and water quality.

The Blanco Drain watershed is approximately 6400 acres of agricultural land near the City of Salinas. Summer flows are predominantly agricultural tile drainage. Irrigation supply in this area is a mix of Salinas Valley Groundwater, recycled water from the Castroville Seawater Intrusion Project and surface water from the Salinas River Diversion Facility. Winter flows also include storm water runoff.

Yields were estimated just above the confluence of the Blanco Drain with the Salinas River. There is an existing pump station at that location used to lift flows from the Blanco Drain into the river during the Salinas River Diversion Facility operating season. To convey the flows to the MRWPCA Regional Treatment Plant, a new pipeline will be required from the proposed pump station, crossing under the Salinas River. Based on previous reviews of the Blanco Drain water quality by the regulatory agencies, it was assumed that all flows may be diverted for the GWR Project. The estimated annual yields for the Blanco Drain are:

2,050 ac-ft/yr, using a maximum diversion rate of 2.9 cfs

2,104 ac-ft/yr, using a maximum diversion rate of 2.99 cfs

2,620 ac-ft/yr, using a maximum diversion rate of 6 cfs

# Section 1 - Introduction

## 1.1 Project Description

The Monterey Peninsula Water Management District (MPWMD) and the Monterey Regional Water Pollution Control Agency (MRWPCA) are jointly sponsoring the proposed Pure Water Monterey Groundwater Replenishment Project (Proposed Project), a water supply project that will serve northern Monterey County. The project will provide purified water for recharge of the Seaside Groundwater Basin that serves as drinking water supply, and recycled water to augment the existing Castroville Seawater Intrusion Project agricultural irrigation supply.

Source water for the project would include agricultural wash water from the City of Salinas Industrial Wastewater Collection System, stormwater from MRWPCA member cities, secondary-treated effluent from the MRWPCA Regional Treatment Plant, and surface water diverted from the Reclamation Ditch, Tembladero Slough and Blanco Drain. Water supplied to the Proposed Project would undergo primary and secondary treatment at the existing Regional Treatment Plant. The portion used for groundwater recharge would then undergo advanced treatment at a new facility to be located at the MRWPCA site, and then be conveyed to the Seaside Groundwater Basin for injection. The portion used for agricultural irrigation would undergo tertiary treatment at the existing Salinas Valley Reclamation Plant, and distribution through the Castroville Seawater Intrusion Project system.

The MRWPCA provides wastewater treatment for municipalities along the Monterey Bay from Pacific Grove north to Moss Landing, and inland to the City of Salinas. Wastewater is collected in an interceptor pipeline system and conveyed to the Regional Treatment Plant (RTP), located two miles north of the City of Marina. A large portion of this incoming flow undergoes tertiary treatment and is used for unrestricted agricultural irrigation within the Castroville Seawater Intrusion Project system in the northern Salinas Valley. Flow that is not sent to the tertiary treatment system is discharged through an outfall to Monterey Bay after receiving secondary treatment. The RTP has an average dry weather design capacity of 29.6 million gallons per day (mgd) and a peak wet weather design capacity of 75.6 mgd. It currently receives and treats approximately 17 to 18 mgd of average dry weather flow and therefore has capacity to treat additional flows. The interceptor pipeline system also has currently unused or excess conveyance capacity. Most of the new source waters would be conveyed to the RTP using the existing wastewater collection system; water from Blanco Drain would be conveyed in a new pipeline directly to the RTP.

Transfers of source water flowing in known and definite channels, such as the Blanco Drain, to the GWR project and thence out of the Salinas Valley to the Monterey Peninsula would be a consumptive use that may require an appropriative permit from the State Water Resources Control Board (SWRCB). The purpose of this study was to analyze water availability in the Blanco Drain and provide an engineering analysis of the potential yields and the infrastructure required to capture and convey those flows to the RTP. This hydrologic information and analysis may then be used in a permit application to the SWRCB.

## 1.2 Water Source Description

The Blanco Drain is a man-made reclamation ditch draining approximately 6,400 acres of agricultural lands near Salinas, CA. The watershed is between the Salinas River and Alisal Slough, and discharges to the Salinas River at river mile 5 (see Figure A-1). The system is maintained by the Monterey County Water Resources Agency (MCWRA).

The system consists of three separate ditches (A, B, and C) as shown in Figure 1.1. Ditch A is what is commonly referred to as the Blanco Drain. A headwall and flap gate at the lower end of Ditch A prevents seasonal high flows in the Salinas River from migrating up the Blanco Drain channel (Figure 1.2). Until 2010, MCWRA operated a seasonal pump station at the confluence of ditches A, B and C to lift summer flows over a low weir and into the ditch channel. This was required to improve tile drainage into ditches B and C (Figure 1.3). The pump station was not operated in the winter months, and ditches B and C were allowed to fill and overflow the weir.

**Figure 1.1: Blanco Drain Schematic**

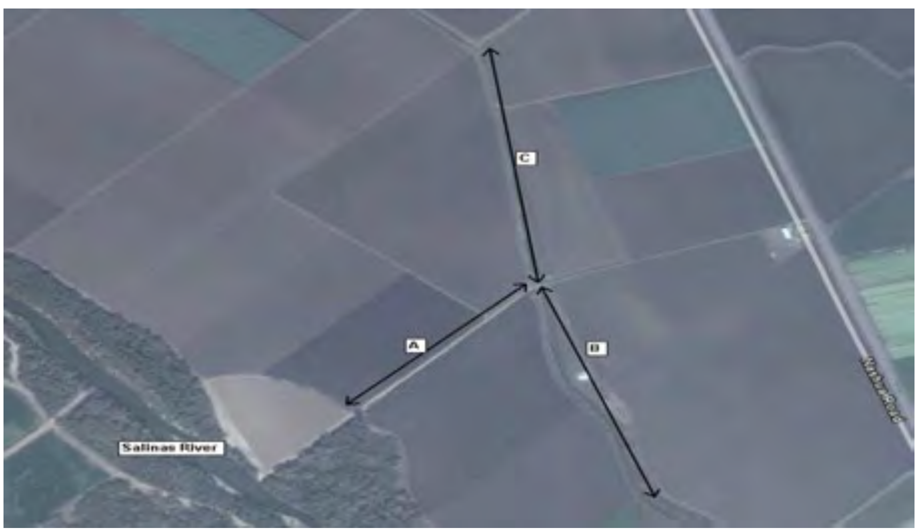


**Figure 1.2: Blanco Drain Flap Gate**

**Figure 1.3: Old Pump Station**

In 2009-2010, the MCWRA Salinas River Diversion Facility (SRDF) was constructed downstream of the Blanco Drain. The SRDF includes an inflatable rubber dam that impounds water during the summer months to supply the diversion pump station. To overcome the backwater into the Blanco Drain channel, the Blanco Drain channels were regraded and a new pump station was installed at the lower end of Ditch A. The new pump station (Figure 1.4) lifts Blanco Drain flows past a new slide gate and into the gravity portion of the channel.

**Figure 1.4: Current Pump Station**

Summer flows in the Blanco Drain are generally tile drainage and runoff from irrigated agriculture. Winter flows include stormwater runoff, although some fields remain in production and under irrigation year-round. Irrigation supply is predominantly groundwater from the Pressure Subarea of the Salinas Valley Groundwater Basin (see Figure A-2). A portion of the area tributary to the Blanco Drain is within the Castroville Seawater Intrusion Project (CSIP) service area (see figure A-3). The CSIP supplies growers with Recycled Water from the Salinas Valley Reclamation Plant (SVRP), located next to the MRWPCA RTP, and Salinas River water diverted at the MCWRA Salinas River Diversion Facility (SRDF).

During the summer months, the Salinas River flows into the Old Salinas River Channel through a gated culvert at the Salinas Lagoon. Direct discharge to the ocean is blocked by a seasonal sand bar which forms across the mouth of the Salinas Lagoon due to wave and tidal action in the Monterey Bay. The Old Salinas River channel is controlled by tide gates at Potrero Road in Moss Landing. River flow combines with Tembladero Slough flow approximately 1.2-miles above the tide gates. During high winter flows in the Salinas River, the sand bar breaches and the river flows directly to the Bay. When this occurs, MCWRA closes the slide gate to the Old Salinas River.

The Central Coast Regional Water Quality Control Board (CCRWQCB) has listed Blanco Drain on the impaired water body listing pursuant to Section 303(d) of the Clean Water Act for pesticides, nitrate and low dissolved oxygen. The lower Salinas River is also listed as an impaired water body for pesticides, nitrate, chloride and other parameters. A summary matrix of

303(d) listed streams is provided in Appendix B, Table B-1. Water quality is discussed in greater detail in Section 4 of this report.

Aquatic habitats within the Blanco Drain system are poor. In addition to the poor water quality, the system is generally maintained as a drainage canal without tree canopy. The adjacent agricultural lands are used for growing table crops (leafy greens, berries and artichokes). The growers prevent vegetation from establishing along the Ditch banks to discourage birds and rodents from nesting near their fields. The Biological Opinion for the Salinas Valley Water project, NMFS noted: “The outlet culvert of the Blanco Drain, where the drain enters the Salinas River, has a flap gate on its downstream end, preventing fish passage in Blanco Drain. Even if the flap gate fails and some fish are able to enter the drain, current water quality conditions are such that survival is not likely.[1]”

[1] NMFS, Biological Opinion for the Salinas River Diversion Facility, pg 84.

# Section 2 - Yield Estimation

## 2.1 Methodology

Estimates of stream flow capture from the Blanco Drain system were made, assuming diversion would occur at the existing MCWRA Blanco Drain pump station. Limited seasonal flow data was available for this location and was used as the basis of this analysis. The Blanco Drain is an 8-mile long channel that drains approximately 6,000 acres of irrigated agricultural land west of Salinas, CA. The terrain is generally flat with type C and D clay soils. Flows are primarily agricultural tile drainage.

The Blanco Drain connects to the Salinas River through a 60-inch pipe culvert with a flap gate. To facilitate drainage, MCWRA historically operated a pump station approximately 2-miles upstream of the pipe culvert, from the drain channel (parallel to the Salinas River) to the connecting channel. This pump station was replaced as part of the Salinas River Diversion Facility (SRDF) project. The current pump station is located at the upstream end of the 60-inch pipe culvert, and includes a slide gate which is closed when the SRDF rubber dam is inflated, and a by-pass pump station which lifts Blanco Drain flows past the gate structure.

Limited flow data is available for the Blanco Drain. A weir gage was installed in 2007 to record flows used in sizing the current pump station, and operational records for the pump station were obtained for 2010 through 2013 and used in this analysis. Because the SRDF only operates during the peak irrigation season (April to October), flow data was not recorded for the rest of the year.

Approximately one third of the area tributary to the Blanco Drain is within the Castroville Seawater Intrusion Project (CSIP) service area. The MCWRA publishes monthly records of the total CSIP water deliveries, which can be used to estimate applied irrigation per acre (= total deliveries ÷ 12,000 acre service area). Similar crops and irrigation methods are used throughout the Blanco Drain tributary areas, so it was assumed that the CSIP irrigation rates applied to the full area.

Flows from the Blanco Drain were estimated as return flows from applied irrigation and natural precipitation. For the months with recorded Blanco Drain flow data, the source flows were calculated as:

(CSIP Irrigation) + (Precipitation at Salinas) x 6,000 acres = total acre-feet/month

Return Rate = (Blanco Drain Flow) / (total ac-ft/mo)

The calculated return rates ranged from 3% to 25%, with an average return of 16.8% (see Table B-2: Blanco Drain Flows as Return Flows). The period with the most complete flow data for the Blanco Drain was August to October 2013, with an average return rate of 16.9%. For this estimate, we assumed a flat 17% return rate. The MCWRA CSIP records were combined with the Salinas rainfall records to calculate the total estimated source flows (Table B-4: Applied Irrigation and Recorded Precipitation in the CSIP Service Area). The return flows were estimated by month as shown below.

**Table 2-1: Estimated Return Flows into Blanco Drain**

| Month | Applied Irrig + Precip | 17% return | Avg Return Flow Rate |
|---|---|---|---|
| | AF | AF | cfs |
| January | 1,229 | 209 | 3.4 |
| February | 1,314 | 223 | 4.0 |
| March | 1,446 | 246 | 4.0 |
| April | 1,481 | 252 | 4.2 |
| May | 1,323 | 225 | 3.7 |
| June | 1,613 | 274 | 4.6 |
| July | 1,629 | 277 | 4.5 |
| August | 1,436 | 244 | 4.0 |
| September | 1,080 | 184 | 3.1 |
| October | 989 | 168 | 2.7 |
| November | 782 | 133 | 2.2 |
| December | 1,088 | 185 | 3.0 |
| **Totals** | **15,410** | **2,620** | |

The values shown in Table 2-1 are monthly average values. Although the average monthly return flow rates range from 2.2 to 4.6 cfs, daily flows rates over 6 cfs have been recorded during the four years the Blanco Drain pump station has been in operation. To achieve an annual average diversion of 2,620 AFY, a peak diversion rate of 6 cfs is therefore required. Yields applying lower average station capacities are shown in Table 2-2. If excess flows on peak days may be stored in-channel behind the slide gate and held until the following day, diverting at a lower rate may be feasible. However, the current pump station configuration and operating regimen is designed to drain the channel to facilitate tile drainage, so the use of in-channel storage should not be assumed.

**Table 2-2: Estimated Yields based on Pump Capacity**

| Station Capacity | Yield |
|---|---|
| cfs | AFY |
| 2.9 | 2,050 |
| 2.99 | 2,104 |
| 3.0 | 2,110 |
| 3.5 | 2,350 |
| 4.0 | 2,538 |
| 4.5 | 2,613 |
| 4.6 | 2,619 |

The permitting process for a water right diversion rate less than 3 cfs is shorter than for a larger diversion rate, so the proposed project assumes an initial water right diversion at 2.99 cfs, and an ultimate water right allowing diversions at up to 6 cfs. Both capacities are considered in Section 3, Facility Requirements.

## 2.2 In-Stream Flow Requirements

For this report, we assumed that all flows within the Blanco Drain are available for diversion and capture. This is based upon previous documentation in the Salinas Valley Water Project EIR and the supporting Biological Opinion prepared by NMFS for the SRDF construction. Those documents identify (1) the water quality within the Blanco Drain is poor and does not support aquatic species, (2) the flap gate between the river and the Blanco Drain prevents the migration of fish from the river into the drain, and (3) the water quality at the downstream Salinas Lagoon would be improved if the flows from the Blanco Drain were diverted to the MRWPCA Regional Treatment Plant.

As a condition of operating the SRDF, MCWRA must maintain certain in-stream flows in the Salinas River. When San Antonio and Nacimiento Reservoirs have a combined storage of 220,000 acre-feet, the SRDF has a requirement to release (1) a minimum of 15 cfs downstream from April 1 to June 30, and (2) a minimum of 2 cfs downstream from July 1 to the end of the SRDF operating season for maintenance of the Salinas River Lagoon habitat. Higher block flow releases are triggered during steelhead migration season if the Salinas Lagoon is open to the ocean. When the combined storage in the two reservoirs is under 220,000 ac-ft, the minimum release requirement for Lagoon habitat maintenance is 2 cfs while the SRDF is in operation. In Table 2-3, we compare the recorded daily by-passed flows at the SRDF (fish ladder plus regulating weir, as shown in Figure 2.1) to the recorded Blanco Drain flows during year 2012. Additional flow is reported to have spilled over the rubber dam during this period, but that volume was not estimated. MCWRA manages releases to by-pass the required minimum plus the Blanco Drain flow[2], so this proposed diversion should not impact SRDF operation.

**Table 2-3: SRDF By-Passed Flows, with and without Blanco Drain[3]**

| Month | Year | Avg Daily By-Passed Flow | Blanco Drain Flow | Average minus B.D. | Required Minimum By-Pass |
|---|---|---|---|---|---|
| | | cfs | cfs | cfs | cfs |
| 4 | 2012 | 22.5 | 4.7 | 17.8 | 2.0 |
| 5 | 2012 | 18.6 | 5.2 | 13.4 | 2.0 |
| 6 | 2012 | 9.1 | 5.4 | 3.7 | 2.0 |
| 7 | 2012 | 10.1 | 5.2 | 4.9 | 2.0 |
| 8 | 2012 | 11.3 | 4.6 | 6.7 | 2.0 |
| 9 | 2012 | 18.3 | 3.5 | 14.8 | 2.0 |
| 10 | 2012 | 15.0 | 2.0 | 13.0 | 2.0 |
| 11 | 2012 | 57.3 | 1.0 | 56.3 | 2.0 |

Note: The triggers for a 15 cfs by-pass in April did not occur in 2012.

[2] Letter from Robert Johnson, MCWRA, June 5, 2015

[3] Salinas Valley Water Project, Annual Flow Monitoring Report, Water Year 2012, revised May 2014

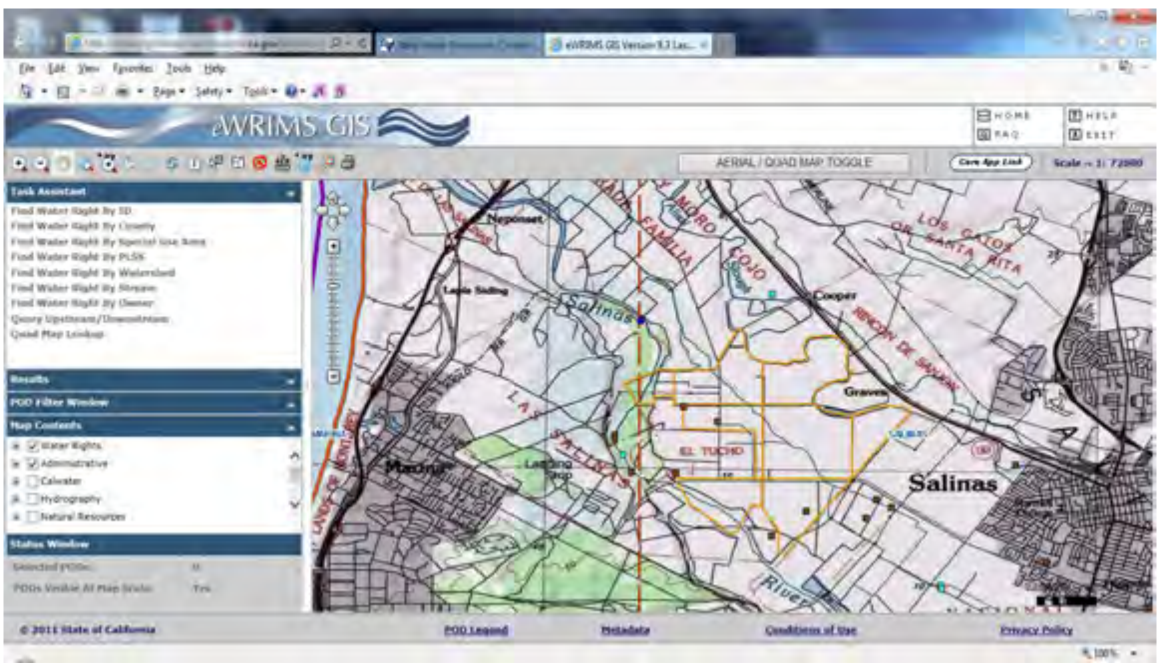
**Figure 2.1: SRDF Release Weir**

## 2.3 Water Rights

Water that enters surface streams and rivers is considered water of the state. A water rights permit is required to impound or divert waters of the state, except for certain riparian uses. Stormwater and agricultural return flows in the Blanco Drain would be subject to water rights permitting rules. Existing surface water rights were researched to assess potential impacts to current water right holders or challenges to the proposed diversions.

The State Water Resources Control Board Electronic Water Rights Information Management System (eWRIMS) was queried to identify existing water rights in the Lower Salinas Watershed. A listing of all current water rights for Monterey County was obtained using a database query. The Points of Diversion (PODs) within the Lower Salinas watershed and vicinity were identified using the on-line GIS mapping tool. The POD listing was used to create a tailored list of water rights within the area of interest (see Table B-4).

**Figure 2.2: SWRCB eWRIMS Interface**




The SWRCB Water Rights Order 98-08, Declaration of Fully Appropriated Stream Systems in California, identifies those stream segments which cannot support additional authorizations for diversion. Neither the Blanco Drain nor the Lower Salinas River were listed in that decision, so there is no regulatory prohibition on requesting a water right on this stream.

The water rights listing includes several water right types:

- Appropriative, for the diversion and use of surface water.
- Stockpond, for the on-stream impoundment and use of water.

- Statements of Diversion and Use, for reporting riparian use of surface water and for the use of groundwater. Statements of Diversion and Use are also used for claims of pre-1914 appropriative water rights. The limitation of the eWRIMS database is that most Claimed water rights do not appear with a Face Amount the way Appropriative Rights are listed.

There are no surface water rights or claims listed within the Blanco Drain watershed. The existing points of diversion within the Blanco Drain watershed are all for groundwater use. The sources for these are listed as “Salinas River Underflow.” The shallow “A-Aquifer” groundwater in this area is not used due to poor water quality. Wells in this area tap the Pressure subarea of the Salinas Valley Groundwater Basin (SVGB), which is recharged in the Forebay and Upper Valley subareas. Diverting surface water for this project should not affect groundwater yields from the SVGB.

The Blanco Drain is tributary to the Salinas River, just above the SRDF (small blue square on the map above). The MCWRA has three water rights (Permits 10137, 21089 and 12261) for water diversion and storage in San Antonio and Nacimiento Reservoirs, with authorized points of rediversion at the SRDF (see Table B-5). There are no surface water rights with points of diversion below the SRDF. MCWRA has a fourth water right, Permit 11043, for run-of-river flows with two authorized points of diversion upstream of the Blanco Drain. This fourth water right has not been used but has a priority date of July 11, 1949.

# Section 3 - Facility Requirements

## 3.1 Description and Sizing

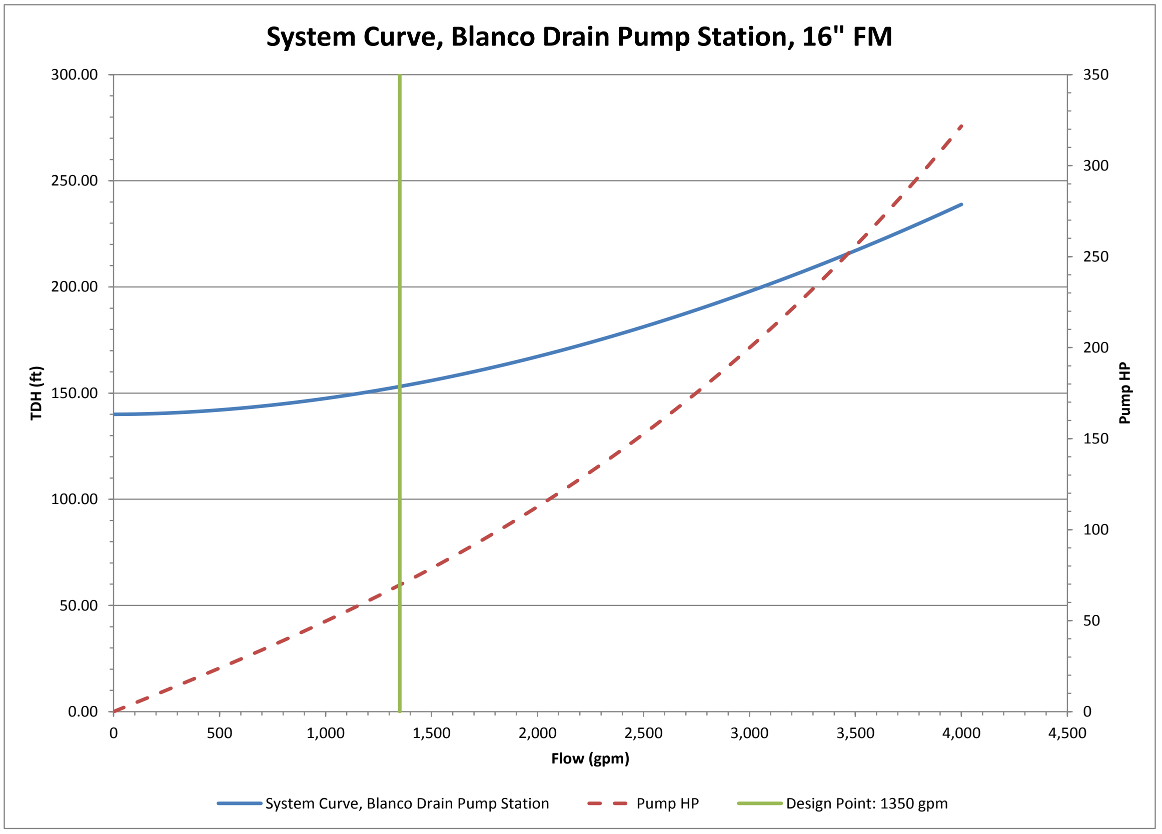
As stated in the Project Description, water supplies for the GWR Project will be conveyed to the RTP using existing excess capacity in the MRWPCA interceptor system. There are no interceptor facilities near the Blanco Drain, so a new pipeline will be required to convey flows to the RTP. There is an existing diversion pump station on the Blanco Drain, used to lift flows from the Drain to the Salinas River while the SRDF rubber dam is inflated. The station consists of a concrete weir with a slide gate, a concrete-box intake structure in the channel bottom, a concrete manhole to house the pumps, a concrete deck above the manhole for the electrical panel and concrete stairs for maintenance operation. As can be seen in the photo below, the current station has a small static lift and a free discharge just below the weir. The plan and profile design drawings are included as Figures C-1 and C-2 in Appendix C.

**Figure 3.1: Existing Blanco Drain Pump Station**

A similar pump station would be required to divert flows for the GWR project. Significantly larger pumps will be needed due to the increased static lift and force main length. The proposed force main is approximately 9,500 LF, from the existing pump station to the head-works side of the RTP (see Figure C-3). A static lift of 140-ft is estimated from the Blanco Drain to the highest point along the force main alignment.

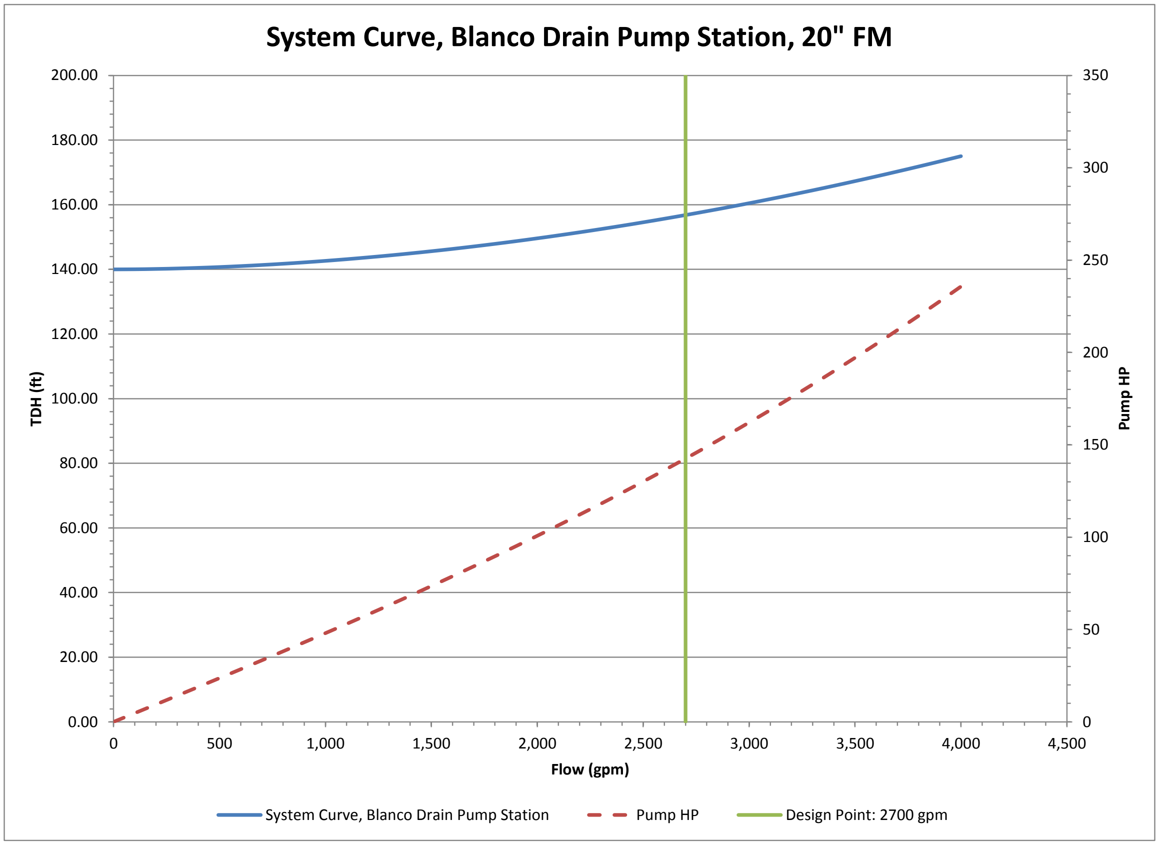
Several flow rates and force main sizes were considered. The force main should be sized for a minimum velocity of 2 ft/s to prevent solids from settling out in the pipeline, and a maximum velocity of 8 ft/s to limit the friction losses. For a 2.99 cfs diversion (nominally 1350 gpm), an 88 hp pump and a 16-in force main are required (see Figure 3.2). For the peak flow rate of 6 cfs (nominally 2700 gpm), a 143 hp pump and a 20-inch force main are required (see Figure 3.3). System head tables are provided in Appendix C.

**Figure 3.2: System Curve for a 16-inch Force Main**




It may be possible to modify the existing pump station to also serve the GWR Project, rather than construct a duplicate pump station next to the existing MCWRA facility. A new wet well may be constructed adjacent to and connected to the existing wet well. This would allow for shared use of the existing inlet structure and pipeline. A second option would be to construct a "mirror" station on the opposite bank, sharing only the inlet box. Either option would use the existing pump station to move excess Blanco Drain flows that exceed the GWR Project diversions into the Salinas River. Conceptual site plan diagrams are provided as Figures C-4 and C-5 in Appendix C.

**Figure 3.3: System Curve for a 20-inch Force Main**




The inlet structure consists of a concrete box with a screened inlet. The inlet must be sized to allow full flow through the screen with a maximum velocity of 1 ft/s to allow fish to escape. Assume the screen has an open area of 50%, and that 50% of the screen is blinded by trash/vegetation. For a maximum flow of 6 cfs:

$A_{screen}$ = 6 cfs / [(1 ft/s) x (50% screen openings) x (50% blinded)] = 24 sq-ft

Minimum dimensions: 4-ft wide x 6-ft long

The existing inlet box is 8-ft x 8-ft, so it exceeds the required minimum.

The channel invert surrounding the intake should be concrete lined to prevent scour during high flow periods. Similarly, the channel banks above the inlet structure should be protected with grouted rip-rap to prevent scour and potential bank sloughing into the inlet. As can be seen in Figure 3.1, the channel bank at the existing pump station is experiencing some erosion within the first year of operation.

The inlet will connect to the wet well through a large diameter pipe, sloped towards the wet well. A new wet well may be connected to the northwest side of the existing wet well (opposite the inlet pipe). The new wet well would be an 8-ft diameter manhole, with mounting rails to facilitate the installation and removal of the submersible pumps. Within the wet well, the pumps will be set below the inlet pipe elevation. The pump operation may be controlled by a pressure transducer in the wet well, with float switches for backup control and alarms. Because the system will be discharging to the RTP head works, a SCADA radio connection to the MRWPCA controls system is recommended so that this station may be shut down to facilitate maintenance at the RTP.

The force main to the RTP must be pressure pipe (typically HDPE, PVC or ductile iron), with a check valve and isolation valve located outside the wet well in a separate vault. The pipeline should be installed with a minimum of 4-ft of cover in the pipe trench. The segment crossing the Salinas River must be installed using trenchless methods. Directional drilling is the most likely method, but the RWQCB may prescribe a different method for the river crossing. The CSIP supply pipeline crosses the river near the SRDF facility. This crossing should be made upstream of the SRDF to avoid potential conflicts.

The pumps may operate at fixed speed or under variable speed control. Operation under fixed speed is simpler to design, but may require excessive cycling if the inflow rates are significantly lower than the pump design point. Variable speed control will allow the pumps to start and stop less frequently.

The proposed pump station is located in a FEMA floodway (Salinas River Overbank). The proposed submersible pumps will not be affected by storm inundation, but the power and control equipment must be elevated above the base flood elevation of 27-ft[4].

The Blanco Drain is within a 40-ft wide parcel, owned by Monterey County. As can be seen on the existing facility drawing, that parcel does not reach to the top of the existing bank. An easement with the adjacent property owner was required for the existing pump station, and an additional easement must be obtained for a GWR pump station and force main.

Construction of the pump station will require regulatory permits from many agencies, including the Army Corps of Engineers (Clean Water Act, Section 404), the CC RWQCB (Clean Water Act, Section 401) and the California Department of Fish and Wildlife. The National Marine Fisheries Service may be required to prepare a Biological Opinion as well.

[4] FEMA Flood Insurance Rate Map, Map Panels 06053C0205G and 06053C0185G, April 2009 (see Appendix A)

### 3.2 Costs

Capital costs were estimated for two pump station configurations, a 3 cfs station with a 16-inch force main, and a 6 cfs station with a 20-inch force main, summarized in Table 3-1, below. The cost of constructing the force main from the pump station to the MRWPCA RTP is just over half of the total capital cost. Detailed estimates are provided in Tables C-3 and C-4 in Appendix C. Non-construction costs (design, permitting, legal, etc.) were estimated as 40% of the construction cost.

Right-of-way acquisition costs were not included in the capital cost estimates. Easements across private property must be negotiated with landowners. The affected agricultural lands are typically in active cultivation during the construction season, so a premium cost should be anticipated.

**Table 3-1: Estimated Capital Costs**

| | 3 cfs Pump Station | 6 cfs Pump Station |
|---|---|---|
| Estimated Construction Cost | $1,789,420 | $2,280,420 |
| Inspection and Testing (15%) | $268,000 | $342,000 |
| Construction Contingency (20%) | $358,000 | $456,000 |
| Estimated Total Construction Cost | $2,415,000 | $3,078,000 |
| | | |
| Design, Permitting, Legal (40%) | $966,000 | $1,232,000 |

Costs are in 1st Quarter 2014 dollars

The MRWPCA has standard capacity charges for connection to the regional wastewater system, based upon the flow rate, the biological oxygen demand (BOD) and the suspended solids concentration, and monthly charges for wastewater treatment. These fees are not included in this estimate, because the MRWPCA is a sponsor of the GWR Project. The primary, secondary and advanced treatment costs for this source of supply will appear in the overall project cost analysis.

Annual operating and debt service costs for each configuration were estimated using the following planning factors:

- Debt service assumes a 30-year bond at 4% annual interest
- Annual operation and maintenance of pump stations is estimated at 2.5% of the capital cost
- Annual operation and maintenance of pipelines is estimated at 1% of the capital cost
- Electrical power cost is assumed at $0.16 per kWh
- Assume the station operates 365 days a year

The factors above provide an order-of-magnitude estimate of annual costs, which may be used in comparing project configurations. The estimated annual costs are provided below.

**Table 3-2: Estimated Annual Costs, 3 cfs Pump Station**

| Category | Basis | Annual $ |
|---|---|---|
| **Capital Repayment** | | |
| Assume 30-year bond at 4% | $2,415,000.00 | $139,659.69 |
| **Annual Operation and Maintenance** | | |
| Assume 2.5% of Pump Station Capital Cost | $795,000.00 | $19,875.00 |
| Assume 1.0% of Pipeline Capital Cost | $1,620,000.00 | $40,500.00 |
| **Electrical Power** | | |
| Number of operating days/year | 365 | |
| Pumps: 88 HP (0.7457 kW/hp) | 65.6 | |
| Estimated annual kWh | 574,845 | |
| Assumed cost per KWH | $0.16 | $91,975.23 |
| **Total Estimated Annual Cost** | | **$292,000.00** |

**Table 3-3: Estimated Annual Costs, 6 cfs Pump Station**

| Category | Basis | Annual $ |
|---|---|---|
| **Capital Repayment** | | |
| Assume 30-year bond at 4% | $3,078,000.00 | $178,001.05 |
| **Annual Operation and Maintenance** | | |
| Assume 2.5% of Pump Station Capital Cost | $1,093,500.00 | $27,337.50 |
| Assume 1.0% of Pipeline Capital Cost | $1,984,500.00 | $49,612.50 |
| **Electrical Power** | | |
| Number of operating days/year | 365 | |
| Pumps: 143 HP (0.7457 kW/hp) | 106.6 | |
| Estimated annual kWh | 934,123 | |
| Assumed cost per KWH | $0.16 | $149,459.76 |
| **Total Estimated Annual Cost** | | **$404,400.00** |

# Section 4 - Water Quality

## 4.1 Summary of Current Condition

The Central Coast Regional Water Quality Control Board (CCRWQCB) Water Quality Control Plan for the Central Coast Basin (Basin Plan) designated beneficial uses of the Blanco Drain as including water contact recreation, non-contact water recreation, wildlife habitat, warm water fish habitat and commercial or sport fishing. These are the minimum uses listed for all inland water bodies within the region, unless specific water quality information caused the RWQCB to remove a specific use (e.g., not listing water contact recreation for a stream segment listed for fecal coliform contamination).

The Blanco Drain is listed as an impaired water body pursuant to Section 303(d) of the Clean Water Act for pesticides, nitrate and low dissolved oxygen. Water quality has been sampled and monitored for the past 15 years under various programs, including the Central Coast Ambient Monitoring Program (CCAMP) under the RWQCB, the Central Coast Watershed Studies (CCoWS) program of the Watershed Institute at California State University Monterey Bay, and the Cooperative Monitoring Program under the Conditional Waiver of Waste Discharges from Irrigated Lands (Ag Waiver). The results of these programs have been consolidated in Table B-6, Stream Water Quality, for the Blanco Drain and all downstream inland water bodies. Figure A-6 shows the primary sampling locations.

The Blanco Drain is not designated for use as municipal or domestic water supply, so Total Maximum Daily Loads (TMDL) for pollutants had to be established by the RWQCB. The Central Coast RWQCB adopted order R3-2013-0008 to establish certain TMDLs for the lower Salinas River Basin in 2013. These and other applicable water quality standards are consolidated in Table B-6, Total Maximum Daily Loads. A summary of the key parameters for the Blanco Drain are shown in Table 4-1, below.

**Table 4-1: Water Quality Parameters, Blanco Drain above Salinas River**

| Parameter | Units | Mean | Max | Standard |
|---|---|---|---|---|
| Ammonia as N, Unionized | mg/L | 0.014 | 0.26 | 0.025 |
| Ammonia as NH3 | mg/L | 0.20 | 4.96 | 0.025 |
| Chlorophyll a, water column | mg/L | 0.0021 | 0.028 | 0.015 |
| Chlorpyrifos | mg/L | 0.0009 | 0.018 | 0.00025 |
| Diazinon | mg/L | 0.01 | 0.17 | 0.00016 |
| Dissolved Solids, Total | mg/L | 2,019 | 2,250 | 1,000 |
| Nitrate as N | mg/L | 65.27 | 325.00 | 8.0 |
| OrthoPhosphate as P | mg/L | 0.85 | 4.40 | 0.3 |
| Oxygen, Dissolved | mg/L | 0.20 | 2.52 | > 5.0 |
| Turbidity | NTU | 66.48 | 1,210.00 | 10 |

### 4.2 Potential Pollutant Removal

In the Biological Opinion for the SRDF Project, NMFS recommended diverting the Blanco Drain flows to the RTP as a means of improving the habitat in the Salinas River Lagoon. Removing water from the drain will carry dissolved pollutants out of the environment along with the water. The quantity removed may be estimated using the conversion factor 1 mg/L = 2.7 lb/AF. The tables below show the estimated annual pollutant removal, assuming average annual flow conditions and historic average pollutant concentrations for two conditions: a 6 cfs pumping capacity and a 3 cfs pumping capacity.

**Table 4-2: Estimated Pollutant Removal at Blanco Drain, 6 cfs capacity**

| Pollutant | Average Conc. | Average Annual Flow | Average Pollutant Load | Diverted Flow | Diverted Pollutant Load |
|---|---|---|---|---|---|
| | (mg/L) | (AFY) | (lb/yr) | (AFY) | (lb/yr) |
| Ammonia as N, Unionized | 0.014 | 2,620 | 98 | 2,620 | 98 |
| Ammonia as NH3 | 0.20 | 2,620 | 1,432 | 2,620 | 1,432 |
| Chlorophyll a, water column | 0.0021 | 2,620 | 15 | 2,620 | 15 |
| Chlorpyrifos | 0.00085 | 2,620 | 6 | 2,620 | 6 |
| Diazinon | 0.011 | 2,620 | 76 | 2,620 | 76 |
| Dissolved Solids, Total | 2019.7 | 2,620 | 14,287,358 | 2,620 | 14,287,358 |
| Nitrate as N | 65.27 | 2,620 | 461,726 | 2,620 | 461,726 |
| OrthoPhosphate as P | 0.85 | 2,620 | 6,026 | 2,620 | 6,026 |

**Table 4-3: Estimated Pollutant Removal at Blanco Drain, 3 cfs capacity**

| Pollutant | Average Conc. | Average Annual Flow | Average Pollutant Load | Diverted Flow | Diverted Pollutant Load |
|---|---|---|---|---|---|
| | (mg/L) | (AFY) | (lb/yr) | (AFY) | (lb/yr) |
| Ammonia as N, Unionized | 0.014 | 2,620 | 98 | 2,110 | 79 |
| Ammonia as NH3 | 0.20 | 2,620 | 1,432 | 2,110 | 1,153 |
| Chlorophyll a, water column | 0.0021 | 2,620 | 15 | 2,110 | 12 |
| Chlorpyrifos | 0.00085 | 2,620 | 6 | 2,110 | 5 |
| Diazinon | 0.011 | 2,620 | 76 | 2,110 | 61 |
| Dissolved Solids, Total | 2019.7 | 2,620 | 14,287,358 | 2,110 | 11,506,231 |
| Nitrate as N | 65.27 | 2,620 | 461,726 | 2,110 | 371,848 |
| OrthoPhosphate as P | 0.85 | 2,620 | 6,026 | 2,110 | 4,853 |

# Section 5 - Hydrology Considerations

The California Environmental Quality Act (CEQA) requires that effects of the Proposed Project on surface water hydrology be analyzed to identify impacts in the following areas:

a. Would the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on- or off-site?

The Blanco Drain diversion would capture some stormwater which currently flows to the Salinas River. Reducing runoff from the Blanco Drain would reduce the amount of sediment carried into the main stem of the Salinas River. The channel around the inlet structure for the diversion pump station would be lined with concrete to prevent local scour and erosion. The Blanco Drain diversion may not be required to operate during wet winter months when storm runoff typically occurs. In that case, the conveyance of sediment from the Blanco Drain into the River will be no greater than under the current condition.

The construction of the Blanco Drain diversion structure and pipeline will require open-cut excavation, which will require the use of erosion and sediment controls to prevent the migration of sediments into the river. The pipeline crossing of the river will be installed using trenchless methods to avoid impacts to the channel. The pipeline trench will be restored to prevent erosion, either by reseeding (if outside a roadway) or by resurfacing if in a trafficked area.

b. Would the project substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site?

The Project would not make physical changes to the Salinas River, and the changes at the Blanco Drain diversion will not alter the channel cross-section. The operation of the Project would reduce the amount of surface runoff entering the river. The proposed project components would increase impervious areas by less than 1000 square feet each at the diversion pump station. The Project would not substantially alter the existing drainage patterns of any of the proposed project sites of the area.

c. Would the project create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff?

The Project would add a new pump station on the bank of the Blanco Drain. Up to 1,000 square-feet of impervious surface may be added, and runoff from the new hardscape would be directed to the existing drainage channel. The soils in this area is Type C (runoff coefficient >80), so the increase in runoff will be small and within the available existing drainage system conveyance capacity. No impact is expected under this criterion

d. Would the project place within a 100-year flood hazard area structures that would impede or redirect flood flows?

The Project would add a diversion pump station on the Blanco Drain adjacent to an existing pump station which would be located within a 100-year flood hazard area. The proposed Blanco Drain pump station intake would be located at the channel bottom, and would be configured to not alter the conveyance capacity of the Blanco Drain. The pump station would not impede or reduce flood flows because they are low profile, small (less than 500 square-feet of vertical structures) and would be located at sites that currently contain similar above-ground structures of similar size and profile.

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## Appendix A: Figures

Figure A-1: Storm Maintenance District No. 2, Blanco Drain
Figure A-2: Salinas Valley Groundwater Basin, Hydrologic Subareas
Figure A-3: Castroville Seawater Intrusion Project Service Area
Figure A-4: FEMA FIRMette, Blanco Drain Pump Station
Figure A-5: FEMA FIRMette, Blanco Drain Force Main
Figure A-6: CCAMP/CMP Water Sampling Sites

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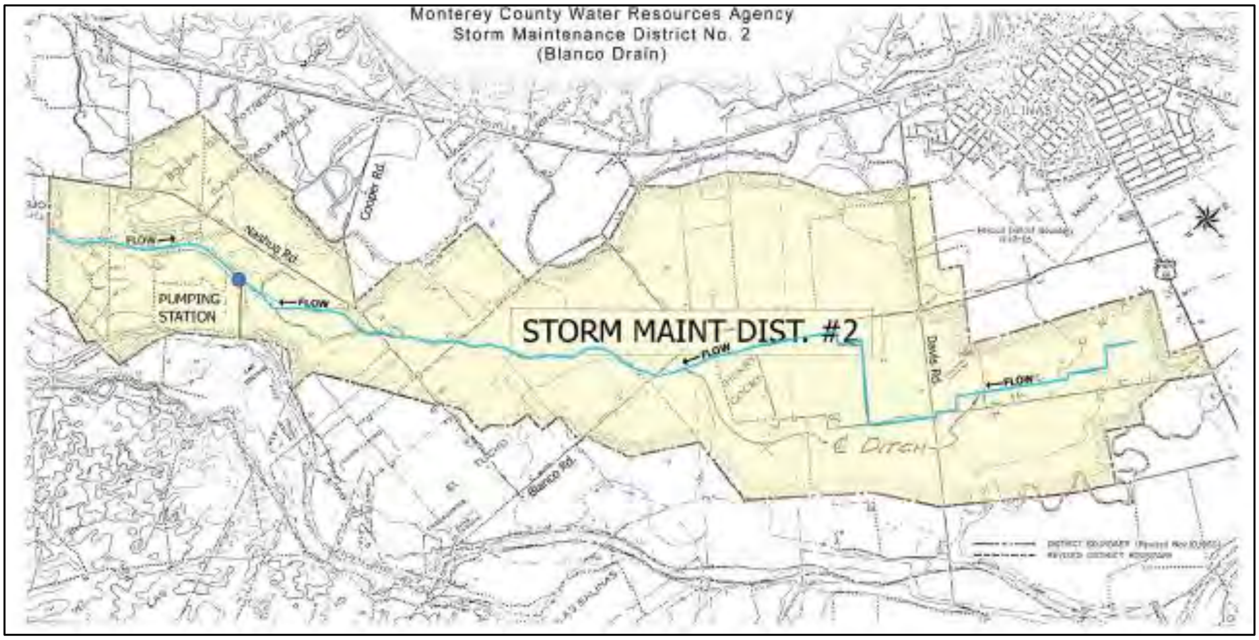


**Figure A-1: Storm Drain Maintenance District No. 2, Blanco Drain**

Source: Monterey County Water Resources Agency

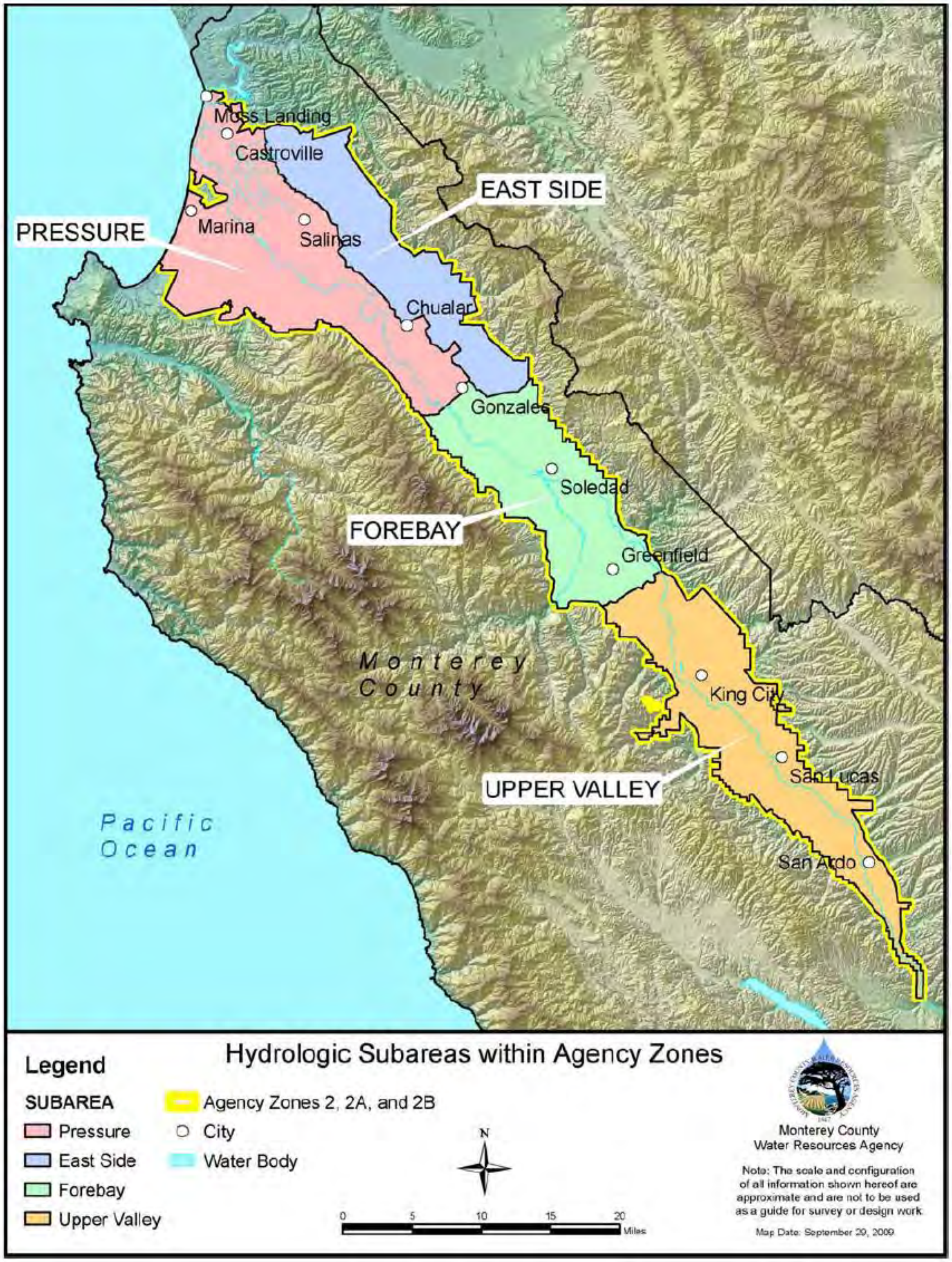


**Figure A-2: Salinas Valley Groundwater Basin, Hydrologic Subareas**

Source: MCWRA Annual Groundwater Report

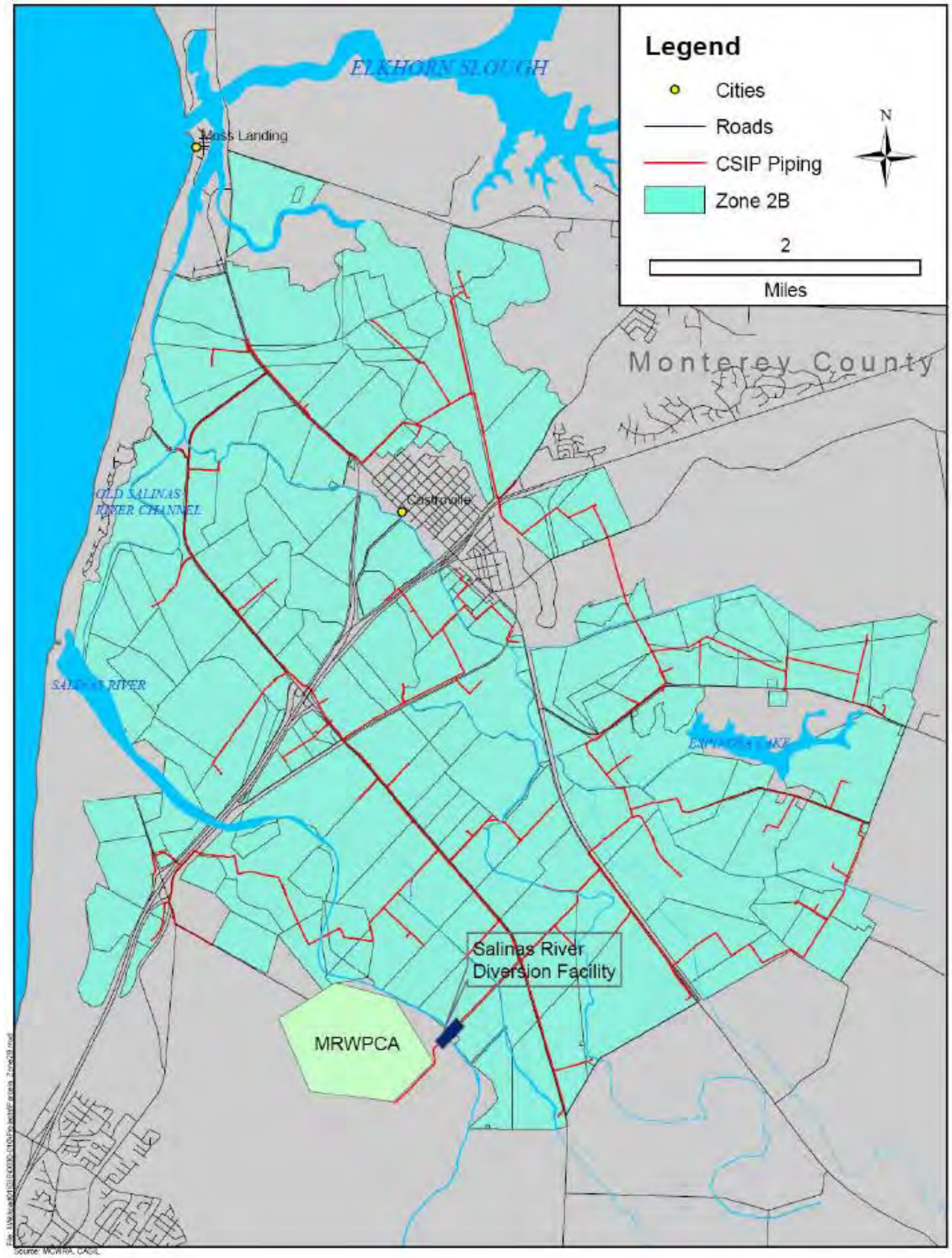


**Figure A-3: Castroville Seawater Intrusion Project Service Area**

Source: Zone 2B, Proposition 218 Engineers Report, RMC Water and Environment, 2007

Figure A-4: FEMA FIRMette, Blanco Drain Pump Station

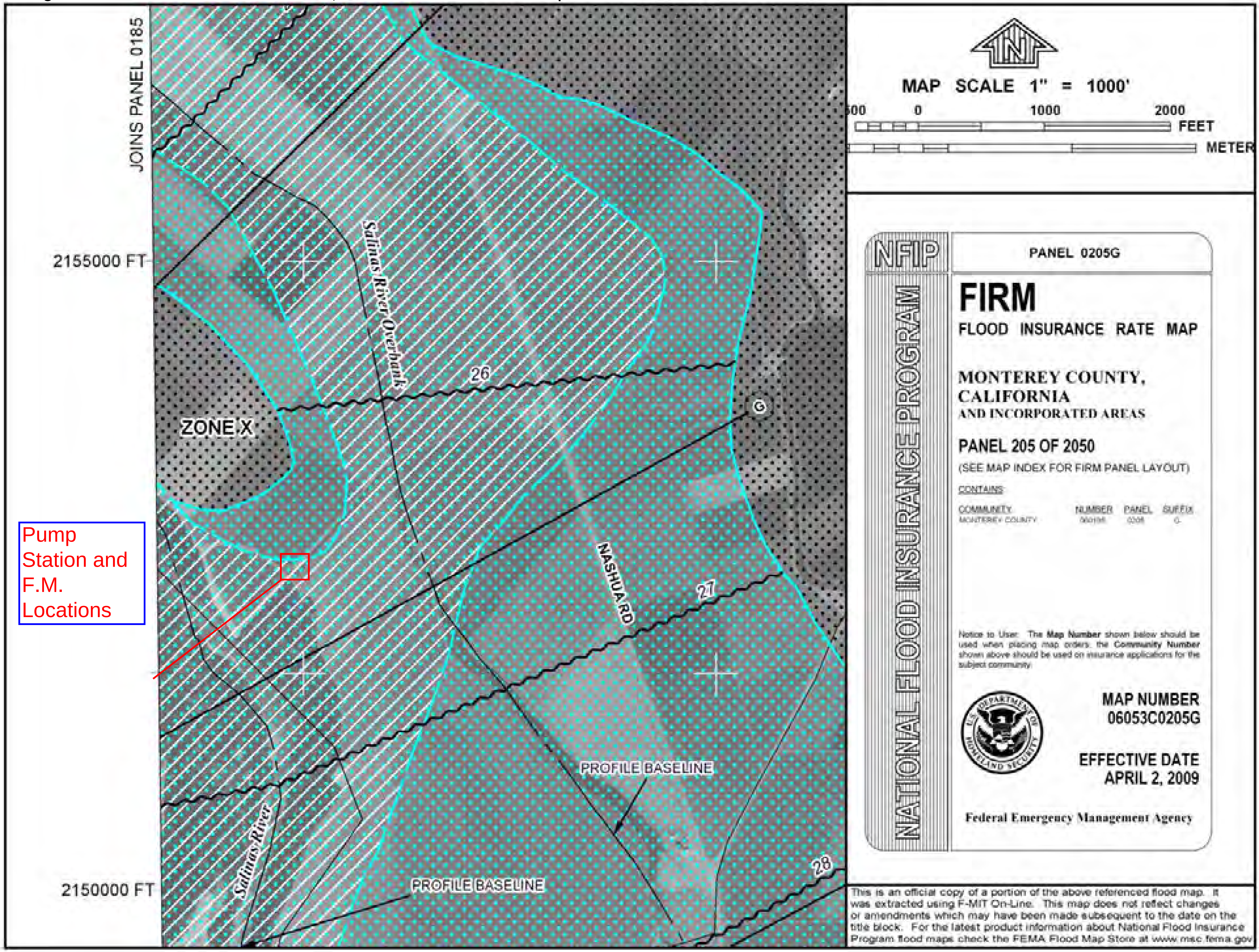

Figure A-5: FEMA FIRMETTE, Blanco Drain Force Main

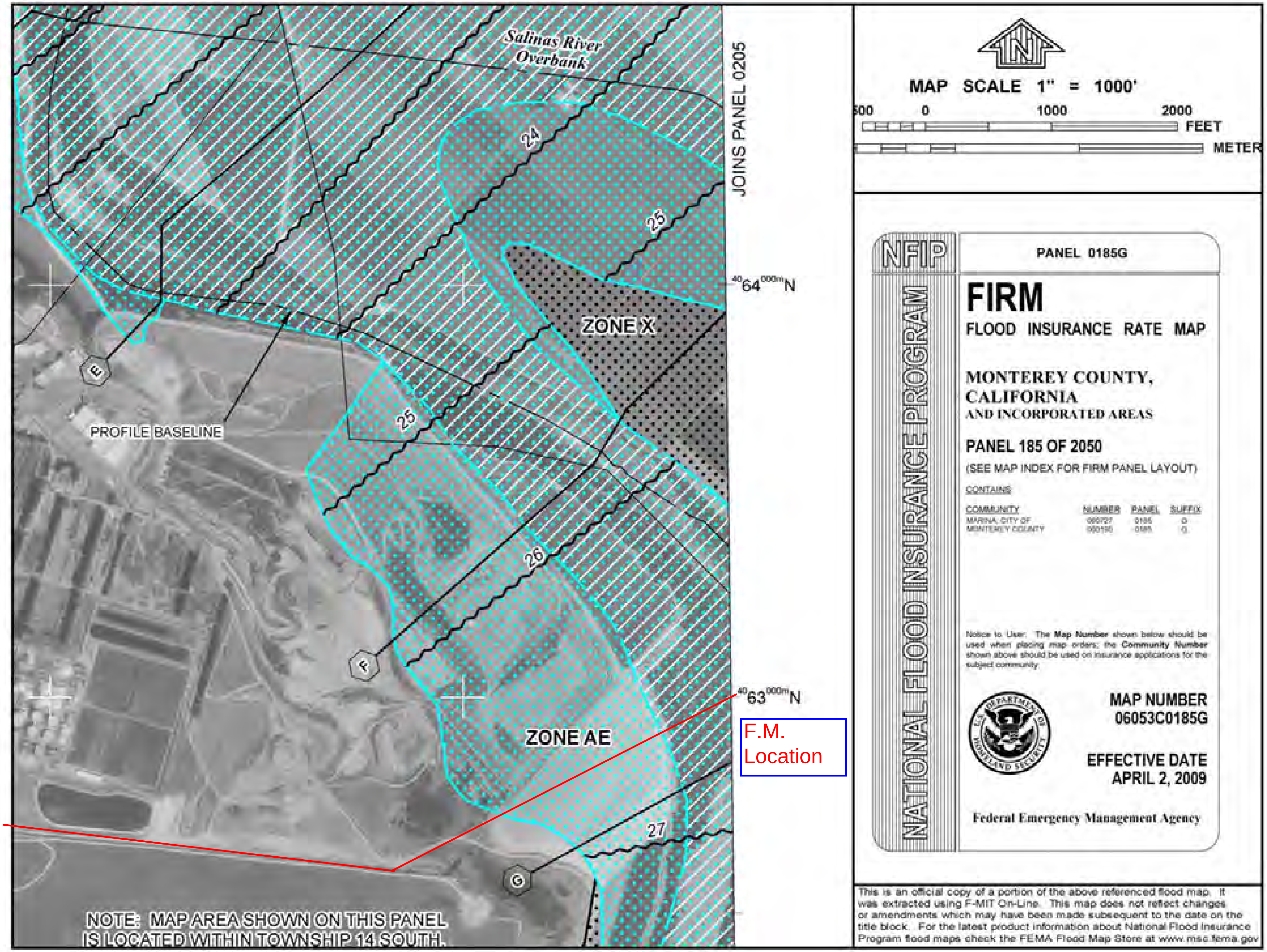

Figure A-5 (continued)

## Definitions of FEMA Flood Zones

Flood zones are geographic areas that FEMA has defined according to varying levels of flood risk and type of flooding. These zones are depicted on the published Flood Insurance Rate Map (FIRM) or Flood Hazard Boundary Map (FHBM).

## Special Flood Hazard Areas – High Risk

Special Flood Hazard Areas represent the area subject to inundation by 1-percent-annual chance flood. Structures located within the SFHA have a 26-percent chance of flooding during the life of a standard 30-year mortgage. Federal floodplain management regulations and mandatory flood insurance purchase requirements apply in these zones.

| ZONE | DESCRIPTION |
|---|---|
| **A** | Areas subject to inundation by the 1-percent-annual-chance flood event. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown. |
| **AE, A1-A30** | Areas subject to inundation by the 1-percent-annual-chance flood event determined by detailed methods. BFEs are shown within these zones. (Zone AE is used on new and revised maps in place of Zones A1–A30.) |
| **AH** | Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are 1–3 feet. BFEs derived from detailed hydraulic analyses are shown in this zone. |
| **AO** | Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are 1–3 feet. Average flood depths derived from detailed hydraulic analyses are shown within this zone. |
| **AR** | Areas that result from the decertification of a previously accredited flood protection system that is determined to be in the process of being restored to provide base flood protection. |
| **A99** | Areas subject to inundation by the 1-percent-annual-chance flood event, but which will ultimately be protected upon completion of an under-construction Federal flood protection system. These are areas of special flood hazard where enough progress has been made on the construction of a protection system, such as dikes, dams, and levees, to consider it complete for insurance rating purposes. Zone A99 may be used only when the flood protection system has reached specified statutory progress toward completion. No BFEs or flood depths are shown. |

Figure A-5 (continued)

## Coastal High Hazard Areas – High Risk

Coastal High Hazard Areas (CHHA) represent the area subject to inundation by 1-percent-annual chance flood, extending from offshore to the inland limit of a primary front al dune along an open coast and any other area subject to high velocity wave action from storms or seismic sources. Structures located within the CHHA have a 26-percent chance of flooding during the life of a standard 30-year mortgage. Federal floodplain management regulations and mandatory purchase requirements apply in these zones.

| ZONE | DESCRIPTION |
|---|---|
| **V** | Areas along coasts subject to inundation by the 1-percent-annual-chance flood event with additional hazards associated with storm-induced waves. Because detailed coastal analyses have not been performed, no BFEs or flood depths are shown. |
| **VE, V1-V30** | Areas along coasts subject to inundation by the 1-percent-annual-chance flood event with additional hazards due to storm-induced velocity wave action. BFEs derived from detailed hydraulic coastal analyses are shown within these zones. (Zone VE is used on new and revised maps in place of Zones V1–V30.) |

## Moderate and Minimal Risk Areas

Areas of moderate or minimal hazard are studied based upon the principal source of flood in the area. However, buildings in these zones could be flooded by severe, concentrated rainfall coupled with inadequate local drainage systems. Local stormwater drainage systems are not normally considered in a community's flood insurance study. The failure of a local drainage system can create areas of high flood risk within these zones. Flood insurance is available in participating communities, but is not required by regulation in these zones. Nearly 25-percent of all flood claims filed are for structures located within these zones.

| ZONE | DESCRIPTION |
|---|---|
| **B, X (shaded)** | Moderate risk areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-annual-chance flood by a levee. No BFEs or base flood depths are shown within these zones. (Zone X (shaded) is used on new and revised maps in place of Zone B.) |
| **C, X (unshaded)** | Minimal risk areas outside the 1-percent and .2-percent-annual-chance floodplains. No BFEs or base flood depths are shown within these zones. (Zone X (unshaded) is used on new and revised maps in place of Zone C.) |

## Undetermined Risk Areas

| ZONE | DESCRIPTION |
|---|---|
| **D** | Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities. |


| # | Site ID | Site Name |
|---|---|---|
| 1 | 306MOR | Moro Cojo Slough @ Highway 1 |
| 2 | 309OLD | Old Salinas River @ Monterey Dunes Way |
| 3 | 309TEH | Tembladero Slough @ Haro |
| 4 | 309MER | Merrit Ditch u/s of 183 |
| 5 | 309ESP | Espinosa Slough u/s of Alisal Slough |
| 6 | 309ASB | Alisal Slough @ White Barn |
| 7 | 309BLA | Lower Salinas River/Blanco? |
| 8 | 309JON | Lower Salinas River |
| 9 | 309GAB | Gabilan Creek @ Independence Road and East Boranda Road |
| 10 | 309NAT | Natividad Creek? |
| 11 | 309ALG | Alisal Creek? |
| 12 | 309SSP | Salinas River @ El Toro Creek |
| 13 | 309QUI | Quail Creek |
| 14 | 309SAC | Salinas River @ Chualar bridge on River Road |
| 15 | 309CRR | Chualar Creek |
| 36 | 309GRN | Salinas River @ Elm Rd in Greenfield |
| 37 | 309SAG | Salinas River @ Gonzales River Rd Bridge |

**Figure A-6: CCAMP/CMP Water Sampling Sites**

Source: Central Coast Region Conditional Waiver Cooperative Monitoring Program, 5 Year Evaluation Report, Larry Walker & Associates, 2010

**Appendix B: Tables**

Table B-1: 2010 California 303(d) Listing
Table B-2: Blanco Drain Flows as Return Flows
Table B-3: Applied Irrigation and Recorded Precipitation in the CSIP Service Area
Table B-4: Water Rights Database GIS Capture, PODs near Salinas
Table B-5: Surface Water Rights and Claims in the Salinas River below Spreckels
Table B-6: Stream Water Quality, Blanco Drain to Potrero Road
Table B-7: Total Maximum Daily Loads

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**Table B-1: 2010 California 303(d) Listing**

| **Listed for:** | Ammonia (Unionized) | Chlordane | Chloride | Chlorophyll-a | Chlorpyrifos | Copper | DDD (Dichlorodiphenyldichloroethane) | Diazinon | Dieldrin | Electrical Conductivity | Enterococcus | Escherichia coli (E. coli) | Fecal Coliform | Low Dissolved Oxygen | Nickel | Nitrate | Nutrients | Pathogens | PCBs (Polychlorinated biphenyls) | Pesticides | pH | Priority Organics | Sediment Toxicity | Sedimentation/Siltation | Sodium | Temperature, water | Total Coliform | Total Dissolved Solids | Toxaphene | Turbidity | Unknown Toxicity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Water Body** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Alisal Creek (Monterey County) | | | | X | | | | | | | | | X | | | X | | | | | | | | | X | | | | | | |
| Alisal Slough (Monterey County) | | | | | | | | | | | | | | X | | X | | | | | | | X | | | | | | | | X |
| **Blanco Drain** | | | | | **X** | | | **X** | | | | | | **X** | | **X** | | | | **X** | | | | | | | | | | **X** | |
| Espinosa Lake | | | | | X | | | X | | | | | | | | | | | | | | | | | | | | | | | |
| Espinosa Slough | X | | | | | | | X | | | | | | | | X | | | | X | X | X | X | | | | | | | X | X |
| Gabilan Creek | X | | | | | | | | | | | | X | | | X | | | | | X | | X | | | | | | | X | X |
| Merrit Ditch | X | | | | | | | | | | | | | X | | X | | | | | | | X | | | | | | | X | X |
| Moss Landing Harbor | | | | | X | | | X | | | | | | X | X | | | X | | X | X | | X | X | | | | | | | |
| Natividad Creek | X | | | | | | | | | | | X | | X | | X | | | | | X | | X | | | X | | | | X | X |
| Old Salinas River | | | | X | X | | | X | | | | X | X | X | | X | | | | | X | | X | | | | | | | X | X |
| Old Salinas River Estuary | | | | | | | | | | | | | | | | | X | | | X | | | | | | | | | | | |
| Salinas Reclamation Canal | X | | | | X | X | | X | | | | X | X | X | | X | | | | X | X | X | X | | | | | | | X | X |
| Salinas River (lower, estuary to near Gonzales Rd crossing, watersheds 30910 and 30920) | | X | X | | X | | X | X | X | X | X | X | X | | | X | | | X | X | X | | | | X | | | X | X | X | X |
| Salinas River Lagoon (North) | | | | | | | | | | | | | | | | | X | | | X | | | | | | | | | | | |
| Santa Rita Creek (Monterey County) | X | | | | | | | | | | | X | X | X | | X | | | | | | | | | X | | | | | X | |
| Tembladero Slough | | | | X | X | | | X | | | X | X | X | | | X | X | | | X | X | | X | | | | X | | | X | X |

**Table B-2: Blanco Drain Flows as Return Flows, Revised August 2015**

| Mo-Yr | Jun-07 | Jul-07 | Aug-07 | Sep-07 | Oct-07 | | Jul-10 | Aug-10 | Sep-10 | | May-11 | Jun-11 | Jul-11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CSIP-Wells (AF) | 1,523 | 1,517 | 1,115 | 380 | 125 | | 267 | 272 | 191 | | 284 | 428 | 316 |
| SRDF-River (AF) | 0 | 0 | 0 | 0 | 0 | | 1,035 | 968 | 478 | | 593 | 1,020 | 1,145 |
| SVRP-Recycled (AF) | 1,874 | 1,957 | 1,927 | 1,616 | 1,129 | | 1,889 | 1,902 | 1,821 | | 1,694 | 1,713 | 1,869 |
| Total Irrig (AF) | 3,397 | 3,474 | 3,042 | 1,996 | 1,254 | | 3,191 | 3,142 | 2,490 | | 2,571 | 3,161 | 3,330 |
| Precip (in) | 0.0 | 0.0 | 0.0 | 0.4 | 1.1 | | 0.0 | 0.0 | 0.0 | | 0.7 | 0.3 | 0.0 |
| Precip (AF) | 0 | 0 | 0 | 400 | 1100 | | 0 | 0 | 0 | | 700 | 300 | 0 |
| Total (AF) | 3,397 | 3,474 | 3,042 | 2,396 | 2,354 | | 3,191 | 3,142 | 2,490 | | 3,271 | 3,461 | 3,330 |
| | | | | | | | | | | | | | |
| Scale to 6,000 ac | 1698.5 | 1737 | 1521 | 1198 | 1177 | | 1595.5 | 1571 | 1245 | | 1635.5 | 1730.5 | 1665 |
| | | | | | | | | | | | | | |
| Measured Flow (see note) | 114.2 | 312.2 | 229.2 | 178.7 | 72.1 | | 106.8 | 355.1 | 225.9 | | 362.8 | 363 | 319.7 |
| Net Loss | 1584.3 | 1424.8 | 1291.8 | 1019.3 | 1104.9 | | 1488.7 | 1215.9 | 1019.1 | | 1272.7 | 1367.5 | 1345.3 |
| Percent Return | 6.7% | 18.0% | 15.1% | 14.9% | 6.1% | | 6.7% | 22.6% | 18.1% | | 22.2% | 21.0% | 19.2% |

Notes:

CSIP/SRDF/SVRP data from MCWRA

CSIP Service area approx 12,000 acres

Blanco Drain area approx 6,000 acres

Rainfall measured at Salinas Airport gage

Measured flow from weir (2007) and Blanco Drain pump station (2010-2012)

April and October are omitted from summary (partial month data)

Recorded Blanco Drain Flows

| | AVG % | AVG Q |
|---|---|---|
| May | 23.5% | 247.5 |
| June | 16.1% | 266.9 |
| July | 16.2% | 264.7 |
| August | 20.1% | 289.5 |
| Sept. | 17.9% | 208.0 |

Statistics for all available data

| | AVG | MAX | MIN |
|---|---|---|---|
| Loss (AF) | 1182 | 1924 | 604 |
| Pct Return | 16.8% | 24.7% | 1.4% |

Revision note: Measured flows at Blanco Drain for year 2012 updated per May 2014 revision to "SVWP Annual Flow Monitoring Report WY2012"

**Table B-2 (continued)**

| Aug-11 | Sep-11 | | Apr-12 | May-12 | Jun-12 | Jul-12 | Aug-12 | Sep-12 | Oct-12 | Nov-12 | | Aug-13 | Sep-13 | Oct-13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 568 | 419 | | 80 | 125 | 276 | 214 | 311 | 135 | 16 | 72 | | 263 | 248 | 165 |
| 709 | 0 | | 0 | 618 | 906 | 992 | 799 | 314 | 65 | 0 | | 220 | 537 | 133 |
| 1,873 | 1,617 | | 1,044 | 1,745 | 1,764 | 1,834 | 1,847 | 1,734 | 1,168 | 731 | | 1803 | 1725 | 1548 |
| 3,150 | 2,036 | | 1,124 | 2,488 | 2,946 | 3,040 | 2,957 | 2,183 | 1,249 | 803 | | 2,286 | 2,510 | 1,846 |
| 0.0 | 0.0 | | 1.9 | 0.1 | 0.2 | 0.0 | 0.0 | 0.0 | 0.2 | 3.1 | | 0 | 0.1 | 0.2 |
| 0 | 0 | | 1900 | 100 | 200 | 0 | 0 | 0 | 200 | 3100 | | 0 | 100 | 200 |
| 3,150 | 2,036 | | 3,024 | 2,588 | 3,146 | 3,040 | 2,957 | 2,183 | 1,449 | 3,903 | | 2,286 | 2,610 | 2,046 |
| | | | | | | | | | | | | | | |
| 1575 | 1018 | | 1512 | 1294 | 1573 | 1520 | 1478.5 | 1091.5 | 724.5 | 1951.5 | | 1143 | 1305 | 1023 |
| | | | | | | | | | | | | | | |
| 301.3 | 226.1 | | 269.2 | 319.9 | 323.5 | 320.0 | 280.8 | 206.5 | 120.3 | 27.4 | | 281.2 | 202.9 | 107.5 |
| 1273.7 | 791.9 | | 1242.85 | 974.07 | 1249.55 | 1200.04 | 1197.71 | 885.02 | 604.22 | 1924.06 | | 861.9 | 1102.1 | 915.5 |
| 19.1% | 22.2% | | 17.8% | 24.7% | 20.6% | 21.1% | 19.0% | 18.9% | 16.6% | 1.4% | | 24.6% | 15.5% | 10.5% |

## Table B-3: Applied Irrigation and Recorded Rainfall within the CSIP Service Area (Acre Feet)

MCWRA & NOAA DATA

| Source | FY 98-99 | FY 99-00 | FY 00-01 | FY 01-02 | FY 02-03 | FY 03-04 | FY 04-05 | FY 05-06 | FY 06-07 | FY 07-08 | FY 08-09 | FY 09-10 | FY 10-11 | FY 11-12 | FY 12-13 | FY 12-13 | | Scale to 6000 ac | 17% return |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Jul-98** | **Jul-99** | **Jul-00** | **Jul-01** | **Jul-02** | **Jul-03** | **Jul-04** | **Jul-05** | **Jul-06** | **Jul-07** | **Jul-08** | **Jul-09** | **Jul-10** | **Jul-11** | **Jul-12** | **Jul-13** | | | |
| **CSIP-Wells** | 772 | 1,318 | 1,234 | 1,535 | 1,363 | 1,821 | 1,565 | 1,507 | 1,424 | 1,517 | 1,590 | 1,699 | 267 | 316 | 214 | 98 | | | |
| **SRDF-River** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,035 | 1,145 | 992 | 1,260 | | | |
| **SVRP-Recycled** | 1,114 | 1,870 | 1,886 | 1,879 | 1,900 | 1,898 | 1,957 | 1,906 | 1,931 | 1,957 | 1,943 | 1,837 | 1,889 | 1,869 | 1,834 | 1,786 | | | |
| **Precip (in)** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | AVG | | |
| **Total Irrig (AF)** | 1,886 | 3,188 | 3,120 | 3,414 | 3,263 | 3,719 | 3,522 | 3,413 | 3,355 | 3,474 | 3,533 | 3,536 | 3,191 | 3,330 | 3,040 | 3,144 | 3,258 | 1,629 | 277 |
| | **Aug-98** | **Aug-99** | **Aug-00** | **Aug-01** | **Aug-02** | **Aug-03** | **Aug-04** | **Aug-05** | **Aug-06** | **Aug-07** | **Aug-08** | **Aug-09** | **Aug-10** | **Aug-11** | **Aug-12** | **Aug-13** | | | |
| **CSIP-Wells** | 748 | 899 | 774 | 1,105 | 1,073 | 1,283 | 1,145 | 770 | 1,103 | 1,115 | 969 | 1,107 | 272 | 568 | 311 | 263 | | | |
| **SRDF-River** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 968 | 709 | 799 | 220 | | | |
| **SVRP-Recycled** | 1,118 | 1,772 | 1,843 | 1,944 | 1,877 | 1,889 | 1,954 | 1,838 | 1,925 | 1,927 | 1,906 | 1,839 | 1,902 | 1,873 | 1,847 | 1,803 | | | |
| **Precip (in)** | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | AVG | | |
| **Total Irrig (AF)** | 1,866 | 2,671 | 2,717 | 3,049 | 2,950 | 3,272 | 3,099 | 2,608 | 3,028 | 3,042 | 2,875 | 3,246 | 3,142 | 3,150 | 2,957 | 2,286 | 2,872 | 1,436 | 244 |
| | **Sep-98** | **Sep-99** | **Sep-00** | **Sep-01** | **Sep-02** | **Sep-03** | **Sep-04** | **Sep-05** | **Sep-06** | **Sep-07** | **Sep-08** | **Sep-09** | **Sep-10** | **Sep-11** | **Sep-12** | **Sep-13** | | | |
| **CSIP-Wells** | 226 | 368 | 517 | 417 | 793 | 561 | 727 | 337 | 342 | 380 | 545 | 509 | 191 | 419 | 135 | 248 | | | |
| **SRDF-River** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 478 | 0 | 314 | 537 | | | |
| **SVRP-Recycled** | 989 | 1,398 | 1,460 | 1,505 | 1,435 | 1,750 | 1,821 | 1,689 | 1,782 | 1,616 | 1,683 | 1,594 | 1,821 | 1,617 | 1,734 | 1,725 | | | |
| **Precip (in)** | 0.1 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.4 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.1 | AVG | | |
| **Total Irrig (AF)** | 1,315 | 1,766 | 2,077 | 2,022 | 2,228 | 2,311 | 2,548 | 2,026 | 2,124 | 2,396 | 2,228 | 2,203 | 2,490 | 2,036 | 2,183 | 2,610 | 2,160 | 1,080 | 184 |
| | **Oct-98** | **Oct-99** | **Oct-00** | **Oct-01** | **Oct-02** | **Oct-03** | **Oct-04** | **Oct-05** | **Oct-06** | **Oct-07** | **Oct-08** | **Oct-09** | **Oct-10** | **Oct-11** | **Oct-12** | **Oct-13** | | | |
| **CSIP-Wells** | 309 | 370 | 450 | 164 | 162 | 174 | 183 | 115 | 172 | 125 | 140 | 119 | 20 | 54 | 16 | 165 | | | |
| **SRDF-River** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 80 | 0 | 65 | 133 | | | |
| **SVRP-Recycled** | 432 | 1,017 | 475 | 1,276 | 1,316 | 1,371 | 862 | 1,241 | 1,509 | 1,129 | 1,378 | 465 | 1,006 | 733 | 1,168 | 1,548 | | | |
| **Precip (in)** | 0.5 | 0.1 | 2.5 | 0.0 | 0.0 | 0.2 | 2.8 | 0.1 | 0.0 | 1.1 | 0.2 | 1.7 | 0.6 | 1.5 | 0.2 | 0.2 | AVG | | |
| **Total Irrig (AF)** | 1,241 | 1,487 | 3,425 | 1,440 | 1,478 | 1,745 | 3,845 | 1,456 | 1,681 | 2,354 | 1,718 | 2,284 | 1,706 | 2,287 | 1,449 | 2,046 | 1,978 | 989 | 168 |
| | **Nov-98** | **Nov-99** | **Nov-00** | **Nov-01** | **Nov-02** | **Nov-03** | **Nov-04** | **Nov-05** | **Nov-06** | **Nov-07** | **Nov-08** | **Nov-09** | **Nov-10** | **Nov-11** | **Nov-12** | **Nov-13** | | | |
| **CSIP-Wells** | 77 | 82 | 230 | 11 | 183 | 134 | 171 | 330 | 90 | 692 | 35 | 575 | 246 | 238 | 72 | 35 | | | |
| **SRDF-River** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |
| **SVRP-Recycled** | 32 | 153 | 0 | 260 | 184 | 149 | 0 | 209 | 342 | 0 | 730 | 0 | 179 | 224 | 731 | 1,127 | | | |
| **Precip (in)** | 2.3 | 1.1 | 0.2 | 0.9 | 0.9 | 0.8 | 0.4 | 0.4 | 1.3 | 0.4 | 1.3 | 0.1 | 2.0 | 1.8 | 3.1 | 0.5 | AVG | | |
| **Total Irrig (AF)** | 2,409 | 1,335 | 430 | 1,171 | 1,267 | 1,083 | 571 | 939 | 1,732 | 1,092 | 2,065 | 675 | 2,425 | 2,262 | 3,903 | 1,662 | 1,564 | 782 | 133 |
| | **Dec-98** | **Dec-99** | **Dec-00** | **Dec-01** | **Dec-02** | **Dec-03** | **Dec-04** | **Dec-05** | **Dec-06** | **Dec-07** | **Dec-08** | **Jan-00** | **Dec-00** | **Dec-01** | **Dec-02** | **Dec-03** | | | |
| **CSIP-Wells** | 72 | 215 | 397 | 10 | 107 | 40 | 150 | 85 | 119 | 445 | 29 | 194 | 69 | 723 | 44 | 730 | | | |
| **SRDF-River** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | |
| **SVRP-Recycled** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 289 | 0 | 0 | 0 | 0 | 88 | | | |
| **Precip (in)** | 0.9 | 0.1 | 0.7 | 1.6 | 2.8 | 3.9 | 3.8 | 3.3 | 2.3 | 1.2 | 2.3 | 1.6 | 3.0 | 0.0 | 3.3 | 0.2 | AVG | | |
| **Total Irrig (AF)** | 972 | 315 | 1,097 | 1,610 | 2,907 | 3,940 | 3,950 | 3,385 | 2,419 | 1,645 | 2,618 | 1,794 | 3,069 | 723 | 3,344 | 1,018 | 2,175 | 1,088 | 185 |
| | **Jan-99** | **Jan-00** | **Jan-01** | **Jan-02** | **Jan-03** | **Jan-04** | **Jan-05** | **Jan-06** | **Jan-07** | **Jan-08** | **Jan-09** | **Jan-10** | **Jan-11** | **Jan-12** | **Jan-13** | **Jan-14** | | | |
| **CSIP-Wells** | 169 | 202 | 189 | 151 | 130 | 179 | 83 | 109 | 687 | 91 | 485 | 100 | 333 | 1,067 | 253 | | | | |
| **SRDF-River** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| **SVRP-Recycled** | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 26 | 0 | 0 | | | | |
| **Precip (in)** | 2.6 | 4.9 | 2.9 | 0.2 | 0.7 | 1.5 | 2.7 | 2.0 | 0.7 | 4.8 | 1.3 | 4.0 | 1.7 | 1.6 | 1.0 | | AVG | | |
| **Total Irrig (AF)** | 2,791 | 5,102 | 3,089 | 351 | 830 | 1,679 | 2,783 | 2,109 | 1,387 | 4,891 | 1,785 | 4,100 | 2,059 | 2,667 | 1,253 | | 2,458 | 1,229 | 209 |
| | **Feb-99** | **Feb-00** | **Feb-01** | **Feb-02** | **Feb-03** | **Feb-04** | **Feb-05** | **Feb-06** | **Feb-07** | **Feb-08** | **Feb-09** | **Feb-10** | **Feb-11** | **Feb-12** | **Feb-13** | **Feb-14** | | | |
| **CSIP-Wells** | 52 | 43 | 128 | 358 | 345 | 121 | 280 | 583 | 252 | 171 | 235 | 143 | 100 | 162 | 334 | | | | |
| **SRDF-River** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| **SVRP-Recycled** | 58 | 0 | 0 | 385 | 32 | 1 | 0 | 0 | 154 | 173 | 112 | 0 | 580 | 1,031 | 692 | | | | |
| **Precip (in)** | 3.1 | 4.2 | 3.0 | 0.3 | 0.7 | 3.1 | 3.4 | 0.9 | 2.4 | 0.9 | 3.5 | 3.1 | 2.9 | 0.8 | 0.6 | | AVG | | |
| **Total Irrig (AF)** | 3,210 | 4,243 | 3,128 | 1,043 | 1,077 | 3,222 | 3,680 | 1,483 | 2,806 | 1,244 | 3,847 | 3,243 | 3,580 | 1,993 | 1,626 | | 2,628 | 1,314 | 223 |
| | **Mar-99** | **Mar-00** | **Mar-01** | **Mar-02** | **Mar-03** | **Mar-04** | **Mar-05** | **Mar-06** | **Mar-07** | **Mar-08** | **Mar-09** | **Mar-10** | **Mar-11** | **Mar-12** | **Mar-13** | **Mar-14** | | | |
| **CSIP-Wells** | 138 | 651 | 529 | 233 | 473 | 455 | 241 | 124 | 459 | 520 | 408 | 529 | 154 | 211 | 218 | | | | |
| **SRDF-River** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | | | | |
| **SVRP-Recycled** | 35 | 11 | 422 | 791 | 1,184 | 1,121 | 0 | 0 | 1,099 | 1,602 | 676 | 49 | 450 | 929 | 1,561 | | | | |
| **Precip (in)** | 1.8 | 1.7 | 1.6 | 0.4 | 0.6 | 0.5 | 4.3 | 5.0 | 0.5 | 0.3 | 1.8 | 2.4 | 4.2 | 2.6 | 0.4 | | AVG | | |
| **Total Irrig (AF)** | 1,973 | 2,362 | 2,551 | 1,424 | 2,257 | 2,076 | 4,541 | 5,124 | 2,058 | 2,422 | 2,884 | 2,978 | 4,804 | 3,740 | 2,179 | | 2,892 | 1,446 | 246 |
| | **Apr-99** | **Apr-00** | **Apr-01** | **Apr-02** | **Apr-03** | **Apr-04** | **Apr-05** | **Apr-06** | **Apr-07** | **Apr-08** | **Apr-09** | **Apr-10** | **Apr-11** | **Apr-12** | **Apr-13** | **Apr-14** | | | |
| **CSIP-Wells** | 601 | 678 | 587 | 564 | 190 | 878 | 482 | 195 | 496 | 1,513 | 1,054 | 143 | 544 | 80 | 239 | | | | |
| **SRDF-River** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 501 | | | | |
| **SVRP-Recycled** | 586 | 1,136 | 1,332 | 1,763 | 1,381 | 1,848 | 740 | 328 | 1,642 | 1,806 | 1,702 | 839 | 1,650 | 1,044 | 1,679 | | | | |
| **Precip (in)** | 1.4 | 0.4 | 1.8 | 0.1 | 1.2 | 0.0 | 1.3 | 2.9 | 1.0 | 0.2 | 0.2 | 3.4 | 0.1 | 1.9 | 0.3 | | AVG | | |
| **Total Irrig (AF)** | 2,587 | 2,214 | 3,719 | 2,427 | 2,771 | 2,726 | 2,522 | 3,423 | 3,138 | 3,519 | 2,956 | 4,382 | 2,294 | 3,024 | 2,719 | | 2,961 | 1,481 | 252 |
| | **May-99** | **May-00** | **May-01** | **May-02** | **May-03** | **May-04** | **May-05** | **May-06** | **May-07** | **May-08** | **May-09** | **May-10** | **May-11** | **May-12** | **May-13** | **May-14** | | | |
| **CSIP-Wells** | 313 | 439 | 531 | 446 | 535 | 810 | 388 | 249 | 417 | 939 | 822 | 150 | 284 | 125 | 239 | | | | |
| **SRDF-River** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 375 | 593 | 618 | 1,219 | | | | |
| **SVRP-Recycled** | 1,561 | 1,283 | 1,805 | 1,770 | 1,722 | 1,933 | 1,770 | 1,751 | 1,907 | 1,914 | 1,717 | 1,737 | 1,694 | 1,745 | 1,799 | | | | |
| **Precip (in)** | 0.0 | 0.6 | 0.0 | 0.0 | 0.2 | 0.0 | 0.8 | 0.7 | 0.1 | 0.0 | 0.3 | 0.6 | 0.7 | 0.1 | 0.0 | | AVG | | |
| **Total Irrig (AF)** | 1,874 | 2,322 | 2,336 | 2,216 | 2,457 | 2,743 | 2,958 | 2,700 | 2,424 | 2,853 | 2,839 | 2,862 | 3,271 | 2,588 | 3,257 | | 2,647 | 1,323 | 225 |
| | **Jun-99** | **Jun-00** | **Jun-01** | **Jun-02** | **Jun-03** | **Jun-04** | **Jun-05** | **Jun-06** | **Jun-07** | **Jun-08** | **Jun-09** | **Jun-10** | **Jun-11** | **Jun-12** | **Jun-13** | **Jun-14** | | | |
| **CSIP-Wells** | 743 | 1,051 | 1,359 | 1,256 | 1,435 | 1,653 | 1,402 | 1,394 | 1,523 | 1,726 | 1,391 | 570 | 428 | 276 | 363 | | | | |
| **SRDF-River** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 944 | 1,020 | 906 | 1,224 | | | | |
| **SVRP-Recycled** | 1,615 | 1,793 | 1,877 | 1,664 | 1,808 | 1,913 | 1,833 | 1,903 | 1,874 | 1,797 | 1,750 | 1,838 | 1,713 | 1,764 | 1,677 | | | | |
| **Precip (in)** | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 | 0.0 | 0.1 | 0.0 | 0.3 | 0.2 | 0.0 | | AVG | | |
| **Total Irrig (AF)** | 2,458 | 2,844 | 3,236 | 2,920 | 3,243 | 3,566 | 3,435 | 3,297 | 3,397 | 3,523 | 3,241 | 3,352 | 3,461 | 3,146 | 3,264 | | 3,226 | 1,613 | 274 |
| **Totals** | **FY 98-99** | **FY 99-00** | **FY 00-01** | **FY 01-02** | **FY 02-03** | **FY 03-04** | **FY 04-05** | **FY 05-06** | **FY 06-07** | **FY 07-08** | **FY 08-09** | **FY 09-10** | **FY 10-11** | **FY 11-12** | **FY 12-13** | **FY 12-13** | | | |
| **CSIP-Wells** | 4,220 | 6,316 | 6,925 | 6,250 | 6,789 | 8,109 | 6,817 | 5,798 | 7,084 | 9,234 | 7,703 | 5,838 | 2,908 | 4,239 | 2,438 | 1,539 | | | |
| **SRDF-River** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1,319 | 4,174 | 3,378 | 5,114 | 2,150 | | Scaled | 17% |
| **SVRP-Recycled** | 7,562 | 10,433 | 11,100 | 13,237 | 12,839 | 13,873 | 10,937 | 10,865 | 14,165 | 13,921 | 13,886 | 10,198 | 12,910 | 12,829 | 14,722 | 8,077 | | to 6000 ac | Return |
| **Precip (in)** | 13 | 13 | 13 | 4 | 7 | 10 | 20 | 15 | 8 | 9 | 11 | 17 | 16 | 11 | 9 | 1 | AVG | | |
| **Total Irrig (AF)** | 24,582 | 29,849 | 30,925 | 23,087 | 26,728 | 32,082 | 37,454 | 31,963 | 29,549 | 32,455 | 32,589 | 34,655 | 35,492 | 30,946 | 31,174 | 12,766 | 29,769 | **14,884** | **2,530** |
| **Year Type** | Normal | Normal | Normal | Dry | Dry | Normal | Wet | Normal | Dry | Dry | Normal | Wet | Normal | Normal | Dry | | | | |
| | 5.8 | 7.0 | 7.3 | 5.4 | 6.3 | 7.5 | 8.8 | 7.5 | 6.9 | 7.6 | 7.7 | 8.1 | 8.3 | 7.3 | 7.3 | | | | |
| | | | | | | | | | | | | | | | | **Sum of monthly values:** | | **15,410** | **2,620** |

CSIP Service Area approx 12,000 acres
Precipitation from Salinas Airport Rain Gage, NOAA Station USW00023233
Blanco Drain area is approximately 6,000 acres

| Year Type | Average Total Irrig | Scale to 6,000 ac | 17% Return |
|---|---|---|---|
| | (AF) | (AF) | (AF) |
| Wet | 36,055 | 18,027 | 3,065 |
| Normal | 31,054 | 15,527 | 2,640 |
| Dry | 28,599 | 14,299 | 2,431 |

**Table B-4: Water Rights Database GIS Capture, PODs near Salinas**

| Application ID | No. | Permit ID | License ID | DB ID | Water Right Type | Water Right Type ID | Status | Holder Name | Date | Face Amt | County | Watershed | Source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| A013225 | 1 | 11043 | 0 | 3413 | Appropriative | 84 | Permitted | MONTEREY COUNTY WATER RESOURCES AGENCY | 7/11/1949 | 168,538.0 | Monterey | SALINAS,<br>SALIN | SALINAS RIVER |
| A016124 | 2 | 10137 | 7543 | 4833 | Appropriative | 84 | Licensed | MONTEREY COUNTY WATER RESOURCES AGENCY | 11/4/1954 | 350,000.0 | Monterey, San L | SALINAS,<br>SALIN | NACIMIENTO RIVER, Salinas River |
| A016761 | 2 | 12261 | 12624 | 5163 | Appropriative | 84 | Licensed | MONTEREY COUNTY WATER RESOURCES AGENCY | 12/2/1955 | 220,000.0 | Monterey | SALINAS,<br>SALIN | SAN ANTONIO RIVER, Salinas River |
| A030532 | 2 | 21089 | 0 | 14037 | Appropriative | 84 | Permitted | MONTEREY COUNTY WATER RESOURCES AGENCY | 3/25/1996 | 27,900.0 | Monterey, San L | SALINAS,<br>SALIN | NACIMIENTO RIVER, Salinas River |
| S014817 | 1 | 0 | 0 | 37657 | Statement of Div and Use | 92 | Inactive | STEPHEN JENSEN | 7/5/2000 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014826 | 1 | 0 | 0 | 37666 | Statement of Div and Use | 92 | Claimed | ELMER N JENSEN & ELSIE R JENSEN LIVING TRUST | 5/28/1997 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014867 | 1 | 0 | 0 | 37707 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014868 | 1 | 0 | 0 | 37708 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014869 | 1 | 0 | 0 | 37709 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014870 | 1 | 0 | 0 | 37710 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014872 | 1 | 0 | 0 | 37712 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014873 | 1 | 0 | 0 | 37713 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014874 | 1 | 0 | 0 | 37714 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014875 | 1 | 0 | 0 | 37715 | Statement of Div and Use | 92 | Inactive | TANIMURA & ANTLE INC | 6/28/2013 | - | Monterey | SALINAS | GROUNDWATER USE |
| S014876 | 1 | 0 | 0 | 37716 | Statement of Div and Use | 92 | Inactive | TANIMURA & ANTLE INC | 6/28/2013 | - | Monterey | SALINAS | GROUNDWATER USE |
| S014877 | 1 | 0 | 0 | 37717 | Statement of Div and Use | 92 | Inactive | TANIMURA & ANTLE INC | 6/28/2013 | - | Monterey | SALINAS | GROUNDWATER USE |
| S014878 | 1 | 0 | 0 | 37718 | Statement of Div and Use | 92 | Claimed | T. Yuki Farms, LPII | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014879 | 1 | 0 | 0 | 37719 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014880 | 1 | 0 | 0 | 37720 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014881 | 1 | 0 | 0 | 37721 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014882 | 1 | 0 | 0 | 37722 | Statement of Div and Use | 92 | Claimed | Robert Tanimura 1980 IrrevocableTrust; et al | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014883 | 1 | 0 | 0 | 37723 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014884 | 1 | 0 | 0 | 37724 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 5/30/2013 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014885 | 1 | 0 | 0 | 37725 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014886 | 1 | 0 | 0 | 37726 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014887 | 1 | 0 | 0 | 37727 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014888 | 1 | 0 | 0 | 37728 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014889 | 1 | 0 | 0 | 37729 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014890 | 1 | 0 | 0 | 37730 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014892 | 1 | 0 | 0 | 37732 | Statement of Div and Use | 92 | Claimed | Tanimura & Antle Partnership; et al | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014893 | 1 | 0 | 0 | 37733 | Statement of Div and Use | 92 | Claimed | Tanimura & Antle Partnership; et al | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014894 | 1 | 0 | 0 | 37734 | Statement of Div and Use | 92 | Claimed | Tanimura & Antle Partnership; et al | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014895 | 1 | 0 | 0 | 37735 | Statement of Div and Use | 92 | Claimed | Tanimura & Antle Partnership; et al | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S014896 | 1 | 0 | 0 | 37736 | Statement of Div and Use | 92 | Claimed | Tanimura & Antle Partnership; et al | 1/22/1998 | - | Monterey | SALINAS | SALINAS RIVER UNDERFLOW |
| S016592 | 1 | 0 | 0 | 51867 | Statement of Div and Use | 92 | Claimed | TANIMURA LAND COMPANY LLC | 7/6/2010 | 192.4 | Monterey | SALINAS | Salinas River Underflow |
| S021637 | 1 | 0 | 0 | 53889 | Statement of Div and Use | 92 | Claimed | PORTER FAMILY PARTNERSHIP, LP | 7/6/2010 | 136,339.0 | Monterey | SALINAS | Salinas River Underflow |
| S021638 | 1 | 0 | 0 | 53890 | Statement of Div and Use | 92 | Claimed | PORTER FAMILY PARTNERSHIP, LP | 7/6/2010 | 107,448.0 | Monterey | SALINAS | Salinas River Underflow |
| S021639 | 1 | 0 | 0 | 53891 | Statement of Div and Use | 92 | Claimed | M.B.T. FAMILY PARTNERSHIP | 7/6/2010 | 202,417.0 | Monterey | SALINAS | Salinas River Underflow |
| S021641 | 1 | 0 | 0 | 53893 | Statement of Div and Use | 92 | Claimed | THE HARDY FAMILY TRUST, ET AL. | 7/6/2010 | 262.5 | Monterey | SALINAS | Salinas River Underflow |
| S021642 | 1 | 0 | 0 | 53900 | Statement of Div and Use | 92 | Claimed | THE HARDY FAMILY TRUST, ET AL. | 7/6/2010 | 333.8 | Monterey | SALINAS | Salinas River Underflow |
| S023945 | 1 | 0 | 0 | | Statement of Div and Use | 92 | Claimed | TANIMURA & ANTLE | 7/2/2013 | - | Monterey | SALINAS | Salinas Valley Basin |
| S023947 | 1 | 0 | 0 | | Statement of Div and Use | 92 | Claimed | TANIMURA & ANTLE | 7/2/2013 | - | Monterey | SALINAS | Salinas Valley Basin |

**Table B-5: Surface Water Rights and Claims in the Salinas River below Spreckels**

| Water Right ID | Source | Direct Diversion Rate (cfs) | Direct Diversion Season | Face Value Direct Diversion Amount Oct. 1-Mar. 31 (af) | Face Value Storage Amount (af) | Storage Season | Reported Use 2011 (Used) | Reported Use 2012 (Used) | Purpose of Use Code** |
|---|---|---|---|---|---|---|---|---|---|
| A016124, Permit 10137 | Nacimento River, Salinas River | | | 350,000 | 377,900 | Oct 1 - July 1 | 197,000 | 158,633 | M, D, I, J, R |
| A016761, Permit 12261 | San Antonio River, Salinas River | | | 220,000 | 335,000 | Oct 1 - July 1 | 26,410 | 72,175 | M, D, I, J, R |
| A030532, Permit 21089 | Nacimento River, Salinas River | | | 27,900 | | Oct 1 - July 1 | - | - | M, D, I, J, R |
| A013225, Permit 11043 | Salinas River | 400 | Jan 1 - Dec 31 | 135,000 | | | 84,270 | - | I, M |
| | | | | | | | | | |
| Totals | | | | 732,900 | 712,900 | | 307,680 | 230,808 | |

Blank fields indicate no data/ no report

**B-Mining, C-Milling, D-Domestic, E-Fire Protection, G-Dust Control, H-Fish Culture, I-Irrigation, J-Industrial, K-Incidental Power, L-Heat Protection, M-Municipal, N-Frost Protection, P-Power, R-Recreational, S-Stockwatering, T-Snow Making, W-Fish and Wildlife Protection and/or Enhancement, Z-Other.

**Table B-6: Stream Water Quality, Blanco Drain to Potrero Road**
Note: Location above or below indicates multiple sampling locations

| Stream | Location | Analyte Name | No. Samples | Units | Mean | Min | Max |
|---|---|---|---|---|---|---|---|
| Blanco Drain | above Salinas River | Ammonia as N, Unionized | 53 | mg/L | 0.014 | 0.0009 | 0.26 |
| Blanco Drain | above Salinas River | Ammonia as NH3 | 37 | mg/L | 0.20 | 0.00 | 4.96 |
| Blanco Drain | above Salinas River | Chlorophyll a, water column | 54 | mg/L | 0.0021 | 0.00 | 0.028 |
| Blanco Drain | above Salinas River | Chlorpyrifos | 55 | mg/L | 0.0009 | 0.00 | 0.018 |
| Blanco Drain | above Salinas River | Diazinon | 59 | mg/L | 0.01 | 0.00 | 0.17 |
| Blanco Drain | above Salinas River | Dissolved Solids, Total | 60 | mg/L | 2,019.70 | 1,450.00 | 2,250.00 |
| Blanco Drain | above Salinas River | Nitrate as N | 98 | mg/L | 65.27 | 0.01 | 325.00 |
| Blanco Drain | above Salinas River | OrthoPhosphate as P | 99 | mg/L | 0.85 | 0.01 | 4.40 |
| Blanco Drain | above Salinas River | Oxygen, Dissolved | 55 | mg/L | 0.20 | 0.00 | 2.52 |
| Blanco Drain | above Salinas River | Turbidity | 94 | NTU | 66.48 | 0.10 | 1,210.00 |
| | | | | | | | |
| Salinas River | below Spreckels | Ammonia as N, Unionized | 37 | mg/L | 0.02 | 0.0007 | 0.13 |
| Salinas River | below Spreckels | Ammonia as NH3 | 38 | mg/L | 0.12 | 0.00 | 0.98 |
| Salinas River | below Spreckels | Chlorophyll a, water column | 36 | mg/L | 0.0033 | 0.0003 | 0.023 |
| Salinas River | below Spreckels | Chlorpyrifos | 32 | mg/L | 0.0011 | 0.00 | 0.029 |
| Salinas River | below Spreckels | Diazinon | 32 | mg/L | 0.008 | 0.00 | 0.22 |
| Salinas River | below Spreckels | Dissolved Solids, Total | 38 | mg/L | 369.60 | 230.00 | 610.00 |
| Salinas River | below Spreckels | Nitrate as N | 76 | mg/L | 5.08 | 0.002 | 78.00 |
| Salinas River | below Spreckels | OrthoPhosphate as P | 75 | mg/L | 0.23 | 0.0075 | 2.60 |
| Salinas River | below Spreckels | Oxygen, Dissolved | 37 | mg/L | 0.36 | 0.00 | 2.66 |
| Salinas River | below Spreckels | Turbidity | 58 | NTU | 118.66 | 1.40 | 2,584.00 |
| | | | | | | | |
| Salinas Lagoon | Salinas Lagoon | Ammonia as NH3 | 32 | mg/L | 0.05 | 0.00 | 0.52 |
| Salinas Lagoon | Salinas Lagoon | Chlorpyrifos | 28 | mg/L | 0.000064 | 0.00 | 0.00021 |
| Salinas Lagoon | Salinas Lagoon | Diazinon | 24 | mg/L | 0.000036 | 0.00 | 0.00020 |
| Salinas Lagoon | Salinas Lagoon | Nitrate as N | 32 | mg/L | 11.31 | 0.06 | 67.00 |
| Salinas Lagoon | Salinas Lagoon | OrthoPhosphate as P | 33 | mg/L | 0.31 | 0.00 | 1.09 |
| Salinas Lagoon | Salinas Lagoon | Turbidity | 18 | NTU | 29.77 | 3.76 | 76.70 |
| | | | | | | | |
| Old Salinas River | above Potrero Rd | Ammonia as N, Unionized | 96 | mg/L | 0.0075 | 0.0002 | 0.027 |
| Old Salinas River | above Potrero Rd | Ammonia as NH3 | 22 | mg/L | 0.24 | 0.00 | 1.17 |
| Old Salinas River | above Potrero Rd | Chloride | 109 | mg/L | 2,504.48 | 79.00 | 17,000.00 |
| Old Salinas River | above Potrero Rd | Chlorophyll a, water column | 134 | mg/L | 0.029 | 0.00045 | 0.24 |
| Old Salinas River | above Potrero Rd | Chlorpyrifos | 33 | mg/L | 0.00022 | 0.000044 | 0.0010 |
| Old Salinas River | above Potrero Rd | Coliform, Fecal | 106 | MPN/100 ml | 3,222.87 | 23.00 | 92,000.00 |
| Old Salinas River | above Potrero Rd | Coliform, Total | 106 | MPN/100 ml | 19,573.45 | 260.00 | 240,000.00 |
| Old Salinas River | above Potrero Rd | Diazinon | 31 | mg/L | 0.011 | 0.00 | 0.21 |
| Old Salinas River | above Potrero Rd | Dissolved Solids, Total | 116 | mg/L | 5,964.12 | 193.00 | 59,000.00 |
| Old Salinas River | above Potrero Rd | Nitrate as N | 138 | mg/L | 19.50 | 0.00 | 64.00 |
| Old Salinas River | above Potrero Rd | OrthoPhosphate as P | 138 | mg/L | 0.42 | 0.00 | 2.40 |
| Old Salinas River | above Potrero Rd | Oxygen, Dissolved | 138 | mg/L | 1.02 | 0.00 | 18.03 |
| Old Salinas River | above Potrero Rd | Suspended Solids, Total | 114 | mg/L | 113.33 | 5.00 | 578.00 |
| Old Salinas River | above Potrero Rd | Turbidity | 158 | NTU | 183.41 | 0.10 | 4,869.00 |

Highlighted cells exceed TMDL / standards. See table B-7.
Min value of 0.00 = Not Detected.

**Table B-7: Total Maximum Daily Loads**

| Analyte Name | Units | Standard | Reference |
|---|---|---|---|
| Ammonia as N, Unionized | mg/L | 0.025 | Board Order R3-2013-0008 |
| Ammonia as NH3 | mg/L | 0.025 | CCAMP Proposed |
| Chloride | mg/L | 150 | Basin Plan |
| Chlorophyll a, water column | mg/L | 0.015 | Board Order R3-2013-0008 |
| Chlorpyrifos | mg/L | CMC 0.00025<br>CCC 0.00015 | Board Decision 2011 |
| Coliform, Fecal | MPN/100 ml | 400 | Basin Plan, Water Body Contact |
| Coliform, Total | MPN/100 ml | 10,000 | US EPA |
| Diazinon | mg/L | CMC 0.00016<br>CCC 0.00010 | CC RWQCB Decision 2011 |
| Dissolved Solids, Total | mg/L | 1000 | CCAMP Proposed |
| Nitrate as N (all streams with MUN use) | mg/L | 10 | Board Order R3-2013-0008 |
| Nitrate as N (Salinas River) | mg/L | 1.4 (dry season)<br>8.0 (wet season) | Board Order R3-2013-0008 |
| Nitrate as N (Rec. Ditch, Tembladero, Blanco Drain, Alisal Slough, Espinosa Slough, Merritt Ditch, Santa Rita Creek) | mg/L | 6.4 (dry season)<br>8.0 (wet season) | Board Order R3-2013-0008 |
| Nitrate as N (OSR) | mg/L | 3.1 (dry season)<br>8.0 (wet season) | Board Order R3-2013-0008 |
| OrthoPhosphate as P (Salinas River) | mg/L | 0.07 (dry season)<br>0.30 (wet season) | Board Order R3-2013-0008 |
| Orthophosphate as P (Rec. Ditch, Tembladero, Blanco Drain, Alisal Slough, Espinosa Slough, Merritt Ditch, Santa Rita Creek) | mg/L | 0.13 (dry season)<br>0.30 (wet season) | Board Order R3-2013-0008 |
| Oxygen, Dissolved | mg/L | >7.0 and <13.0 (Cold)<br>>5.0 and <13.0 (Warm) | Board Order R3-2013-0008 |
| Suspended Solids, Total | mg/L | 500 | CCAMP Proposed |
| Turbidity | NTU | 10 | CCAMP Proposed |

CMC = Criterion Maximum Concentration (1-hr average)
CCC = Criterion Continuous Concentration (96-hour average)
Seasonal targets for nitrate and orthophosphate

## Appendix C: Conceptual Diversion Facility

Figure C-1: Existing Pump Station, Plan View
Figure C-2: Existing Pump Station, Profile View
Figure C-3: Proposed Pump Station and Force Main Location
Figure C-4: Station Configuration Option A – Adjacent Wet Well
Figure C-5: Station Configuration Option B – New Pump Station with Shared Inlet
Table C-1: Blanco Pump Station, 16-inch Force Main, System Head Calculations
Table C-2: Blanco Pump Station, 20-inch Force Main, System Head Calculations
Table C-3: Estimated Construction Cost, 3 cfs Pump Station with 16-inch Force Main
Table C-4: Estimated Construction Cost, 6 cfs Pump Station with 20-inch Force Main

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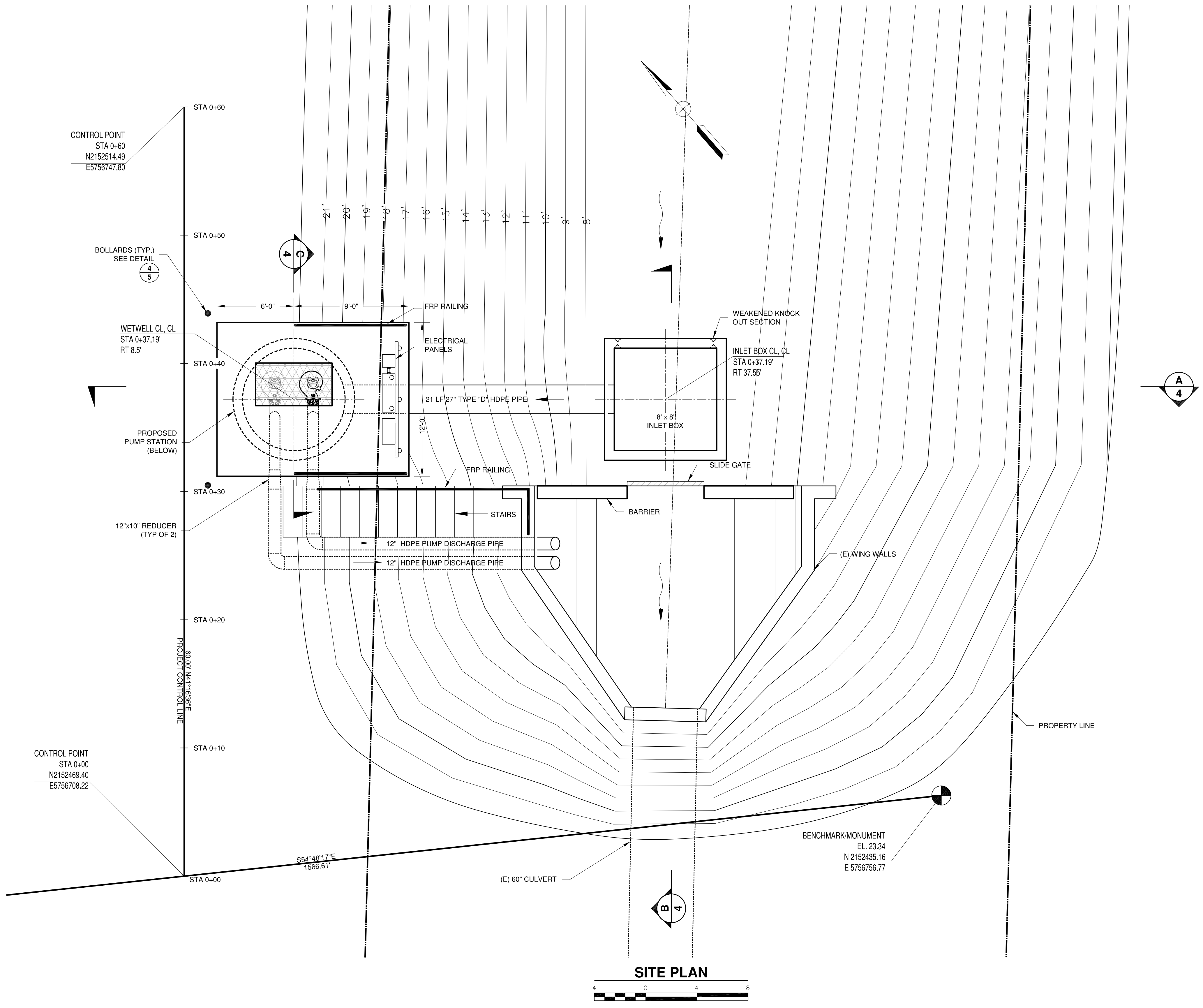



J:\JOBS\MCFC-20-Blanco\Drawings\100%\SHEET03-LAYOUT PLAN.dwg, 2/22/2008 2:37:33 PM

| REVISION | DESCRIPTION | BY | DATE |
|---|---|---|---|
| 1 | | | |
| 2 | | | |
| 3 | | | |
| 4 | | | |
| 5 | | | |
| 6 | | | |
| 7 | | | |

MONTEREY COUNTY WATER RESOURCE AGENCY

AGENCY ENGINEER ______ DATE

DIRECTOR OF AGENCY ______ DATE

REGISTERED PROFESSIONAL ENGINEER — No. 59577 — Exp. 09/30/09 — CIVIL — STATE OF CALIFORNIA

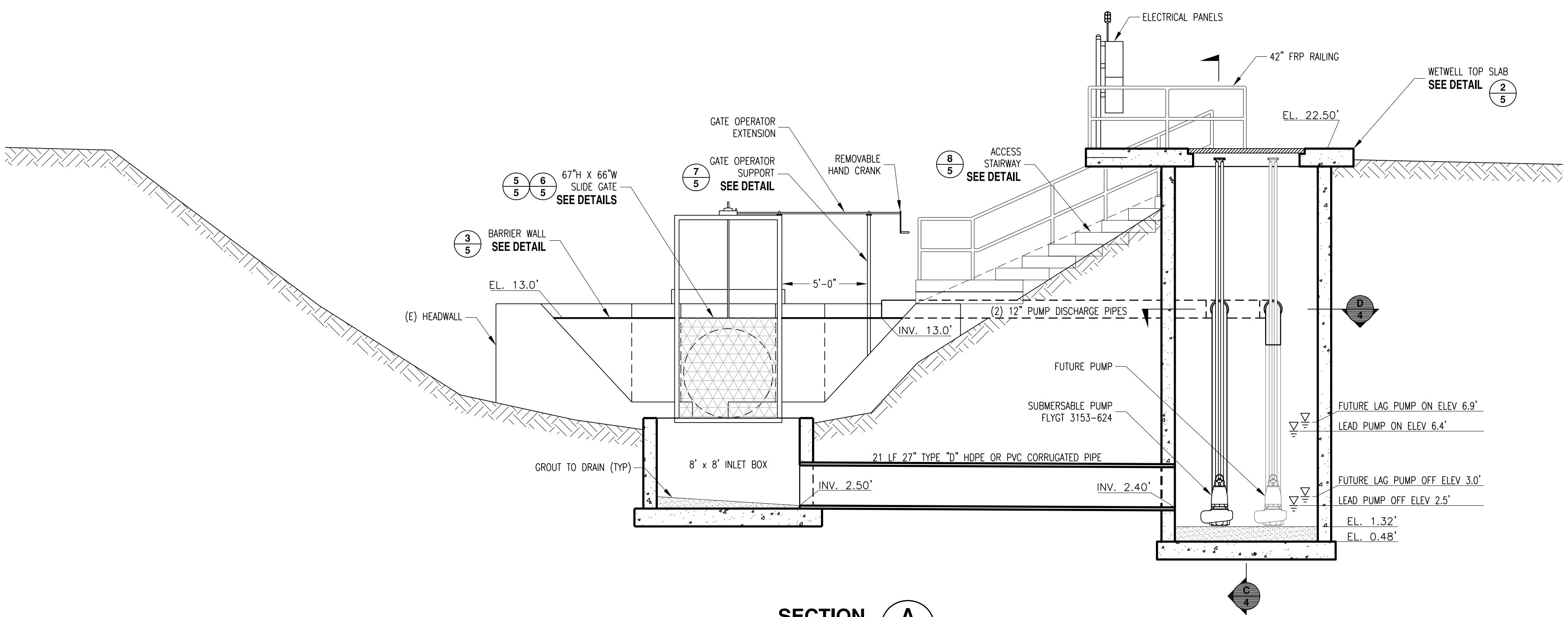
Schaaf & Wheeler
CONSULTING CIVIL ENGINEERS
100 N. WINCHESTER BLVD, STE. 200
SANTA CLARA, CA 95050
(408) 246-4848

# BLANCO DRAIN PUMP STATION SITE PLAN

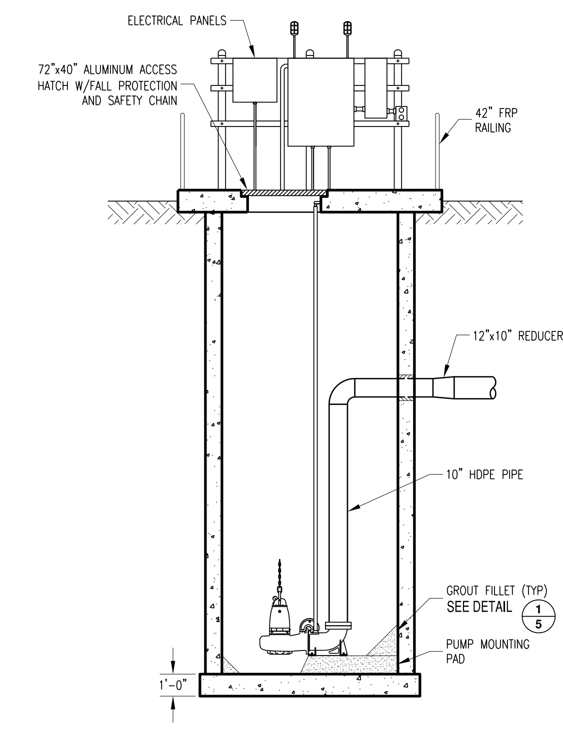
SURVEYED BY: DATE:
BOOK NO.
DRAWN BY: NJL DATE: 2/08
CHECKED BY: DAF DATE: 2/08
SCALE: AS SHOWN
PROJECT NO.: MCFC.20.07

| CASE | DRAWER | SET |
|---|---|---|

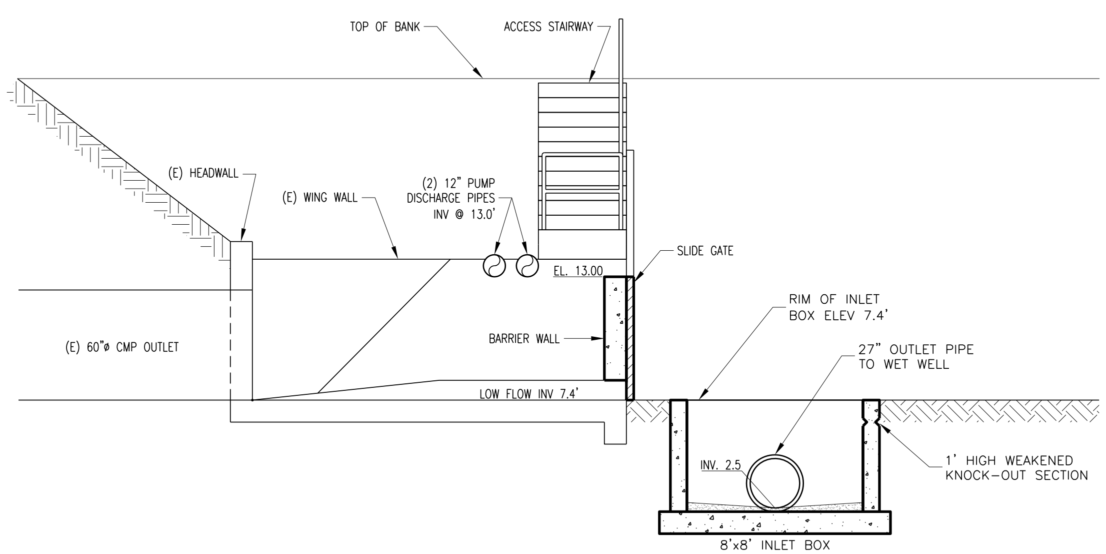
SHEET 3 OF 12



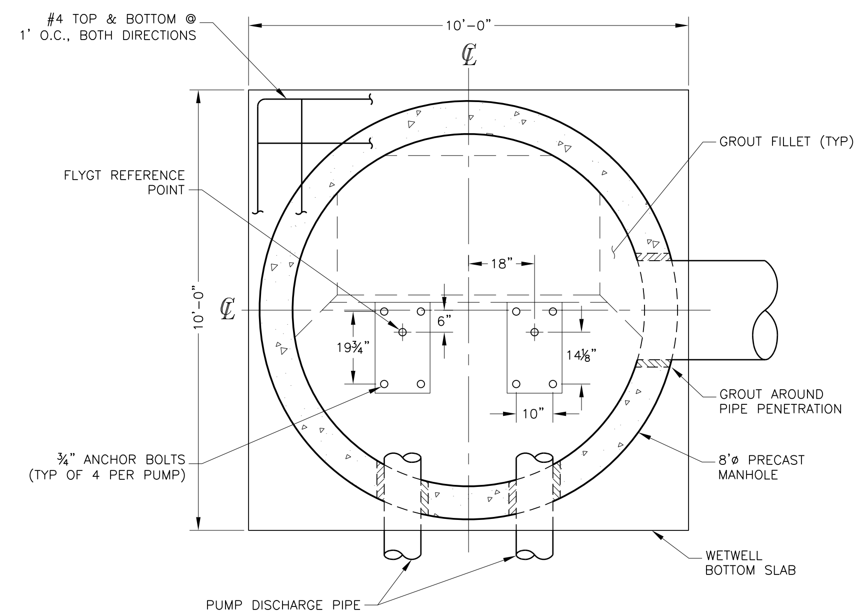

**SECTION A/4**
SCALE: 1/4"=1'




**SECTION C/4**
SCALE: 1/4"=1'




**SECTION B/4**
SCALE: 1/4"=1'




**WETWELL SECTION: EL. = 13.5 D/4**
SCALE: 1" = 2'-0"

| REVISION | DESCRIPTION | BY | DATE |
|---|---|---|---|

MONTEREY COUNTY WATER RESOURCE AGENCY

AGENCY ENGINEER — DATE
DIRECTOR OF AGENCY — DATE


Schaaf & Wheeler
CONSULTING CIVIL ENGINEERS
100 N. WINCHESTER BLVD, STE. 200
SANTA CLARA, CA 95050
(408) 246-4848

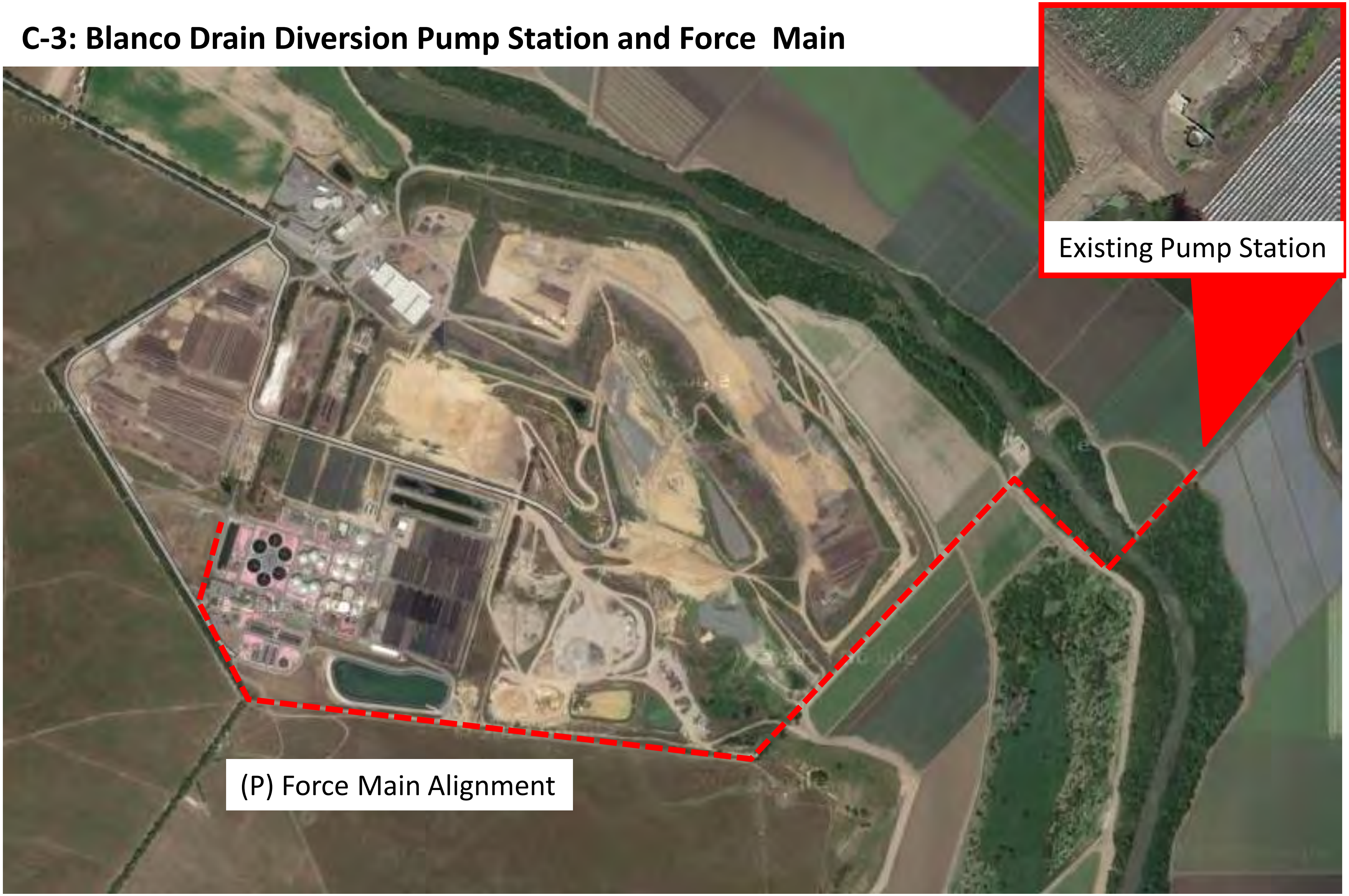

# BLANCO DRAIN PUMP STATION ELEVATIONS

SURVEYED BY: — DATE:
BOOK NO.
DRAWN BY: NJL DATE: 2/08
CHECKED BY: DAF DATE: 2/08
SCALE: AS SHOWN
PROJECT NO.: MCFC.20.07

| CASE | DRAWER | SET |
|---|---|---|

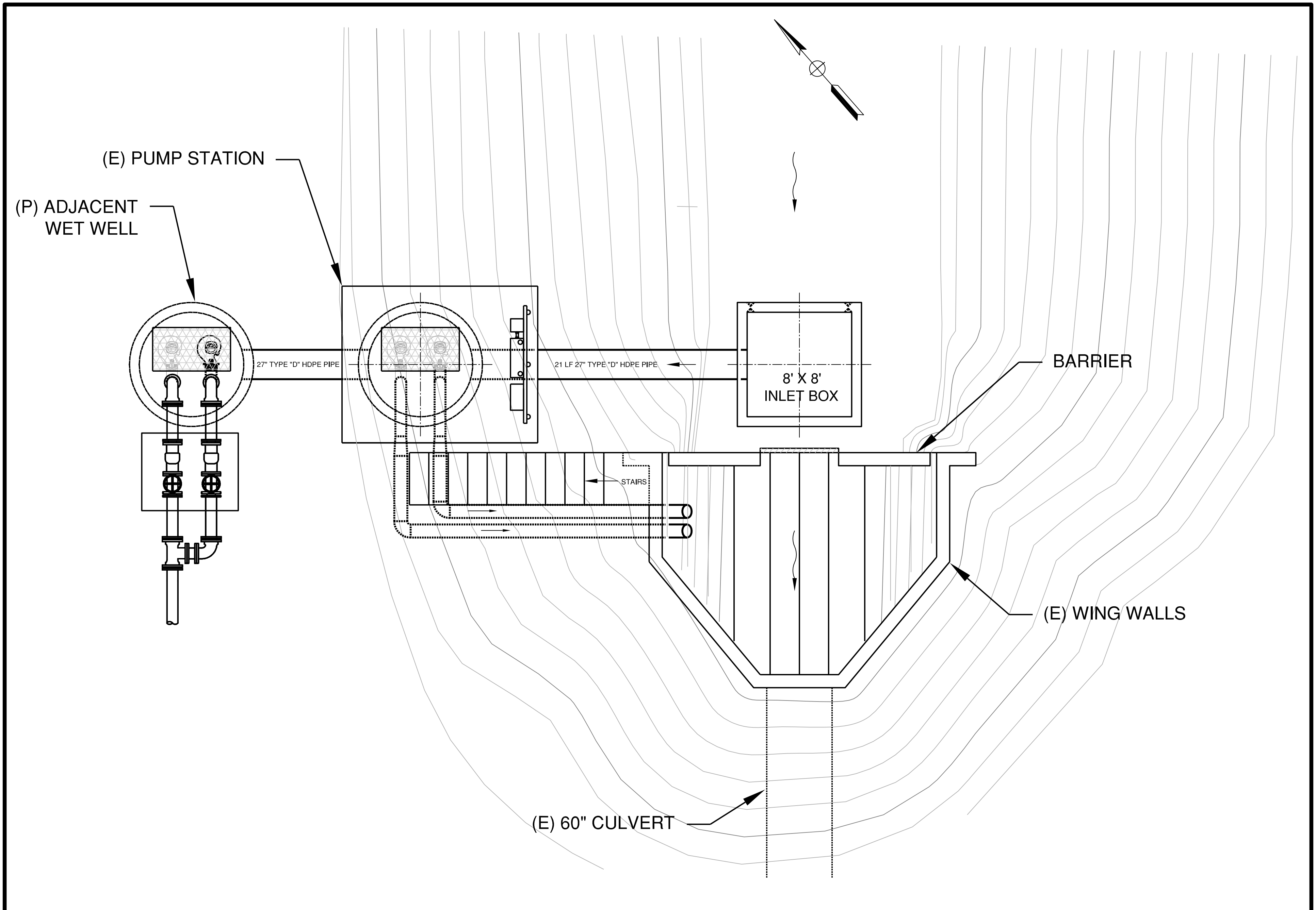
SHEET 4 OF 12

# C-3: Blanco Drain Diversion Pump Station and Force Main



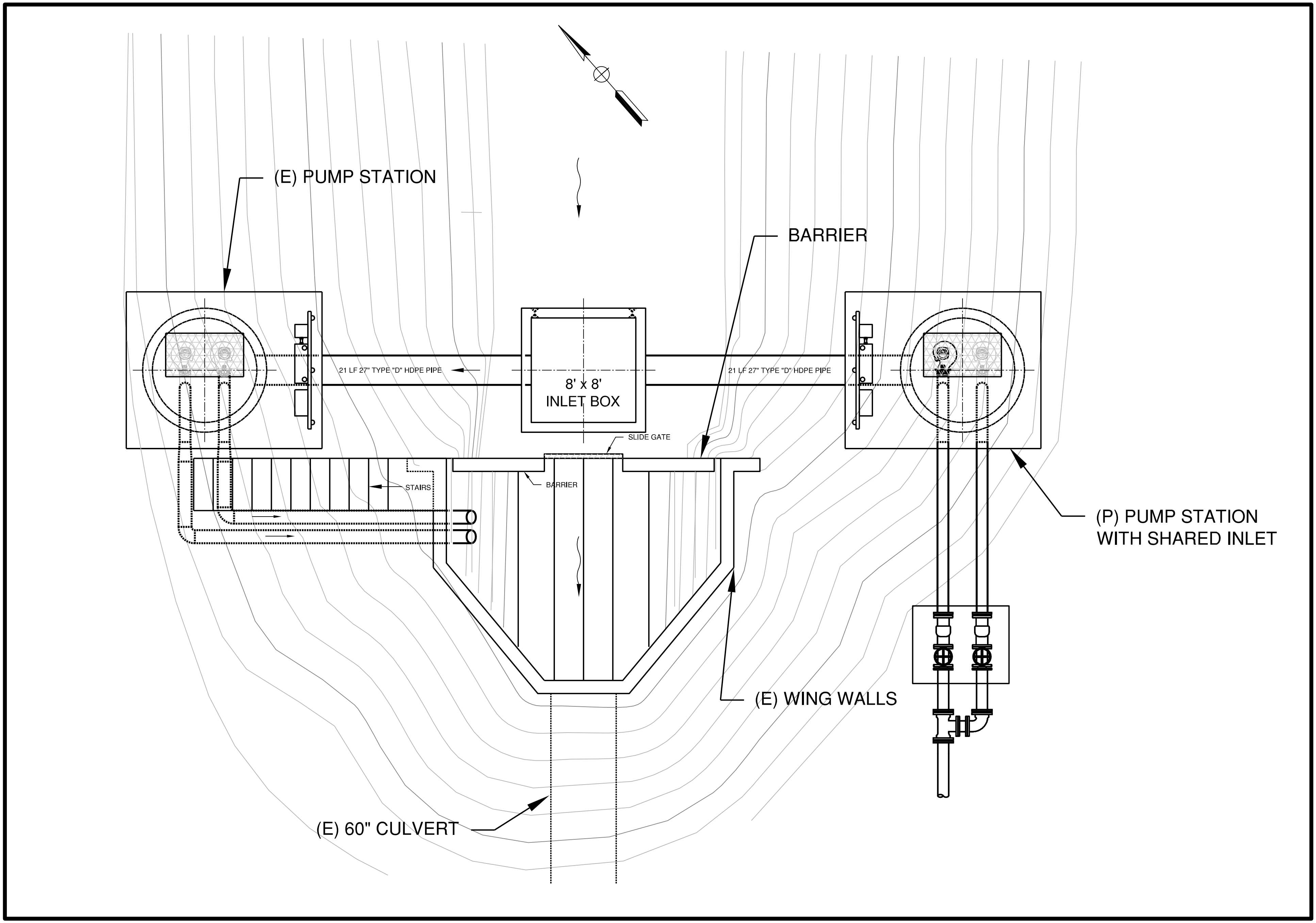

Schaaf & Wheeler

# Option A - Adjacent Wet Well




Schaaf & Wheeler

# Option B - New Pump Station with Shared Inlet



## Table C-1: Blanco Drain Diversion Pump Station, 16-inch Force Main

### System Head Calculations

| | |
|---|---|
| Number of Pumps in Parallel | **1** |
| Pump Discharge Diameter (inches) | **12** |
| Length of Pump Discharge (feet) | **40** |
| Discharge Hazen-Williams Coefficient (C) | **130** |
| Force Main Diameter in PS#2 (inches) | **16** |
| Force Main Length in PS#2 (feet) | **0** |
| Force Main Diameter from PS#2 to MH (inches) | **16** |
| Force Main Length from PS#2 to MH (feet) | **9500** |
| Force Main Hazen-Williams Coefficient (C) | **120** |
| Outfall Elevation (feet) | **143.00** |
| Wetwell Pumping Level (feet) | **3.00** |
| Static Lift (feet) | 140.00 |

| Fitting | K Value |
|---|---|
| 45 Elbow | 0.2 |
| 90 Elbow | 0.3 |
| 22.5 Elbow | 0.075 |
| 11.25 Elbow | 0 |
| GV | 0.3 |
| CV | 2.5 |
| Reducer | 0.03 |
| FR Elbow | 0.3 |
| Tee branch | 0.75 |

| Pump Discharge Piping | | | | | | | | | | | | Force Main in PS | | | | | Force Main from PS to MH | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Minor Losses | | | | | | | | | | | | | | | | | | | | | | |
| Flow (gpm) | Velocity (fps) | Velocity Head (ft) | Friction Loss (ft) | K: | Flare Elbow **0** (ft) | Suction Elbow **0** (ft) | Discharge Elbows **0.8** (ft) | Tee Branch **0** (ft) | Gate Valve **0.3** (ft) | Check Valve **2.5** (ft) | Total Minor Losses (ft) | Flow (gpm) | Velocity (fps) | Velocity Head (ft) | Friction Loss (ft) | **0.0** Minor Losses (ft) | Flow (gpm) | Velocity (fps) | Velocity Head (ft) | Friction Loss (ft) | **0.3** Minor Losses (ft) | Total Loss (ft) | TDH (ft) | Pump Flow (gpm) | HP at 75% eff. HP | |
| **0** | 0.00 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 140.00 | **0** | **0** | |
| **100** | 0.28 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 100 | 0.16 | 0.00 | 0.00 | 0.00 | 100 | 0.16 | 0.00 | 0.10 | 0.00 | 0.10 | 140.10 | **100** | **5** | |
| **200** | 0.57 | 0.00 | 0.01 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.02 | 200 | 0.32 | 0.00 | 0.00 | 0.00 | 200 | 0.32 | 0.00 | 0.35 | 0.00 | 0.38 | 140.38 | **200** | **9** | |
| **300** | 0.85 | 0.01 | 0.01 | | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.03 | 0.04 | 300 | 0.48 | 0.00 | 0.00 | 0.00 | 300 | 0.48 | 0.00 | 0.75 | 0.00 | 0.80 | 140.80 | **300** | **14** | |
| **400** | 1.13 | 0.02 | 0.02 | | 0.00 | 0.00 | 0.02 | 0.00 | 0.01 | 0.05 | 0.07 | 400 | 0.64 | 0.01 | 0.00 | 0.00 | 400 | 0.64 | 0.01 | 1.27 | 0.00 | 1.37 | 141.37 | **400** | **19** | |
| **500** | 1.42 | 0.03 | 0.03 | | 0.00 | 0.00 | 0.02 | 0.00 | 0.01 | 0.08 | 0.11 | 500 | 0.80 | 0.01 | 0.00 | 0.00 | 500 | 0.80 | 0.01 | 1.92 | 0.00 | 2.07 | 142.07 | **500** | **24** | |
| **600** | 1.70 | 0.04 | 0.04 | | 0.00 | 0.00 | 0.04 | 0.00 | 0.01 | 0.11 | 0.16 | 600 | 0.96 | 0.01 | 0.00 | 0.00 | 600 | 0.96 | 0.01 | 2.70 | 0.00 | 2.90 | 142.90 | **600** | **29** | |
| **700** | 1.99 | 0.06 | 0.05 | | 0.00 | 0.00 | 0.05 | 0.00 | 0.02 | 0.15 | 0.22 | 700 | 1.12 | 0.02 | 0.00 | 0.00 | 700 | 1.12 | 0.02 | 3.59 | 0.01 | 3.86 | 143.86 | **700** | **34** | |
| **800** | 2.27 | 0.08 | 0.07 | | 0.00 | 0.00 | 0.06 | 0.00 | 0.02 | 0.20 | 0.29 | 800 | 1.28 | 0.03 | 0.00 | 0.00 | 800 | 1.28 | 0.03 | 4.59 | 0.01 | 4.95 | 144.95 | **800** | **39** | |
| **900** | 2.55 | 0.10 | 0.08 | | 0.00 | 0.00 | 0.08 | 0.00 | 0.03 | 0.25 | 0.36 | 900 | 1.44 | 0.03 | 0.00 | 0.00 | 900 | 1.44 | 0.03 | 5.71 | 0.01 | 6.17 | 146.17 | **900** | **44** | |
| **1,000** | 2.84 | 0.12 | 0.10 | | 0.00 | 0.00 | 0.10 | 0.00 | 0.04 | 0.31 | 0.45 | 1,000 | 1.60 | 0.04 | 0.00 | 0.00 | 1,000 | 1.60 | 0.04 | 6.94 | 0.01 | 7.50 | 147.50 | **1,000** | **50** | |
| **1,100** | 3.12 | 0.15 | 0.12 | | 0.00 | 0.00 | 0.12 | 0.00 | 0.05 | 0.38 | 0.54 | 1,100 | 1.76 | 0.05 | 0.00 | 0.00 | 1,100 | 1.76 | 0.05 | 8.27 | 0.01 | 8.95 | 148.95 | **1,100** | **55** | |
| **1,200** | 3.40 | 0.18 | 0.14 | | 0.00 | 0.00 | 0.14 | 0.00 | 0.05 | 0.45 | 0.65 | 1,200 | 1.91 | 0.06 | 0.00 | 0.00 | 1,200 | 1.91 | 0.06 | 9.72 | 0.02 | 10.53 | 150.53 | **1,200** | **61** | |
| **1,300** | 3.69 | 0.21 | 0.17 | | 0.00 | 0.00 | 0.17 | 0.00 | 0.06 | 0.53 | 0.76 | 1,300 | 2.07 | 0.07 | 0.00 | 0.00 | 1,300 | 2.07 | 0.07 | 11.27 | 0.02 | 12.21 | 152.21 | **1,300** | **67** | |
| **1,400** | 3.97 | 0.24 | 0.19 | | 0.00 | 0.00 | 0.20 | 0.00 | 0.07 | 0.61 | 0.88 | 1,400 | 2.23 | 0.08 | 0.00 | 0.00 | 1,400 | 2.23 | 0.08 | 12.92 | 0.02 | 14.02 | 154.02 | **1,400** | **73** | 3 cfs |
| **1,500** | 4.26 | 0.28 | 0.22 | | 0.00 | 0.00 | 0.22 | 0.00 | 0.08 | 0.70 | 1.01 | 1,500 | 2.39 | 0.09 | 0.00 | 0.00 | 1,500 | 2.39 | 0.09 | 14.68 | 0.03 | 15.94 | 155.94 | **1,500** | **79** | |
| **1,600** | 4.54 | 0.32 | 0.24 | | 0.00 | 0.00 | 0.26 | 0.00 | 0.10 | 0.80 | 1.15 | 1,600 | 2.55 | 0.10 | 0.00 | 0.00 | 1,600 | 2.55 | 0.10 | 16.55 | 0.03 | 17.97 | 157.97 | **1,600** | **85** | |
| **1,700** | 4.82 | 0.36 | 0.27 | | 0.00 | 0.00 | 0.29 | 0.00 | 0.11 | 0.90 | 1.30 | 1,700 | 2.71 | 0.11 | 0.00 | 0.00 | 1,700 | 2.71 | 0.11 | 18.51 | 0.03 | 20.12 | 160.12 | **1,700** | **92** | |
| **1,800** | 5.11 | 0.40 | 0.30 | | 0.00 | 0.00 | 0.32 | 0.00 | 0.12 | 1.01 | 1.46 | 1,800 | 2.87 | 0.13 | 0.00 | 0.00 | 1,800 | 2.87 | 0.13 | 20.57 | 0.04 | 22.37 | 162.37 | **1,800** | **98** | |
| **1,900** | 5.39 | 0.45 | 0.33 | | 0.00 | 0.00 | 0.36 | 0.00 | 0.14 | 1.13 | 1.62 | 1,900 | 3.03 | 0.14 | 0.00 | 0.00 | 1,900 | 3.03 | 0.14 | 22.74 | 0.04 | 24.74 | 164.74 | **1,900** | **105** | |
| **2,000** | 5.67 | 0.50 | 0.37 | | 0.00 | 0.00 | 0.40 | 0.00 | 0.15 | 1.25 | 1.80 | 2,000 | 3.19 | 0.16 | 0.00 | 0.00 | 2,000 | 3.19 | 0.16 | 25.00 | 0.05 | 27.22 | 167.22 | **2,000** | **113** | |
| **2,100** | 5.96 | 0.55 | 0.40 | | 0.00 | 0.00 | 0.44 | 0.00 | 0.17 | 1.38 | 1.98 | 2,100 | 3.35 | 0.17 | 0.00 | 0.00 | 2,100 | 3.35 | 0.17 | 27.36 | 0.05 | 29.80 | 169.80 | **2,100** | **120** | |
| **2,200** | 6.24 | 0.60 | 0.44 | | 0.00 | 0.00 | 0.48 | 0.00 | 0.18 | 1.51 | 2.18 | 2,200 | 3.51 | 0.19 | 0.00 | 0.00 | 2,200 | 3.51 | 0.19 | 29.82 | 0.06 | 32.50 | 172.50 | **2,200** | **128** | |
| **2,300** | 6.53 | 0.66 | 0.48 | | 0.00 | 0.00 | 0.53 | 0.00 | 0.20 | 1.65 | 2.38 | 2,300 | 3.67 | 0.21 | 0.00 | 0.00 | 2,300 | 3.67 | 0.21 | 32.38 | 0.06 | 35.30 | 175.30 | **2,300** | **136** | 5 cfs |
| **2,400** | 6.81 | 0.72 | 0.52 | | 0.00 | 0.00 | 0.58 | 0.00 | 0.22 | 1.80 | 2.59 | 2,400 | 3.83 | 0.23 | 0.00 | 0.00 | 2,400 | 3.83 | 0.23 | 35.03 | 0.07 | 38.21 | 178.21 | **2,400** | **144** | |
| **2,500** | 7.09 | 0.78 | 0.56 | | 0.00 | 0.00 | 0.62 | 0.00 | 0.23 | 1.95 | 2.81 | 2,500 | 3.99 | 0.25 | 0.00 | 0.00 | 2,500 | 3.99 | 0.25 | 37.78 | 0.07 | 41.22 | 181.22 | **2,500** | **153** | |
| **2,600** | 7.38 | 0.84 | 0.60 | | 0.00 | 0.00 | 0.68 | 0.00 | 0.25 | 2.11 | 3.04 | 2,600 | 4.15 | 0.27 | 0.00 | 0.00 | 2,600 | 4.15 | 0.27 | 40.62 | 0.08 | 44.34 | 184.34 | **2,600** | **161** | |
| **2,700** | 7.66 | 0.91 | 0.64 | | 0.00 | 0.00 | 0.73 | 0.00 | 0.27 | 2.28 | 3.28 | 2,700 | 4.31 | 0.29 | 0.00 | 0.00 | 2,700 | 4.31 | 0.29 | 43.56 | 0.09 | 47.57 | 187.57 | **2,700** | **171** | |
| **2,800** | 7.94 | 0.98 | 0.69 | | 0.00 | 0.00 | 0.78 | 0.00 | 0.29 | 2.45 | 3.53 | 2,800 | 4.47 | 0.31 | 0.00 | 0.00 | 2,800 | 4.47 | 0.31 | 46.59 | 0.09 | 50.90 | 190.90 | **2,800** | **180** | |
| **2,900** | 8.23 | 1.05 | 0.73 | | 0.00 | 0.00 | 0.84 | 0.00 | 0.32 | 2.63 | 3.78 | 2,900 | 4.63 | 0.33 | 0.00 | 0.00 | 2,900 | 4.63 | 0.33 | 49.72 | 0.10 | 54.33 | 194.33 | **2,900** | **190** | |
| **3,000** | 8.51 | 1.12 | 0.78 | | 0.00 | 0.00 | 0.90 | 0.00 | 0.34 | 2.81 | 4.05 | 3,000 | 4.79 | 0.36 | 0.00 | 0.00 | 3,000 | 4.79 | 0.36 | 52.93 | 0.11 | 57.87 | 197.87 | **3,000** | **200** | |
| **3,100** | 8.79 | 1.20 | 0.83 | | 0.00 | 0.00 | 0.96 | 0.00 | 0.36 | 3.00 | 4.32 | 3,100 | 4.95 | 0.38 | 0.00 | 0.00 | 3,100 | 4.95 | 0.38 | 56.24 | 0.11 | 61.51 | 201.51 | **3,100** | **210** | |
| **3,200** | 9.08 | 1.28 | 0.88 | | 0.00 | 0.00 | 1.02 | 0.00 | 0.38 | 3.20 | 4.61 | 3,200 | 5.11 | 0.40 | 0.00 | 0.00 | 3,200 | 5.11 | 0.40 | 59.65 | 0.12 | 65.25 | 205.25 | **3,200** | **221** | 7 cfs |
| **3,300** | 9.36 | 1.36 | 0.93 | | 0.00 | 0.00 | 1.09 | 0.00 | 0.41 | 3.40 | 4.90 | 3,300 | 5.27 | 0.43 | 0.00 | 0.00 | 3,300 | 5.27 | 0.43 | 63.14 | 0.13 | 69.10 | 209.10 | **3,300** | **232** | |
| **3,400** | 9.65 | 1.44 | 0.98 | | 0.00 | 0.00 | 1.16 | 0.00 | 0.43 | 3.61 | 5.20 | 3,400 | 5.43 | 0.46 | 0.00 | 0.00 | 3,400 | 5.43 | 0.46 | 66.73 | 0.14 | 73.05 | 213.05 | **3,400** | **244** | |
| **3,500** | 9.93 | 1.53 | 1.04 | | 0.00 | 0.00 | 1.22 | 0.00 | 0.46 | 3.83 | 5.51 | 3,500 | 5.59 | 0.48 | 0.00 | 0.00 | 3,500 | 5.59 | 0.48 | 70.40 | 0.15 | 77.09 | 217.09 | **3,500** | **256** | |
| **3,600** | 10.21 | 1.62 | 1.09 | | 0.00 | 0.00 | 1.30 | 0.00 | 0.49 | 4.05 | 5.83 | 3,600 | 5.74 | 0.51 | 0.00 | 0.00 | 3,600 | 5.74 | 0.51 | 74.17 | 0.15 | 81.24 | 221.24 | **3,600** | **268** | |
| **3,700** | 10.50 | 1.71 | 1.15 | | 0.00 | 0.00 | 1.37 | 0.00 | 0.51 | 4.28 | 6.16 | 3,700 | 5.90 | 0.54 | 0.00 | 0.00 | 3,700 | 5.90 | 0.54 | 78.02 | 0.16 | 85.49 | 225.49 | **3,700** | **281** | |
| **3,800** | 10.78 | 1.80 | 1.21 | | 0.00 | 0.00 | 1.44 | 0.00 | 0.54 | 4.51 | 6.50 | 3,800 | 6.06 | 0.57 | 0.00 | 0.00 | 3,800 | 6.06 | 0.57 | 81.97 | 0.17 | 89.85 | 229.85 | **3,800** | **294** | |
| **3,900** | 11.06 | 1.90 | 1.27 | | 0.00 | 0.00 | 1.52 | 0.00 | 0.57 | 4.75 | 6.84 | 3,900 | 6.22 | 0.60 | 0.00 | 0.00 | 3,900 | 6.22 | 0.60 | 86.01 | 0.18 | 94.30 | 234.30 | **3,900** | **308** | |
| **4,000** | 11.35 | 2.00 | 1.33 | | 0.00 | 0.00 | 1.60 | 0.00 | 0.60 | 5.00 | 7.20 | 3,900 | 6.38 | 0.63 | 0.00 | 0.00 | 4,000 | 6.38 | 0.63 | 90.13 | 0.19 | 98.85 | 238.85 | **4,000** | **322** | |

## Table C-2: Blanco Drain Divserion Pump Station, 20-inch Force Main

### System Head Calculations

| Parameter | Value |
|---|---|
| Number of Pumps in Parallel | **1** |
| Pump Discharge Diameter (inches) | **14** |
| Length of Pump Discharge (feet) | **40** |
| Discharge Hazen-Williams Coefficient (C) | **130** |
| Force Main Diameter in PS#2 (inches) | **16** |
| Force Main Length in PS#2 (feet) | **0** |
| Force Main Diameter from PS#2 to MH (inches) | **20** |
| Force Main Length from PS#2 to MH (feet) | **9500** |
| Force Main Hazen-Williams Coefficient (C) | **120** |
| Outfall Elevation (feet) | **143.00** |
| Wetwell Pumping Level (feet) | **3.00** |
| Static Lift (feet) | 140.00 |

| Fitting | K Value |
|---|---|
| 45 Elbow | 0.2 |
| 90 Elbow | 0.3 |
| 22.5 Elbow | 0.075 |
| 11.25 Elbow | 0 |
| GV | 0.3 |
| CV | 2.5 |
| Reducer | 0.03 |
| FR Elbow | 0.3 |
| Tee branch | 0.75 |

| Pump Discharge Piping | | | | | | | | | | | | Force Main in PS | | | | | Force Main from PS to MH | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Minor Losses | | | | | | | | | | | | | | | | | | | | | | |
| Flow (gpm) | Velocity (fps) | Velocity Head (ft) | Friction Loss (ft) | K: | Flare Elbow **0** (ft) | Suction Elbow **0** (ft) | Discharge Elbows **0.8** (ft) | Tee Branch **0** (ft) | Gate Valve **0.3** (ft) | Check Valve **2.5** (ft) | Total Minor Losses (ft) | Flow (gpm) | Velocity (fps) | Velocity Head (ft) | Friction Loss (ft) | **0.0** Minor Losses (ft) | Flow (gpm) | Velocity (fps) | Velocity Head (ft) | Friction Loss (ft) | **0.3** Minor Losses (ft) | Total Loss (ft) | TDH (ft) | Pump Flow (gpm) | HP at 75% eff. HP | |
| **0** | 0.00 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0.00 | 0.00 | 0.00 | 0.00 | - | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 140.00 | **0** | **0** | |
| **100** | 0.21 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 100 | 0.16 | 0.00 | 0.00 | 0.00 | 100 | 0.10 | 0.00 | 0.03 | 0.00 | 0.04 | 140.04 | **100** | **5** | |
| **200** | 0.42 | 0.00 | 0.00 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 200 | 0.32 | 0.00 | 0.00 | 0.00 | 200 | 0.20 | 0.00 | 0.12 | 0.00 | 0.13 | 140.13 | **200** | **9** | |
| **300** | 0.63 | 0.01 | 0.01 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.02 | 300 | 0.48 | 0.00 | 0.00 | 0.00 | 300 | 0.31 | 0.00 | 0.25 | 0.00 | 0.28 | 140.28 | **300** | **14** | |
| **400** | 0.83 | 0.01 | 0.01 | | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.03 | 0.04 | 400 | 0.64 | 0.01 | 0.00 | 0.00 | 400 | 0.41 | 0.00 | 0.43 | 0.00 | 0.48 | 140.48 | **400** | **19** | |
| **500** | 1.04 | 0.02 | 0.01 | | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.04 | 0.06 | 500 | 0.80 | 0.01 | 0.00 | 0.00 | 500 | 0.51 | 0.00 | 0.65 | 0.00 | 0.72 | 140.72 | **500** | **24** | |
| **600** | 1.25 | 0.02 | 0.02 | | 0.00 | 0.00 | 0.02 | 0.00 | 0.01 | 0.06 | 0.09 | 600 | 0.96 | 0.01 | 0.00 | 0.00 | 600 | 0.61 | 0.01 | 0.91 | 0.00 | 1.02 | 141.02 | **600** | **28** | |
| **700** | 1.46 | 0.03 | 0.02 | | 0.00 | 0.00 | 0.03 | 0.00 | 0.01 | 0.08 | 0.12 | 700 | 1.12 | 0.02 | 0.00 | 0.00 | 700 | 0.71 | 0.01 | 1.21 | 0.00 | 1.36 | 141.36 | **700** | **33** | |
| **800** | 1.67 | 0.04 | 0.03 | | 0.00 | 0.00 | 0.03 | 0.00 | 0.01 | 0.11 | 0.16 | 800 | 1.28 | 0.03 | 0.00 | 0.00 | 800 | 0.82 | 0.01 | 1.55 | 0.00 | 1.74 | 141.74 | **800** | **38** | |
| **900** | 1.88 | 0.05 | 0.04 | | 0.00 | 0.00 | 0.04 | 0.00 | 0.02 | 0.14 | 0.20 | 900 | 1.44 | 0.03 | 0.00 | 0.00 | 900 | 0.92 | 0.01 | 1.93 | 0.00 | 2.17 | 142.17 | **900** | **43** | |
| **1,000** | 2.08 | 0.07 | 0.05 | | 0.00 | 0.00 | 0.05 | 0.00 | 0.02 | 0.17 | 0.24 | 1,000 | 1.60 | 0.04 | 0.00 | 0.00 | 1,000 | 1.02 | 0.02 | 2.34 | 0.00 | 2.64 | 142.64 | **1,000** | **48** | |
| **1,100** | 2.29 | 0.08 | 0.06 | | 0.00 | 0.00 | 0.07 | 0.00 | 0.02 | 0.20 | 0.29 | 1,100 | 1.76 | 0.05 | 0.00 | 0.00 | 1,100 | 1.12 | 0.02 | 2.79 | 0.01 | 3.15 | 143.15 | **1,100** | **53** | |
| **1,200** | 2.50 | 0.10 | 0.07 | | 0.00 | 0.00 | 0.08 | 0.00 | 0.03 | 0.24 | 0.35 | 1,200 | 1.91 | 0.06 | 0.00 | 0.00 | 1,200 | 1.23 | 0.02 | 3.28 | 0.01 | 3.71 | 143.71 | **1,200** | **58** | |
| **1,300** | 2.71 | 0.11 | 0.08 | | 0.00 | 0.00 | 0.09 | 0.00 | 0.03 | 0.29 | 0.41 | 1,300 | 2.07 | 0.07 | 0.00 | 0.00 | 1,300 | 1.33 | 0.03 | 3.80 | 0.01 | 4.30 | 144.30 | **1,300** | **63** | |
| **1,400** | 2.92 | 0.13 | 0.09 | | 0.00 | 0.00 | 0.11 | 0.00 | 0.04 | 0.33 | 0.48 | 1,400 | 2.23 | 0.08 | 0.00 | 0.00 | 1,400 | 1.43 | 0.03 | 4.36 | 0.01 | 4.94 | 144.94 | **1,400** | **68** | |
| **1,500** | 3.13 | 0.15 | 0.10 | | 0.00 | 0.00 | 0.12 | 0.00 | 0.05 | 0.38 | 0.55 | 1,500 | 2.39 | 0.09 | 0.00 | 0.00 | 1,500 | 1.53 | 0.04 | 4.96 | 0.01 | 5.62 | 145.62 | **1,500** | **74** | |
| **1,600** | 3.33 | 0.17 | 0.12 | | 0.00 | 0.00 | 0.14 | 0.00 | 0.05 | 0.43 | 0.62 | 1,600 | 2.55 | 0.10 | 0.00 | 0.00 | 1,600 | 1.63 | 0.04 | 5.59 | 0.01 | 6.34 | 146.34 | **1,600** | **79** | |
| **1,700** | 3.54 | 0.19 | 0.13 | | 0.00 | 0.00 | 0.16 | 0.00 | 0.06 | 0.49 | 0.70 | 1,700 | 2.71 | 0.11 | 0.00 | 0.00 | 1,700 | 1.74 | 0.05 | 6.25 | 0.01 | 7.09 | 147.09 | **1,700** | **84** | |
| **1,800** | 3.75 | 0.22 | 0.14 | | 0.00 | 0.00 | 0.17 | 0.00 | 0.07 | 0.55 | 0.79 | 1,800 | 2.87 | 0.13 | 0.00 | 0.00 | 1,800 | 1.84 | 0.05 | 6.95 | 0.02 | 7.89 | 147.89 | **1,800** | **90** | |
| **1,900** | 3.96 | 0.24 | 0.16 | | 0.00 | 0.00 | 0.19 | 0.00 | 0.07 | 0.61 | 0.88 | 1,900 | 3.03 | 0.14 | 0.00 | 0.00 | 1,900 | 1.94 | 0.06 | 7.68 | 0.02 | 8.73 | 148.73 | **1,900** | **95** | |
| **2,000** | 4.17 | 0.27 | 0.17 | | 0.00 | 0.00 | 0.22 | 0.00 | 0.08 | 0.67 | 0.97 | 2,000 | 3.19 | 0.16 | 0.00 | 0.00 | 2,000 | 2.04 | 0.06 | 8.44 | 0.02 | 9.61 | 149.61 | **2,000** | **101** | |
| **2,100** | 4.38 | 0.30 | 0.19 | | 0.00 | 0.00 | 0.24 | 0.00 | 0.09 | 0.74 | 1.07 | 2,100 | 3.35 | 0.17 | 0.00 | 0.00 | 2,100 | 2.14 | 0.07 | 9.24 | 0.02 | 10.52 | 150.52 | **2,100** | **106** | |
| **2,200** | 4.59 | 0.33 | 0.21 | | 0.00 | 0.00 | 0.26 | 0.00 | 0.10 | 0.82 | 1.18 | 2,200 | 3.51 | 0.19 | 0.00 | 0.00 | 2,200 | 2.25 | 0.08 | 10.07 | 0.02 | 11.48 | 151.48 | **2,200** | **112** | |
| **2,300** | 4.79 | 0.36 | 0.23 | | 0.00 | 0.00 | 0.29 | 0.00 | 0.11 | 0.89 | 1.28 | 2,300 | 3.67 | 0.21 | 0.00 | 0.00 | 2,300 | 2.35 | 0.09 | 10.93 | 0.03 | 12.47 | 152.47 | **2,300** | **118** | 5 cfs |
| **2,400** | 5.00 | 0.39 | 0.24 | | 0.00 | 0.00 | 0.31 | 0.00 | 0.12 | 0.97 | 1.40 | 2,400 | 3.83 | 0.23 | 0.00 | 0.00 | 2,400 | 2.45 | 0.09 | 11.83 | 0.03 | 13.50 | 153.50 | **2,400** | **124** | |
| **2,500** | 5.21 | 0.42 | 0.26 | | 0.00 | 0.00 | 0.34 | 0.00 | 0.13 | 1.05 | 1.52 | 2,500 | 3.99 | 0.25 | 0.00 | 0.00 | 2,500 | 2.55 | 0.10 | 12.76 | 0.03 | 14.57 | 154.57 | **2,500** | **130** | |
| **2,600** | 5.42 | 0.46 | 0.28 | | 0.00 | 0.00 | 0.36 | 0.00 | 0.14 | 1.14 | 1.64 | 2,600 | 4.15 | 0.27 | 0.00 | 0.00 | 2,600 | 2.66 | 0.11 | 13.72 | 0.03 | 15.67 | 155.67 | **2,600** | **136** | |
| **2,700** | 5.63 | 0.49 | 0.30 | | 0.00 | 0.00 | 0.39 | 0.00 | 0.15 | 1.23 | 1.77 | 2,700 | 4.31 | 0.29 | 0.00 | 0.00 | 2,700 | 2.76 | 0.12 | 14.71 | 0.04 | 16.82 | 156.82 | **2,700** | **143** | 6 cfs |
| **2,800** | 5.84 | 0.53 | 0.32 | | 0.00 | 0.00 | 0.42 | 0.00 | 0.16 | 1.32 | 1.90 | 2,800 | 4.47 | 0.31 | 0.00 | 0.00 | 2,800 | 2.86 | 0.13 | 15.73 | 0.04 | 18.00 | 158.00 | **2,800** | **149** | |
| **2,900** | 6.04 | 0.57 | 0.35 | | 0.00 | 0.00 | 0.45 | 0.00 | 0.17 | 1.42 | 2.04 | 2,900 | 4.63 | 0.33 | 0.00 | 0.00 | 2,900 | 2.96 | 0.14 | 16.79 | 0.04 | 19.22 | 159.22 | **2,900** | **155** | |
| **3,000** | 6.25 | 0.61 | 0.37 | | 0.00 | 0.00 | 0.49 | 0.00 | 0.18 | 1.52 | 2.19 | 3,000 | 4.79 | 0.36 | 0.00 | 0.00 | 3,000 | 3.06 | 0.15 | 17.87 | 0.04 | 20.47 | 160.47 | **3,000** | **162** | |
| **3,100** | 6.46 | 0.65 | 0.39 | | 0.00 | 0.00 | 0.52 | 0.00 | 0.19 | 1.62 | 2.33 | 3,100 | 4.95 | 0.38 | 0.00 | 0.00 | 3,100 | 3.17 | 0.16 | 18.99 | 0.05 | 21.76 | 161.76 | **3,100** | **169** | |
| **3,200** | 6.67 | 0.69 | 0.41 | | 0.00 | 0.00 | 0.55 | 0.00 | 0.21 | 1.73 | 2.49 | 3,200 | 5.11 | 0.40 | 0.00 | 0.00 | 3,200 | 3.27 | 0.17 | 20.14 | 0.05 | 23.09 | 163.09 | **3,200** | **176** | 7 cfs |
| **3,300** | 6.88 | 0.73 | 0.44 | | 0.00 | 0.00 | 0.59 | 0.00 | 0.22 | 1.84 | 2.64 | 3,300 | 5.27 | 0.43 | 0.00 | 0.00 | 3,300 | 3.37 | 0.18 | 21.32 | 0.05 | 24.46 | 164.46 | **3,300** | **183** | |
| **3,400** | 7.09 | 0.78 | 0.46 | | 0.00 | 0.00 | 0.62 | 0.00 | 0.23 | 1.95 | 2.81 | 3,400 | 5.43 | 0.46 | 0.00 | 0.00 | 3,400 | 3.47 | 0.19 | 22.53 | 0.06 | 25.86 | 165.86 | **3,400** | **190** | |
| **3,500** | 7.30 | 0.83 | 0.49 | | 0.00 | 0.00 | 0.66 | 0.00 | 0.25 | 2.07 | 2.97 | 3,500 | 5.59 | 0.48 | 0.00 | 0.00 | 3,500 | 3.57 | 0.20 | 23.77 | 0.06 | 27.30 | 167.30 | **3,500** | **197** | |
| **3,600** | 7.50 | 0.87 | 0.52 | | 0.00 | 0.00 | 0.70 | 0.00 | 0.26 | 2.19 | 3.15 | 3,600 | 5.74 | 0.51 | 0.00 | 0.00 | 3,600 | 3.68 | 0.21 | 25.04 | 0.06 | 28.77 | 168.77 | **3,600** | **205** | |
| **3,700** | 7.71 | 0.92 | 0.54 | | 0.00 | 0.00 | 0.74 | 0.00 | 0.28 | 2.31 | 3.32 | 3,700 | 5.90 | 0.54 | 0.00 | 0.00 | 3,700 | 3.78 | 0.22 | 26.35 | 0.07 | 30.28 | 170.28 | **3,700** | **212** | |
| **3,800** | 7.92 | 0.97 | 0.57 | | 0.00 | 0.00 | 0.78 | 0.00 | 0.29 | 2.44 | 3.51 | 3,800 | 6.06 | 0.57 | 0.00 | 0.00 | 3,800 | 3.88 | 0.23 | 27.68 | 0.07 | 31.83 | 171.83 | **3,800** | **220** | |
| **3,900** | 8.13 | 1.03 | 0.60 | | 0.00 | 0.00 | 0.82 | 0.00 | 0.31 | 2.57 | 3.69 | 3,900 | 6.22 | 0.60 | 0.00 | 0.00 | 3,900 | 3.98 | 0.25 | 29.04 | 0.07 | 33.41 | 173.41 | **3,900** | **228** | |
| **4,000** | 8.34 | 1.08 | 0.63 | | 0.00 | 0.00 | 0.86 | 0.00 | 0.32 | 2.70 | 3.89 | 4,000 | 6.38 | 0.63 | 0.00 | 0.00 | 4,000 | 4.09 | 0.26 | 30.43 | 0.08 | 35.02 | 175.02 | **4,000** | **236** | |

**Table C-3: Estimated Cost of Construction of the Blanco Drain Diversion Pump Station**
**16" Force Main**
Preliminary Design Cost Estimate

April-14
By: Josh Tabije

| Item of Work | Unit | Unit Cost | Quantity | Subtotal |
|---|---|---|---|---|
| ***Mobilization / Demobilization*** | | | | |
| ~ 5% of of project cost. This cost includes permits, fees, temporary structures, equipment rental and various misc. items | | | | ***$86,000*** |
| ***Structures*** | | | | |
| 96" Precast Manhole | EA | $30,000 | 1 | $30,000 |
| Cast-In-Place Concrete | CY | $1,000 | 40 | $40,000 |
| Concrete Dowel Inserts | EA | $300 | 30 | $9,000 |
| Wetwell Inlet Pipe | LF | $300 | 80 | $24,000 |
| | | | | ***$79,000*** |
| ***Miscellaneous Exterior Site Work*** | | | | |
| Excavation | CY | $140 | 180 | $25,200 |
| Site Shoring | SF | $3 | 1200 | $3,600 |
| Concrete Channel Lining | CY | $410 | 20 | $8,200 |
| Concrete Seal Slab | CY | $340 | 4 | $1,360 |
| Concrete Stairs | CY | $420 | 4 | $1,680 |
| Grouted RipRap | CY | $160 | 38 | $6,080 |
| | | | | ***$46,120*** |
| ***Pump Station/Channel Ammenities*** | | | | |
| 88 hp Flygt Centrifugal Pump | EA | $79,200 | 2 | $158,400 |
| Pump Installation | LS | $12,000 | 1 | $12,000 |
| Pump Discharge Pipe | LF | $200 | 50 | $10,000 |
| Aluminum Pump Access Hatch | EA | $17,900 | 1 | $17,900 |
| Fiberglass Railing | LS | $12,000 | 1 | $12,000 |
| | | | | ***$210,300*** |
| ***Force Main*** | | | | |
| 16-Inch C900 PVC with Trench and Backfill | LF | $100 | 9000 | $900,000 |
| 16-Inch C900 PVC HDD | LF | $600 | 500 | $300,000 |
| | | | | ***$1,200,000*** |
| ***Electrical Equipment*** | | | | |
| Electrical Equipment (Including Installation) | LS | $158,000 | 1 | $158,000 |
| Electrical Conduit Run | LF | $100 | 100 | $10,000 |
| | | | | ***$168,000*** |
| **ESTIMATED CONSTRUCTION COST** | | | | **$1,789,420** |
| **INSPECTION AND TESTING (15%)** | | | | **$268,000** |
| **CONSTRUCTION CONTINGENCY (20%)** | | | | **$358,000** |
| **ESTIMATED TOTAL CONSTRUCTION COST** | | | | **$2,415,000** |
| **DESIGN, PERMITTING, LEGAL (40%)** | | | | **$966,000** |

**This estimate of construction cost is a professional opinion, based upon the engineer's experience with the design and construction of similar projects. It is prepared only as a guide and is subject to change. Schaaf & Wheeler and its subconsultants make no warranty, whether expressed or implied, that the actual costs will not vary from these estimated costs, and assumes no liability for such variances. This estimate specifically excludes any costs associated with designing for handling and disposal of hazardous wastes and contaminated materials. Costs associated with land, right-of-way, or easement purchase are not included in this estimate.**

**Table C-4: Estimated Cost of Construction of the Blanco Drain Diversion Pump Station**
**20" Force Main**
Preliminary Design Cost Estimate

2-Apr-14
By: Josh Tabije

| Item of Work | Unit | Unit Cost | Quantity | Subtotal |
|---|---|---|---|---|
| ***Mobilization / Demobilization*** | | | | |
| ~ 5% of of project cost. This cost includes permits, fees, temporary structures, equipment rental and various misc. items | | | | ***$109,000*** |
| ***Structures*** | | | | |
| 96" Precast Manhole | EA | $30,000 | 1 | $30,000 |
| Cast-In-Place Concrete | CY | $1,000 | 40 | $40,000 |
| Concrete Dowel Inserts | EA | $300 | 30 | $9,000 |
| Wetwell Inlet Pipe | LF | $300 | 80 | $24,000 |
| | | | | ***$79,000*** |
| ***Miscellaneous Exterior Site Work*** | | | | |
| Excavation | CY | $140 | 180 | $25,200 |
| Site Shoring | SF | $3 | 1200 | $3,600 |
| Concrete Channel Lining | CY | $410 | 20 | $8,200 |
| Concrete Seal Slab | CY | $340 | 4 | $1,360 |
| Concrete Stairs | CY | $420 | 4 | $1,680 |
| Grouted RipRap | CY | $160 | 38 | $6,080 |
| | | | | ***$46,120*** |
| ***Pump Station/Channel Ammenities*** | | | | |
| 143 hp Pump | EA | $128,700 | 2 | $257,400 |
| Pump Installation | LS | $12,000 | 1 | $12,000 |
| Pump Discharge Pipe | LF | $200 | 50 | $10,000 |
| Aluminum Pump Access Hatch | EA | $17,900 | 1 | $17,900 |
| Fiberglass Railing | LS | $12,000 | 1 | $12,000 |
| | | | | ***$309,300*** |
| ***Force Main*** | | | | |
| 20-Inch C900 PVC with Trench and Backfill | LF | $130 | 9000 | $1,170,000 |
| 20-Inch C900 PVC HDD | LF | $600 | 500 | $300,000 |
| | | | | ***$1,470,000*** |
| ***Electrical Equipment*** | | | | |
| Electrical Equipment (Including Installation) | LS | $257,000 | 1 | $257,000 |
| Electrical Conduit Run | LF | $100 | 100 | $10,000 |
| | | | | ***$267,000*** |
| **ESTIMATED CONSTRUCTION COST** | | | | **$2,280,420** |
| **INSPECTION AND TESTING (15%)** | | | | **$342,000** |
| **CONSTRUCTION CONTINGENCY (20%)** | | | | **$456,000** |
| **ESTIMATED TOTAL CONSTRUCTION COST** | | | | **$3,078,000** |
| **DESIGN, PERMITTING, LEGAL (40%)** | | | | **$1,232,000** |

**This estimate of construction cost is a professional opinion, based upon the engineer's experience with the design and construction of similar projects. It is prepared only as a guide and is subject to change. Schaaf & Wheeler and its subconsultants make no warranty, whether expressed or implied, that the actual costs will not vary from these estimated costs, and assumes no liability for such variances. This estimate specifically excludes any costs associated with designing for handling and disposal of hazardous wastes and contaminated materials. Costs associated with land, right-of-way, or easement purchase are not included in this estimate.**

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# Appendix R

# Groundwater Replenishment Project Urban Runoff Capture at Lake El Estero

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# GROUNDWATER REPLENISHMENT PROJECT

# URBAN RUNOFF CAPTURE AT LAKE EL ESTERO

Prepared for

**DENISE DUFFY & ASSOCIATES**


Prepared by

**Schaaf & Wheeler**
CONSULTING CIVIL ENGINEERS
3 QUAIL RUN CIRCLE, SUITE 101
SALINAS, CA 93907

**April 2014**

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**Table i. Acronyms Used in this Report**

| Acronym | Description |
|---|---|
| AFY, ac-ft/yr | Acre-feet/year |
| cfs | Cubic foot per second |
| gpd | Gallons per day |
| mgd | Million gallons per day |
| mg/L | Milligrams per liter |
| µg/L | Micrograms per liter |
| MPN | Most Probable Number |
| ppb | Parts per billion |
| ppm | Parts per million |
| | |
| ASBS | Areas of Special Biological Significance |
| ASR | Aquifer Storage and Recovery |
| BMP | Best management practice |
| CAW, CalAm | California American Water Company |
| CCAMP | Central Coast Ambient Monitoring Program |
| CCR | California Code of Regulations |
| CCRWQCB | Central Coast Regional Water Quality Control Board |
| CDPH | California Department of Public Health |
| CEQA | California Environmental Quality Act |
| CSIP | Castroville Seawater Intrusion Project |
| CWC | California Water Code |
| DWR | California Department of Water Resources |
| GWR | Groundwater Replenishment |
| MCWRA | Monterey County Water Resources Agency |
| MPWMD | Monterey Peninsula Water Management District |
| MRSWMP | Monterey Regional Stormwater Management Program |
| MRWPCA | Monterey Regional Water Pollution Control Agency |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic and Atmospheric Administration |
| NRCS | USDA Natural Resources Conservation Service |
| RTP | Regional Treatment Plant |
| SB | California Senate Bill |
| SIWTF | Salinas Industrial Wastewater Treatment Facility |
| SRDF | Salinas River Diversion Facility |
| SRDP | Salinas River Diversion Project |
| SVRP | Salinas Valley Reclamation Plant |
| SVWP | Salinas Valley Water Project |
| SVGB | Salinas Valley Groundwater Basin |
| SWRCB | California State Water Resources Control Board |
| USACE | U.S. Army Corps of Engineers |
| USBR | U.S. Bureau of Reclamation |
| USGS | U.S. Geologic Survey |

**Table ii. Units of Measure Used in this Report**

| Unit | Equals |
|---|---|
| 1 acre-foot | = 43,560 cubic feet<br>= 325,851 gallons |
| 1 cubic foot | = 7.48 gallons |
| 1 cfs | = 448.8 gallons per minute |
| 1 MGD | = 1,000,000 gallons/day<br>= 1,120 acre-feet / year |
| 1 mg/L | = 1 ppm<br>= $1 / 10^6$ |
| 1 µg/L | = 1 ppb<br>=$1 / 10^9$ |

## Summary of Lake El Estero Yield Study

The Monterey Peninsula Water Management District (MPWMD) and the Monterey Regional Water Pollution Control Agency (MRWPCA) are studying the proposed Groundwater Replenishment Project (Proposed Project), with the goal of producing highly treated recycled water supply for injection into the Seaside Groundwater Basin to replace existing supplies. The purpose of this study was to analyze the availability of stormwater runoff from portions of the City of Monterey for this project, and provide an engineering analysis of the infrastructure required and the effect of flow reductions to the Monterey Bay.

The City of Monterey maintains Lake El Estero as the central feature of the Lake El Estero Municipal Park. The Lake covers approximately 18-acres, and collects runoff from approximately 3.78 square-miles of urban, suburban and wooded area. Although the Lake is within one mile of the Monterey Bay, it does not directly connect to ocean. The Lake level is maintained for aesthetics and recreation use, and storm flows are pumped to the ocean through a gated pipeline. Two gravity pipelines provide an overflow outlet from the Lake to the beach.

Diverting stormwater flows into the sanitary sewer system as a source of supply for the Proposed Project was analyzed. Annual runoff into the Lake was estimated to average 268 acre-feet per year. Of that, an average of 87 acre-feet per year may be diverted to the Proposed Project using existing capacity in the City's wastewater collection system. Stormwater not captured for the Proposed Project would remain in the Lake or continue to be discharged to the ocean.

The drainage basin immediately to the west of the Lake drained into Lake El Estero until 1941, when a new storm sewer was installed in Figueroa Street which redirected those flows to Del Monte Beach. This basin is approximately 1.85 square-miles, and produces an estimated average runoff of 227 acre-feet per year. If this drainage basin were reconnected to the Lake, the average Proposed Project yield would increase to 136 acre-feet per year.

Limited water quality sampling indicates that the water in Lake El Estero is of a better quality than City stormwater discharging directly to the Bay. The Lake provides a basin for sediments and metals to settle out of the water column. As such, it is currently one of the more benign sources of fresh water inflow to the Bay. The Monterey Bay at Del Monte Beach is not classified as an estuary, so minimum targets for freshwater inflows have not been established. Reducing the annual discharge of stormwater is not anticipated to have a negative effect on the Bay water quality. If stormwater flows that currently discharge directly to the Bay are routed through the Lake, the average quality of stormwater discharges would be expected to improve. The only noted water quality risk of the Proposed Project is an increased chance of overflows in the sanitary sewer system due to adding stormwater to a portion of the collection system. Automated in-pipe flow monitoring will be required to shut off the stormwater diversion system if the pipeline capacity is needed to convey peak wet weather sanitary sewer flows.

# Section 1 - Introduction

## 1.1 Project Description

The Monterey Peninsula Water Management District (MPWMD) and the Monterey Regional Water Pollution Control Agency (MRWPCA) are studying the proposed Monterey Peninsula Groundwater Recharge Project (Proposed Project), with the goal of producing highly treated recycled water supply for injection into the Seaside Groundwater Basin. Source water for the project may come from the City of Salinas Industrial Wastewater Treatment Facility, the Reclamation Ditch, the Blanco Drain, stormwater from MRWPCA member cities and/or secondary effluent from the MRWPCA Regional Treatment Plant. Water supplied to the Proposed Project would undergo primary and secondary treatment at the existing Regional Treatment Plant, followed by advanced treatment at a new facility to be located at the MRWPCA site, and then be conveyed to the Seaside Groundwater Basin for injection.

The MRWPCA provides wastewater treatment for municipalities along the Monterey Bay from Pacific Grove north to Moss Landing, and inland to the City of Salinas. Wastewater is collected in an interceptor pipeline system and conveyed to the Regional Treatment Plant (RTP), located north of the City of Marina. The RTP has an average dry weather design capacity of 29.6 million gallons per day (mgd) and a peak wet weather design capacity of 75.6 mgd. It currently receives and treats approximately 17 to 18 mgd of average dry weather flow and therefore has capacity to treat additional flows. The interceptor pipeline system also has currently unused or excess conveyance capacity. The Proposed Project will use the existing excess capacity in the wastewater interceptor system to convey source flows to the RTP using, rather than constructing a parallel conveyance system.

The purpose of this study was to analyze water availability from urban stormwater runoff into Lake El Estero and provide an engineering analysis of the potential yields and the infrastructure required to capture and convey those flows to the RTP. Transfers of source water flowing in known and definite channels, such as the City of Monterey's Lake El Estero, to the Proposed Project would be a consumptive use that may require an appropriative permit from the State Water Resources Control Board (SWRCB). If a permit is required, this hydrologic information and analysis may be used in the permit application to the SWRCB.

## 1.2 Water Source Description

Lake El Estero is an 18-acre lake located in the City of Monterey, less than one mile from the coast. It is fed by four tributary streams and a portion of the City's stormwater collection system. One tributary is a named stream (Majors Creek which runs through Dahvee Park), and the other three are unnamed streams. The Lake El Estero drainage basin is 2,418 acres, or approximately 3.78 square miles.

The Lake was originally a brackish lagoon, connected by a surface stream to the Monterey Bay. The connection to the bay was changed to pipe culverts in the 1870s when the Monterey and Salinas Valley Railroad was constructed. The Lake has been dredged several times during the last century to remove accumulated sediment. Until 1941, the drainage basin included 1,186-acres to the west, extending to Huckleberry Hill, which entered the Lake through a box culvert under Pearl Street. This portion of the City stormwater system was reconfigured with the addition of a box culvert under Figueroa Street, which now carries the flow from Pearl Street to discharge into the Monterey Bay at the Municipal Wharf. In 1968, the current stormwater pump station at the northeast corner of the lake and outfall pipeline were constructed to facilitate better management of water levels in the Lake.

In 1999, Fugro West[1] prepared a study of potential non-potable water supplies for the City of Monterey, and concluded that shallow groundwater percolates into Lake El Estero. Based upon their observations, groundwater inflows were estimated at 135 acre-feet/year. These inflows were found to replace evaporative losses and provide irrigation supply water to the City, which uses lake water for irrigation of the surrounding park (and cemetery). This groundwater inflow was not considered for diversion to the Proposed Project.

The Lake is surrounded by the City of Monterey's El Estero Park Complex, which includes sports facilities, play grounds, a fishing pier and a paddle boat wharf. The lake provides habitat for fish, amphibians, reptiles and native and migratory birds.

The Central Coast Regional Water Quality Control Board (CCRWQCB) has listed Majors Creek on the impaired water body listing pursuant to Section 303(d) of the Clean Water Act for copper, lead, zinc and Escherichia coli concentrations, and has listed the Monterey Harbor as impaired for metals and sediment toxicity. Lake El Estero is not a listed water body. A summary matrix of 303(d) listed streams is provided in Table B-1. Water quality is discussed in greater detail in Section 4 of this report.

[1] Engineering Analysis, Development of Non-Potable Irrigation Water Systems, pages 24-25

# Section 2 - Yield Estimation

## 2.1 Methodology

Estimates of surface runoff into Lake El Estero from the City of Monterey were made based on daily rainfall gage data, National Resource Conservation Service[2] mapped hydrologic soil group information, and land use as shown on aerial photographs. Calculations were made for each day and aggregated by month and water year (October 1 through September 30) using the methods in SCS Manual TR-55, Urban Hydrology for Small Watersheds. Runoff curve numbers (CN) were determined based on soil group and cover. Curve numbers appropriate for scrub cover were used for areas of natural vegetation, and curve numbers appropriate for irrigated pasture were used for lawns and other irrigated ground cover. A curve number of 98 for antecedent moisture condition (AMC) II was used for all impervious areas. The runoff curve numbers used to calculate runoff varied between AMC I (with 1.4 inches or less during previous five days) and AMC III (with 2.1 inches or more during the previous five days) depending on the precipitation during the previous five days.

For each land use and soil group combination, runoff was determined for each day during the period of record. The following equations are used in the NRCS model:

$$R = \frac{(P - 0.2S)^2}{(P - 0.8S)}$$

Where P is the precipitation in inches, R is the runoff in inches, and S is the storage in inches:

$$S = \frac{1000}{CN} - 10$$

Rainfall Data for Monterey was obtained from NOAA gage USC00045795, Monterey, CA, for the period 10/1/1951 to 9/30/1998, and from gage USC00045802, Monterey WFO, for the period 10/1/1998 to 9/30/2013 (Table B-2). The average annual precipitation is 18.6 inches/year. The Lake El Estero drainage basin is 2,418 acres, or approximately 3.78 square miles (Figure A-1). Using the method described above, the total estimated runoff into Lake El Estero averages 268 acre-feet per year (Table B-3).

Runoff capture from Lake El Estero was estimated for two diversion options, as discussed below.

Option 1 is to divert water from the lake into the municipal sanitary sewer system (Figure A-2). SSMH D05-052 is located near the existing El Estero Stormwater Pump Station. This is a 21-inch vitrified clay pipe (VCP) sewer with a crown elevation lower than the water surface of the lake. Looking at the profile between this manhole and the MRWPCA Monterey Lift Station, the

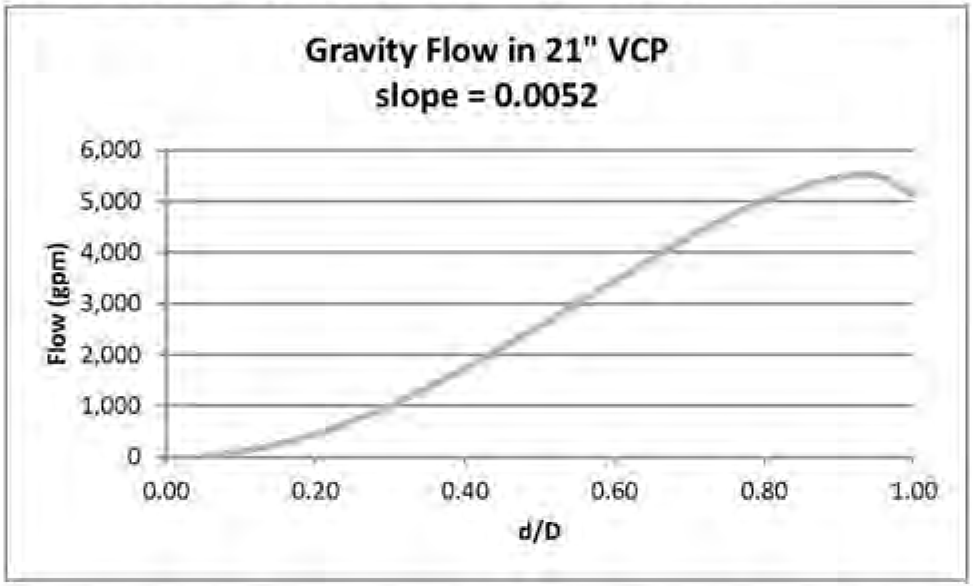
[2] Formerly the USDA Soil Conservation Service

limiting segment is a 21-inch VCP pipe at a slope of 0.0052 (Table 2-1). A flow monitor was installed in the pipeline during the months of November 2013 and January 2014 (see Appendix D). The observed peak dry weather flow (PDWF) in the pipeline was approximately 2,100 gpm. The peak wet weather flow (PWWF) was assumed to be 1.5 x PDWF = 3,100 gpm. Based on the pipeline slope and material, the capacity at d/D = 0.95 is estimated at 5,500 gpm (Figure 2.1), leaving an excess capacity of about 2,400 gpm for stormwater conveyance, or approximately 10.6 acre-feet/day. This diversion may be made with a gravity pipeline controlled by a motorized control valve.

**Table 2-1: Existing Sanitary Sewer Manholes and Pipelines**

| Upstream SSMH | Invert | Downstream SSMH | Invert | D (in) | L (ft) | Slope |
|---|---|---|---|---|---|---|
| D06-004 | -8.6 | D06-005 | -9.1 | 21 | 90 | 0.0056 |
| D06-005 | -9.1 | D05-052 | -10.89 | 21 | 223 | 0.0080 |
| D05-052 | -11.4 | D05-061 | -12.0 | 21 | 88 | 0.0068 |
| D05-061 | -12.0 | MRW-006 | -13.73 | 21 | 343 | 0.0052 |

**Figure 2.1: Capacity Curve for Limiting Sewer Segment**




Runoff capture from Lake El Estero was calculated based on two diversion limits. A lower limit of 5 acre-feet/day was assumed to be too small to initiate the runoff capture system (about three inches of rise in the 18-acre lake surface). The next 10.6 acre-feet were captured by the diversion system. Runoff in excess of 15.6 acre-feet/day was assumed to bypass the system and overflow to the bay. Using these limits, the estimated annual runoff capture was 87 AFY. This varied greatly based on the annual rainfall pattern, from a minimum of 0 AFY to a maximum of 224 AFY.

The City of Monterey and MRWPCA Staff conducted a two-day shunt test during the period February 24-26, 2014, to assess the effects of adding water from Lake El Estero to the municipal wastewater collection and treatment systems. A temporary pump was installed at the stormwater pump station and piped to SSMH D05-052. The pump operated at approximately 1,500 gpm for a period of 50 hours, transferring 4.5 million gallons. The inflow was reported to have caused minor surcharging at the receiving manhole due to the configuration of the temporary piping. Spills or surcharging were not reported for the limiting pipeline segment downstream.

Option 2 is to install a pump station and force main to divert flow directly to the MRWPCA Monterey Pump Station (MPS), which is approximately 0.75 miles from Lake El Estero. The MPS has a rated maximum day capacity of 20 MGD, but is currently using only 8 MGD on peak days, leaving an excess of 12 MGD, or 30 acre-feet/day (Figure A-3). Calculating the daily runoff capture using the same 5 AF/day minimum limit and increasing the maximum capture to 30 AF/day, the estimated annual capture volume is 140 AFY, with a range from 14 AFY (minimum) to 390 AFY (maximum). Although this yield is nearly twice that of the gravity diversion, the total yield is too small to justify the construction cost of a pump station and long force main.

The drainage basin adjacent to the west of the Lake El Estero drainage basin previously drained to the Lake, but was diverted directly to the bay with the construction of a box culvert in Figueroa Street. The connection to the lake may be restored to increase the volume of stormwater captured. This basin has an area of 1,186 acres (1.85 sq-mi). Soil types were identified using the NRCS Web Soil Survey, and land cover was estimated using the USGS 7.5 Minute Topographic Quadrangle for Monterey, CA (Table B-7). Runoff from the basin was estimated using the same method as for Lake El Estero (Table B-8). Although the basin is smaller, the average annual runoff is projected to be nearly equal to Lake El Estero (227 AFY in this basin, compared to 268 AFY in the Lake El Estero basin). The Figueroa basin has approximately the same amount of impervious cover (pavement and rooftops) as the El Estero basin, and the soil is predominantly Group D, which has a high runoff potential. The model results were checked against observed flow data for the Figueroa Box Culvert (see Appendix D). The single day results were within 5% of the metered flows. The multiple day results had a greater error, likely due to over-estimating the effects of antecedent rainfall.

The two areas were combined in a single model, and the runoff capture was recalculated (Tables B-9, 10 and 11). The average annual inflow to the Lake increased to 495 AFY, and the yield from the combined inflows was 136 AFY, an increase of 49 AFY over the Lake alone. To achieve this additional capture, the previous storm drain connection along Pearl Street must be reestablished. This connection should be configured with a by-pass weir, limiting the added inflow to the Lake to 4 ac-ft/day, or about 8 cfs, and allowing higher flows to overflow into the Figueroa Street box culvert. Routing all of the flows through the Lake would result in increased use of the existing stormwater pump station, which is an unnecessary cost.

## 2.2 In-Stream Flow Requirements

Lake El Estero is a land-locked water body which only discharges to the ocean during large storm events. There is no normal connection to the ocean nor a regular or consistent means of fish passage. The City's primary means of discharging water to the ocean is through their stormwater pump station at the northeast corner of the lake. This station moves water from the lake into a 48-inch pipeline that outfalls on Del Monte State Beach above the normal high water line. The pump station intake is screened to prevent fish from entering the station. The outfall structure is gated to prevent sand from accumulating inside the structure when not in use. If the pump station cannot divert the full volume of stormwater runoff entering the lake and the lake level rises sufficiently, water flows through two 33-inch gravity pipelines to a second point of discharge on Del Monte State Beach, west of the pump station outfall (see Figure A-2).

To the east of Lake El Estero is Del Monte Lake, which is a similarly land-locked water body. To the west, the City of Monterey stormwater collection system outfalls to the bay at several locations, the nearest being at the Municipal Wharf.

The City maintains the Lake El Estero water level for aesthetics and recreational use. The proposed project should not reduce the water levels below those currently maintained by the City. It should only reduce the volume of stormwater being discharged to the ocean.

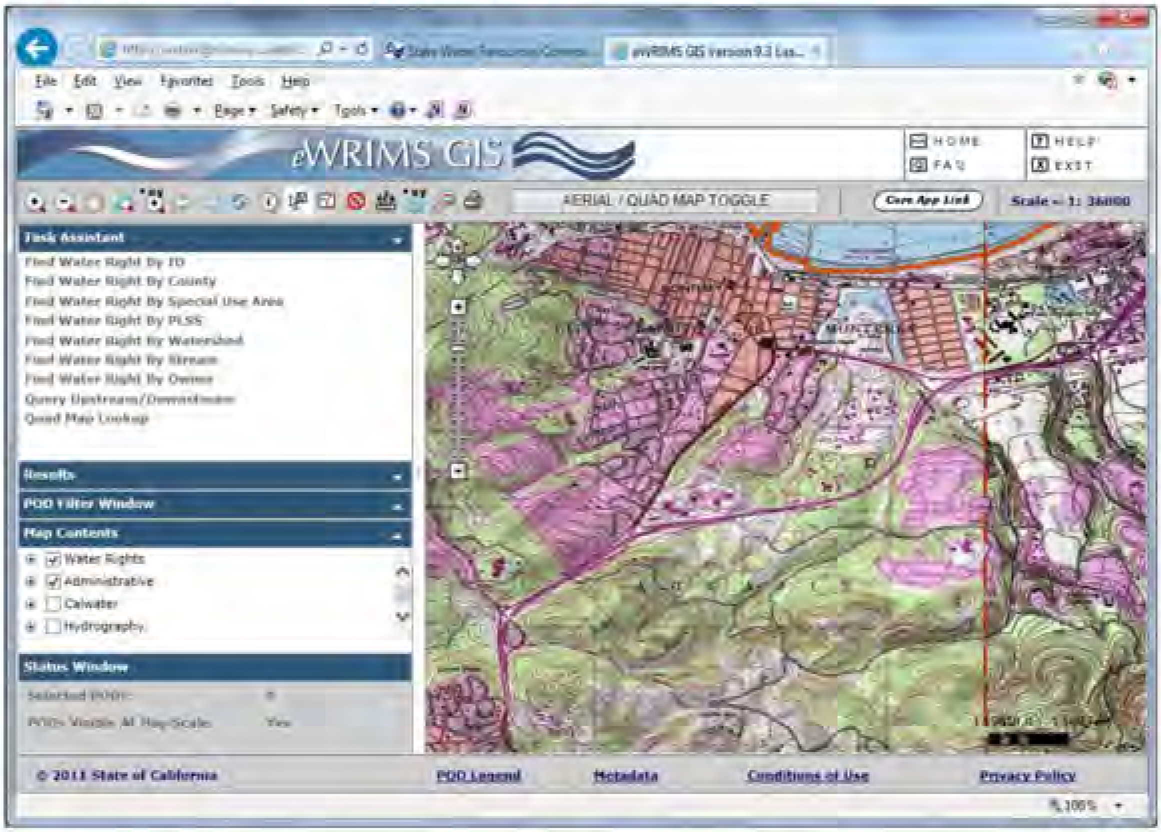
The Monterey Harbor and the Monterey Bay South Coastline are not classified as estuaries, so seasonal freshwater inflows are not required to maintain aquatic habitats. The Monterey Bay National Marine Sanctuary Final Management Plan was reviewed and no requirements for freshwater inflows to this portion of the Bay were listed. The reduction of urban stormwater inflows would be considered a marine water quality benefit because those flows currently carry pollutants into the Sanctuary.

## 2.3 Water Rights

It is not clear that a state water right would be required for the diversion of urban stormwater flows to the Proposed Project. The City of Monterey currently diverts water from the lake for irrigation within the surrounding park without a water right permit. That use may be considered a riparian claim, and therefore exempt from the formal permitting requirement. Existing water rights were researched to determine if any potential conflicts may exist.

The State Water Resources Control Board Electronic Water Rights Information Management System (eWRIMS) was queried to identify existing water rights in the Lake El Estero Watershed. The on-line GIS mapping tool was queried, and no Points of Diversion (PODs) within the Lake El Estero watershed were identified (Figure 2.2). A listing of all current water rights for Monterey County was obtained using a database query, and it also returned negative results for this area.

**Figure 2.2: SWRCB eWRIMS Interface**




The SWRCB Water Rights Order 98-08, Declaration of Fully Appropriated Stream Systems in California, identifies those stream segments which cannot support additional authorizations for diversion. The Carmel River is listed in that decision, but Lake El Estero and its tributary streams are not. There is no regulatory prohibition on requesting a water right from this source.

# Section 3 - Facility Requirements

## 3.1 Description and Sizing

Two conceptual designs were developed for stormwater diversion facilities from the Lake: a gravity connection to the sanitary sewer system controlled by a motorized valve and a pumped diversion with a short force main. The following design criteria and assumptions were used:

- The inlet may be located on the lake bank or within the existing pump station
- The inlet must be screened to minimize fish and trash capture
- The diversion pipeline will connect to the existing sanitary sewer manhole near the stormwater pump station (D05-052)
- The minimum velocity in the pipeline shall be 2 feet/second to prevent the settling of suspended sediments in the pipeline
- The maximum velocity in the pipeline shall be less than 8 feet/second to limit the friction losses
- If required, submersible pumps will be used

Two sets of conceptual design diagrams are provided in Appendix C.

The normal water level of the Lake is above the crown of the receiving sanitary sewer main, so the first option considered was a gravity connection (Figures 1 and 2 in Appendix C). This proposed facility would be configured with a new gravity inlet located on the lake bank, equipped with a fish screen, a 12-inch gravity pipeline connecting to SSMH D05-052, a flow meter, a motorized control valve, and a check valve. The discharge pipe would be above the crown of the existing pipe connections in the manhole to provide an air-gap between the sanitary system and the lake. A control panel will be required to operate the motorized valve. It may be configured as autonomous, looking at a lake level sensor and the flow meter, or it may connect to the MRWPCA SCADA system and be controlled remotely. Because the system will be discharging to the municipal sanitary sewer, pressure transducers or float switches must be installed in the receiving system to shut off this system if the receiving sewer is flowing full.

The second option considered was a pumped connection (Figures 3 and 4 in Appendix C). Pumping the water will have a higher operating cost than a gravity connection, but offers positive flow control. This option is configured as adding a column-type pump in the existing pump station wet well, and a similar discharge pipeline with a check valve and flow meter as in the first option.

The screened inlet must be sized to allow full flow through the screen with a maximum velocity of 1 ft/s to allow fish to escape. Assume the screen has an open area of 50%, and that 50% of the screen is blinded by trash/vegetation. For a maximum flow of 5.3 cfs (= 2,400 gpm):

$A_{screen}$ = 5.3 cfs / [(1 ft/s) x (50% screen openings) x (50% blinded)] = 21.2 sq-ft

Minimum dimensions: 4-ft wide x 5.3-ft long

For a new inlet, the Lake bank at the pipe penetration should be lined with rock or concrete to prevent erosion. If rock is used, a concrete cut-off collar should be cast around the pipeline to prevent water from migrating through the pipe bedding material. An alternative option would be to core-drill through the wall of the existing pump station wet well for the new inlet. The existing station uses diesel drives for the pumps, and the fuel tank and pipeline are located underground between the wet well and the receiving sanitary sewer, preventing the installation of a new pipeline at a uniform slope, so this inlet configuration was not used for the gravity option.

The pipeline would be a 12-inch PVC (AWWA C-900 pressure pipe). The size was selected based upon the calculated velocity and friction losses in the pipeline. It was assumed that the lake would provide a minimum of 5-feet of static head between the inlet and discharge. A 12-inch main flowing at 2400 gpm would have a velocity of 6.8 feet per second and estimated losses totaling 3.6 feet (Table C-1). A 10-inch main would have estimated losses totaling 7.6 feet, which exceeds the available system head. The pipeline should be installed with a minimum of 3-feet of cover in the pipe trench.

For the pumped option, an axial flow or column-type pump is recommended. A column may be added to the existing wet well, suspended from the pump deck and braced to the wall. The discharge piping may pass through the wall of the wet well (as shown in the diagram), or it may extend over the pump deck and then go underground. The lake provides a substantial forebay for the pump station, so a variable speed drive will not be required to match the incoming flow rate. Using a 12-inch discharge pipeline, the system horsepower requirement is only 5.3 hp. However, pumps of this type are typically sized for larger flows. The closest match found using the Flygt pump catalog was a 27 hp pump, model PL 7020 with a trimmed impellor to meet the low design point.

The proposed facilities are in a FEMA floodplain[3]. The proposed submersible pumps will not be affected by storm inundation, but the electrical power and control equipment must be elevated above the base flood elevation of 11-ft (approximately 2-ft above the existing pump station deck).

[3] FEMA Flood Insurance Rate Map, Panel 06053C0703G, April 2009 (see Appendix A)

### 3.2 Costs

Capital costs were estimated for the two transfer station configurations, gravity and pumped. Detailed estimates are provided in Tables C-3 and C-4 in Appendix C. Non-construction costs (design, permitting, legal, etc.) were estimated as 40% of the construction cost.

The condition of the existing box culvert in Pearl Street at Figueroa Street is unknown (was it bricked closed or physically removed), so no estimate was made of the cost to reconnect the adjacent drainage basin to Lake El Estero.

Right-of-way acquisition costs were not included in the capital cost estimates. The proposed site is on City of Monterey property, so standard encroachment fees should apply.

**Table 3-1: Estimated Capital Costs**

| | El Estero Gravity | El Estero Pump Station |
|---|---|---|
| Estimated Construction Cost | $65,800 | $157,900 |
| Inspection and Testing (15%) | $10,000 | $24,000 |
| Construction Contingency (20%) | $13,000 | $32,000 |
| Estimated Total Construction Cost | $89,000 | $214,000 |
| | | |
| Design, Permitting, Legal (40%) | $35,600 | $85,600 |

Costs are in 1st Quarter 2014 dollars

The City of Monterey has standard capacity charges and monthly fees for connecting to the sanitary sewer collection system, which should apply to this connection. Similarly, the MRWPCA has standard capacity charges for connection to the regional wastewater system that are based on the flow rate, the biological oxygen demand (BOD) and the suspended solids concentration, and monthly charges for wastewater treatment. These fees are not included in this estimate, because the MRWPCA is a sponsor of the Proposed Project. The primary, secondary and advanced treatment costs for this source of supply will appear in the overall project cost analysis.

Annual operating and debt service costs for each configuration were estimated using the following planning factors:

- Debt service assumes a 30-year bond at 4% annual interest
- Annual operation and maintenance of pump stations is estimated at 2.5% of the capital cost
- Annual operation and maintenance of pipelines is estimated at 1% of the capital cost
- Electrical power cost is assumed at $0.16 per kWh
- Assume the station operates 13.5 days per year (average from runoff capture model)

The factors above provide an order-of-magnitude estimate of annual costs, which may be used in comparing project configurations. The estimated annual costs are provided below.

**Table 3-2: Estimated Annual Costs, Gravity Option**

| Category | Basis | Annual $ |
|---|---|---|
| **Capital Repayment** | | |
| Assume 30-year bond at 4% | $146,000.00 | $8,443.19 |
| **Annual Operation and Maintenance** | | |
| Assume 2.5% of Pump Station Capital Cost | $0.00 | $0.00 |
| Assume 1.0% of Pipeline Capital Cost | $146,000.00 | $3,650.00 |
| **Electrical Power** | | |
| Number of operating days/year | 13.5 | |
| Pumps: None | | |
| Estimated annual kWh | - | |
| Assumed cost per KWH | $0.16 | $0.00 |
| **Total Estimated Annual Cost** | | **$12,100.00** |

**Table 3-3: Estimated Annual Costs, Pump Station Option**

| Category | Basis | Annual $ |
|---|---|---|
| **Capital Repayment** | | |
| Assume 30-year bond at 4% | $214,000.00 | $12,375.64 |
| **Annual Operation and Maintenance** | | |
| Assume 2.5% of Pump Station Capital Cost | $200,500.00 | $5,012.50 |
| Assume 1.0% of Pipeline Capital Cost | $13,500.00 | $337.50 |
| **Electrical Power** | | |
| Number of operating days/year | 13.5 | |
| Pumps: 27 HP (0.7457 kW/hp) | 20.1 | |
| Estimated annual kWh | 6,523 | |
| Assumed cost per KWH | $0.16 | $1,043.74 |
| **Total Estimated Annual Cost** | | **$18,800.00** |

# Section 4 - Water Quality

## 4.1 Summary of Current Condition

The Central Coast Regional Water Quality Control Board (CCRWQCB) Water Quality Control Plan for the Central Coast Basin (Basin Plan) designated beneficial uses of the Lake El Estero as including municipal and domestic supply, groundwater recharge, water contact recreation, non-contact water recreation, wildlife habitat, cold water fish habitat, warm water fish habitat, spawning/reproduction/early development habitat and commercial or sport fishing. Many of these are the minimum uses listed for all inland water bodies within the region, unless specific water quality information caused the RWQCB to remove a specific use (e.g., not listing water contact recreation for a stream segment listed for fecal coliform contamination). The Monterey Harbor has designated beneficial uses of water contact recreation, non-contact water recreation, industrial service supply, navigation, marine habitat, shellfish harvesting, commercial or sport fishing and rare/threatened/endangered species habitat.

Lake El Estero is not listed as an impaired water body, but Majors Creek (at tributary stream to Lake El Estero) and the Monterey Harbor are listed. Majors Creek is listed as impaired water body pursuant to Section 303(d) of the Clean Water Act for copper, lead, zinc and Escherichia coliform. The Monterey Harbor is listed as an impaired water body for metals and sediment toxicity. Water quality has been sampled and monitored for the past 15 years under various programs, including the Central Coast Long-term Environmental Assessment Network (CCLEAN), the Monterey Bay Sanctuary Citizen Watershed Monitoring Network and the City of Monterey Urban Watch. The results of these programs have been consolidated in Table B-12, for Lake El Estero, Majors Creek, Monterey Harbor and Monterey Bay South Coastline. Sampling locations are shown on Figure A-5.

The Monterey Regional Storm Water Management Program identifies water quality objectives for stormwater discharging into the Monterey Bay. These and other applicable water quality standards are consolidated in Table B-13, Water Quality Objectives.

### 4.2 Effect of Diversion on Monterey Bay Water Quality

Stormwater runoff can carry pollutants such as oils, sediments and metals into the Monterey Bay, which is a National Marine Sanctuary. Lake El Estero serves as a settling basin for stormwater, which is a treatment process. Water passing through the lake carries lower levels of suspended solids than stormwater discharging directly to the Bay. Samples of the water discharged through the Lake El Estero stormwater pump station have not been collected and tested, but looking at the available water quality data in Table B-7, it may be inferred that these discharges will be of better quality than direct discharges from other portions of the municipal system. Therefore, the proposed diversion should have a little to no effect on the Bay.

Reconnecting the adjacent drainage basin to Lake El Estero through the Pearl Street box culvert should have a positive effect on near-shore water quality. Passing these flows through the lake will provide settling of suspended solids. During peak rain events, the addition of these flows to the lake will cause increased use of the stormwater pump station. The increased inflow rates will decrease the detention time in the lake, leading to a decline in water quality during stormwater pumping periods. However, the quality of the pumped discharge will be better than the current quality of flows directly discharged to the Bay.

Adding stormwater to the sanitary sewer system increases the risk of sanitary sewer overflows, which can convey bacterial pollutants into the Bay. The sanitary sewer pipeline between Lake El Estero and the MRWPCA interceptor will flow at maximum capacity during peak diversions, so certain safeguards should be included in the project. First, the sewer pipeline and manholes should be inspected for cracks and leaking joints. If found, they should be repaired to prevent the combined flows from leaking out into the surrounding soil. Second, pressure sensors should be installed in one or more manholes to identify backwater effects in the system. If the combined storm and sewer flow exceeds the gravity capacity of the sewer main, the stormwater system can shut off to prevent the sanitary flows from spilling. The stormwater can be held in the lake for later diversion or discharged through the stormwater pump station, depending upon the level of the lake at the time.

**Appendix A: Figures**

Figure A-1: Lake El Estero Drainage Basins
Figure A-2: City of Monterey Storm and Sanitary Sewer Pipelines
Figure A-3: MRWPCA Interceptor System Schematic
Figure A-4: FEMA FIRMette, El Estero Pump Station
Figure A-5: Water Quality Sampling Locations

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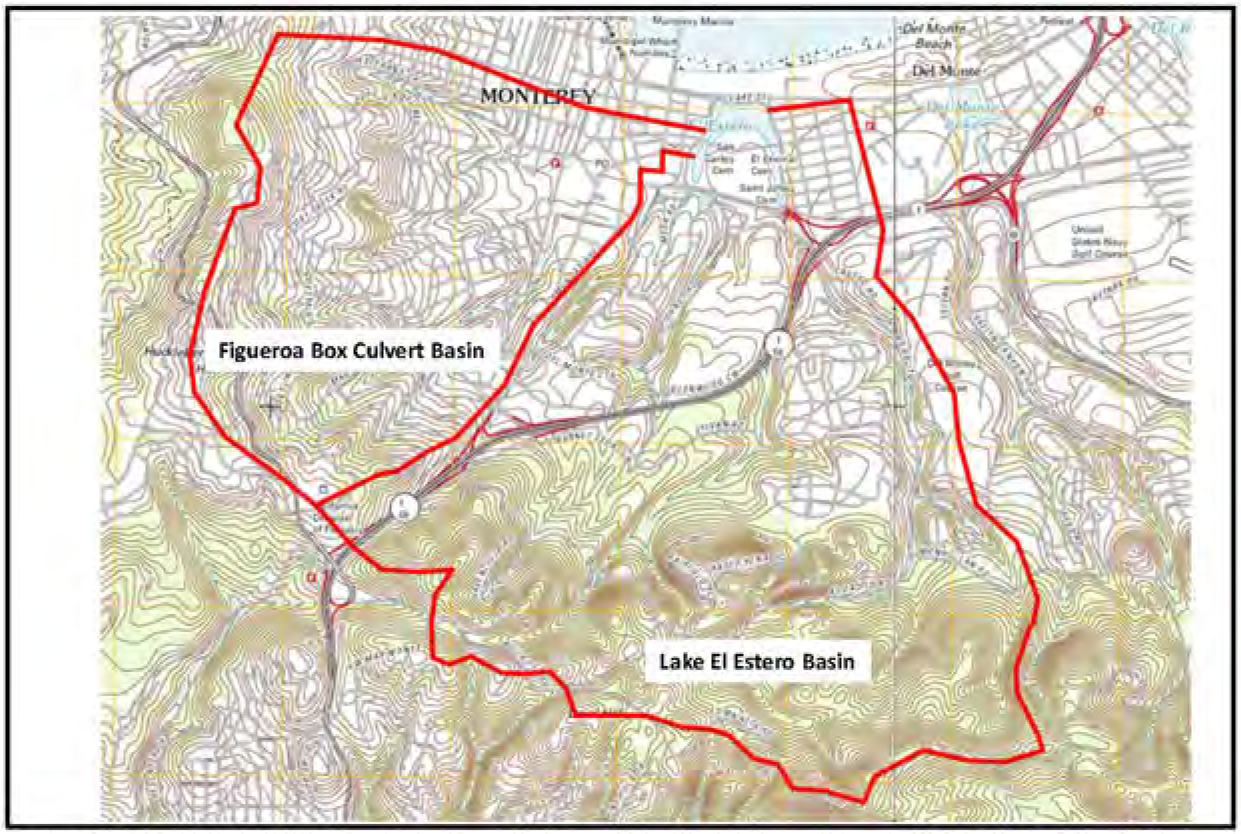



Not to Scale

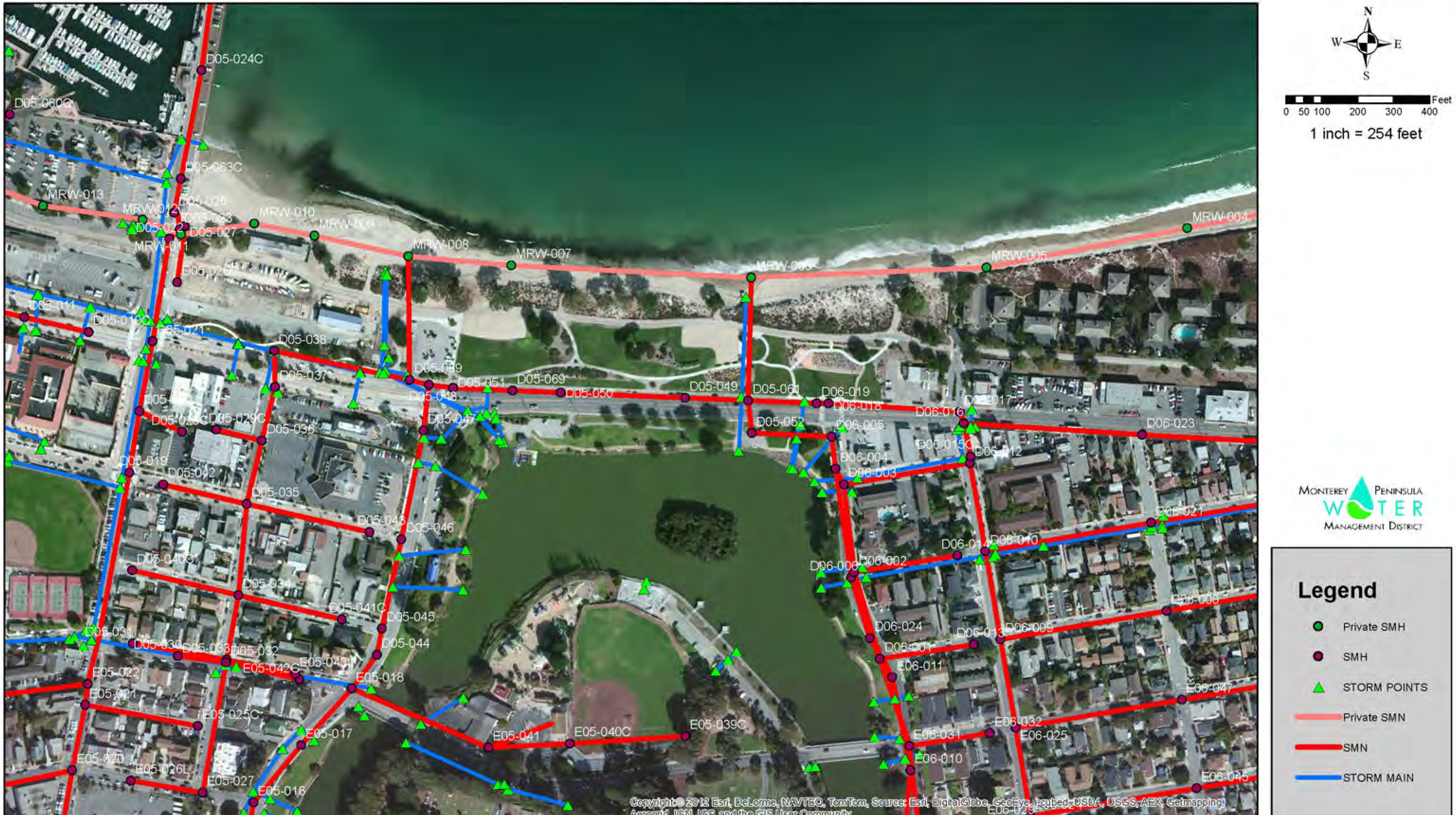
Schaaf & Wheeler

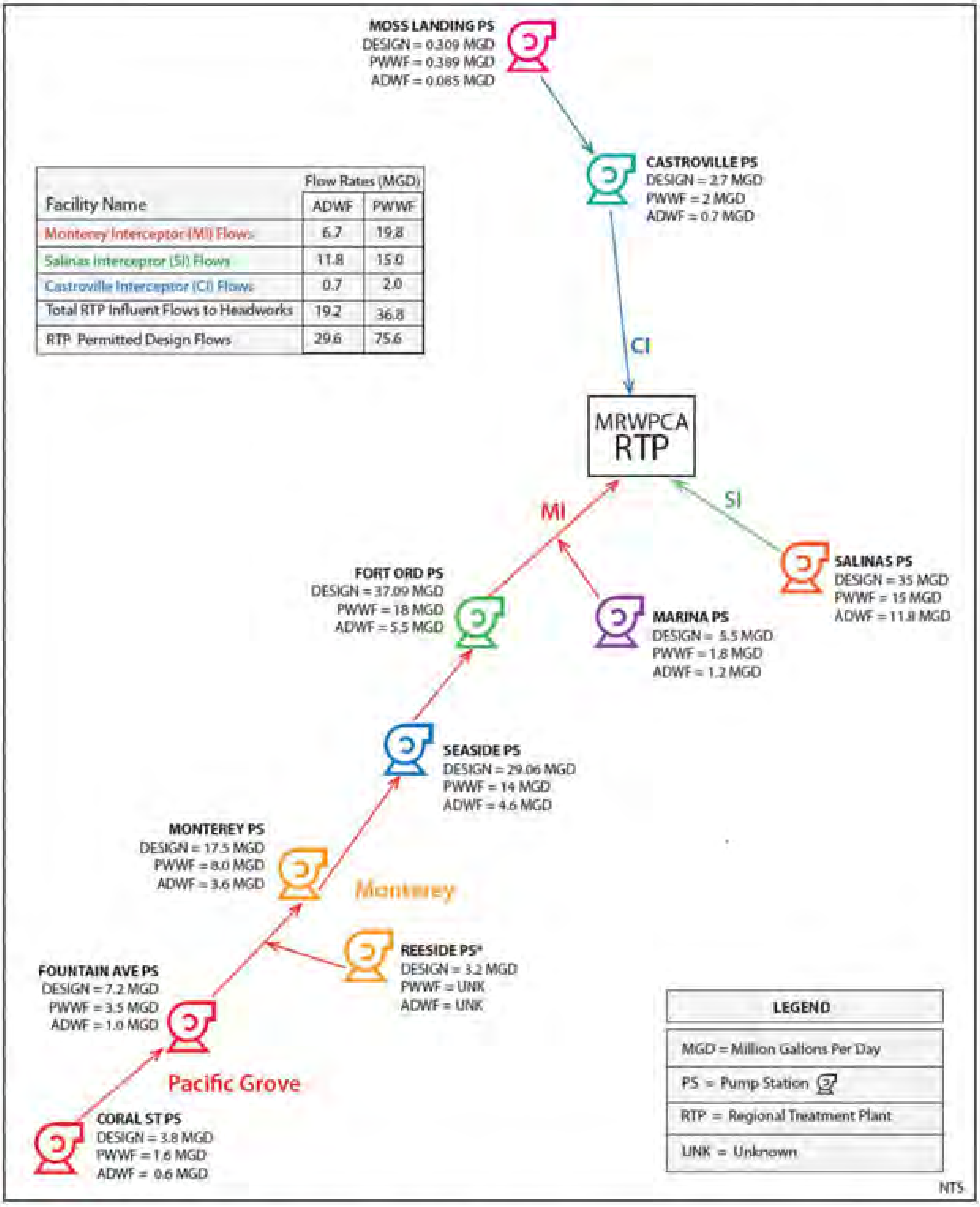
**Figure A-1: Lake El Estero Drainage Basins**

Source: overlay on USGS 7.5 Minute Quadrangles, Monterey, CA and Seaside, CA

# Ground Water Replenishment

## EIR Scoping Data






| Facility Name | Flow Rates (MGD) ADWF | PWWF |
|---|---|---|
| Monterey Interceptor (MI) Flows | 6.7 | 19.8 |
| Salinas Interceptor (SI) Flows | 11.8 | 15.0 |
| Castroville Interceptor (CI) Flows | 0.7 | 2.0 |
| Total RTP Influent Flows to Headworks | 19.2 | 36.8 |
| RTP Permitted Design Flows | 29.6 | 75.6 |

**Figure A-3: MRWPCA Interceptor System Schematic**

Source: Brezack and Associates Planners, September 2013

Figure A-4: FEMA FIRMette, Lake El Estero Pump Station

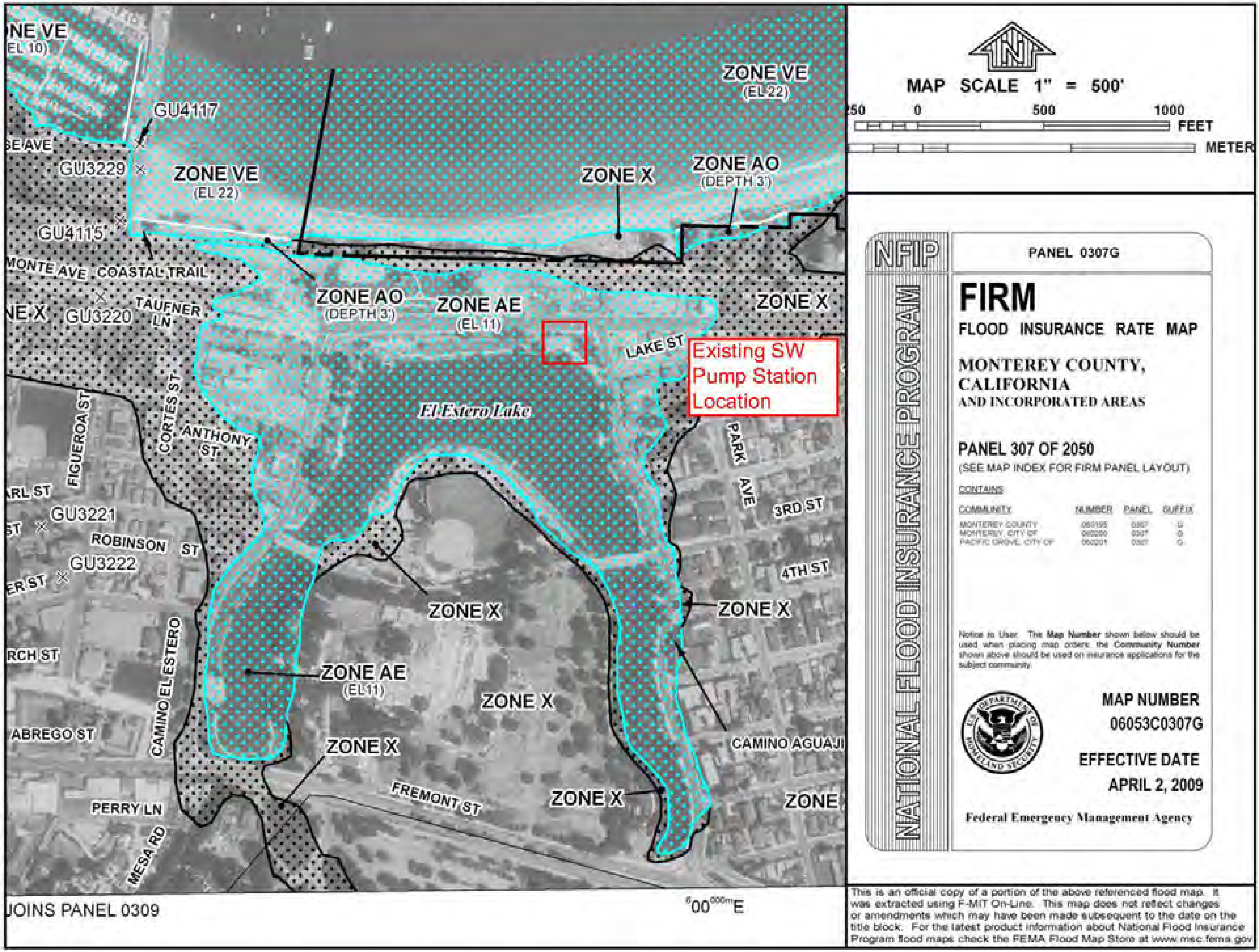


Figure A-4 (continued)

## Definitions of FEMA Flood Zones

Flood zones are geographic areas that FEMA has defined according to varying levels of flood risk and type of flooding. These zones are depicted on the published Flood Insurance Rate Map (FIRM) or Flood Hazard Boundary Map (FHBM).

## Special Flood Hazard Areas – High Risk

Special Flood Hazard Areas represent the area subject to inundation by 1-percent-annual chance flood. Structures located within the SFHA have a 26-percent chance of flooding during the life of a standard 30-year mortgage. Federal floodplain management regulations and mandatory flood insurance purchase requirements apply in these zones.

| ZONE | DESCRIPTION |
|---|---|
| A | Areas subject to inundation by the 1-percent-annual-chance flood event. Because detailed hydraulic analyses have not been performed, no Base Flood Elevations (BFEs) or flood depths are shown. |
| AE, A1-A30 | Areas subject to inundation by the 1-percent-annual-chance flood event determined by detailed methods. BFEs are shown within these zones. (Zone AE is used on new and revised maps in place of Zones A1–A30.) |
| AH | Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually areas of ponding) where average depths are 1–3 feet. BFEs derived from detailed hydraulic analyses are shown in this zone. |
| AO | Areas subject to inundation by 1-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are 1–3 feet. Average flood depths derived from detailed hydraulic analyses are shown within this zone. |
| AR | Areas that result from the decertification of a previously accredited flood protection system that is determined to be in the process of being restored to provide base flood protection. |
| A99 | Areas subject to inundation by the 1-percent-annual-chance flood event, but which will ultimately be protected upon completion of an under-construction Federal flood protection system. These are areas of special flood hazard where enough progress has been made on the construction of a protection system, such as dikes, dams, and levees, to consider it complete for insurance rating purposes. Zone A99 may be used only when the flood protection system has reached specified statutory progress toward completion. No BFEs or flood depths are shown. |

Figure A-4 (continued)

## Coastal High Hazard Areas – High Risk

Coastal High Hazard Areas (CHHA) represent the area subject to inundation by 1-percent-annual chance flood, extending from offshore to the inland limit of a primary front al dune along an open coast and any other area subject to high velocity wave action from storms or seismic sources. Structures located within the CHHA have a 26-percent chance of flooding during the life of a standard 30-year mortgage. Federal floodplain management regulations and mandatory purchase requirements apply in these zones.

| ZONE | DESCRIPTION |
|---|---|
| **V** | Areas along coasts subject to inundation by the 1-percent-annual-chance flood event with additional hazards associated with storm-induced waves. Because detailed coastal analyses have not been performed, no BFEs or flood depths are shown. |
| **VE, V1-V30** | Areas along coasts subject to inundation by the 1-percent-annual-chance flood event with additional hazards due to storm-induced velocity wave action. BFEs derived from detailed hydraulic coastal analyses are shown within these zones. (Zone VE is used on new and revised maps in place of Zones V1–V30.) |

## Moderate and Minimal Risk Areas

Areas of moderate or minimal hazard are studied based upon the principal source of flood in the area. However, buildings in these zones could be flooded by severe, concentrated rainfall coupled with inadequate local drainage systems. Local stormwater drainage systems are not normally considered in a community's flood insurance study. The failure of a local drainage system can create areas of high flood risk within these zones. Flood insurance is available in participating communities, but is not required by regulation in these zones. Nearly 25-percent of all flood claims filed are for structures located within these zones.

| ZONE | DESCRIPTION |
|---|---|
| **B, X (shaded)** | Moderate risk areas within the 0.2-percent-annual-chance floodplain, areas of 1-percent-annual-chance flooding where average depths are less than 1 foot, areas of 1-percent-annual-chance flooding where the contributing drainage area is less than 1 square mile, and areas protected from the 1-percent-annual-chance flood by a levee. No BFEs or base flood depths are shown within these zones. (Zone X (shaded) is used on new and revised maps in place of Zone B.) |
| **C, X (unshaded)** | Minimal risk areas outside the 1-percent and .2-percent-annual-chance floodplains. No BFEs or base flood depths are shown within these zones. (Zone X (unshaded) is used on new and revised maps in place of Zone C.) |

## Undetermined Risk Areas

| ZONE | DESCRIPTION |
|---|---|
| **D** | Unstudied areas where flood hazards are undetermined, but flooding is possible. No mandatory flood insurance purchase requirements apply, but coverage is available in participating communities. |

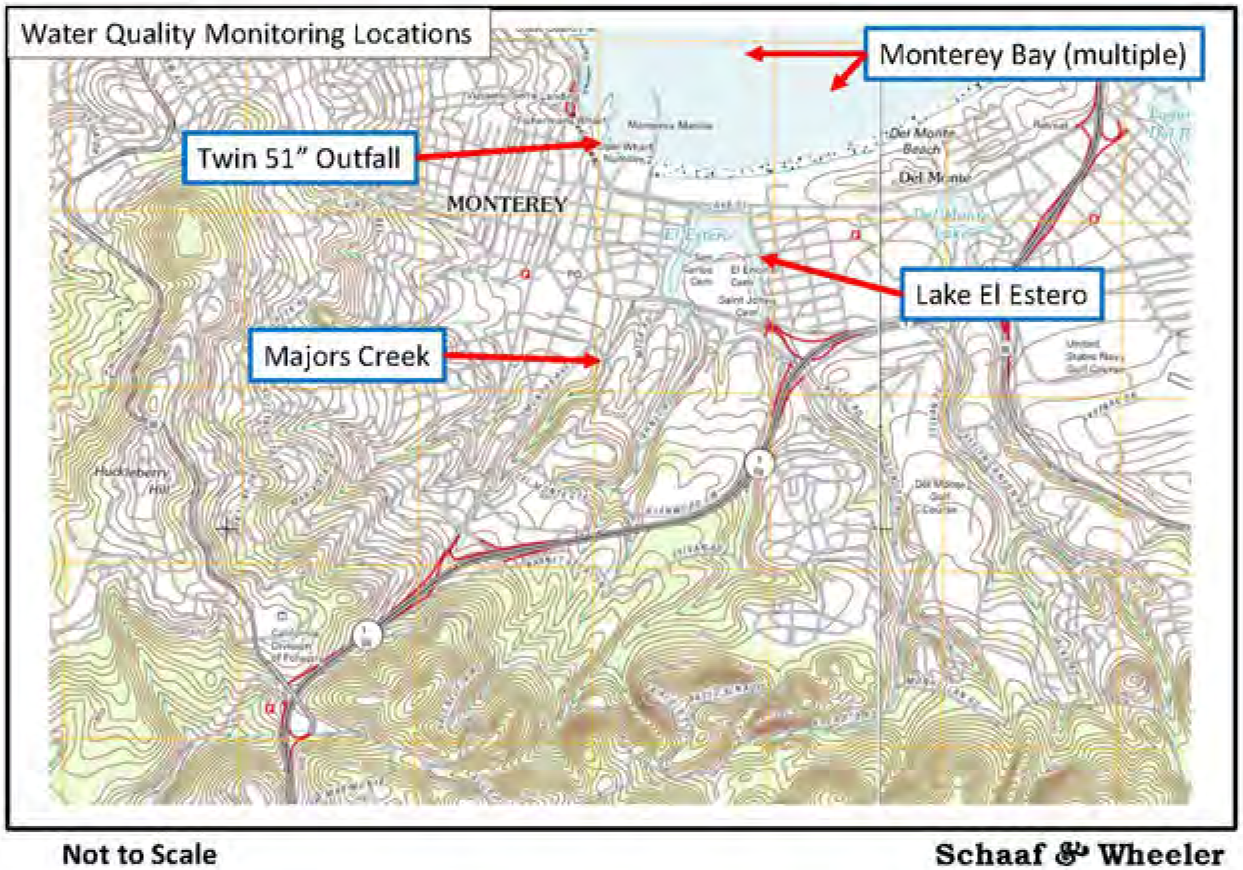



**Figure A-5: MRSWMP/ MBNMS/ Monterey Urban Watch Water Sampling Sites**

Source: various reports

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**Appendix B: Tables**

Table B-1: 2010 California 303(d) Listing
Table B-2: Recorded Precipitation in Monterey, CA
Table B-3: El Estero Watershed Areas and Curve Numbers
Table B-4: Estimated Runoff to Lake El Estero
Table B-5: Estimate of Runoff Captured at Lake El Estero
Table B-6: Estimate of Runoff Captured at Lake El Estero with new connection to MPS
Table B-7: Figueroa Watershed Areas and Curve Numbers
Table B-8: Estimated Runoff from the Figueroa Drainage Basin
Table B-9: Combined El Estero and Figueroa Watershed Areas and Curve Numbers
Table B-10: Estimated Runoff to Lake El Estero adding Figueroa Basin
Table B-11: Estimated Transferable Runoff at Lake El Estero adding Figueroa Basin
Table B-12: Water Quality, El Estero Basin and Monterey Bay
Table B-13: Water Quality Objectives

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**Table B-1: 2010 California 303(d) Listing**

| Listed for: | Ammonia (Unionized) | Chlordane | Chloride | Chlorophyll-a | Chlorpyrifos | Copper | DDD (Dichlorodiphenyldichloroethane) | Diazinon | Dieldrin | Electrical Conductivity | Enterococcus | Escherichia coli (E. coli) | Fecal Coliform | Low Dissolved Oxygen | Metals | Nickel | Nitrate | Nutrients | Pathogens | PCBs (Polychlorinated biphenyls) | Pesticides | pH | Priority Organics | Sediment Toxicity | Sedimentation/Siltation | Sodium | Temperature, water | Total Coliform | Total Dissolved Solids | Toxaphene | Turbidity | Unknown Toxicity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Water Body** | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Alisal Creek (Monterey County) | | | | X | | | | | | | | | X | | | | X | | | | | | | | | X | | | | | | |
| Alisal Slough (Monterey County) | | | | | | | | | | | | | | X | | | X | | | | | | | X | | | | | | | | X |
| Blanco Drain | | | | | X | | | X | | | | | | X | | | X | | | | X | | | | | | | | | | X | |
| Espinosa Lake | | | | | X | | | X | | | | | | | | | | | | | | | | | | | | | | | | |
| Espinosa Slough | X | | | | | | | X | | | | | | | | | X | | | | X | X | X | X | | | | | | | X | X |
| Gabilan Creek | X | | | | | | | | | | | | X | | | | X | | | | | X | | X | | | | | | | X | X |
| **Majors Creek (Monterey County)** | | | | | | **X** | | | | | | **X** | | | | | | | | | | | | | | | | | | | | |
| Merrit Ditch | X | | | | | | | | | | | | | X | | | X | | | | | | | X | | | | | | | X | X |
| **Monterey Harbor** | | | | | | | | | | | | | | | **X** | | | | | | | | | **X** | | | | | | | | |
| Moss Landing Harbor | | | | | X | | | X | | | | | | X | | X | | | X | | X | X | | X | X | | | | | | | |
| Natividad Creek | X | | | | | | | | | | | X | | X | | | X | | | | | X | | X | | | X | | | | X | X |
| Old Salinas River | | | | X | X | | | X | | | | X | X | X | | | X | | | | | X | | X | | | | | | | X | X |
| Old Salinas River Estuary | | | | | | | | | | | | | | | | | | X | | | X | | | | | | | | | | | |
| Salinas Reclamation Canal | X | | | | X | X | | X | | | | X | X | X | | | X | | | | X | X | X | X | | | | | | | X | X |
| Salinas River (lower, estuary to near Gonzales Rd crossing, watersheds 30910 and 30920) | | X | X | | X | | X | X | X | X | X | X | X | | | | X | | | X | X | X | | | | X | | | X | X | X | X |
| Salinas River Lagoon (North) | | | | | | | | | | | | | | | | | | X | | | X | | | | | | | | | | | |
| Santa Rita Creek (Monterey County) | X | | | | | | | | | | | X | X | X | | | X | | | | | | | | | X | | | | | X | |

Groundwater Recharge Project

Table B-2: Recorded Precipitation in Monterey, CA (inches)

| Water Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
| 1952 | 0.9 | 2.8 | 6.9 | 10.0 | 3.0 | 4.4 | 1.1 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 29.7 |
| 1953 | 0.2 | 2.2 | 5.9 | 2.1 | 0.0 | 1.2 | 1.7 | 0.5 | 0.2 | 0.0 | 0.1 | 0.1 | 14.1 |
| 1954 | 0.4 | 2.2 | 0.6 | 4.3 | 2.3 | 4.9 | 0.9 | 0.4 | 0.4 | 0.0 | 0.2 | 0.1 | 16.4 |
| 1955 | 0.0 | 1.4 | 3.1 | 5.8 | 1.7 | 0.0 | 1.7 | 0.9 | 0.1 | 0.0 | 0.0 | 0.0 | 14.8 |
| 1956 | 0.1 | 2.0 | 9.8 | 5.8 | 2.3 | 0.2 | 1.7 | 0.6 | 0.0 | 0.1 | 0.0 | 0.4 | 22.8 |
| 1957 | 1.0 | 0.0 | 0.8 | 4.7 | 3.5 | 1.9 | 1.5 | 2.4 | 0.2 | 0.0 | 0.0 | 0.2 | 16.2 |
| 1958 | 1.6 | 0.9 | 3.7 | 3.7 | 5.7 | 7.2 | 4.7 | 0.6 | 0.4 | 0.0 | 0.0 | 0.5 | 28.9 |
| 1959 | 0.0 | 0.5 | 0.5 | 4.9 | 5.8 | 0.3 | 0.3 | 0.1 | 0.0 | 0.0 | 0.0 | 3.1 | 15.6 |
| 1960 | 0.0 | 0.0 | 0.6 | 4.3 | 4.5 | 0.8 | 0.9 | 0.3 | 0.0 | 0.0 | 0.0 | 0.1 | 11.6 |
| 1961 | 0.1 | 2.1 | 0.9 | 1.9 | 1.2 | 2.6 | 1.3 | 0.7 | 0.0 | 0.0 | 0.1 | 0.1 | 10.9 |
| 1962 | 0.0 | 1.7 | 1.2 | 2.6 | 5.2 | 2.6 | 0.3 | 0.2 | 0.2 | 0.0 | 0.3 | 0.2 | 14.4 |
| 1963 | 1.3 | 0.4 | 2.2 | 3.1 | 2.7 | 4.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 13.8 |
| 1964 | 1.5 | 3.8 | 0.5 | 3.5 | 0.4 | 2.2 | 0.2 | 0.9 | 0.2 | 0.1 | 0.4 | 0.0 | 13.7 |
| 1965 | 0.8 | 3.3 | 6.5 | 2.6 | 1.1 | 2.4 | 2.3 | 0.2 | 0.2 | 0.1 | 0.2 | 0.0 | 19.4 |
| 1966 | 0.2 | 6.5 | 5.6 | 2.3 | 1.9 | 0.4 | 0.3 | 0.1 | 0.1 | 0.3 | 0.1 | 0.3 | 18.1 |
| 1967 | 0.1 | 4.7 | 4.2 | 5.3 | 0.5 | 5.5 | 7.1 | 0.4 | 1.6 | 0.0 | 0.1 | 0.2 | 29.6 |
| 1968 | 0.4 | 1.6 | 2.3 | 3.1 | 1.4 | 3.1 | 0.8 | 0.3 | 0.0 | 0.1 | 0.2 | 0.1 | 13.3 |
| 1969 | 0.3 | 3.1 | 3.3 | 9.5 | 7.3 | 1.3 | 2.7 | 0.1 | 0.4 | 0.0 | 0.0 | 0.1 | 28.2 |
| 1970 | 0.5 | 0.7 | 3.1 | 5.9 | 2.0 | 3.0 | 0.4 | 0.1 | 0.3 | 0.0 | 0.1 | 0.0 | 16.0 |
| 1971 | 0.6 | 6.2 | 5.0 | 1.1 | 0.6 | 2.0 | 1.2 | 0.7 | 0.0 | 0.1 | 0.1 | 0.4 | 18.0 |
| 1972 | 0.1 | 2.0 | 4.8 | 1.2 | 1.1 | 0.0 | 0.9 | 0.1 | 0.2 | 0.1 | 0.0 | 0.1 | 10.5 |
| 1973 | 2.5 | 6.0 | 2.1 | 6.1 | 5.9 | 4.5 | 0.1 | 0.1 | 0.0 | 0.0 | 0.1 | 0.3 | 27.6 |
| 1974 | 2.2 | 3.9 | 4.7 | 3.7 | 0.9 | 4.5 | 3.4 | 0.0 | 0.4 | 0.3 | 0.0 | 0.0 | 24.0 |
| 1975 | 1.5 | 0.6 | 2.5 | 1.3 | 3.6 | 4.1 | 1.8 | 0.0 | 0.2 | 0.2 | 0.4 | 0.0 | 16.2 |
| 1976 | 1.7 | 0.5 | 0.4 | 0.2 | 3.0 | 1.5 | 1.7 | 0.1 | 0.2 | 0.0 | 1.0 | 0.4 | 10.7 |
| 1977 | 0.6 | 0.7 | 2.1 | 1.7 | 0.8 | 1.8 | 0.0 | 1.2 | 0.1 | 0.0 | 0.0 | 0.7 | 9.8 |
| 1978 | 0.1 | 0.5 | 5.9 | 6.8 | 4.8 | 5.2 | 5.4 | 0.0 | 0.1 | 0.0 | 0.0 | 0.3 | 29.2 |
| 1979 | 0.0 | 2.1 | 1.6 | 4.8 | 4.5 | 4.4 | 0.6 | 0.3 | 0.0 | 0.4 | 0.1 | 0.0 | 18.8 |
| 1980 | 1.8 | 2.9 | 3.2 | 4.8 | 4.8 | 2.4 | 1.8 | 0.6 | 0.0 | 0.7 | 0.1 | 0.1 | 23.1 |
| 1981 | 0.1 | 0.1 | 1.7 | 6.6 | 2.1 | 4.0 | 1.0 | 0.2 | 0.0 | 0.0 | 0.2 | 0.1 | 16.0 |
| 1982 | 2.1 | 5.7 | 1.7 | 4.7 | 2.4 | 8.0 | 3.1 | 0.1 | 0.5 | 0.1 | 0.1 | 1.5 | 29.9 |
| 1983 | 2.3 | 6.2 | 3.6 | 6.9 | 5.6 | 9.6 | 4.4 | 0.3 | 0.2 | 0.0 | 0.0 | 1.2 | 40.3 |
| 1984 | 0.5 | 5.3 | 3.7 | 0.1 | 2.4 | 1.2 | 0.8 | 0.2 | 0.2 | 0.0 | 0.0 | 0.0 | 14.5 |
| 1985 | 2.1 | 4.8 | 2.0 | 1.1 | 1.4 | 3.9 | 0.8 | 0.3 | 0.3 | 0.1 | 0.0 | 0.2 | 16.9 |
| 1986 | 1.6 | 4.4 | 1.5 | 2.1 | 4.5 | 5.1 | 0.4 | 0.4 | 0.1 | 0.0 | 0.1 | 0.9 | 21.2 |
| 1987 | 0.1 | 0.3 | 1.7 | 3.4 | 3.0 | 2.8 | 0.5 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 | 12.1 |
| 1988 | 1.1 | 1.8 | 3.2 | 2.2 | 0.7 | 0.1 | 1.9 | 0.6 | 0.3 | 0.0 | 0.0 | 0.0 | 12.1 |
| 1989 | 0.2 | 2.7 | 3.4 | 1.6 | 2.2 | 2.9 | 1.0 | 0.3 | 0.0 | 0.0 | 0.0 | 1.0 | 15.3 |
| 1990 | 1.7 | 1.4 | 0.2 | 3.5 | 2.9 | 1.6 | 0.9 | 1.8 | 0.0 | 0.0 | 0.1 | 0.1 | 14.1 |
| 1991 | 0.1 | 0.5 | 1.7 | 0.7 | 2.3 | 7.5 | 0.5 | 0.2 | 0.0 | 0.1 | 0.3 | 0.0 | 13.9 |
| 1992 | 1.3 | 0.1 | 3.5 | 2.2 | 6.3 | 4.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.1 | 0.1 | 17.8 |
| 1993 | 0.7 | 0.2 | 6.3 | 9.7 | 7.6 | 3.1 | 0.9 | 0.8 | 0.8 | 0.0 | 0.0 | 0.0 | 30.1 |
| 1994 | 0.2 | 1.8 | 2.2 | 3.0 | 4.0 | 0.5 | 1.4 | 0.8 | 0.0 | 0.0 | 0.1 | 0.1 | 14.0 |
| 1995 | 0.3 | 2.8 | 2.4 | 10.6 | 0.7 | 7.3 | 2.2 | 0.6 | 1.4 | 0.0 | 0.0 | 0.0 | 28.4 |
| 1996 | 0.0 | 0.2 | 2.3 | 5.0 | 8.1 | 2.9 | 0.9 | 1.3 | 0.0 | 0.1 | 0.0 | 0.0 | 21.0 |
| 1997 | 1.1 | 2.6 | 8.0 | 8.8 | 0.2 | 0.2 | 0.4 | 0.1 | 0.1 | 0.0 | 0.2 | 0.0 | 21.7 |
| 1998 | 0.6 | 7.5 | 3.6 | 10.4 | 14.3 | 4.2 | 3.4 | 2.7 | 0.3 | 0.3 | 0.0 | 0.2 | 47.4 |
| 1999 | 0.6 | 2.5 | 1.2 | 2.7 | 3.1 | 3.4 | 2.2 | 0.0 | 0.2 | 0.0 | 0.0 | 0.4 | 16.3 |
| 2000 | 0.1 | 1.0 | 0.2 | 5.3 | 5.8 | 2.4 | 0.7 | 0.4 | 0.0 | 0.0 | 0.0 | 0.2 | 16.2 |
| 2001 | 3.9 | 0.0 | 0.2 | 3.6 | 3.7 | 1.7 | 1.8 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 15.0 |
| 2002 | 0.2 | 2.3 | 4.8 | 1.1 | 1.0 | 1.0 | 0.4 | 0.7 | 0.0 | 0.0 | 0.0 | 0.0 | 11.4 |
| 2003 | 0.0 | 1.9 | 6.2 | 1.0 | 1.9 | 1.0 | 2.1 | 0.8 | 0.0 | 0.0 | 0.1 | 0.0 | 15.0 |
| 2004 | 0.4 | 1.7 | 5.3 | 1.3 | 4.1 | 0.5 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.1 | 13.5 |
| 2005 | 3.3 | 1.0 | 4.9 | 4.4 | 4.2 | 4.2 | 1.6 | 0.8 | 0.3 | 0.0 | 0.0 | 0.0 | 24.7 |
| 2006 | 0.1 | 1.1 | 3.6 | 3.2 | 0.9 | 7.1 | 2.8 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 19.5 |
| 2007 | 0.1 | 1.3 | 2.3 | 1.1 | 3.1 | 0.5 | 1.0 | 0.2 | 0.1 | 0.0 | 0.0 | 0.4 | 10.2 |
| 2008 | 1.1 | 0.5 | 1.1 | 6.3 | 2.6 | 0.5 | 0.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12.4 |
| 2009 | 0.2 | 1.3 | 2.7 | 2.2 | 5.0 | 2.3 | 0.3 | 0.2 | 0.0 | 0.0 | 0.1 | 0.1 | 14.5 |
| 2010 | 2.4 | 0.3 | 2.2 | 5.9 | 2.9 | 3.2 | 3.0 | 0.6 | 0.0 | 0.0 | 0.2 | 0.1 | 20.6 |
| 2011 | 0.9 | 2.2 | 4.0 | 2.0 | 4.5 | 4.8 | 0.2 | 0.9 | 0.8 | 0.0 | 0.1 | 0.0 | 20.4 |
| 2012 | 1.9 | 1.4 | 0.2 | 1.3 | 0.7 | 3.5 | 2.2 | 0.1 | 0.3 | 0.0 | 0.0 | 0.0 | 11.8 |
| 2013 | 0.6 | 3.5 | 3.9 | 0.9 | 0.8 | 1.1 | 0.3 | 0.0 | 0.1 | 0.0 | 0.1 | 0.0 | 11.2 |
| **Average** | 0.8 | 2.2 | 3.0 | 3.9 | 3.2 | 3.0 | 1.5 | 0.5 | 0.2 | 0.1 | 0.1 | 0.2 | 18.6 |
| **Minimum** | 0.0 | 0.0 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 9.8 |
| **Maximum** | 3.9 | 7.5 | 9.8 | 10.6 | 14.3 | 9.6 | 7.1 | 2.7 | 1.6 | 0.7 | 1.0 | 3.1 | 47.4 |

Data from 1951-10-01 to 1998-09-30 is from gage USC00045795 Monterey, CA

Data from 1998-10-01 to 2013-09-30 is from gage USC00045802 Monterey WFO

**Table B-3: El Estero Watershed Areas and Curve Numbers**

Determination of available surface water for non-potable water supply

| | Land Use | Soil Group | Curve Number (AMC II) | Area (acres) | Percent Impervious | Impervious Area (acres) | Pervious Area (acres) |
|---|---|---|---|---|---|---|---|
| 1 | LD | A | 34 | 22 | 15% | 3.3 | 18.7 |
| 2 | UHD | A | 34 | 31 | 90% | 28.1 | 3.1 |
| 3 | DV | B | 43 | 275 | 0% | 0.0 | 274.6 |
| 4 | MD | B | 48 | 186 | 30% | 55.9 | 130.5 |
| 5 | HD | B | 48 | 68 | 50% | 34.0 | 34.0 |
| 6 | LD | B | 48 | 10 | 15% | 1.5 | 8.6 |
| 7 | UHD | B | 48 | 60 | 90% | 53.7 | 6.0 |
| 8 | DV | C | 60 | 1466 | 0% | 0.0 | 1465.6 |
| 9 | HD | C | 65 | 31 | 50% | 15.6 | 15.6 |
| 10 | LD | C | 65 | 2 | 15% | 0.3 | 1.6 |
| 11 | UHD | C | 65 | 27 | 90% | 24.0 | 2.7 |
| 12 | DV | D | 66 | 18 | 0% | 0.0 | 18.4 |
| 13 | HD | D | 70 | 31 | 50% | 15.6 | 15.6 |
| 14 | LD | D | 70 | 3 | 15% | 0.4 | 2.3 |
| 15 | UHD | D | 70 | 169 | 90% | 152.1 | 16.9 |
| 16 | Lake | n\a | 100 | 19 | 100% | 19.3 | 0.0 |
| | | | | **2418** | | **404** | **2014** |

| Curve Number (AMC II) | Area (acres) | Curve Number (AMC I) | Curve Number (AMC III) |
|---|---|---|---|
| Pervious Area | | | |
| 34 | 21.9 | 18 | 54 |
| 43 | 274.6 | 25 | 63 |
| 48 | 179.0 | 29 | 68 |
| 60 | 1465.6 | 40 | 78 |
| 65 | 19.8 | 45 | 82 |
| 66 | 18.4 | 46 | 82 |
| 70 | 34.8 | 51 | 85 |
| | **2014** | | |
| Impervious Area | | | |
| 98 | 404 | 94 | 99 |

Scrub runoff curve numbers used for dense vegetation
Irrigated pasture runoff curve numbers used for pervious areas of all other land use

Curve numbers come from NRCS Pub TR-55
AMC values come from NRCS Pub NEH-4 (National Engineering Handbook, Part 630, Chapter 10)

## Groundwater Recharge Project

### Table B-4: Estimated Runoff into Lake El Estero (acre-feet)

| Water Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | |
| *1952* | 8 | 47 | 134 | 248 | 21 | 56 | 10 | - | - | - | - | - | 525 |
| *1953* | - | 30 | 86 | 15 | - | 10 | 14 | - | - | - | - | - | 155 |
| *1954* | 1 | 32 | 4 | 62 | 29 | 69 | 7 | 3 | 0 | - | - | - | 208 |
| *1955* | - | 14 | 41 | 92 | 17 | - | 7 | 3 | - | - | - | - | 174 |
| *1956* | - | 26 | 215 | 92 | 31 | - | 19 | 3 | - | - | - | 1 | 387 |
| *1957* | 3 | - | 6 | 58 | 36 | 7 | 12 | 31 | - | - | - | 0 | 153 |
| *1958* | 14 | 4 | 55 | 66 | 80 | 106 | 142 | 5 | 0 | - | - | 1 | 473 |
| *1959* | - | 1 | 2 | 111 | 110 | 0 | 1 | - | - | - | - | 72 | 298 |
| *1960* | - | - | 1 | 54 | 67 | 1 | 4 | 0 | - | - | - | - | 126 |
| *1961* | - | 21 | 5 | 14 | 8 | 26 | 14 | 1 | - | - | - | - | 88 |
| *1962* | - | 10 | 9 | 40 | 71 | 36 | 0 | - | 0 | - | 1 | - | 168 |
| *1963* | 21 | 1 | 33 | 57 | 49 | 68 | - | - | - | - | - | - | 228 |
| *1964* | 18 | 38 | 2 | 55 | 2 | 15 | - | 1 | - | - | 1 | - | 131 |
| *1965* | 4 | 40 | 154 | 24 | 7 | 25 | 18 | - | - | - | - | - | 272 |
| *1966* | 0 | 116 | 110 | 37 | 13 | 1 | 0 | - | - | 1 | - | 1 | 278 |
| *1967* | - | 52 | 127 | 112 | 1 | 118 | 114 | 1 | 16 | - | - | - | 541 |
| *1968* | 2 | 11 | 17 | 31 | 7 | 34 | 11 | - | - | - | 0 | - | 112 |
| *1969* | 0 | 34 | 20 | 269 | 128 | 10 | 34 | - | 0 | - | - | - | 496 |
| *1970* | 3 | 7 | 39 | 118 | 19 | 88 | 0 | - | 0 | - | - | - | 274 |
| *1971* | 1 | 199 | 67 | 4 | 1 | 23 | 6 | 1 | - | - | - | 3 | 305 |
| *1972* | - | 21 | 63 | 9 | 5 | - | 1 | - | 0 | - | - | - | 98 |
| *1973* | 30 | 136 | 8 | 75 | 89 | 43 | - | - | - | - | - | 0 | 381 |
| *1974* | 30 | 33 | 82 | 61 | 2 | 65 | 91 | - | 1 | 0 | - | - | 366 |
| *1975* | 16 | 2 | 24 | 9 | 31 | 36 | 6 | - | - | - | 3 | - | 127 |
| *1976* | 20 | 0 | 0 | - | 30 | 18 | 19 | - | 0 | - | 4 | 1 | 93 |
| *1977* | 7 | 4 | 44 | 39 | 4 | 19 | - | 4 | - | - | - | 4 | 125 |
| *1978* | - | 2 | 104 | 171 | 115 | 65 | 72 | - | - | - | - | 0 | 530 |
| *1979* | - | 26 | 13 | 58 | 39 | 53 | 1 | 0 | - | 2 | - | - | 193 |
| *1980* | 20 | 31 | 43 | 58 | 81 | 19 | 10 | 1 | - | 9 | - | - | 272 |
| *1981* | - | - | 19 | 153 | 12 | 36 | 8 | - | - | - | - | - | 228 |
| *1982* | 30 | 97 | 10 | 64 | 29 | 123 | 63 | - | 2 | - | - | 15 | 432 |
| *1983* | 35 | 125 | 68 | 190 | 60 | 246 | 69 | 0 | - | - | - | 19 | 814 |
| *1984* | 1 | 81 | 31 | - | 18 | 5 | 1 | 1 | - | - | - | - | 137 |
| *1985* | 30 | 57 | 15 | 4 | 22 | 35 | 5 | 0 | 1 | - | - | 0 | 168 |
| *1986* | 27 | 84 | 10 | 12 | 82 | 117 | 0 | 1 | - | - | - | 7 | 340 |
| *1987* | - | 0 | 9 | 30 | 46 | 25 | 3 | - | - | - | - | - | 114 |
| *1988* | 11 | 18 | 21 | 19 | 2 | 0 | 13 | 0 | - | - | - | - | 83 |
| *1989* | - | 29 | 40 | 13 | 31 | 21 | 5 | 0 | - | - | - | 7 | 145 |
| *1990* | 25 | 20 | 0 | 50 | 36 | 6 | 12 | 17 | - | - | - | - | 166 |
| *1991* | 0 | 5 | 11 | 4 | 23 | 128 | 0 | - | - | - | - | - | 172 |
| *1992* | 16 | - | 59 | 35 | 167 | 62 | - | - | - | - | - | - | 339 |
| *1993* | 3 | 0 | 115 | 273 | 172 | 37 | 6 | 1 | 3 | - | - | - | 611 |
| *1994* | - | 17 | 42 | 54 | 63 | 0 | 6 | 5 | - | - | - | - | 186 |
| *1995* | 1 | 13 | 17 | 220 | 2 | 118 | 13 | 2 | 17 | - | - | - | 403 |
| *1996* | - | 0 | 16 | 67 | 253 | 39 | 5 | 16 | - | - | - | - | 396 |
| *1997* | 5 | 49 | 165 | 202 | - | - | 1 | - | - | - | 0 | - | 423 |
| *1998* | 2 | 146 | 56 | 260 | 653 | 44 | 52 | 19 | - | - | - | - | 1,232 |
| *1999* | 7 | 23 | 4 | 20 | 37 | 16 | 24 | - | - | - | - | 2 | 133 |
| *2000* | - | 5 | - | 122 | 74 | 43 | 2 | 1 | - | - | - | 0 | 247 |
| *2001* | 53 | - | - | 38 | 43 | 11 | 12 | - | - | - | - | - | 158 |
| *2002* | 0 | 22 | 57 | 13 | 5 | 5 | 0 | 4 | - | - | - | - | 107 |
| *2003* | - | 30 | 116 | 6 | 16 | 7 | 5 | 1 | - | - | - | - | 181 |
| *2004* | 2 | 9 | 84 | 29 | 35 | 2 | - | - | - | - | - | - | 162 |
| *2005* | 52 | 4 | 112 | 80 | 55 | 52 | 6 | 2 | 0 | - | - | - | 363 |
| *2006* | - | 3 | 33 | 47 | 1 | 71 | 35 | 7 | - | - | - | - | 197 |
| *2007* | - | 5 | 20 | 4 | 26 | 2 | 5 | - | - | - | - | 1 | 63 |
| *2008* | 8 | 1 | 3 | 112 | 17 | 3 | 0 | - | - | - | - | - | 144 |
| *2009* | 0 | 6 | 22 | 28 | 57 | 22 | 0 | 0 | - | - | - | 0 | 135 |
| *2010* | 59 | 0 | 14 | 117 | 16 | 44 | 32 | 1 | - | - | - | - | 283 |
| *2011* | 2 | 16 | 33 | 27 | 88 | 99 | - | 2 | 4 | - | - | - | 271 |
| *2012* | 21 | 5 | 0 | 10 | 1 | 41 | 21 | - | 1 | - | - | - | 100 |
| *2013* | 1 | 48 | 58 | 2 | 5 | 3 | - | - | - | - | - | - | 117 |
| **Average** | 9 | 30 | 45 | 70 | 52 | 40 | 16 | 2 | 1 | 0 | 0 | 2 | 268 |
| **Minimum** | - | - | - | - | - | - | - | - | - | - | - | - | 63 |
| **Maximum** | 59 | 199 | 215 | 273 | 653 | 246 | 142 | 31 | 17 | 9 | 4 | 72 | 1,232 |

## Groundwater Recharge Project

### Table B-5: Estimated Transferable Runoff from Lake El Estero (acre-feet)

| Year | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total | Type Year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1952 | 69 | 2 | 26 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 12 | 42 | 154 | Wet |
| 1953 | 6 | 0 | 5 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 29 | Dry |
| 1954 | 32 | 13 | 21 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 13 | 88 | Normal |
| 1955 | 33 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 38 | 90 | Wet |
| 1956 | 33 | 12 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 56 | Dry |
| 1957 | 30 | 12 | 0 | 5 | 11 | 0 | 0 | 0 | 0 | 5 | 0 | 25 | 87 | Normal |
| 1958 | 24 | 23 | 52 | 47 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 147 | Normal |
| 1959 | 40 | 52 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 0 | 0 | 0 | 113 | Dry |
| 1960 | 16 | 38 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 65 | Normal |
| 1961 | 2 | 0 | 11 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 3 | 2 | 26 | Dry |
| 1962 | 18 | 26 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 12 | 77 | Dry |
| 1963 | 21 | 24 | 23 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 12 | 0 | 90 | Normal |
| 1964 | 18 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 55 | 95 | Normal |
| 1965 | 11 | 0 | 11 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 45 | 35 | 107 | Normal |
| 1966 | 15 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 28 | 69 | Dry |
| 1967 | 41 | 0 | 35 | 39 | 0 | 11 | 0 | 0 | 0 | 0 | 3 | 6 | 134 | Normal |
| 1968 | 13 | 0 | 15 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 1 | 47 | Normal |
| 1969 | 88 | 43 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 19 | 163 | Wet |
| 1970 | 42 | 7 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 33 | 31 | 135 | Wet |
| 1971 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 30 | 51 | Dry |
| 1972 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 13 | 52 | 0 | 67 | Normal |
| 1973 | 33 | 31 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 12 | 24 | 128 | Wet |
| 1974 | 31 | 0 | 22 | 11 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 8 | 81 | Normal |
| 1975 | 0 | 11 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 31 | Normal |
| 1976 | 0 | 13 | 9 | 9 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 11 | 43 | Dry |
| 1977 | 23 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 51 | Dry |
| 1978 | 37 | 38 | 29 | 36 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 4 | 158 | Wet |
| 1979 | 27 | 8 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 14 | 15 | 94 | Normal |
| 1980 | 27 | 29 | 2 | 0 | 0 | 0 | 4 | 0 | 0 | 0 | 0 | 9 | 71 | Dry |
| 1981 | 49 | 1 | 11 | 2 | 0 | 0 | 0 | 0 | 0 | 11 | 44 | 3 | 122 | Normal |
| 1982 | 28 | 17 | 41 | 25 | 0 | 0 | 0 | 0 | 6 | 21 | 38 | 24 | 200 | Wet |
| 1983 | 64 | 20 | 60 | 25 | 0 | 0 | 0 | 0 | 11 | 0 | 33 | 11 | 224 | Wet |
| 1984 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 17 | 7 | 42 | Dry |
| 1985 | 0 | 11 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 39 | 1 | 66 | Dry |
| 1986 | 1 | 33 | 52 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 87 | Normal |
| 1987 | 9 | 11 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 7 | 5 | 44 | Normal |
| 1988 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 | 13 | 34 | Dry |
| 1989 | 1 | 11 | 5 | 0 | 0 | 0 | 0 | 0 | 2 | 11 | 11 | 0 | 39 | Dry |
| 1990 | 18 | 15 | 0 | 7 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 47 | Dry |
| 1991 | 0 | 4 | 52 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 11 | 78 | Normal |
| 1992 | 11 | 39 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 111 | Normal |
| 1993 | 91 | 42 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 8 | 14 | 172 | Normal |
| 1994 | 25 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 50 | Normal |
| 1995 | 68 | 0 | 40 | 2 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 5 | 126 | Wet |
| 1996 | 32 | 43 | 18 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 15 | 36 | 154 | Wet |
| 1997 | 59 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 39 | 20 | 118 | Normal |
| 1998 | 68 | 101 | 16 | 17 | 5 | 0 | 0 | 0 | 0 | 2 | 11 | 0 | 220 | Wet |
| 1999 | 5 | 11 | 5 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | Normal |
| 2000 | 26 | 40 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 0 | 0 | 103 | Normal |
| 2001 | 13 | 16 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 25 | 72 | Normal |
| 2002 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 40 | 59 | Dry |
| 2003 | 0 | 9 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 | 34 | Dry |
| 2004 | 11 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 22 | 0 | 35 | 78 | Normal |
| 2005 | 16 | 22 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 15 | 67 | Wet |
| 2006 | 19 | 0 | 26 | 11 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 66 | Normal |
| 2007 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 8 | Dry |
| 2008 | 38 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 9 | 48 | Normal |
| 2009 | 15 | 27 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 0 | 61 | Normal |
| 2010 | 39 | 3 | 21 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 10 | 94 | Wet |
| 2011 | 12 | 44 | 43 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 110 | Normal |
| 2012 | 2 | 0 | 21 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 22 | 65 | Normal |
| 2013 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | Dry |
| **25th Percentile** | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 50 | |
| **50th Percentile** | 18 | 11 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 9 | 77 | |
| **75th Percentile** | 33 | 24 | 21 | 7 | 0 | 0 | 0 | 0 | 0 | 9 | 13 | 23 | 112 | |
| **Average** | 24 | 15 | 14 | 5 | 1 | 0 | 0 | 0 | 1 | 4 | 10 | 13 | 87 | |
| **Minimum** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | |
| **Maximum** | 91 | 101 | 60 | 47 | 11 | 11 | 4 | 0 | 21 | 25 | 52 | 55 | 224 | |

This is based on only runoff in excess of 5 acre-feet in one day being transferable.
A maximum of 10.6 acre-feet from one day of runoff may be transferred to the MRWPCA system.

Water Year Type based on Salinas Airport Gage, Dry < 25th percentile, Wet > 75th percentile

| Average by Type | |
|---|---|
| Wet | 147 |
| Normal | 85 |
| Dry | 48 |

Groundwater Recharge Project

Table B-6: Estimated Transferable Runoff from Lake El Estero using new connection to Monterey Pump Station (acre-feet)

| Water Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1952 | 3 | 31 | 82 | 157 | 2 | 32 | 4 | 0 | 0 | 0 | 0 | 0 | 311 |
| 1953 | 0 | 20 | 59 | 6 | 0 | 5 | 7 | 0 | 0 | 0 | 0 | 0 | 97 |
| 1954 | 0 | 26 | 0 | 43 | 13 | 41 | 2 | 0 | 0 | 0 | 0 | 0 | 125 |
| 1955 | 0 | 7 | 27 | 58 | 9 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 101 |
| 1956 | 0 | 19 | 90 | 58 | 18 | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 200 |
| 1957 | 0 | 0 | 0 | 31 | 12 | 0 | 5 | 24 | 0 | 0 | 0 | 0 | 72 |
| 1958 | 5 | 0 | 35 | 46 | 43 | 65 | 96 | 0 | 0 | 0 | 0 | 0 | 289 |
| 1959 | 0 | 0 | 0 | 78 | 75 | 0 | 0 | 0 | 0 | 0 | 0 | 59 | 212 |
| 1960 | 0 | 0 | 0 | 22 | 39 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 61 |
| 1961 | 0 | 14 | 0 | 2 | 0 | 19 | 8 | 0 | 0 | 0 | 0 | 0 | 43 |
| 1962 | 0 | 3 | 2 | 23 | 36 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 92 |
| 1963 | 16 | 0 | 20 | 47 | 33 | 45 | 0 | 0 | 0 | 0 | 0 | 0 | 160 |
| 1964 | 10 | 12 | 0 | 36 | 0 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 64 |
| 1965 | 0 | 15 | 96 | 11 | 0 | 12 | 5 | 0 | 0 | 0 | 0 | 0 | 140 |
| 1966 | 0 | 78 | 55 | 21 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 159 |
| 1967 | 0 | 24 | 58 | 64 | 0 | 78 | 58 | 0 | 11 | 0 | 0 | 0 | 293 |
| 1968 | 0 | 3 | 6 | 13 | 0 | 15 | 6 | 0 | 0 | 0 | 0 | 0 | 42 |
| 1969 | 0 | 22 | 1 | 169 | 68 | 0 | 22 | 0 | 0 | 0 | 0 | 0 | 282 |
| 1970 | 0 | 2 | 22 | 72 | 7 | 54 | 0 | 0 | 0 | 0 | 0 | 0 | 157 |
| 1971 | 0 | 72 | 37 | 0 | 0 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 120 |
| 1972 | 0 | 9 | 31 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 43 |
| 1973 | 16 | 83 | 0 | 40 | 43 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 200 |
| 1974 | 20 | 12 | 47 | 39 | 0 | 39 | 31 | 0 | 0 | 0 | 0 | 0 | 188 |
| 1975 | 9 | 0 | 8 | 0 | 11 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 37 |
| 1976 | 10 | 0 | 0 | 0 | 16 | 9 | 9 | 0 | 0 | 0 | 0 | 0 | 44 |
| 1977 | 2 | 0 | 31 | 24 | 0 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 70 |
| 1978 | 0 | 0 | 37 | 60 | 57 | 34 | 45 | 0 | 0 | 0 | 0 | 0 | 233 |
| 1979 | 0 | 16 | 4 | 40 | 8 | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 101 |
| 1980 | 8 | 15 | 29 | 40 | 37 | 2 | 0 | 0 | 0 | 4 | 0 | 0 | 136 |
| 1981 | 0 | 0 | 9 | 90 | 1 | 11 | 2 | 0 | 0 | 0 | 0 | 0 | 114 |
| 1982 | 21 | 63 | 3 | 36 | 18 | 60 | 44 | 0 | 0 | 0 | 0 | 6 | 252 |
| 1983 | 25 | 85 | 48 | 123 | 20 | 118 | 43 | 0 | 0 | 0 | 0 | 14 | 476 |
| 1984 | 0 | 48 | 11 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 60 |
| 1985 | 20 | 27 | 7 | 0 | 17 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 76 |
| 1986 | 21 | 59 | 1 | 1 | 46 | 84 | 0 | 0 | 0 | 0 | 0 | 1 | 213 |
| 1987 | 0 | 0 | 0 | 9 | 30 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 48 |
| 1988 | 4 | 7 | 5 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 |
| 1989 | 0 | 14 | 16 | 1 | 21 | 5 | 0 | 0 | 0 | 0 | 0 | 2 | 59 |
| 1990 | 19 | 15 | 0 | 24 | 21 | 0 | 7 | 4 | 0 | 0 | 0 | 0 | 90 |
| 1991 | 0 | 0 | 2 | 0 | 4 | 82 | 0 | 0 | 0 | 0 | 0 | 0 | 88 |
| 1992 | 11 | 0 | 30 | 22 | 59 | 45 | 0 | 0 | 0 | 0 | 0 | 0 | 167 |
| 1993 | 0 | 0 | 69 | 162 | 100 | 18 | 0 | 0 | 0 | 0 | 0 | 0 | 349 |
| 1994 | 0 | 8 | 32 | 29 | 35 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 105 |
| 1995 | 0 | 0 | 5 | 110 | 0 | 60 | 2 | 0 | 12 | 0 | 0 | 0 | 188 |
| 1996 | 0 | 0 | 5 | 42 | 101 | 21 | 0 | 11 | 0 | 0 | 0 | 0 | 180 |
| 1997 | 0 | 34 | 75 | 131 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 240 |
| 1998 | 0 | 74 | 39 | 138 | 209 | 16 | 27 | 5 | 0 | 0 | 0 | 0 | 508 |
| 1999 | 2 | 11 | 0 | 5 | 26 | 5 | 10 | 0 | 0 | 0 | 0 | 0 | 59 |
| 2000 | 0 | 0 | 0 | 65 | 44 | 27 | 0 | 0 | 0 | 0 | 0 | 0 | 135 |
| 2001 | 27 | 0 | 0 | 13 | 16 | 4 | 4 | 0 | 0 | 0 | 0 | 0 | 64 |
| 2002 | 0 | 11 | 35 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 54 |
| 2003 | 0 | 21 | 70 | 0 | 9 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 101 |
| 2004 | 0 | 0 | 51 | 22 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 83 |
| 2005 | 31 | 0 | 81 | 35 | 30 | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 211 |
| 2006 | 0 | 0 | 15 | 31 | 0 | 26 | 25 | 2 | 0 | 0 | 0 | 0 | 99 |
| 2007 | 0 | 0 | 9 | 0 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| 2008 | 2 | 0 | 0 | 61 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 64 |
| 2009 | 0 | 0 | 9 | 15 | 31 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 63 |
| 2010 | 30 | 0 | 0 | 79 | 3 | 27 | 15 | 0 | 0 | 0 | 0 | 0 | 155 |
| 2011 | 0 | 6 | 10 | 12 | 63 | 61 | 0 | 0 | 0 | 0 | 0 | 0 | 152 |
| 2012 | 10 | 0 | 0 | 2 | 0 | 21 | 11 | 0 | 0 | 0 | 0 | 0 | 42 |
| 2013 | 0 | 30 | 32 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 62 |
| **25th Percentile** | 0 | 0 | 1 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 63 |
| **50th Percentile** | 0 | 7 | 10 | 27 | 12 | 12 | 0 | 0 | 0 | 0 | 0 | 0 | 103 |
| **75th Percentile** | 9 | 20 | 36 | 58 | 35 | 33 | 7 | 0 | 0 | 0 | 0 | 0 | 188 |
| **Average** | 5 | 16 | 23 | 40 | 23 | 21 | 8 | 1 | 0 | 0 | 0 | 1 | 140 |
| **Minimum** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 14 |
| **Maximum** | 31 | 85 | 96 | 169 | 209 | 118 | 96 | 24 | 12 | 4 | 0 | 59 | 508 |

This is based on only runoff in excess of 5 acre-feet in one day being transferable.
A maximum of 30 acre-feet from one day of runoff may be transferred to the MRWPCA system.

**Table B-7: Figueroa Watershed Areas and Curve Numbers**

Determination of available surface water for non-potable water supply

| | Land Use | Soil Group | Curve Number (AMC II) | Area (acres) | Percent Impervious | Impervious Area (acres) | Pervious Area (acres) |
|---|---|---|---|---|---|---|---|
| 1 | LD | A | 34 | 0 | 15% | 0.0 | 0.0 |
| 2 | UHD | A | 34 | 0 | 90% | 0.0 | 0.0 |
| 3 | DV | B | 43 | 98 | 0% | 0.0 | 98.0 |
| 4 | MD | B | 48 | 0 | 30% | 0.0 | 0.0 |
| 5 | HD | B | 48 | 0 | 50% | 0.0 | 0.0 |
| 6 | LD | B | 48 | 98 | 15% | 14.7 | 83.3 |
| 7 | UHD | B | 48 | 0 | 90% | 0.0 | 0.0 |
| 8 | DV | C | 60 | 36 | 0% | 0.0 | 36.0 |
| 9 | HD | C | 65 | 0 | 50% | 0.0 | 0.0 |
| 10 | LD | C | 65 | 53 | 15% | 8.0 | 45.1 |
| 11 | UHD | C | 65 | 0 | 90% | 0.0 | 0.0 |
| 12 | DV | D | 66 | 230 | 0% | 0.0 | 230.0 |
| 13 | HD | D | 70 | 198 | 50% | 99.0 | 99.0 |
| 14 | LD | D | 70 | 273 | 15% | 41.0 | 232.1 |
| 15 | UHD | D | 70 | 200 | 90% | 180.0 | 20.0 |
| 16 | Lake | n\a | 100 | 0 | 100% | 0.0 | 0.0 |
| | | | | **1186** | | **343** | **843** |

| Curve Number (AMC II) | Area (acres) | Curve Number (AMC I) | Curve Number (AMC III) |
|---|---|---|---|
| Pervious Area | | | |
| 34 | 0.0 | 18 | 54 |
| 43 | 98.0 | 25 | 63 |
| 48 | 83.3 | 29 | 68 |
| 60 | 36.0 | 40 | 78 |
| 65 | 45.1 | 45 | 82 |
| 66 | 230.0 | 46 | 82 |
| 70 | 351.1 | 51 | 85 |
| | **843** | | |
| Impervious Area | | | |
| 98 | 343 | 94 | 99 |

Scrub runoff curve numbers used for dense vegetation
Irrigated pasture runoff curve numbers used for pervious areas of all other land use

Curve numbers come from NRCS Pub TR-55
AMC values come from NRCS Pub NEH-4 (National Engineering Handbook, Part 630, Chapter 10)

## Groundwater Recharge Project
### Table B-8: Estimated Runoff from Figueroa Drainage Basin (acre-feet)

| Water Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *1* | *2* | *3* | *4* | *5* | *6* | *7* | *8* | *9* | *10* | *11* | *12* | |
| *1952* | 7 | 40 | 115 | 213 | 18 | 48 | 8 | - | - | - | - | - | 449 |
| *1953* | - | 25 | 73 | 13 | - | 9 | 12 | - | - | - | - | - | 132 |
| *1954* | 1 | 27 | 3 | 53 | 24 | 58 | 6 | 3 | 0 | - | - | - | 176 |
| *1955* | - | 12 | 35 | 78 | 14 | - | 6 | 2 | - | - | - | - | 147 |
| *1956* | - | 22 | 192 | 78 | 27 | - | 16 | 2 | - | - | - | 1 | 338 |
| *1957* | 3 | - | 5 | 49 | 31 | 6 | 10 | 26 | - | - | - | 0 | 130 |
| *1958* | 12 | 3 | 46 | 56 | 68 | 90 | 122 | 4 | 0 | - | - | 1 | 403 |
| *1959* | - | 1 | 2 | 95 | 95 | 0 | 1 | - | - | - | - | 62 | 255 |
| *1960* | - | - | 1 | 46 | 57 | 0 | 3 | 0 | - | - | - | - | 108 |
| *1961* | - | 18 | 4 | 11 | 7 | 22 | 12 | 1 | - | - | - | - | 75 |
| *1962* | - | 8 | 8 | 34 | 61 | 31 | 0 | - | 0 | - | 1 | - | 143 |
| *1963* | 18 | 1 | 28 | 48 | 43 | 58 | - | - | - | - | - | - | 195 |
| *1964* | 15 | 32 | 2 | 47 | 2 | 13 | - | 0 | - | - | 1 | - | 112 |
| *1965* | 3 | 34 | 133 | 21 | 6 | 21 | 15 | - | - | - | - | - | 233 |
| *1966* | 0 | 100 | 97 | 31 | 11 | 1 | 0 | - | - | 0 | - | 1 | 241 |
| *1967* | - | 44 | 101 | 95 | 1 | 102 | 98 | 1 | 14 | - | - | - | 455 |
| *1968* | 2 | 9 | 14 | 26 | 6 | 28 | 9 | - | - | - | 0 | - | 95 |
| *1969* | 0 | 29 | 17 | 230 | 111 | 8 | 29 | - | 0 | - | - | - | 424 |
| *1970* | 2 | 6 | 33 | 101 | 16 | 73 | 0 | - | 0 | - | - | - | 232 |
| *1971* | 1 | 153 | 58 | 3 | 1 | 20 | 5 | 1 | - | - | - | 2 | 244 |
| *1972* | - | 18 | 54 | 7 | 4 | - | 1 | - | 0 | - | - | - | 84 |
| *1973* | 26 | 117 | 6 | 64 | 76 | 36 | - | - | - | - | - | 0 | 324 |
| *1974* | 26 | 28 | 69 | 53 | 2 | 55 | 78 | - | 1 | 0 | - | - | 313 |
| *1975* | 14 | 1 | 20 | 8 | 26 | 30 | 5 | - | - | - | 3 | - | 108 |
| *1976* | 17 | 0 | 0 | - | 26 | 15 | 16 | - | 0 | - | 3 | 1 | 79 |
| *1977* | 6 | 4 | 37 | 35 | 4 | 16 | - | 3 | - | - | - | 3 | 108 |
| *1978* | - | 2 | 92 | 134 | 98 | 55 | 61 | - | - | - | - | 0 | 442 |
| *1979* | - | 22 | 11 | 50 | 33 | 45 | 1 | 0 | - | 1 | - | - | 164 |
| *1980* | 17 | 26 | 37 | 50 | 71 | 16 | 8 | 1 | - | 8 | - | - | 233 |
| *1981* | - | - | 16 | 137 | 10 | 30 | 7 | - | - | - | - | - | 201 |
| *1982* | 25 | 84 | 9 | 54 | 25 | 105 | 54 | - | 2 | - | - | 12 | 371 |
| *1983* | 30 | 108 | 58 | 162 | 51 | 207 | 59 | 0 | - | - | - | 17 | 690 |
| *1984* | 1 | 68 | 26 | - | 15 | 4 | 1 | 0 | - | - | - | - | 116 |
| *1985* | 25 | 48 | 12 | 3 | 19 | 30 | 5 | 0 | 1 | - | - | 0 | 143 |
| *1986* | 23 | 73 | 8 | 10 | 72 | 102 | 0 | 1 | - | - | - | 6 | 295 |
| *1987* | - | 0 | 8 | 26 | 39 | 21 | 2 | - | - | - | - | - | 97 |
| *1988* | 9 | 15 | 18 | 16 | 2 | 0 | 11 | 0 | - | - | - | - | 71 |
| *1989* | - | 25 | 34 | 11 | 26 | 18 | 4 | 0 | - | - | - | 6 | 123 |
| *1990* | 21 | 17 | 0 | 42 | 30 | 5 | 10 | 15 | - | - | - | - | 141 |
| *1991* | 0 | 4 | 9 | 4 | 19 | 111 | 0 | - | - | - | - | - | 148 |
| *1992* | 14 | - | 50 | 29 | 133 | 52 | - | - | - | - | - | - | 279 |
| *1993* | 3 | 0 | 100 | 234 | 150 | 32 | 5 | 1 | 2 | - | - | - | 527 |
| *1994* | - | 14 | 35 | 45 | 53 | 0 | 5 | 4 | - | - | - | - | 158 |
| *1995* | 1 | 11 | 14 | 194 | 2 | 100 | 11 | 2 | 14 | - | - | - | 350 |
| *1996* | - | 0 | 13 | 57 | 201 | 33 | 4 | 14 | - | - | - | - | 322 |
| *1997* | 5 | 42 | 143 | 172 | - | - | 1 | - | - | - | 0 | - | 362 |
| *1998* | 2 | 126 | 48 | 217 | 488 | 37 | 46 | 16 | - | - | - | - | 979 |
| *1999* | 6 | 20 | 3 | 17 | 32 | 14 | 20 | - | - | - | - | 1 | 113 |
| *2000* | - | 4 | - | 102 | 63 | 36 | 2 | 1 | - | - | - | 0 | 208 |
| *2001* | 45 | - | - | 33 | 37 | 10 | 10 | - | - | - | - | - | 134 |
| *2002* | 0 | 19 | 49 | 11 | 4 | 5 | 0 | 4 | - | - | - | - | 90 |
| *2003* | - | 26 | 99 | 5 | 14 | 6 | 4 | 1 | - | - | - | - | 155 |
| *2004* | 1 | 8 | 71 | 27 | 30 | 2 | - | - | - | - | - | - | 139 |
| *2005* | 44 | 4 | 95 | 68 | 47 | 44 | 5 | 2 | 0 | - | - | - | 309 |
| *2006* | - | 3 | 28 | 40 | 1 | 61 | 30 | 6 | - | - | - | - | 168 |
| *2007* | - | 4 | 17 | 3 | 22 | 2 | 5 | - | - | - | - | 1 | 53 |
| *2008* | 7 | 1 | 3 | 96 | 14 | 2 | 0 | - | - | - | - | - | 123 |
| *2009* | 0 | 5 | 18 | 23 | 49 | 19 | 0 | 0 | - | - | - | 0 | 114 |
| *2010* | 50 | 0 | 12 | 102 | 14 | 37 | 27 | 1 | - | - | - | - | 244 |
| *2011* | 1 | 13 | 28 | 23 | 76 | 85 | - | 2 | 4 | - | - | - | 233 |
| *2012* | 18 | 4 | 0 | 8 | 1 | 35 | 18 | - | 1 | - | - | - | 85 |
| *2013* | 1 | 41 | 51 | 2 | 4 | 2 | - | - | - | - | - | - | 101 |
| **Average** | 8 | 25 | 38 | 60 | 43 | 34 | 14 | 2 | 1 | 0 | 0 | 2 | 227 |
| **Minimum** | - | - | - | - | - | - | - | - | - | - | - | - | 53 |
| **Maximum** | 50 | 153 | 192 | 234 | 488 | 207 | 122 | 26 | 14 | 8 | 3 | 62 | 979 |

**Table B-9: Combined El Estero and Figueroa Watershed Areas and Curve Numbers**

Determination of available surface water for non-potable water supply

| | Land Use | Soil Group | Curve Number (AMC II) | Area (acres) | Percent Impervious | Impervious Area (acres) | Pervious Area (acres) |
|---|---|---|---|---|---|---|---|
| 1 | LD | A | 34 | 22 | 15% | 3.3 | 18.7 |
| 2 | UHD | A | 34 | 31 | 90% | 28.1 | 3.1 |
| 3 | DV | B | 43 | 373 | 0% | 0.0 | 372.6 |
| 4 | MD | B | 48 | 186 | 30% | 55.9 | 130.5 |
| 5 | HD | B | 48 | 68 | 50% | 34.0 | 34.0 |
| 6 | LD | B | 48 | 108 | 15% | 16.2 | 91.9 |
| 7 | UHD | B | 48 | 60 | 90% | 53.7 | 6.0 |
| 8 | DV | C | 60 | 1502 | 0% | 0.0 | 1501.6 |
| 9 | HD | C | 65 | 31 | 50% | 15.6 | 15.6 |
| 10 | LD | C | 65 | 55 | 15% | 8.2 | 46.6 |
| 11 | UHD | C | 65 | 27 | 90% | 24.0 | 2.7 |
| 12 | DV | D | 66 | 248 | 0% | 0.0 | 248.4 |
| 13 | HD | D | 70 | 229 | 50% | 114.6 | 114.6 |
| 14 | LD | D | 70 | 276 | 15% | 41.4 | 234.4 |
| 15 | UHD | D | 70 | 369 | 90% | 332.1 | 36.9 |
| 16 | Lake | n\a | 100 | 19 | 100% | 19.3 | 0.0 |
| | | | | **3604** | | **746** | **2857** |

| Curve Number (AMC II) | Area (acres) | Curve Number (AMC I) | Curve Number (AMC III) |
|---|---|---|---|
| Pervious Area | | | |
| 34 | 21.9 | 18 | 54 |
| 43 | 372.6 | 25 | 63 |
| 48 | 262.3 | 29 | 68 |
| 60 | 1501.6 | 40 | 78 |
| 65 | 64.9 | 45 | 82 |
| 66 | 248.4 | 46 | 82 |
| 70 | 385.9 | 51 | 85 |
| | **2857** | | |
| Impervious Area | | | |
| 98 | 746 | 94 | 99 |

Scrub runoff curve numbers used for dense vegetation
Irrigated pasture runoff curve numbers used for pervious areas of all other land use

Curve numbers come from NRCS Pub TR-55
AMC values come from NRCS Pub NEH-4 (National Engineering Handbook, Part 630, Chapter 10)

## Groundwater Recharge Project
### Table B-10: Estimated Runoff into Lake El Estero adding Figueroa Basin (acre-feet)

| Water Year | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | |
| 1952 | 16 | 88 | 249 | 462 | 38 | 104 | 18 | - | - | - | - | - | 974 |
| 1953 | - | 55 | 159 | 28 | - | 19 | 26 | - | - | - | - | - | 287 |
| 1954 | 3 | 59 | 7 | 115 | 53 | 127 | 14 | 6 | 1 | - | - | - | 384 |
| 1955 | - | 27 | 76 | 169 | 31 | - | 14 | 5 | - | - | - | - | 321 |
| 1956 | - | 48 | 407 | 169 | 58 | - | 36 | 5 | - | - | - | 2 | 725 |
| 1957 | 6 | - | 10 | 107 | 67 | 12 | 23 | 58 | - | - | - | 1 | 282 |
| 1958 | 25 | 7 | 101 | 122 | 148 | 196 | 265 | 10 | 1 | - | - | 2 | 876 |
| 1959 | - | 2 | 3 | 207 | 206 | 0 | 1 | - | - | - | - | 134 | 553 |
| 1960 | - | - | 3 | 99 | 124 | 1 | 7 | 1 | - | - | - | - | 234 |
| 1961 | - | 39 | 9 | 25 | 14 | 48 | 25 | 2 | - | - | - | - | 163 |
| 1962 | - | 18 | 18 | 74 | 132 | 67 | 0 | - | 1 | - | 1 | - | 312 |
| 1963 | 39 | 2 | 60 | 105 | 92 | 126 | - | - | - | - | - | - | 423 |
| 1964 | 32 | 70 | 4 | 102 | 3 | 27 | - | 1 | - | - | 3 | - | 243 |
| 1965 | 7 | 74 | 287 | 45 | 14 | 46 | 33 | - | - | - | - | - | 505 |
| 1966 | 0 | 216 | 207 | 68 | 24 | 2 | 0 | - | - | 1 | - | 1 | 519 |
| 1967 | - | 95 | 228 | 207 | 3 | 220 | 212 | 2 | 29 | - | - | - | 997 |
| 1968 | 3 | 20 | 31 | 57 | 13 | 62 | 20 | - | - | - | 0 | - | 207 |
| 1969 | 0 | 63 | 37 | 499 | 239 | 18 | 63 | - | 0 | - | - | - | 919 |
| 1970 | 5 | 12 | 72 | 219 | 35 | 162 | 0 | - | 0 | - | - | - | 506 |
| 1971 | 1 | 353 | 125 | 8 | 2 | 43 | 10 | 2 | - | - | - | 5 | 549 |
| 1972 | - | 38 | 117 | 16 | 9 | - | 1 | - | 0 | - | - | - | 182 |
| 1973 | 56 | 252 | 14 | 138 | 165 | 79 | - | - | - | - | - | 0 | 705 |
| 1974 | 56 | 61 | 151 | 114 | 4 | 120 | 170 | - | 3 | 0 | - | - | 679 |
| 1975 | 30 | 3 | 43 | 17 | 57 | 66 | 12 | - | - | - | 6 | - | 234 |
| 1976 | 38 | 1 | 0 | - | 56 | 34 | 35 | - | 0 | - | 7 | 2 | 172 |
| 1977 | 12 | 8 | 82 | 74 | 8 | 36 | - | 7 | - | - | - | 7 | 233 |
| 1978 | - | 4 | 196 | 304 | 213 | 121 | 133 | - | - | - | - | 1 | 972 |
| 1979 | - | 49 | 23 | 108 | 73 | 98 | 3 | 1 | - | 3 | - | - | 358 |
| 1980 | 37 | 56 | 80 | 108 | 152 | 36 | 18 | 2 | - | 17 | - | - | 505 |
| 1981 | - | - | 36 | 290 | 23 | 66 | 15 | - | - | - | - | - | 430 |
| 1982 | 55 | 180 | 19 | 118 | 54 | 228 | 117 | - | 4 | - | - | 27 | 803 |
| 1983 | 65 | 233 | 126 | 352 | 111 | 453 | 128 | 1 | - | - | - | 36 | 1,504 |
| 1984 | 2 | 149 | 57 | - | 32 | 9 | 2 | 1 | - | - | - | - | 252 |
| 1985 | 55 | 105 | 27 | 7 | 41 | 64 | 10 | 0 | 2 | - | - | 0 | 311 |
| 1986 | 49 | 157 | 18 | 23 | 154 | 218 | 0 | 3 | - | - | - | 13 | 635 |
| 1987 | - | 0 | 17 | 56 | 86 | 46 | 5 | - | - | - | - | - | 211 |
| 1988 | 20 | 33 | 38 | 34 | 4 | 0 | 25 | 1 | - | - | - | - | 154 |
| 1989 | - | 54 | 73 | 24 | 57 | 38 | 9 | 0 | - | - | - | 13 | 268 |
| 1990 | 46 | 38 | 0 | 92 | 66 | 11 | 22 | 32 | - | - | - | - | 307 |
| 1991 | 0 | 9 | 20 | 8 | 42 | 239 | 1 | - | - | - | - | - | 320 |
| 1992 | 30 | - | 109 | 64 | 300 | 114 | - | - | - | - | - | - | 618 |
| 1993 | 6 | 0 | 215 | 508 | 322 | 69 | 11 | 2 | 5 | - | - | - | 1,138 |
| 1994 | - | 31 | 77 | 99 | 116 | 1 | 11 | 10 | - | - | - | - | 344 |
| 1995 | 2 | 25 | 31 | 415 | 4 | 218 | 23 | 3 | 32 | - | - | - | 753 |
| 1996 | - | 0 | 29 | 123 | 454 | 73 | 9 | 30 | - | - | - | - | 718 |
| 1997 | 10 | 91 | 307 | 374 | - | - | 2 | - | - | - | 1 | - | 785 |
| 1998 | 4 | 272 | 104 | 477 | 1,141 | 81 | 98 | 35 | - | - | - | - | 2,211 |
| 1999 | 13 | 43 | 7 | 37 | 69 | 30 | 44 | - | - | - | - | 3 | 246 |
| 2000 | - | 9 | - | 224 | 137 | 79 | 4 | 2 | - | - | - | 0 | 455 |
| 2001 | 97 | - | - | 71 | 80 | 21 | 23 | - | - | - | - | - | 292 |
| 2002 | 0 | 41 | 106 | 24 | 9 | 10 | 0 | 8 | - | - | - | - | 197 |
| 2003 | - | 56 | 215 | 12 | 29 | 13 | 9 | 2 | - | - | - | - | 336 |
| 2004 | 3 | 17 | 155 | 56 | 65 | 4 | - | - | - | - | - | - | 301 |
| 2005 | 95 | 8 | 207 | 148 | 101 | 97 | 11 | 3 | 1 | - | - | - | 671 |
| 2006 | - | 6 | 61 | 87 | 2 | 132 | 65 | 12 | - | - | - | - | 366 |
| 2007 | - | 9 | 37 | 7 | 48 | 4 | 10 | - | - | - | - | 2 | 116 |
| 2008 | 14 | 2 | 6 | 209 | 31 | 5 | 0 | - | - | - | - | - | 267 |
| 2009 | 0 | 11 | 40 | 51 | 106 | 40 | 0 | 0 | - | - | - | 0 | 249 |
| 2010 | 109 | 0 | 25 | 220 | 30 | 81 | 59 | 2 | - | - | - | - | 527 |
| 2011 | 3 | 29 | 61 | 51 | 164 | 184 | - | 4 | 8 | - | - | - | 504 |
| 2012 | 38 | 10 | 0 | 18 | 2 | 76 | 40 | - | 2 | - | - | - | 185 |
| 2013 | 3 | 89 | 108 | 4 | 9 | 5 | - | - | - | - | - | - | 218 |
| **Average** | 18 | 55 | 83 | 130 | 96 | 74 | 30 | 4 | 1 | 0 | 0 | 4 | 495 |
| **Minimum** | - | - | - | - | - | - | - | - | - | - | - | - | 116 |
| **Maximum** | 109 | 353 | 407 | 508 | 1,141 | 453 | 265 | 58 | 32 | 17 | 7 | 134 | 2,211 |

## Groundwater Recharge Project

### Table B-11: Estimated Transferable Runoff from Lake El Estero adding Figueroa Basin (acre-feet)

| Year | *Jan* | *Feb* | *Mar* | *Apr* | *May* | *Jun* | *Jul* | *Aug* | *Sep* | *Oct* | *Nov* | *Dec* | **Total** | **Type Year** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *1952* | 90 | 16 | 32 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 18 | 51 | 217 | Wet |
| *1953* | 11 | 0 | 11 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 2 | 45 | Dry |
| *1954* | 32 | 22 | 27 | 9 | 1 | 0 | 0 | 0 | 0 | 0 | 11 | 19 | 121 | Normal |
| *1955* | 44 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 56 | 120 | Wet |
| *1956* | 44 | 17 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 5 | 77 | Dry |
| *1957* | 43 | 28 | 4 | 11 | 11 | 0 | 0 | 0 | 0 | 13 | 0 | 32 | 141 | Normal |
| *1958* | 31 | 57 | 64 | 59 | 5 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 216 | Normal |
| *1959* | 42 | 61 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 0 | 0 | 0 | 124 | Dry |
| *1960* | 36 | 53 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 100 | Normal |
| *1961* | 13 | 5 | 11 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 10 | 8 | 56 | Dry |
| *1962* | 23 | 43 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 17 | 105 | Dry |
| *1963* | 21 | 30 | 28 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 39 | 0 | 129 | Normal |
| *1964* | 25 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 29 | 74 | 139 | Normal |
| *1965* | 16 | 5 | 14 | 15 | 0 | 0 | 0 | 0 | 0 | 0 | 65 | 62 | 178 | Normal |
| *1966* | 27 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 36 | 32 | 106 | Dry |
| *1967* | 48 | 0 | 45 | 79 | 0 | 11 | 0 | 0 | 0 | 0 | 10 | 11 | 204 | Normal |
| *1968* | 29 | 3 | 29 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 12 | 103 | Normal |
| *1969* | 107 | 56 | 5 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 7 | 25 | 212 | Wet |
| *1970* | 63 | 18 | 21 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 44 | 37 | 183 | Wet |
| *1971* | 0 | 0 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 45 | 87 | Dry |
| *1972* | 9 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 70 | 1 | 105 | Normal |
| *1973* | 45 | 67 | 33 | 0 | 0 | 0 | 0 | 0 | 0 | 16 | 24 | 34 | 219 | Wet |
| *1974* | 34 | 0 | 31 | 16 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 13 | 105 | Normal |
| *1975* | 6 | 30 | 30 | 4 | 0 | 0 | 0 | 1 | 0 | 21 | 0 | 0 | 91 | Normal |
| *1976* | 0 | 22 | 13 | 21 | 0 | 0 | 0 | 0 | 0 | 7 | 2 | 16 | 81 | Dry |
| *1977* | 30 | 3 | 11 | 0 | 0 | 0 | 0 | 0 | 2 | 0 | 0 | 33 | 78 | Dry |
| *1978* | 54 | 51 | 53 | 45 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 11 | 234 | Wet |
| *1979* | 32 | 30 | 25 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 26 | 21 | 153 | Normal |
| *1980* | 32 | 62 | 15 | 3 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 21 | 144 | Dry |
| *1981* | 53 | 11 | 25 | 9 | 0 | 0 | 0 | 0 | 0 | 12 | 55 | 10 | 174 | Normal |
| *1982* | 41 | 21 | 77 | 32 | 0 | 0 | 0 | 0 | 13 | 21 | 49 | 31 | 285 | Wet |
| *1983* | 64 | 58 | 86 | 41 | 0 | 0 | 0 | 0 | 11 | 0 | 63 | 20 | 343 | Wet |
| *1984* | 0 | 13 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 21 | 33 | 11 | 78 | Dry |
| *1985* | 0 | 11 | 29 | 5 | 0 | 0 | 0 | 0 | 0 | 11 | 51 | 8 | 114 | Dry |
| *1986* | 8 | 49 | 64 | 0 | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 5 | 133 | Normal |
| *1987* | 25 | 11 | 22 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 18 | 20 | 107 | Normal |
| *1988* | 19 | 0 | 0 | 10 | 0 | 0 | 0 | 0 | 0 | 0 | 25 | 24 | 77 | Dry |
| *1989* | 9 | 15 | 18 | 4 | 0 | 0 | 0 | 0 | 8 | 11 | 11 | 0 | 73 | Dry |
| *1990* | 39 | 23 | 1 | 11 | 17 | 0 | 0 | 0 | 0 | 0 | 4 | 8 | 102 | Dry |
| *1991* | 3 | 22 | 73 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 15 | 124 | Normal |
| *1992* | 15 | 55 | 24 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 51 | 145 | Normal |
| *1993* | 109 | 68 | 30 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 21 | 240 | Normal |
| *1994* | 44 | 34 | 0 | 2 | 4 | 0 | 0 | 0 | 0 | 0 | 6 | 11 | 100 | Normal |
| *1995* | 102 | 0 | 62 | 8 | 0 | 11 | 0 | 0 | 0 | 0 | 0 | 12 | 196 | Wet |
| *1996* | 43 | 64 | 31 | 2 | 11 | 0 | 0 | 0 | 0 | 1 | 21 | 58 | 232 | Wet |
| *1997* | 73 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 60 | 25 | 158 | Normal |
| *1998* | 90 | 120 | 35 | 38 | 13 | 0 | 0 | 0 | 0 | 8 | 21 | 0 | 325 | Wet |
| *1999* | 16 | 13 | 12 | 17 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 0 | 62 | Normal |
| *2000* | 34 | 53 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 43 | 0 | 0 | 149 | Normal |
| *2001* | 34 | 46 | 11 | 11 | 0 | 0 | 0 | 0 | 0 | 0 | 19 | 35 | 156 | Normal |
| *2002* | 11 | 2 | 5 | 0 | 2 | 0 | 0 | 0 | 0 | 0 | 14 | 64 | 98 | Dry |
| *2003* | 2 | 11 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 29 | 54 | Dry |
| *2004* | 11 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 41 | 2 | 42 | 121 | Normal |
| *2005* | 34 | 35 | 26 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 31 | 126 | Wet |
| *2006* | 31 | 0 | 54 | 13 | 7 | 0 | 0 | 0 | 0 | 0 | 3 | 21 | 129 | Normal |
| *2007* | 0 | 27 | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 8 | 0 | 0 | 38 | Dry |
| *2008* | 65 | 6 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | 14 | 89 | Normal |
| *2009* | 21 | 36 | 20 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 0 | 10 | 97 | Normal |
| *2010* | 58 | 11 | 25 | 29 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 28 | 161 | Wet |
| *2011* | 25 | 53 | 59 | 0 | 0 | 3 | 0 | 0 | 0 | 21 | 0 | 0 | 161 | Normal |
| *2012* | 8 | 0 | 35 | 14 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 33 | 100 | Normal |
| *2013* | 0 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | Dry |
| **25th Percentile** | 11 | 5 | 4 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 97 | |
| **50th Percentile** | 31 | 19 | 20 | 3 | 0 | 0 | 0 | 0 | 0 | 0 | 11 | 17 | 123 | |
| **75th Percentile** | 44 | 46 | 31 | 11 | 0 | 0 | 0 | 0 | 0 | 11 | 21 | 32 | 161 | |
| **Average** | 33 | 26 | 23 | 9 | 1 | 0 | 0 | 0 | 1 | 6 | 16 | 21 | 136 | |
| **Minimum** | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 | |
| **Maximum** | 109 | 120 | 86 | 79 | 17 | 11 | 11 | 1 | 21 | 43 | 70 | 74 | 343 | |

This is based on only runoff in excess of 5 acre-feet in one day being transferable.
A maximum of 10.6 acre-feet from one day of runoff may be transferred to the MRWPCA system.

Water Year Type based on Salinas Airport Gage, Dry < 25th percentile, Wet > 75th percentile

| **Average by Type** | |
|---|---|
| Wet | 220 |
| Normal | 134 |
| Dry | 81 |

Table B-12: Lake El Estero and Monterey Bay Water Quality

| Stream | Location | Analyte Name | No. Samples | Units | Mean | Min | Max |
|---|---|---|---|---|---|---|---|
| Lake El Estero | 2 samples, 7/6/2009 | Bicarbonate Alkalinity (HCO3) | 2 | mg/L | 284.25 | 283.0000 | 285.50 |
| Lake El Estero | 2 samples, 7/6/2009 | Boron | 2 | mg/L | 0.24 | 0.23 | 0.25 |
| Lake El Estero | 2 samples, 7/6/2009 | Calcium | 2 | mg/L | 108.5 | 108.0 | 109.0 |
| Lake El Estero | 2 samples, 7/6/2009 | Nitrate as N | 2 | mg/L | ND | ND | ND |
| Lake El Estero | 2 samples, 7/6/2009 | E. Coli | 2 | #/100 ml | 48 | 10 | 86 |
| Lake El Estero | 2 samples, 7/6/2009 | Coliform, Total | 2 | #/100 ml | 6,499 | 6,131 | 6,867 |
| Lake El Estero | 2 samples, 7/6/2009 | Enterococcus | 2 | #/100 ml | 31 | 31 | 31 |
| Lake El Estero | 2 samples, 7/6/2009 | Sulfate | 2 | mg/L | 158.0 | 156.0 | 160.0 |
| Lake El Estero | 2 samples, 7/6/2009 | Dissolved Solids, Total | 2 | mg/L | 1,028.0 | 1,024.0 | 1,032.0 |
| Lake El Estero | 2 samples, 7/6/2009 | Total Suspended Solids | 2 | mg/L | 20.5 | 18.0 | 23.0 |
| Lake El Estero | 2 samples, 7/6/2009 | Chloride | 2 | mg/L | 320.5 | 317.0 | 324.0 |
| Lake El Estero | 2 samples, 7/6/2009 | Potassium | 2 | mg/L | 5.6 | 5.5 | 5.6 |
| Lake El Estero | 2 samples, 7/6/2009 | Magnesium | 2 | mg/L | 36.0 | 36.0 | 36.0 |
| | | | | | | | |
| Twin 51" Outfalls | below El Estero | Nitrate | 14 | mg/L | 0.62 | 0.16 | 1.30 |
| Twin 51" Outfalls | below El Estero | Phosporus | 15 | mg/L | 0.40 | 0.00 | 0.97 |
| Twin 51" Outfalls | below El Estero | Urea | 16 | ug/L | 317.86 | 16.00 | 920.00 |
| Twin 51" Outfalls | below El Estero | E. Coli | 17 | MPN/100 mL | 61,240 | 50 | 229,170 |
| Twin 51" Outfalls | below El Estero | Enteroccoccus | 18 | MPN/100 mL | 54,199 | 125 | 227,516 |
| Twin 51" Outfalls | below El Estero | Zinc | 19 | ug/L | 142.0 | 20.0 | 385.0 |
| Twin 51" Outfalls | below El Estero | Copper | 20 | ug/L | 36.54 | 5.00 | 99.00 |
| Twin 51" Outfalls | below El Estero | Lead | 21 | ug/L | 9.85 | 0.00 | 44.00 |
| Twin 51" Outfalls | below El Estero | Total Suspended Solids | 22 | mg/L | 40.07 | 0.00 | 183.00 |
| | | | | | | | |
| Majors Creek | above El Estero | Calcium | 5 | mg/L | 20.22 | 15.40 | 26.00 |
| Majors Creek | above El Estero | Coliform, Total | 18 | MPN/100 ml | 104,651 | 2,400 | 240,000 |
| Majors Creek | above El Estero | Copper | 15 | ug/L | 65.2 | 0.0 | 150.0 |
| Majors Creek | above El Estero | Escherichia coli | 18 | MPN/100 ml | 1,993 | 17 | 24,000 |
| Majors Creek | above El Estero | Lead | 15 | ug/L | 19.50 | 0.00 | 87.00 |
| Majors Creek | above El Estero | Magnesium | 6 | mg/L | 10.10 | 5.20 | 29.00 |
| Majors Creek | above El Estero | Nitrate as N | 19 | mg/L | 0.87 | 0.00 | 2.25 |
| Majors Creek | above El Estero | Oil and Grease | 1 | mg/L | 0.00 | 0.00 | 0.00 |
| Majors Creek | above El Estero | Orthophosphate as P | 19 | mg/L | 0.37 | 0.00 | 1.68 |
| Majors Creek | above El Estero | Oxygen, Dissolved | 5 | mg/L | 8.20 | 8.00 | 9.00 |
| Majors Creek | above El Estero | Total Dissolved Solids | 15 | mg/L | 399.73 | 149.00 | 930.00 |
| Majors Creek | above El Estero | Total Suspended Solids | 15 | mg/L | 101.13 | 12.40 | 531.00 |
| Majors Creek | above El Estero | Zinc | 15 | ug/L | 337.40 | 0.00 | 750.00 |
| | | | | | | | |
| Monterey Bay | South Coastline | Ammonia as N | 11 | mg/L | 0.023636 | 0.02 | 0.04000 |
| Monterey Bay | South Coastline | Chlordanes | 3 | ng/L | 0.01 | 0.01 | 0.01 |
| Monterey Bay | South Coastline | ColiformFecal | 13 | MPN/100 ml | 2 | 2 | 2 |
| Monterey Bay | South Coastline | ColiformTotal | 12 | MPN/100 ml | 60 | 2 | 659 |
| Monterey Bay | South Coastline | Enterococcus | 12 | MPN/100 ml | 2 | 2 | 2 |
| Monterey Bay | South Coastline | Nitrate as N | 12 | mg/L | 0.04 | 0.01 | 0.16 |
| Monterey Bay | South Coastline | Orthophosphate as P | 12 | mg/L | 0.02 | 0.01 | 0.04 |
| Monterey Bay | South Coastline | Silica | 12 | mg/L | 0.51 | 0.17 | 1.20 |
| Monterey Bay | South Coastline | Total Suspended Solids | 12 | mg/L | 13.35 | 6.70 | 34.40 |
| Monterey Bay | South Coastline | Urea as N | 12 | ug/L | 0.01 | 0.01 | 0.01 |

Highlighted cells exceed objective / standards. See table B13

Min value of 0.00 = Not Detected.

**Table B-13: Water Quality Objectives**

| Analyte Name | Units | Standard | Reference |
|---|---|---|---|
| Nitrate as N | mg/L | 2.25 | CCAMP Proposed |
| Orthophosphate as P | mg/L | 0.12 | CCAMP Proposed |
| *E. coli* | MPN/100 ml | 400 | EPA Ambient Water Quality Criteria |
| Enterococcus | MPN/100 ml | 104 | EPA Ambient Water Quality Criteria |
| Zinc | ug/L | 200 | Basin Plan Objective |
| Copper | ug/L | 30 | Basin Plan Objective |
| Lead | ug/L | 30 | Basin Plan Objective |
| Total Suspended Solids (TSS) | mg/L | 500 | Basin Plan Objective |

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## Appendix C: Conceptual Diversion Facility

Figure 1: Lake El Estero Water Intake Alignments
Figure 2: Lake El Estero Water Intake, Elevation
Figure 3: Lake El Estero Water Intake, Pump Option
Figure 4: Pump House Detail
Table C-1: Gravity Option Head Calculations
Table C-2: Pump Option Head Calculations
Table C-3: Estimated Cost of Construction, Gravity Option
Table C-4: Estimated Cost of Construction, Pump Option

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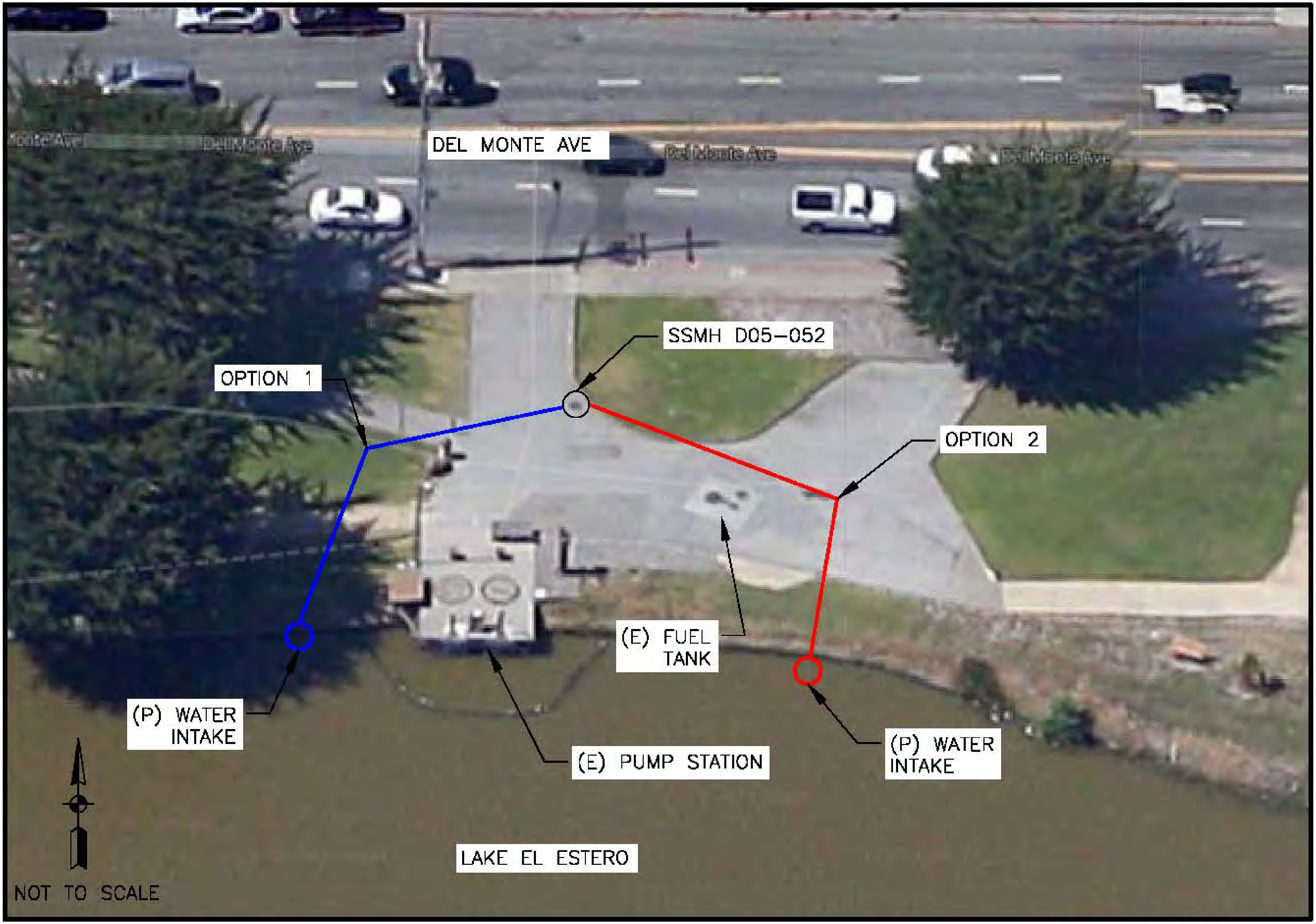
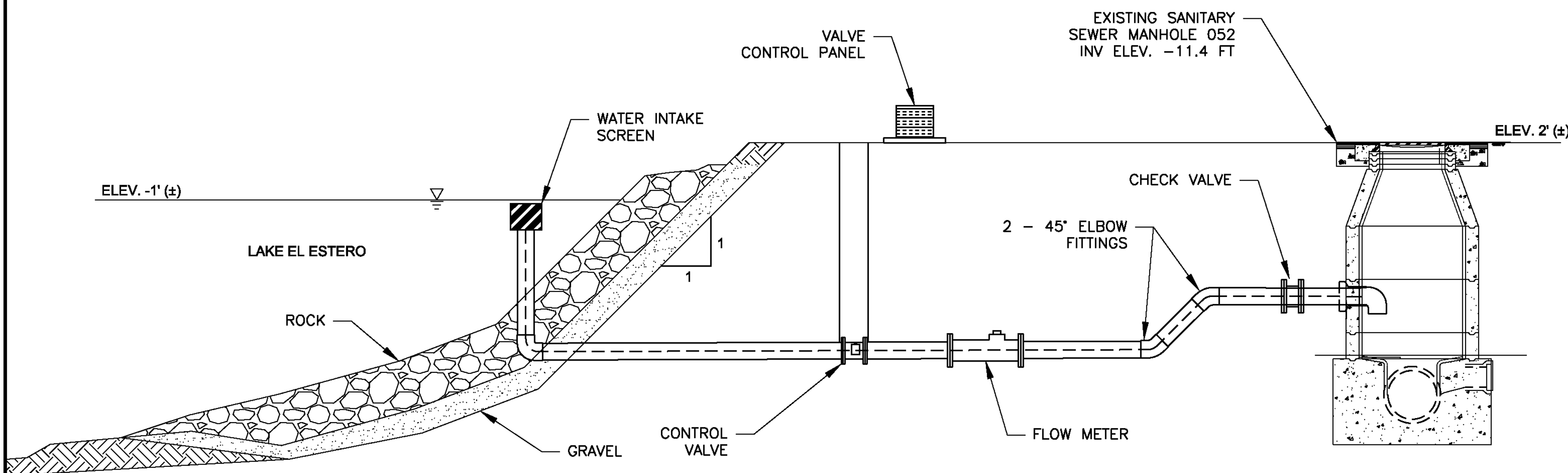
## Figure 1 - Lake El Estero Water Intake Alignments

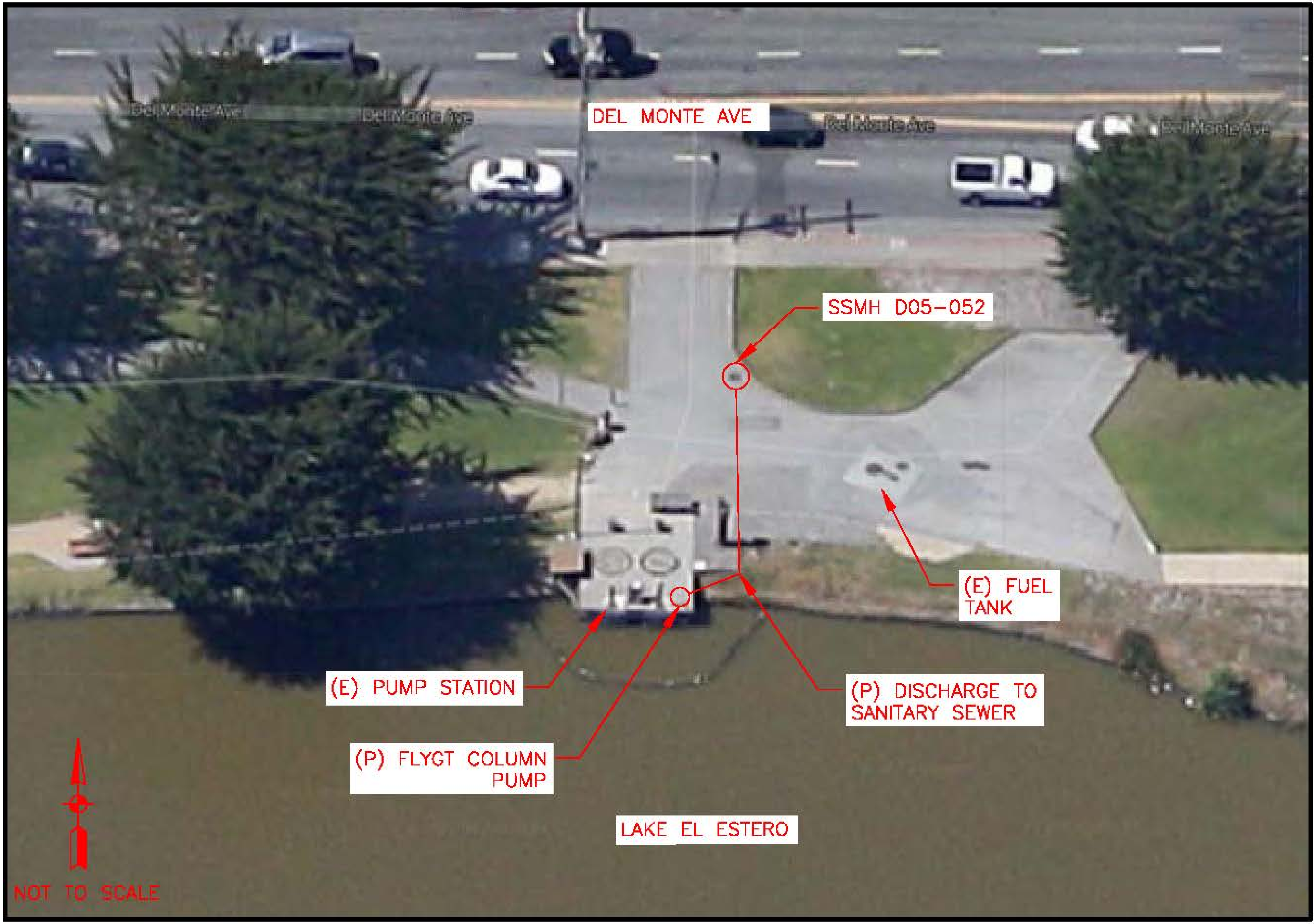



Schaaf & Wheeler


EXISTING SANITARY
SEWER MANHOLE 052
INV ELEV. -11.4 FT
VALVE
CONTROL PANEL
ELEV. 2' (±)
WATER INTAKE
SCREEN
CHECK VALVE
ELEV. -1' (±)
2 - 45° ELBOW
FITTINGS
LAKE EL ESTERO
1
1
ROCK
CONTROL
VALVE
FLOW METER
GRAVEL

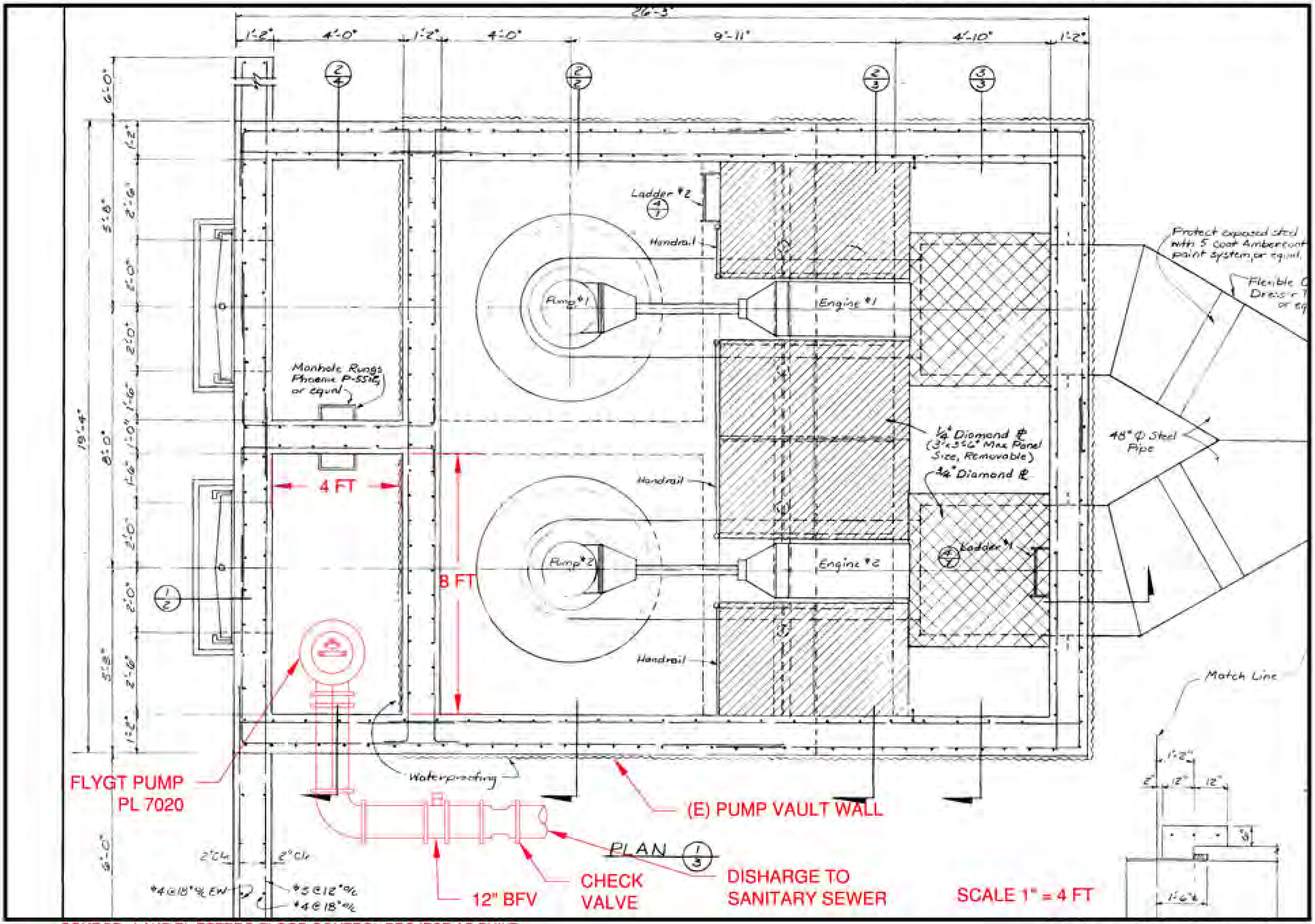
NOT TO SCALE

## Figure 3 - Lake El Estero Water Intake Pump Option




Schaaf & Wheeler

Figure 4 - Pump House Detail




SOURCE: LAKE EL ESTERO FLOOD CONTROL PROJECT AS BUILT
6/17/68

Schaaf & Wheeler

**Table C-1: Gravity Option Head Calculations**
Estimate gravity flow potential from the lake to the SSMH.

Available head approx 5-ft for up-turned outlet.

| | | |
|---|---|---|
| **Length** | 40 | ft |
| **Diameter** | 10 | inch |
| **Material** | C900 | PVC |
| **Hazen-Williams** | 130 | |

| **Fitting** | **K** |
|---|---|
| entrance | 1.00 |
| 90-bend | 0.30 |
| gate valve | 0.19 |
| mag meter | 0 |
| swing check | 2.00 |
| 90-bend | 0.30 |
| 90-bend | 0.30 |
| sharp exit | 0.19 |
| Total minor losses | 4.28 |

| | Q gpm | Q cfs | V fps | Pipeline Loss ft | Minor Losses ft | Total Losses ft | gpd | AF/day |
|---|---|---|---|---|---|---|---|---|
| | 1500 | 3.342 | 6.13 | 0.52 | 2.50 | 3.02 | 2,160,000 | 6.63 |
| | 1600 | 3.565 | 6.54 | 0.59 | 2.84 | 3.43 | 2,304,000 | 7.07 |
| | 1700 | 3.788 | 6.94 | 0.66 | 3.21 | 3.86 | 2,448,000 | 7.51 |
| | 1800 | 4.011 | 7.35 | 0.73 | 3.59 | 4.32 | 2,592,000 | 7.96 |
| | 1900 | 4.234 | 7.76 | 0.80 | 4.00 | 4.81 | 2,736,000 | 8.40 |
| | 2000 | 4.456 | 8.17 | 0.88 | 4.44 | 5.32 | 2,880,000 | 8.84 |
| | 2100 | 4.679 | 8.58 | 0.97 | 4.89 | 5.86 | 3,024,000 | 9.28 |
| | 2200 | 4.902 | 8.99 | 1.06 | 5.37 | 6.42 | 3,168,000 | 9.72 |
| | 2300 | 5.125 | 9.40 | 1.15 | 5.87 | 7.01 | 3,312,000 | 10.16 |
| Target Flow --> | **2400** | **5.348** | **9.80** | **1.24** | **6.39** | **7.63** | **3,456,000** | **10.61** |
| | 2500 | 5.570 | 10.21 | 1.34 | 6.93 | 8.27 | 3,600,000 | 11.05 |
| | 2600 | 5.793 | 10.62 | 1.44 | 7.50 | 8.94 | 3,744,000 | 11.49 |
| | 2700 | 6.016 | 11.03 | 1.54 | 8.09 | 9.63 | 3,888,000 | 11.93 |
| | 2800 | 6.239 | 11.44 | 1.65 | 8.70 | 10.34 | 4,032,000 | 12.37 |
| | 2900 | 6.462 | 11.85 | 1.76 | 9.33 | 11.09 | 4,176,000 | 12.82 |
| | 3000 | 6.684 | 12.26 | 1.87 | 9.98 | 11.86 | 4,320,000 | 13.26 |

**Table C-2: Pump Option Head Calculations**

Estimate pump size and pipeline diameter to move flow from the lake to the SSMH.
Maximum flow of 3,000 gpm.

| | | |
|---|---|---|
| **Length** | 40 | ft |
| **Diameter** | 12 | inch |
| **Material** | C900 PVC | |
| **Hazen-Williams** | 130 | |

| **Fitting** | **K** |
|---|---|
| entrance | 1.00 |
| 90-bend | 0.30 |
| gate valve | 0.19 |
| mag meter | 0 |
| swing check | 0.00 |
| 90-bend | 0.30 |
| 90-bend | 0.30 |
| sharp exit | 0.19 |
| Total minor loss | 2.28 |

| | Q | Q | V | Pipeline Loss | Minor Losses | Static Lift | Total Losses | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | gpm | cfs | fps | ft | ft | ft | ft | gpd | AF/day | HP |
| | 2000 | 4.456 | 5.67 | 0.36 | 1.14 | 4.00 | 5.50 | 2,880,000 | 8.84 | 4.0 |
| | 2100 | 4.679 | 5.96 | 0.40 | 1.26 | 4.00 | 5.66 | 3,024,000 | 9.28 | 4.3 |
| | 2200 | 4.902 | 6.24 | 0.43 | 1.38 | 4.00 | 5.81 | 3,168,000 | 9.72 | 4.6 |
| | 2300 | 5.125 | 6.53 | 0.47 | 1.51 | 4.00 | 5.98 | 3,312,000 | 10.16 | 5.0 |
| Target Flow --> | **2400** | **5.348** | **6.81** | **0.51** | **1.64** | **4.00** | **6.15** | **3,456,000** | **10.61** | **5.3** |
| | 2500 | 5.570 | 7.09 | 0.55 | 1.78 | 4.00 | 6.33 | 3,600,000 | 11.05 | 5.7 |
| | 2600 | 5.793 | 7.38 | 0.59 | 1.93 | 4.00 | 6.52 | 3,744,000 | 11.49 | 6.1 |
| | 2700 | 6.016 | 7.66 | 0.63 | 2.08 | 4.00 | 6.71 | 3,888,000 | 11.93 | 6.5 |
| | 2800 | 6.239 | 7.94 | 0.68 | 2.23 | 4.00 | 6.91 | 4,032,000 | 12.37 | 7.0 |
| | 2900 | 6.462 | 8.23 | 0.72 | 2.40 | 4.00 | 7.12 | 4,176,000 | 12.82 | 7.4 |
| | 3000 | 6.684 | 8.51 | 0.77 | 2.56 | 4.00 | 7.34 | 4,320,000 | 13.26 | 7.9 |

HP calculation assumes 70% pump-motor efficiency

**Table C-3 - Estimated Cost Of Construction of the Lake El Estero Diversion Structure**
Gravity Option - Conceptual Design Cost Estimate

21-Apr-14
By: Josh Tabije

| Item of Work | Unit | Unit Cost | Quantity | Subtotal |
|---|---|---|---|---|
| ***Mobilization / Demobilization*** | | | | |
| ~ 5% of of project cost. This cost includes permits, fees, temporary structures, equipment rental and various misc. items | | | | ***$5,000*** |
| ***Site Improvements*** | | | | |
| Intake Screen | EA | $500.00 | 1 | $500 |
| 8" PVC Pipe w/ Trenching and Backfill | LF | $200.00 | 80 | $16,000 |
| Control Valve | EA | $5,000.00 | 1 | $5,000 |
| Control Panel | EA | $1,230.00 | 1 | $1,230 |
| Flow Meter | EA | $210.00 | 1 | $210 |
| Check Valve | EA | $2,850.00 | 1 | $2,850 |
| De-watering & Site Preparation | LS | $10,000.00 | 1 | $10,000 |
| Tie-in to Existing SSMH | LS | $5,000.00 | 1 | $5,000 |
| Site Restoration | LS | $10,000.00 | 1 | $10,000 |
| ***Electrical Equipment*** | | | | |
| Electrical Control Equipment | LS | $10,000.00 | 1 | $10,000 |
| **ESTIMATED CONSTRUCTION COST** | | | | **$65,800** |
| **INSPECTION AND TESTING (15%)** | | | | **$10,000** |
| **CONSTRUCTION CONTINGENCY (20%)** | | | | **$13,000** |
| **ESTIMATED TOTAL CONSTRUCTION COST** | | | | **$89,000** |

**This estimate of construction cost is a professional opinion, based upon the engineer's experience with the design and construction of similar projects. It is prepared only as a guide and is subject to change. Schaaf & Wheeler and its subconsultants make no warranty, whether expressed or implied, that the actual costs will not vary from these estimated costs, and assumes no liability for such variances. This estimate specifically excludes any costs associated with designing for handling and disposal of hazardous wastes and contaminated materials. Costs associated with land, right-of-way, or easement purchase are not included in this estimate.**

**Table C-4 - Estimated Cost Of Construction of the Lake El Estero Diversion Structure**

Pump Option - Conceptual Design Cost Estimate

21-Apr-14

By: Josh Tabije

| Item of Work | Unit | Unit Cost | Quantity | Subtotal |
|---|---|---|---|---|
| ***Mobilization / Demobilization*** | | | | |
| ~ 5% of of project cost. This cost includes permits, fees, temporary structures, equipment rental and various misc. items | | | | ***$5,000*** |
| ***Pump*** | | | | |
| Flygt Pump 7020 (27hp) | EA | $54,000.00 | 1 | $54,000 |
| Pump Column | LF | $500.00 | 10 | $5,000 |
| ***Site Improvements*** | | | | |
| 12" PVC Pipe w/ Trenching and Backfill | LF | $240.00 | 40 | $9,600 |
| Control Valve | EA | $5,000.00 | 1 | $5,000 |
| Control Panel | EA | $1,230.00 | 1 | $1,230 |
| Flow Meter | EA | $210.00 | 1 | $210 |
| Check Valve | EA | $2,850.00 | 1 | $2,850 |
| De-watering & Site Preparation | LS | $10,000.00 | 1 | $10,000 |
| Tie-in to Existing SSMH | LS | $5,000.00 | 1 | $5,000 |
| Site Restoration | LS | $10,000.00 | 1 | $10,000 |
| ***Electrical Equipment*** | | | | |
| Electrical and Control Equipment | LS | $50,000.00 | 1 | $50,000 |
| **ESTIMATED CONSTRUCTION COST** | | | | **$157,900** |
| **INSPECTION AND TESTING (15%)** | | | | **$24,000** |
| **CONSTRUCTION CONTINGENCY (20%)** | | | | **$32,000** |
| **ESTIMATED TOTAL CONSTRUCTION COST** | | | | **$214,000** |

**This estimate of construction cost is a professional opinion, based upon the engineer's experience with the design and construction of similar projects. It is prepared only as a guide and is subject to change. Schaaf & Wheeler and its subconsultants make no warranty, whether expressed or implied, that the actual costs will not vary from these estimated costs, and assumes no liability for such variances. This estimate specifically excludes any costs associated with designing for handling and disposal of hazardous wastes and contaminated materials. Costs associated with land, right-of-way, or easement purchase are not included in this estimate.**

## Appendix D: Flow Monitoring

### D1. Sanitary Sewer at Lake El Estero

Schaaf & Wheeler conducted sewer flow monitoring of the City of Monterey Sanitary Sewer at Lake El Estero. A depth monitor and data logger was installed on the sewer pipeline exiting manhole D05-052, located next to the Stormwater Pump Station, on November 12, 2013. The initial installation was not secure, and the monitor was reset on November 22, 2013. Data was downloaded from the monitor on several occasions. It was removed on February 24, 2014.

The data logger records the depth of water in the pipeline at set time intervals. The depth of water was converted to flow using Manning's equation:

$$V = \left(\frac{1.486}{n}\right) R^{2/3} S^{1/2}$$

Where:

V= velocity in feet/second
n = roughness coefficient
R = hydraulic radius
S = slope of the pipeline

The pipe roughness coefficient was assumed to be 0.013 for sewer pipe. The hydraulic radius is equal to the wetted perimeter of the pipe divided by the cross-sectional area of flow, which were calculated based on depth of flow and the pipeline diameter of 21-inches. The pipeline slope was calculated as 0.0068 based on the invert of SSMH D05-052 at -11.4 feet, the invert of SSMH D05-061 at -12.0-feet, and the pipeline length of 88-feet. The flow quantity was calculated by multiplying the flow velocity by the cross-sectional area of flow.

The data set and graph include several flow spikes where the instantaneous flow greatly exceeds the normal curve. These are likely caused by debris hanging up on the monitor or the mounting bracket and may be disregarded.

Based upon the monitoring, the average daily sewer flow at this location is 1,140 gallons per minute or 1.6 million gallons per day. The peak hourly flow was approximately 2,100 gpm. There were no significant rain events during the monitoring period, so these results should be considered Average and Peak Dry Weather Flows.

**D2. Figueroa Box Culvert**

Schaaf & Wheeler conducted storm sewer flow monitoring in Pearl Street above Figueroa Street in Monterey. A depth monitor and data logger was installed in the storm drain downstream of Pearl Street. The gage was active from November 26, 2013, to March 28, 2014. During that period there was limited rainfall. The two-day storm of February 28 – March 1, 2014 was used as a calibration check for the runoff prediction model.

The data logger collected water depth at a one-minute time step. Depth was converted to flow using Manning's equation and the following parameters: Pipe roughness of n = 0.013, slope = 0.0071 ft/ft, box width 9-ft, box height 4.5-ft at center and 4.25-ft at sides (valley gutter at invert). Cumulative flow was totaled and converted to acre-feet. Totals for the 2-day storm were compared to the modeled outputs:

| Date | Precipitation (in) | Metered Flow (ac-ft) | Modeled Flow (ac-ft) |
|---|---|---|---|
| 2/28/2014 | 1.38 | 23.1 | 23.7 |
| 3/1/2014 | 0.98 | 11.7 | 30.3 |

Modeled results for the first day were within 5% of the metered daily flow, which was better than expected. The modeled results for the second day were almost 300% of the metered flow. The majority of the flows on both days are from the hardscape. The difference between the two on 3/1/14 was due the model's adjustment of the curve numbers based on the cumulative precipitation in the preceding 5 days. The model applied below-average curve numbers for the condition on 2/28/14 and matched the observed flows. It applied above-average curve numbers for the condition on 3/1/14. This error does not affect the stormwater capture model, which by-passes peak flows above 15.6 ac-ft/day. Therefore, the runoff model was not adjusted.

Figures in this appendix:

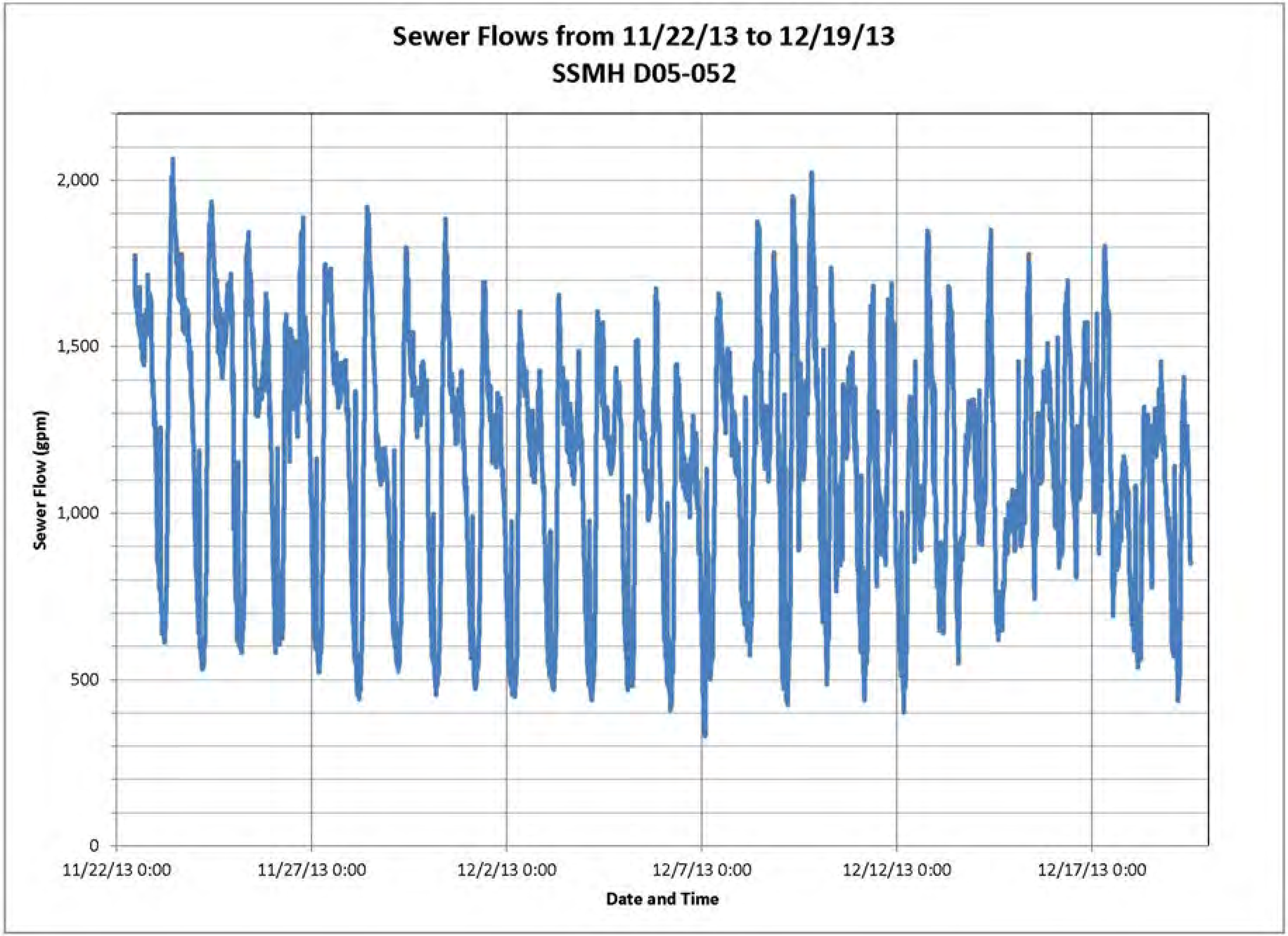
Monitoring Locations

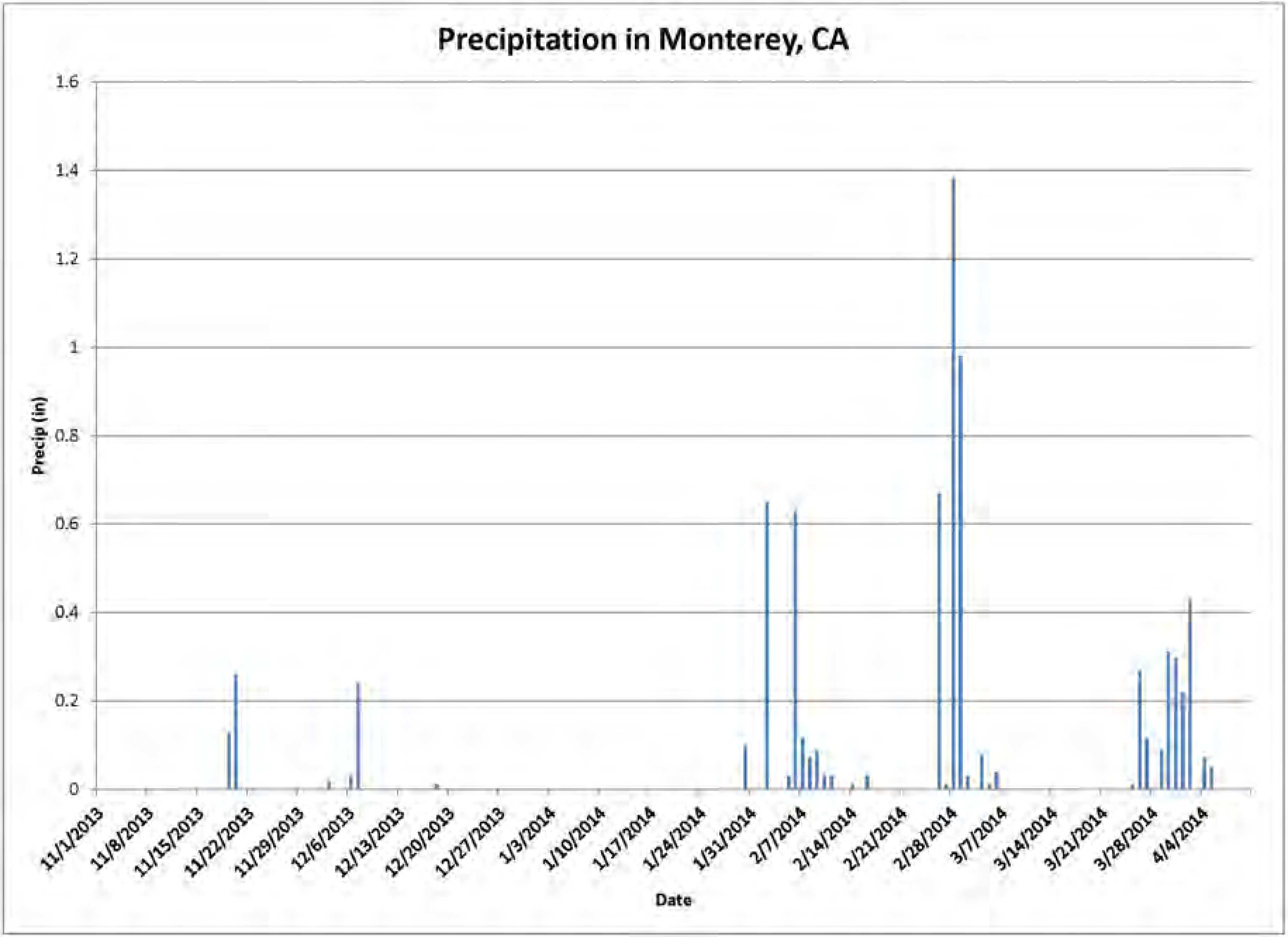
Graphed Sanitary Sewer Flows, 11/22/2013 – 12/19/2013

Precipitation during Monitoring Period

Figueroa Box Culvert Flows, 2/26/2014 – 3/1/2014

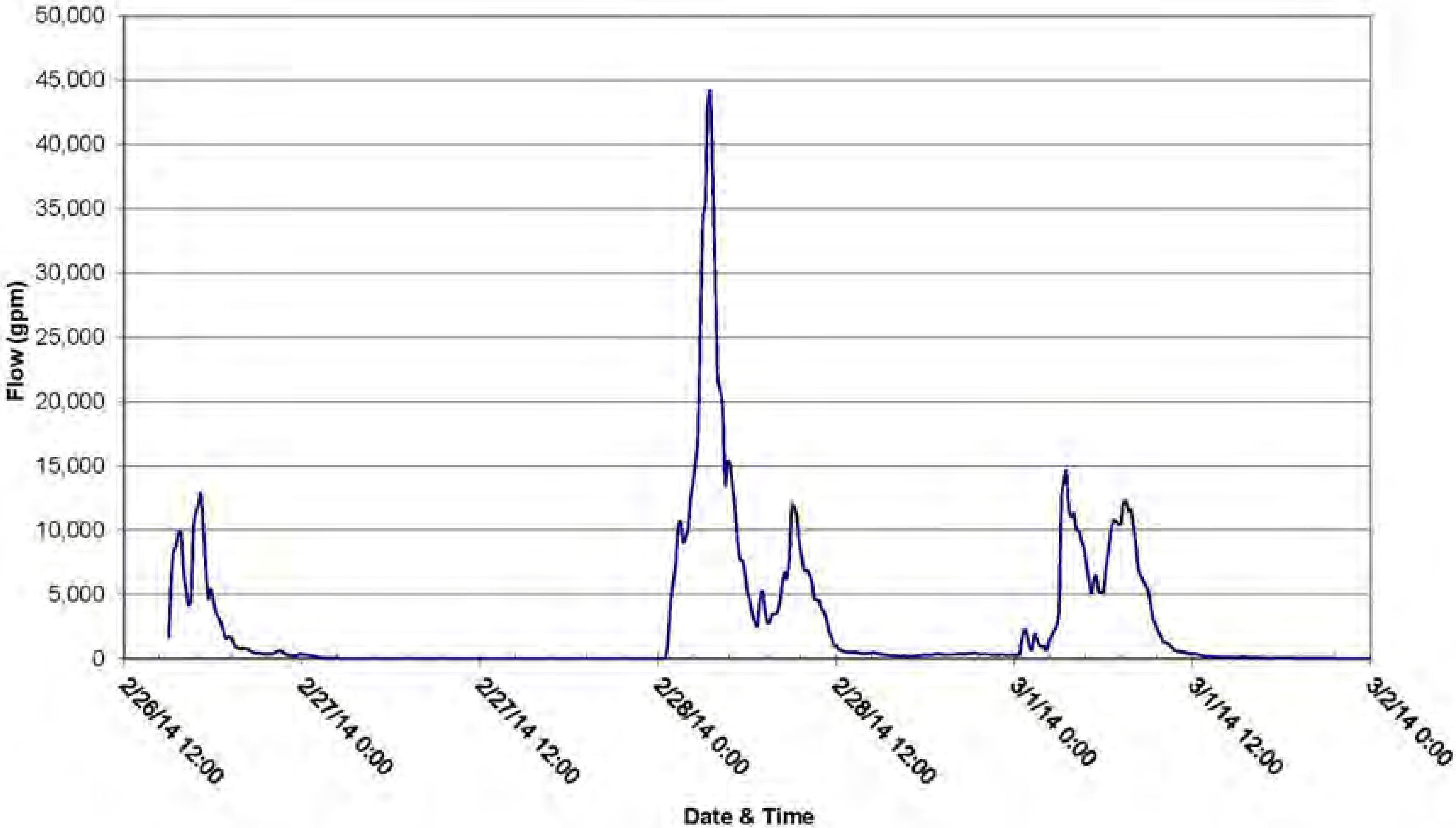
**Figure D-1: Flow Monitoring Locations for Lake El Estero**



Sewer Flows from 11/22/13 to 12/19/13
SSMH D05-052
Sewer Flow (gpm)
2,000
1,500
1,000
500
0
11/22/13 0:00
11/27/13 0:00
12/2/13 0:00
12/7/13 0:00
12/12/13 0:00
12/17/13 0:00
Date and Time



Precipitation in Monterey, CA
Precip (in)
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
11/1/2013
11/8/2013
11/15/2013
11/22/2013
11/29/2013
12/6/2013
12/13/2013
12/20/2013
12/27/2013
1/3/2014
1/10/2014
1/17/2014
1/24/2014
1/31/2014
2/7/2014
2/14/2014
2/21/2014
2/28/2014
3/7/2014
3/14/2014
3/21/2014
3/28/2014
4/4/2014
Date

Figurereoa Box Culvert
February 26, 2014 to March 1, 2014
10-Minute Average



**Appendix E: References**


California Department of Water Resources:

California Irrigation Management Information System (CIMIS) website. www.cimis.water.gov

California State Water Resources Control Board

eWRIMS, Electronic Water Rights Information System (on-line database)

Section 303(d) Listing of Impaired Water Bodies, 2010

Central Coast Regional Water Quality Control Board

Central Coast Ambient Monitoring Program, 2010.

Water Quality Control Plan for the Central Coast Basin, 2011 Update

City of Monterey, CA

Engineering Analysis, Development of Non-Potable Irrigation Water Systems, prepared by Fugro West, Inc., August 1999

Lake El Estero Water Quality Samples, BSK Analytical Laboratories, July 16, 2009.

Monterey Urban Watch Report, 2012, City of Monterey, CA, Coastal Watershed Council, the City of Monterey, and the Water Quality Protection Program of the Monterey Bay National Marine Sanctuary

Federal Emergency Management Agency, Flood Insurance Study, Monterey County, CA and Incorporated Areas, FSI No. 06053CV001A, April 2009

Monterey Bay National Marine Sanctuary, Final Management Plan, U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service, Office of National Marine Sanctuaries, October 2008

Monterey Regional Storm Water Management Program:

2010-2011 MRSWMP Monitoring Final Report, September 2011

Year 6 Annual Report, 2011-2012, January 2013

Monterey Regional Water Pollution Control Agency:

Member Agencies Projected Needs Inventory, prepared by EMC Planning Group, April 2013

Monterey Peninsula Groundwater Replenishment Project, Draft Source Water Alternatives Report, prepared by Kimley-Horn and Associates, September 2013

NOAA Rainfall Records

Station USC00045795, MONTEREY CA US

Station USC00045802, MONTEREY NWSFO CA US

USDA Natural Resources Conservation Service, Technical Release 55, Urban Hydrology for Small Watersheds, June 1986

# Appendix S

# Memorandum Regarding Predicted Impact on Farming from Use of Recycled Water with Higher Salinity

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**Bahman Sheikh, PhD, PE**

# Tech Memo

**To:** Mike McCullough, Monterey Regional Water Pollution Control Agency (MRWPCA)

**From:** Bahman Sheikh

**Reviewed By:** Alison Imamura, Margaret H. Nellor, Jim Crook

**Date:** January 15, 2015

**Re:** Predicted Impact on Farming from Use of Recycled Water with Higher Salinity

## ABBREVIATIONS

| | |
|---|---|
| AF | Acre-feet |
| AFY | Acre-feet per year |
| Ca | Calcium |
| cfs | Cubic feet per second |
| CSIP | Castroville Seawater Intrusion Project |
| dS/m | deci Siemens per meter (units of electrical conductivity) |
| EC | Electrical Conductivity (a measure of salinity of water) |
| ECe | Electrical Conductivity of Soil Solution |
| ECw | Electrical Conductivity of Irrigation Water |
| FAO | Food and Agriculture Organization of the United Nations |
| LF | Leaching Fraction (extra water applied to leach salts below the root zone) |
| LR | Leaching Requirement (a calculated LF, based on formula) |
| MCAC | Monterey County Agricultural Commission |
| Mg | Magnesium |
| mgd | Million gallons per day |
| mg/L | Milligrams per liter |
| meq/L | Milliequivalents per Liter |
| MRWPCA | Monterey Regional Water Pollution Control Agency |
| MWRSA | Monterey Wastewater Reclamation Study for Agriculture |
| Na | Sodium |
| RTP | Regional Treatment Plant (located in Marina, operated by MRWPCA) |
| S | Slope |
| SAR | Sodium Adsorption Ratio |
| SWRCB | California State Water Resources Control Board |
| T | Threshold |
| TDS | Total Dissolved Solids |
| TM | Technical Memorandum |
| US | United States |

# Predicted Impact on Farming from Use of Recycled Water with Higher Salinity

## EXECUTIVE SUMMARY

The proposed Pure Water Monterey Groundwater Replenishment Project (proposed project) is a water supply project that will serve northern Monterey County. The project includes the collection of a variety of new source waters that would be combined with existing incoming wastewater flows for conveyance to and treatment at the Monterey Regional Water Pollution Control Agency's Regional Wastewater Treatment Plant (RTP). The effluent would be further treated at a new advanced water treatment facility to produce highly-purified recycled water for injection into the Seaside Groundwater Basin (and later extraction for replacement of existing municipal water supplies) and to provide additional tertiary recycled water for agricultural irrigation in northern Salinas Valley as part of the Castroville Seawater Intrusion Project (CISP).

Water quality guidelines critical to plant growth and development include salinity (as measured by total dissolved solids or electrical conductivity, sodicity (represented by a non-dimensional parameter called Sodium Adsorption Ratio), and specific ions (primarily sodium, chloride, and boron). Salinity is the most critical of these criteria with regard to its impact on farming under the conditions prevailing in the CSIP service area and the recycled water blend scenarios anticipated in the future as part of the proposed project.

The addition of new source waters for the proposed project is likely to increase the salinity of recycled water above that currently produced at the RTP. This change in water quality is not expected to impact the farming activities within the CSIP service area to a significant extent, mainly because of the various management tools and expertise available to the growers, some of which are already in practice. It is estimated that the increased salinity of the recycled water resulting from the blend of existing raw wastewater with the new source waters may result in a 13% reduction in total crop production value in the CSIP service area under a drought year scenario only under two conditions (1) if Salinas River water is not available for dilution with recycled water for irrigation and (2) if salinity control crop management practices are not implemented to maintain yield. The calculations leading up to this conclusion are based on agronomic and soil science literature combined with data from local conditions, holding all other variables constant. To maintain the integrity of these calculations, all other factors are assumed unchanged, even though in practice, that would not be the case. In practice, the potential loss of crop value would be ameliorated by the implementation of standard strategies and management practices to address higher salinity levels in irrigation water sources.

Recycled water currently is blended with Salinas River water during most parts of the year (April 1 through October 31) and in most years, except following multiple drought years, before delivery to the growers. This practice is expected to continue in the future. Therefore, few—if any—of the growers will be irrigating with a straight blend of recycled water at all times. Salinas River water has a much lower salinity than any of the new source waters that will become recycled water (except the storm water). Of the new source waters to be used for the proposed project, Agricultural Wash Water will be the highest volumetric contributor and has higher salinity than the current recycled water. Thus, timing of the Agricultural Wash Water contribution to the RTP is important when understanding the effects of blending recycled water with Salinas River water. Significantly, the greatest extent of blending with Salinas River water and with the recycled water containing Agricultural Wash Water is expected to occur during the peak summer period when plants would be growing at the highest rate and would benefit the most from a reduced salinity level.

It is the considered opinion of the author that the potential losses in crop production can and will be mitigated with irrigation management practices, such as additional leaching fraction, modified irrigation scheduling, and addition of amendments as described further below in this technical memorandum.

# Predicted Impact on Farming from Use of Recycled Water with Higher Salinity

## INTRODUCTION

The coastal lands in northern Monterey County are some of the most fertile agricultural areas in the State of California. Combined with an ideal climate for growing a large variety of food crops, this area is an economic powerhouse. The Monterey County Agricultural Commissioner's 2013 Crop Report (MCAC 2013) estimates that the annual value of agricultural products from the County is $4.4 billion. Growers in the Castroville Seawater Intrusion Project (CSIP) service area have been growing high value crops under a recycled water irrigation regime for the past 17 years. With the choice of crop varieties, management practices, and a sophisticated irrigation management system there have been no complaints about yield, quality of crops, or sales of crops sent to market. In fact, the availability of recycled water has ensured the continued cultivation of high-value crops in this region. Recycled water has served as a valuable regional resource to replace groundwater wells that historically provided irrigation water, but were abandoned as a result of seawater intrusion caused by overdraft of the local aquifers.

The proposed Pure Water Monterey Groundwater Replenishment Project (proposed project) is a water supply project that will serve northern Monterey County. The project includes the use of new source waters that would be combined with existing incoming wastewater flows for conveyance to, and treatment at, the Monterey Regional Water Pollution Control Agency's Regional Wastewater Treatment Plant (RTP). The effluent from the RTP would be further treated at a new advanced water treatment facility to produce highly-purified recycle water for injection into the Seaside Groundwater Basin (and later extraction for replacement of existing municipal water supplies) and treated through the SVRP to provide additional tertiary recycled water for agricultural irrigation in northern Salinas Valley. The new source waters would include the following: 1) water from the City of Salinas agricultural wash water system, 2) stormwater flows from the southwestern part of Salinas and the Lake El Estero facility in Monterey, 3) surface water and agricultural tile drain water that is captured in the Reclamation Ditch and Tembladero Slough, and 4) surface water and agricultural tile drain water that flows in the Blanco Drain.

The purpose of this technical memorandum (TM) is to assess the impact of introduction of additional source waters on farming resulting from the anticipated increase in the salinity of disinfected tertiary recycled water. An increase in the salinity of recycled water could result in yield reduction of crops grown with recycled water unless specific management practices are implemented to account for the change in salinity levels in the recycled water. Such adjustments to management practices may be costly, may not be fully effective, or may have additional adverse impacts of their own. The added cost elements may include extra water application commonly applied with each irrigation to increase the leaching fraction. It may also include the material and labor costs of amendments, such as gypsum to increase soil permeability, which would allow free movement of the extra water past the plant root zone. Another cost element that may be required is additional tile drain installation.

For the purposes of calculating impacts of increased salinity on crop production, it was assumed that the current scenarios and management practices would not change in the future.

## WATER QUALITY AND FARM PRODUCTIVITY

A one-year monitoring program from July 2013 to June 2014 was conducted for five of the potential source waters for the proposed project. Monthly and quarterly sampling was carried out for the RTP secondary effluent, agricultural wash water, and Blanco Drain drainage water. Limited sampling of stormwater from Lake El Estero was performed due to seasonal availability, and there was one sampling event for the Tembladero Slough drainage water.

The agronomic water quality parameters of the greatest importance with regard to sustainable soil productivity and maximum crop yield potential along with applicable guidelines are shown in first four rows of Table 1, and can be found in standard agronomic and soil science literature (e.g., FAO, 1976). Inorganic salts will not be removed during primary or secondary treatment at the RTP, or during tertiary treatment/disinfection, and thus it is possible to calculate a predicted concentration (Blended Mix) based on the volumetric contributions of each source water and their constituent concentrations. The 5th through 10th rows in Table 1 present the median concentrations for each parameter for each source water. The last row (Blended Mix) presents the calculated predicted concentration of each parameter for the blend of the source waters at a time when their impact might approach worst-case scenario. As described more fully in the section below titled "Salinity of Blended Water," the Phase B drought scenario of source water blends reflects this worst-case.

With the exception of chloride, the other parameters fall within the green zone (generally safe). Chloride, at a Blended Mix concentration of 264 mg/L falls within the red (problem) zone and would require some management on the part of the growers. However, the existing recycled water comprised of municipal wastewater has the same average chloride concentration, and thus the Blended Mix recycled water quality would be the same, not necessitating changes in management practices or impacts on crops.

Potassium chloride is used as a soil amendment in the Salinas Valley as a fertilizer to replenish the essential macronutrient, potassium. As a result of increasing levels of chloride, detected in the soil in recent years, it was recommended that growers use alternative potassium amendments, such as potassium thiosulfate or potassium sulfate. More recent monitoring in recent years has shown a steadily declining level of chloride in the CSIP area soils (Platts, 2015).

***Table 1 Water Quality Parameters of Agronomic Relevance in Irrigation of Agricultural Crops***

| Sustainability Guidelines | Salinity (EC) dS/m[1] | Sodium Adsorption Ratio (SAR) | Sodium, mg/L[2] | Chloride, mg/L | Boron, mg/L |
|---|---|---|---|---|---|
| **Generally No Problem** | **0.5 - 2.0** | **<6** | **< 70** | **<100** | **<0.5** |
| **Slight to Moderate Problem** | **2.0 - 4.0** | **7 - 9'** | **70 - 230** | **100 - 250** | **0.5 - 5** |
| **Problem** | **> 4.0** | **>9** | **>230** | **>250** | **>5** |
| **Source Waters** | **Average Values of Parameters** | | | | |
| **Municipal Wastewater** | 1.44 | 4.75 | 174 | 264 | 0.31 |
| **Agricultural Wash Water** | 1.59 | 4.15 | 177 | 237 | 0.23 |
| **Blanco Drain** | 2.84 | 3.32 | 241 | 274 | 0.66 |
| **Lake El Estero** | 2.56 | 4.96 | 235 | 423 | 0.18 |
| **Tembladero Slough** | 2.94 | 4.41 | 333 | 394 | 0.51 |
| **Reclamation Ditch** | 1.17 | 2.45 | 96 | 130 | 0.51[3] |
| **Blended Mix[4]** | 1.75 | 4.75 | 174 | 264 | <0.5 |

1. EC – electrical conductivity; dS/m – deci Siemans per meter.
2. mg/L – milligrams per liter.
3. Reclamation Ditch boron is assumed to be equal to the concentration of boron in Tembladero Slough since they are both part of the same ditch system.
4. These water quality parameters reflect the worst-case scenarios of source water flow diversions for the purpose of assessing water quality of the treated secondary effluent/tertiary-treated water (i.e., Phase B in a drought year). Under all other Phases and scenarios, these values would be less.

As can be seen from a comparison of the value of each parameter with the corresponding guidelines in Table 1, some source waters fall in the problem range if used unblended with other sources. However, in the drought year, Phase B blended scenario (see discussion about this scenario, below), the average values, under blending scenarios considered, are in the safe range, with the exception of chloride. But as noted above, the predicted Blended Mix chloride concentration is equivalent to the current recycled water concentration.

Data for boron is provided in Table 1 because boron is an essential nutrient for plant growth and development at very low concentrations. However, at concentrations indicated to be problematic in Table 1, it can be toxic and cause severe damage to plants. While the current levels of boron in the recycled water (i.e., RTP effluent) and other potential source waters are not problematic in the blend, it may change in the future should the Monterey Peninsula Water Supply Project be implemented. It is a proposed ocean desalination project that would produce between 9.6 million gallons per day (mgd) to 6.4 mgd of water to be added to the region's water supply. The desalinated ocean water could increase the concentration of boron in recycled water by as much as 0.1 mg/L. If the increase is limited to this prediction, the blend will still be safe for irrigation. If the boron level in the blend rises to problematic ranges, additional actions would be needed to maintain the boron levels below the 0.5 mg/L guideline.

Aside from this overall evaluation of water quality parameters, there are two major additional concerns that must be addressed: (1) salinity, and (2) SAR. The impacts of salinity on crop yield are the most important consideration and are evaluated in most of the remainder of this TM.

Sodium adsorption ratio is a unitless parameter derived from the following empirical formula:

$$SAR = \frac{Na}{\sqrt{\frac{Ca+Mg}{2}}}$$

wherein concentrations of each of the ionic species (sodium [Na], calcium [Ca], and magnesium [Mg]) are expressed as meq/L. SAR is a measure of the potential for impact on soil permeability. A high SAR is indicative of problems in infiltrating water into the soil profile. However, the impact potential of SAR in a given irrigation water source is strictly related to the salinity of that irrigation water. This interdependence is best described by the graphic depiction[1] in Figure 1. Plotting the intersection of electrical conductivity (EC) and SAR for each source water indicates that none of the source waters (singly or in the Mixed Blend), as irrigation water, are problematic in terms of long-term potential impact on soil infiltration rate. This conclusion is consistent with findings of a long-term field study of recycled water impacts on the soils of CSIP service area (Platts, 2014A):

> "*Our analysis of study data from 2000 to 2012 supports the general conclusions of the MWRSA in the 1980s: The use of recycled water has caused an increase in soil salinity in the area; however, SAR values are not deleterious and Na has shown little accumulation in the rooting zone (1 to 12 inches)*."

Over a ten-year period of irrigation with a blend of varying proportions of recycled water and river water, moderate increases in salinity, sodium, chloride, and SAR in the soil solution were recorded. The increase in chloride was of particular interest and concern. A second paper in the same publication (Platts, 2014B) documents the critical role that annual rainfall plays in ameliorating salt impacts by leaching the salts and preventing accumulation in the root zone.

[1] This graphic depiction is commonly used in the classic agronomic literature and textbooks, such as Grattan (2002).

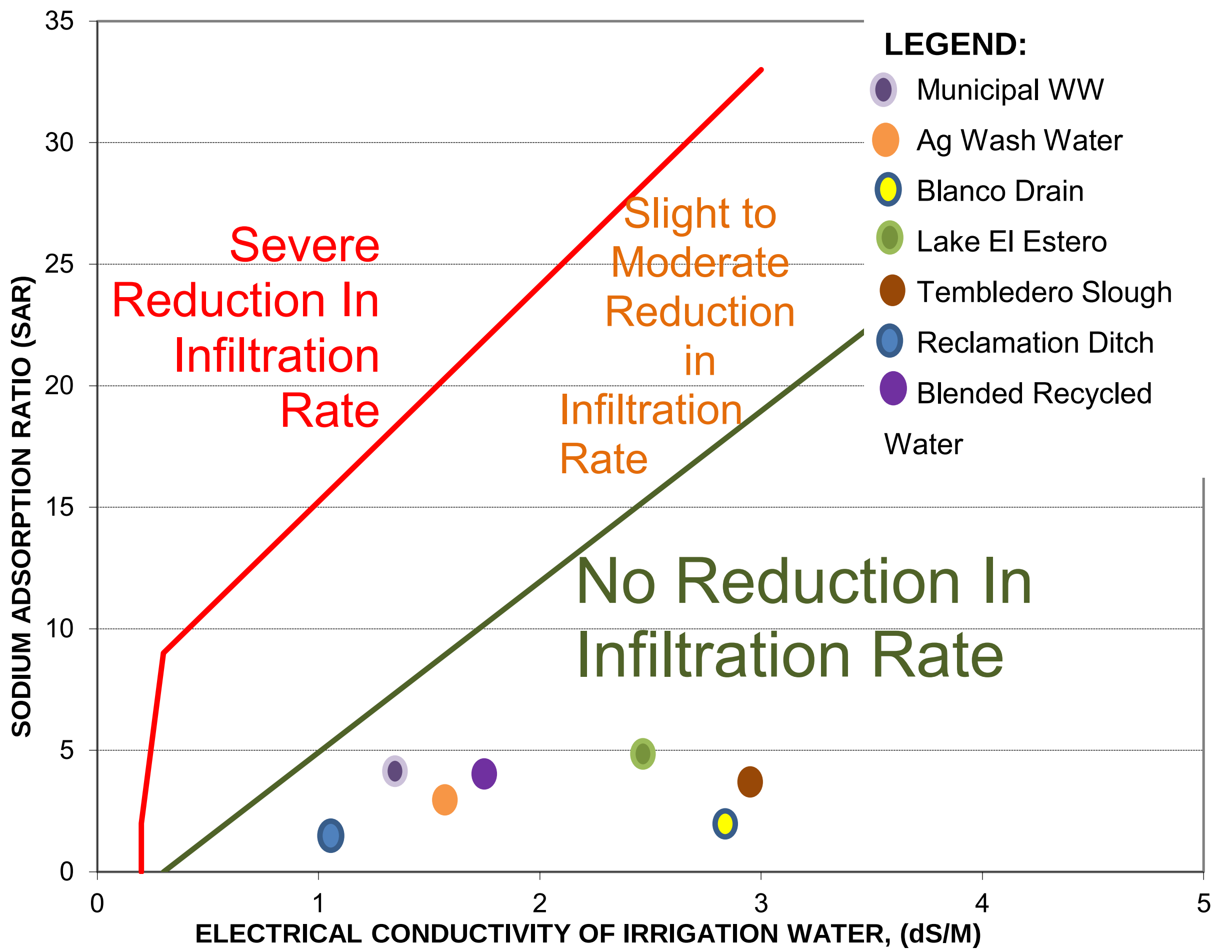



***Figure 1 Potential for Impact on Soil Infiltration Rate As a Result of Irrigation with Undiluted Source Waters and Blended Mix***

## SALINITY OF IRRIGATION WATER

Salinity of an irrigation water source is the most important short-term and long-term predictor of farm productivity, as measured by the yield potential of crops irrigated with that water. The most common indicator of salinity is total dissolved solids (TDS). Another indicator, favored by agronomists and field practitioners is the EC of the water, since it is linearly proportional to the concentration of inorganic compounds present in the water.

## IMPACT OF SALINITY ON CROP YIELD

Yield reductions occur when salts accumulate in the plant root zone, thus increasing its osmotic pressure. If the increase in salinity is to such an extent that the crop is no longer able to extract sufficient water from the salty soil solution, water stress occurs in plant tissues for a significant period of time—a condition termed physiological drought, since the symptoms are identical with those resulting from a prolonged lack of water. If water uptake is thus appreciably reduced, the plant slows its rate of growth and crop yield is proportionately reduced, as discussed in more detail below, under the heading "Salt Impact on Crop Yield".

## SALT CONTENT OF SOURCE WATERS

The anticipated monthly flows of various source waters into the RTP were used to compute predicted salinity concentrations in the blended recycled water under various scenarios. The blend ratios of the various water sources are shown in tabular and graphic forms in Appendix A.

The source waters and their average salinities are shown in Table 2 based on the Source Water Analysis prepared for the proposed project dated October 17, 2014 by the Monterey Peninsula Water Management District. The last column in the table is the most likely salinity of the water at equilibrium in the root zone, relevant to each source water if used independently for irrigation (which is not the case for the proposed project). This value, known in soil science terminology as ECe (electrical conductivity of the soil saturated paste extract), would be the salinity experienced at the root zone by plant roots. Crop tolerance and yield potential are related to this parameter.

*Table 2 Salinity of Source Waters and Long-Term Root Zone Soil Water*

| Source of Water | Salinity, TDS[1] (mg/L) | Salinity, ECw (dS/m) | Likely Root Zone Salinity, ECe (dS/m) |
|---|---|---|---|
| Municipal Wastewater | 793 | 1.44 | 2.88 |
| Agricultural Wash Water | 820 | 1.59 | 3.18 |
| Blanco Drain | 2003 | 2.84 | 5.68 |
| Lake El Estero | 1226 | 2.56 | 5.12 |
| Tembladero Slough | 1963 | 2.94 | 5.88 |
| Reclamation Ditch | 641 | 1.17 | 2.34 |

1. Source of salinity data: Williams, 2014.

When the build-up of soluble salts in the soil becomes or is expected to become excessive, the salts can be leached by applying more water than is needed by the crop during the growing season. This extra water moves at least a portion of the salts below the root zone by deep percolation (leaching). Leaching is the key factor in controlling soluble salts brought in by the irrigation water. Over time, salt removal by leaching must equal or exceed the salt additions from the applied water or salts will build up and eventually reach damaging concentrations. The terms "leaching fraction (LF)" and "leaching requirement (LR)" are used interchangeably. They both refer to that portion of the irrigation water that should pass through the root zone to control salts at a specific level. While LF indicates that the value be expressed as a fraction, LR can be expressed either as a fraction or percentage of irrigation water.

ECe is a function of the applied irrigation water salinity (ECw) and the LR. Because variations in existing irrigation management practices among farmers are too great to generalize, a conservative 10 to 15% LR is assumed in translating the ECw to the salinity in the root zone (ECe). According to Grattan (2002), the relationship between ECw, LR, and ECe is as follows:

**LR at 10% leads to ECw x 2.1 = ECe**
**LR at 15-20% leads to ECw x 1.5 = ECe**
**LR at 30% leads to ECw ~ ECe**

For the purposes of this analysis, it is estimated (conservatively) that the **ECw x 2.0 = ECe**. This estimate is consistent with field observations in the CSIP service area over a ten-year period (Platts, 2014A).

Both sets of data (TDS and EC) for all source waters are presented in Table 2, in addition to the anticipated salinity in the root zone, under long-term irrigation equilibrium with moderate leaching fraction of 15% to 20%.

**SALINITY—TDS or EC?**

The data used in this TM for calculating the predicted impact of salinity on crop yield are derived from average measurements of electrical conductivity on the various source waters involved. The salinity of those same source waters is also often reported as total dissolved solids. While this parameter was not used in the impact analysis, it is important to note that it is directly related to EC. The linear relationship between EC and TDS is a function of the specific mix of cations, anions, and other compounds in the water.

According to the soil science/agronomy literature, the generalized conversion factor for salinity, from TDS to EC, is:

**TDS in mg/L = 640 x EC in dS/m**
(Grattan, 2002)

Salinity measurements on water samples from Reclamation Ditch and Blanco Drain appear to follow this equation. However, actual measurements of both TDS and EC on samples of recycled water from the RTP, over the last several years, lead to a different conversion factor:

**TDS in mg/L = 550 x EC in dS/m**

The agricultural wash water and Lake Estero water samples also appear to follow this equation. Because of the availability of actual data for some of the source waters, the latter conversion factor is preferred for converting salinity units from TDS to an equivalent electrical conductivity value.

## SALINITY OF BLENDED WATER

Blended recycled water will have a different composition every month and under various phases and scenarios. The projected operational scenarios are described in the textbox to the right.

While Table 2 indicates that most of the new source water salinities are significantly higher than the salinity of the existing RTP recycled water, it is important to understand what the predicted blend salinity will be based on the actual composition of blends of the different source waters that will be combined with wastewater and treated to produce future recycled water (Holden, Sterbenz 2014).

The composition of blends during each month of the year, under various scenarios is provided in Appendix A. The most critical blend (flows of various sources under the drought scenario) is graphically presented in Appendix A, Figure A-1.

A detailed analysis of potential maximum salinity of the blended water sources under various scenarios was performed by Trussell Technologies, Inc. (Williams, 2014). Based on that analysis, the salinity of recycled water during the highest-salinity month for each scenario is depicted in Figure 2.

**PROJECT PHASES AND OPERATIONAL SCENARIOS**

**Phase A:** includes administrative permit applications to the State Water Resources Control Board for diverting less than 3 cubic feet per second (cfs) and less than 200 acre-feet per year (AFY) of storage of surface water from the Reclamation Ditch at Davis Road, Tembladero Slough at Castroville, and Blanco Drain.

**Phase B:** includes an application to the State Water Resources Control Board (SWRCB) to increase diversions to up to 6 cfs each from the Reclamation Ditch at Davis Road and from Blanco Drain.

**Normal Rain–Wet; Building Reserve:** Under this scenario, during normal and above-normal rainfall, only the most favorable water sources—in terms of water quality—would be utilized, avoiding the high-salinity sources (Tembladero Slough and Blanco Drain). During such periods, the system would be producing extra water to store in the ground as a “water bank”, which is 200 AFY, up to a total storage of no more than 1,000 acre-feet (AY).

**Normal Rain–Wet; Full Reserve:** This scenario pertains when the banked maximum 1,000 AF of storage total has been met and the system is not producing extra water for storage

**Drought:** Under drought conditions, water is still withdrawn from the Seaside Groundwater Basin by California American Water (i.e., water previously banked). In these scenarios, additional source waters are provided after secondary treatment to the Salinas Valley Reclamation Plant for recycling and crop irrigation, in lieu of advanced treatment for Seaside Groundwater Basin injection.

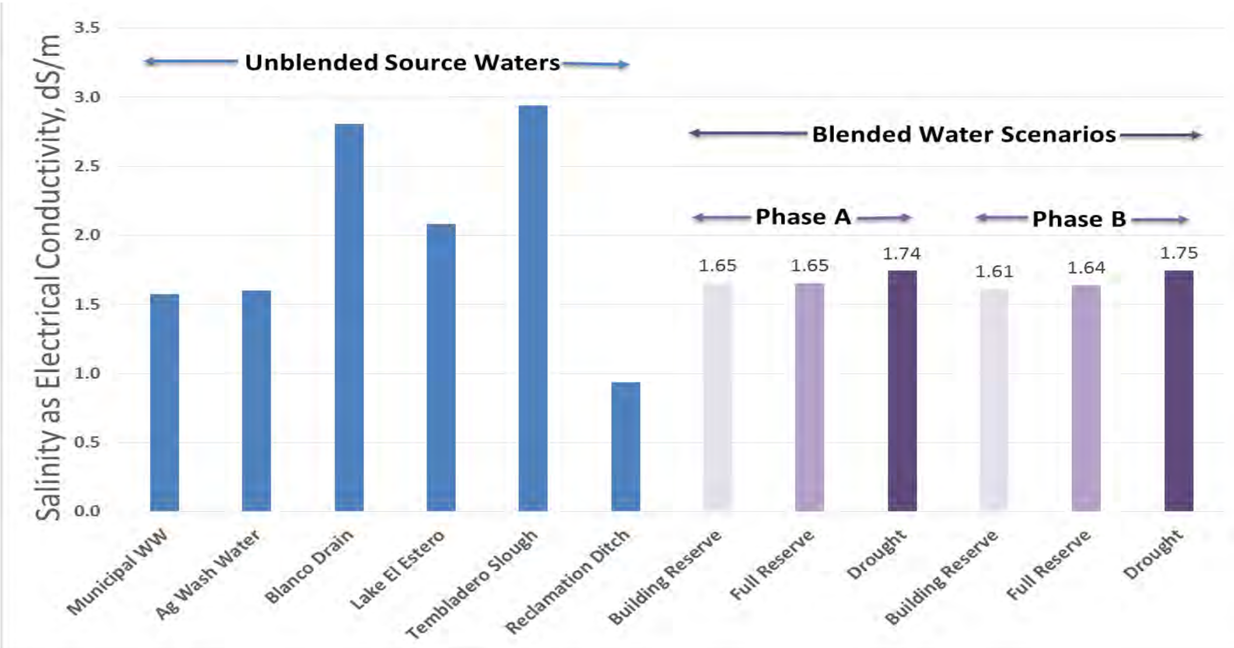



***Figure 2  Highest Monthly Salinity in Source Water Blends under Various Scenarios***

## SALT IMPACT ON CROP YIELD

The classic salinity/yield relationship was described by Shannon (1997) in a graphic reproduced below as Figure 3.

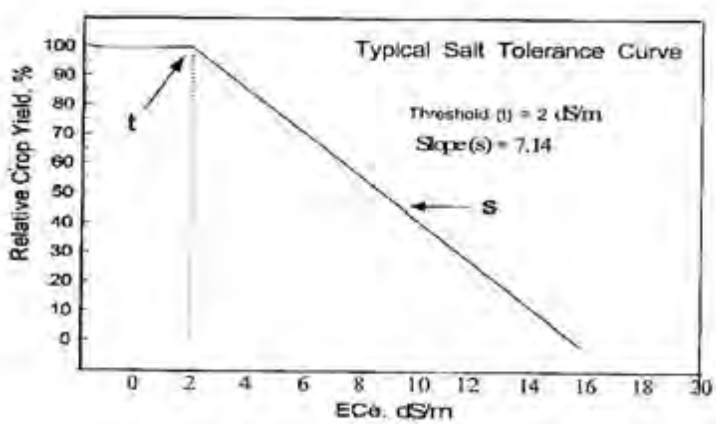



***Figure 3  Relative Crop Yield (% of maximum potential) As a Function of Root Zone Salinity (ECe)***

According to this model, there is a salinity threshold for each crop below which 100% yield can be obtained, assuming that there are no other limitations. Beyond that threshold, increasing salinities result in decreasing yields. For each crop, there is a different rate at which this decline takes place. For salt-tolerant crops, the threshold occurs at higher ECe and the slope is shallower. For salt-sensitive crops, the threshold occurs at lower ECe and the slope is much steeper.

## CROPS GROWN IN CSIP SERVICE AREA

The typical crops grown with recycled water in the CSIP service area are presented in Table 3.

***Table 3 Crops Commonly Grown in the CSIP Service Area and their Salinity-Yield Threshold[1]***

| Crop | Acres | Percentage of US Acreage [2] | Threshold Salinity as ECe (dS/m) |
|---|---|---|---|
| Artichoke | 4,000 | 76 | 6.1 |
| Lettuce | 4,000 | 1.8 | 1.3 |
| Cauliflower | 2,000 | 4.8 | 2.8 |
| Broccoli | 800 | 1.1 | 2.8 |
| Strawberries | 1,650 | 2.3 | 1.0 |
| Celery | 270 | 1.0 | 2.4 |

1. Source for crop acreage: Holden, 2015 and 2005; Source for threshold salinity: Shannon, 1997
2. The percent of United States acreage may be inaccurate because of the ten-year age of the data, while acreages for the CSIP service area are estimates for current conditions.

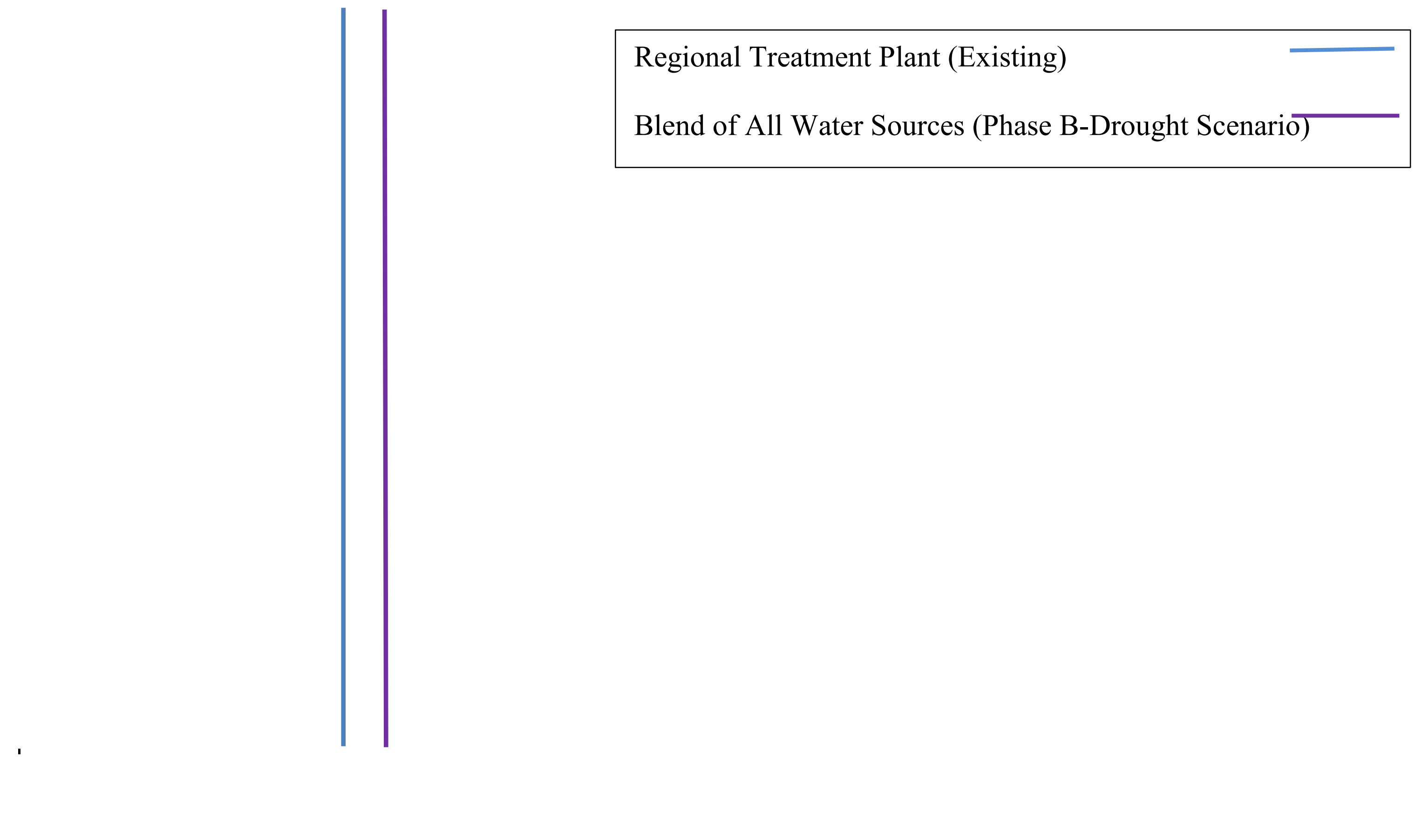
## YIELD REDUCTION UNDER DIFFERENT BLEND SCENARIOS

Salinity and yield are related based on extensive field experiments at agricultural research stations managed by the University of California Agricultural Extension Service. The baseline for these graphics is an ideal growing environment where crop yield is not restricted by any environmental or artificial limitations. Under those conditions, the yield of a given crop is pegged as its 100% potential yield. Keeping all other environmental and artificial conditions constant and varying only the soil water salinity over a series of experimental plots produces the graphics similar to those on Figures 3, 4, and 5. These graphics have been published in textbooks, monographs and periodicals (Shannon, 1997, Grattan, 2002, and others).

For the purposes of this TM, the graphical representations from Shannon (1997) are reproduced in Figures 4, 5, and 6 below. Each graphic is annotated with the equilibrium root zone soil water salinities resulting from irrigation with the two recycled waters in the scenarios under discussion:

(1) the existing RTP recycled water, potentially resulting in soil water salinity of **2.88 dS/m** (1.44 x 2 = 2.88)

(2) maximum salinity in Phase B drought condition, potentially resulting in soil water salinity of **3.50 dS/m** (1.75 x 2 = 3.50)




Source: Shannon, 1997

*Figure 4 Relative Yield of Lettuce, Broccoli, and Cabbage at two Root Zone Salinities*

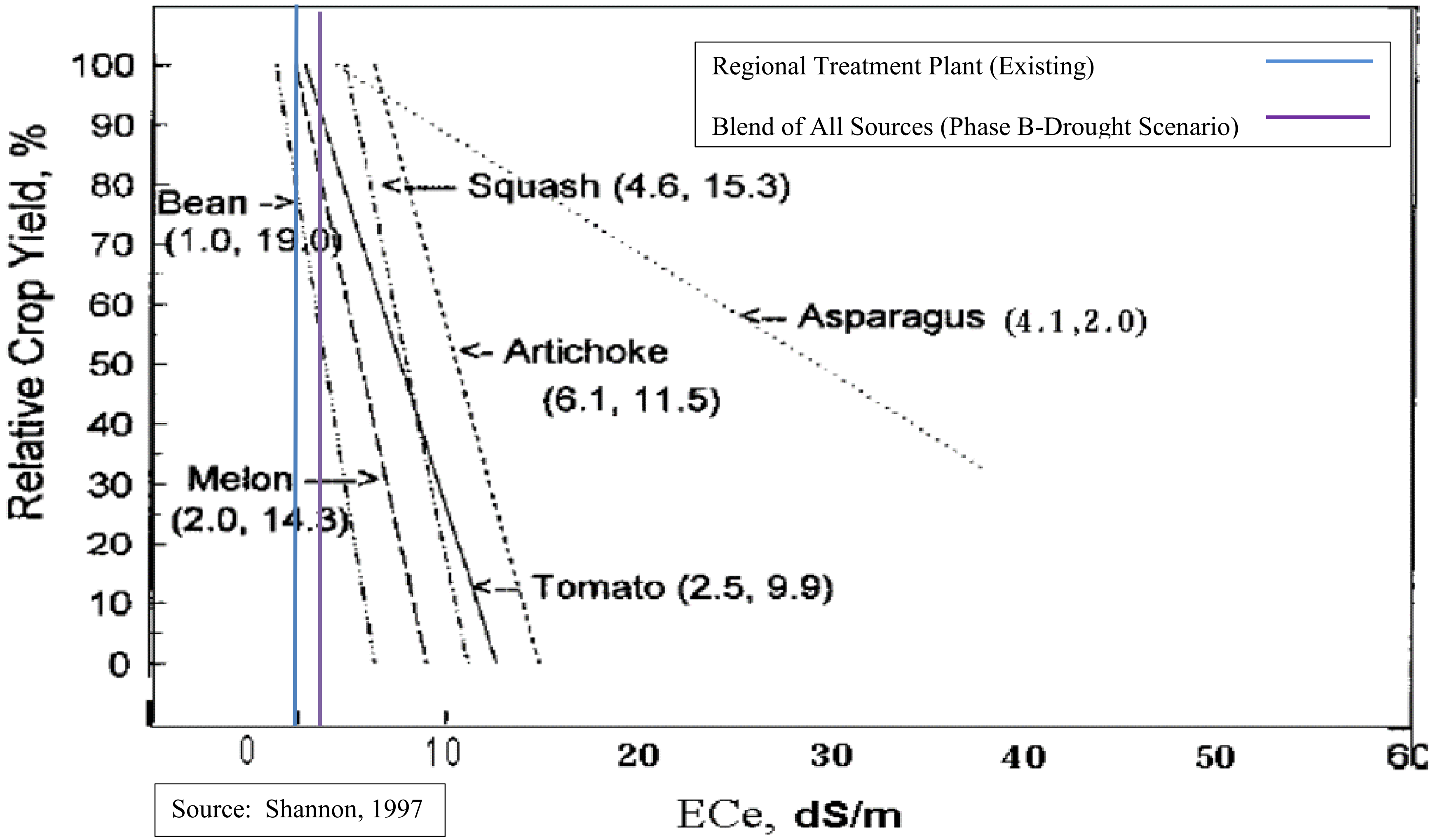



***Figure 5 Relative Yield of Artichoke at two Root Zone Salinities***

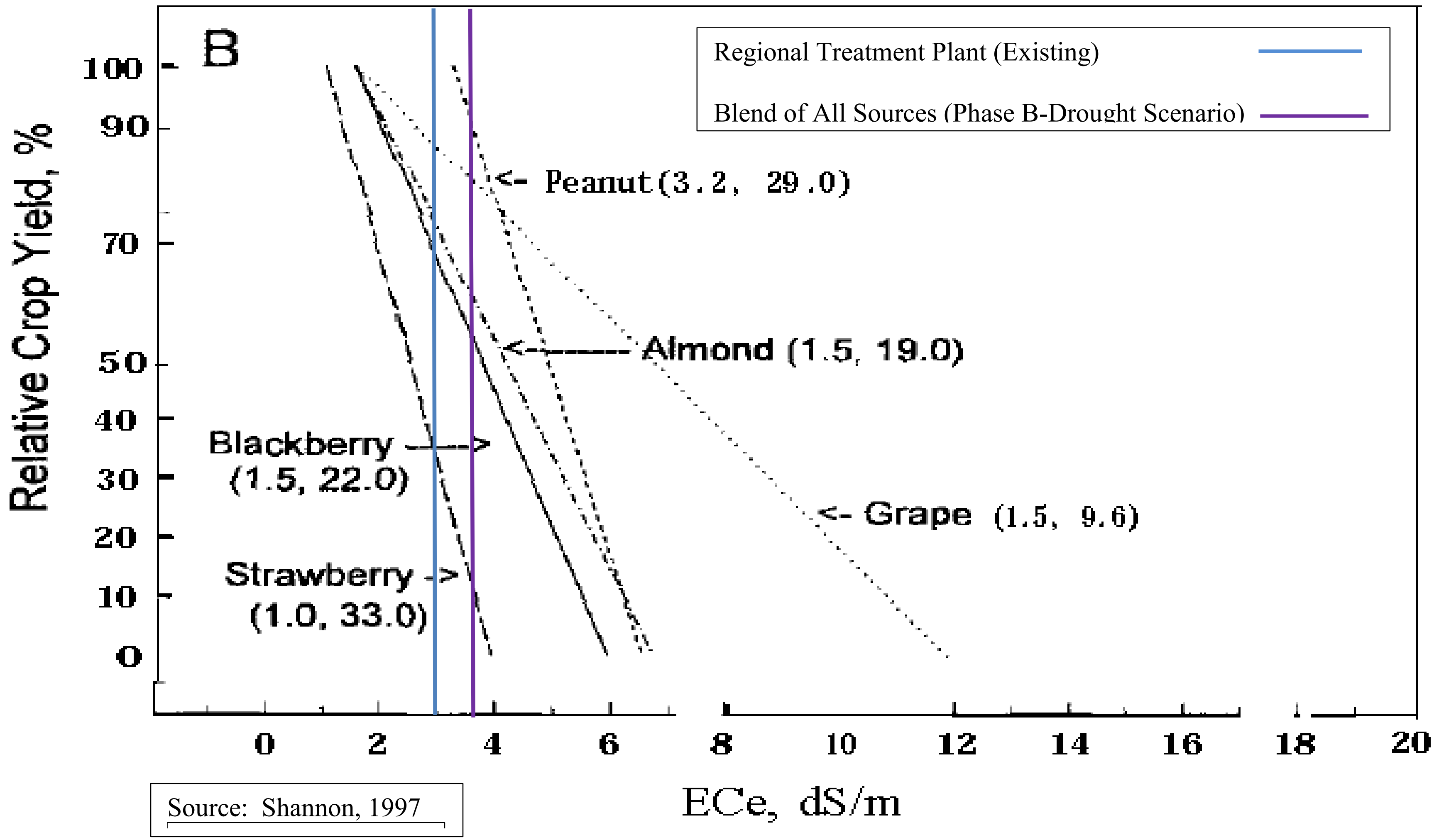



*Figure 6 Relative Yield of Strawberry at two Root Zone Salinities*

Intersection points of each soil water salinity (ECe) with the corresponding crop's yield graph provides the estimated percent yield potential resulting from long-term use of recycled water associated with that average salinity value. The results are summarized in Table 4.

***Table 4 Estimated Crop Yield, as Percentage of Maximum Potential Yield, with Two Recycled Water Salinity Scenarios***

| Crop | Yield with Existing RTP Water, ECe = 2.88 (dS/m) | Yield with Blend of All Source Waters, without River Water ECe = 3.5 (dS/m) | Yield Impact, % |
|---|---|---|---|
| Artichoke | 100% | 100% | 0 |
| Lettuce | 80% | 73% | -7% |
| Cauliflower | 100% | 95% | -5% |
| Broccoli | 100% | 95% | -5% |
| Strawberries | 35% | 15% | -20% |
| Celery | 95% | 85% | -10% |

## PREDICTED ECONOMIC IMPACT OF YIELD REDUCTION

Subtracting percent yield obtained for each crop irrigated with the blend of source waters from the yield of that same crop irrigated with the existing RTP recycled water gives percent yield reduction for each crop as shown in the first column of Table 5. Extending the percentage yield reduction to the acreage and value of each crop provides the estimated maximum annual loss of value that would result from use of all source water blends as irrigation water.

As discussed previously, this maximum annual loss is provided for the worst-case scenario of source water diversions in a drought year without dilution with river water or implementation of any salinity management measures by farmers. The next section describes the measures that have been used in the past, and that can be used in the future by farmers to safely and profitably irrigate the land and avoid these potential losses.

**Table 5 Estimated Yield Reduction for Each Crop Irrigated with Source Waters**

| Crop | Maximum Yield Decrease Due to Use of Blend with All Source Waters | Annual Value of Crop[1] $/Acre | Total Value of Crop In CSIP Area[2] $/Year | Loss of Value Due to Use of Blend of All Source Waters $/Year |
|---|---|---|---|---|
| Artichoke | 0% | 9,108 | 36,433,000 | 0 |
| Lettuce | -7% | 11,034 | 44,135,000 | -3,089,000 |
| Cauliflower | -5% | 7,782 | 15,564,000 | -778,000 |
| Broccoli | -5% | 6,510 | 5,208,000 | -260,000 |
| Strawberries | -20% | 79,188 | 130,661,000 | -26,132,000 |
| Celery | -10% | 16,024 | 4,327,000 | -433,000 |
| Total: | | | **236,328,000** | -30,692,000 |
| Percent Loss: | | | | -13% |

1. Annual crop values were obtained from Monterey County Office of Agricultural Commissioner's 2013 Crop Reports (MCAC, 2014), by dividing the County-wide value of each crop by the acreage in which the crop was produced in that year.
2. Total value of each crop was calculated by multiplying the annual value of the crop by the estimated acreage of the crop in the CSIP service area, shown in Table 3.

## DISCUSSION

The estimated losses of crop production value shown in Table 5 are based on simple theoretical relationships and can only be realized if the growers do nothing in response to the elevated level of salinity. Strong evidence for the ability of the currently produced recycled water to provide a safe and profitable irrigation resource has been obtained from previous research:

### Monterey Wastewater Reclamation Study for Agriculture

Prior to large-scale use of recycled water in the CSIP area, a five-year field pilot project was undertaken to determine the potential impact of using recycled water for irrigation of food crops, its safety, and the potential for marketing the produce. The results of that research project, in which recycled water from the now-demolished Castroville wastewater treatment plant was used, have been published (Sheikh et al., 1998). The results provided evidence, over a five-year period, that

- soil permeability, as measured in the field on plots irrigated with recycled water and those irrigated with well water were not significantly different,
- crop yields were equal to or higher than those irrigated with well water, and
- quality and shelf-life of the crops were not significantly different from those grown with well water.

### Soil Salinity Monitoring in CSIP Area

A monitoring study of soil characteristics has been underway at several test sites and control sites to track changes attributable to long-term use of recycled water in the CSIP service area. Some of the results were recently published in California Agriculture (Platts 2014A, 2014B). While some trends in increasing levels of EC, sodium, chloride, and SAR were noted, above control levels, the critical role of annual precipitation in diluting and removing accumulated salts was also observed. Overall, it was concluded that

> "In 13 years of data, the average soil salinity parameters at each site were highly correlated with the average water quality values of the recycled water. Soil salinity did increase, though not deleteriously. Of most concern was the accumulation of chloride at four of the sites, to levels above the critical threshold values for chloride-sensitive crops."

Another conclusion from this research is that

> "Increasing rainfall depths were significantly correlated with decreasing soil salinity of the shallow soil at all test sites, though this effect also diminished with increased soil depth. When applied water had high salinity levels, winter rainfall in this area was inadequate to prevent soil salinity from increasing."

Several types of management strategies are in use for salinity control and would be used to prevent any theoretically calculated reductions in yield. These strategies are listed below:

### Blending with Salinas River Water

Recycled water currently is blended with Salinas River water during most parts of the year and in most years, except following the driest winters, before delivery to the farmers. This practice is expected to continue in the future. Therefore, few if any of the framers will be irrigating at all times with a straight blend of recycled water from the sources indicated above. Salinas River water has a much lower salinity than any of the source waters discussed here (except the storm water). Of the new source waters to be used for the proposed project, Agricultural Wash Water will be highest volumetric contributor and has higher EC values than those in the current recycled water. Thus, timing of the Agricultural Wash Water contribution to the RTP is important when understanding the effects of blending recycled water with Salinas River water. Significantly, the greatest extent of blending with Salinas River water and recycled water containing Agricultural Wash Water is expected to occur during the peak summer period when plants would be growing at the highest rate and would benefit the most from a reduced salinity level. The beneficial, counteracting impact of the Salinas River water cannot be readily quantified because of the variable and temporal rates at which it will be introduced as influent to the irrigation system. If the CSIP service area is expanded in the future, more Salinas River water will be required to be blended to meet the demand. This will further dilute the salt content of the blended recycled water from all sources.

### Agronomic Management Practices

Growers in Salinas Valley are some of the most sophisticated and technologically advanced farmers in the world. They will, in all likelihood, respond to a higher salinity blend of recycled water by employing agronomic management practices, including the following: regular monitoring using sensors; increasing the leaching fraction; modifying irrigation scheduling; leaching during the cool seasons to improve leaching efficiency; scheduling leachings at periods of low crop water use or postponing leachings until after the cropping season; land leveling for better water distribution; installing additional tile drains to improve leaching, scheduling timing of irrigations to prevent crusting and water stress; placement of seed to avoid areas likely to be salinized; careful selection of materials, rate and placement of fertilizers; and addition of agricultural amendments, as needed.

### Salt Tolerant Varietals

California's academic institutions and agricultural research services are continuing research in plant breeding for salt tolerance, higher yields, and more consumer-attractive characteristics. These efforts routinely produce varietals and cultivars that, among other beneficial traits, can tolerate higher salt levels in the soil root zone, producing near maximum potential yield. In particular, the strawberries grown in the CSIP service area are patented proprietary varietals adapted to the conditions and water quality at hand.

### Trends for Crops Grown in the CSIP Service Area

Even though the calculations in this TM indicate a significant yield reduction for strawberries grown with the RTP recycled water, actual field experience of the farmers does not bear this out. In fact, over the period of recycled water delivery, much of the farmland in the CSIP service area has been shifted from growing artichoke (a salt-tolerant plant) to producing strawberries (a salt-sensitive crop), as shown in Table 6. This shift indicates that the farmers are obtaining adequate (possibly superior) yields and high-quality harvests from their investment, under the recycled water irrigation regime.

***Table 6 Shifts in Crop Acreage and Corresponding Value[1] from Artichokes to Strawberries in CSIP Service Area***

| Crop | | 1998 | 2010-2014[2] | Change |
|---|---|---|---|---|
| Artichokes | Acres | 4,200 | 3,900 | -7% |
| | Dollars | 25,262,000 | 35,522,000 | 41% |
| Strawberries | Acres | 120 | 1,642 | 1,300% |
| | Dollars | 3,641,000 | 130,027,000 | 3,500% |

1. Crop values were obtained from Monterey County Office of Agricultural Commissioner's 2013 Crop Reports (MCAC, 2014). Crop acreages were provided by Bob Holden, MRWPCA.
2. Artichoke acreage is for 2010; strawberry acreage is for 2014.

## CONCLUSION

The addition of new source waters for the proposed project is likely to increase the recycled water salinity above that currently produced at the RTP. This change in water quality is not expected to impact the farming activities within the CSIP service area to a significant extent, mainly because of the various management tools and expertise available to the growers, some of which are already in practice. It is estimated that the increased salinity of the recycled water resulting from the blend of existing raw wastewater with the new source waters may result in a 13% reduction in total crop production value in the CSIP service area during a drought year scenario only under two conditions (1) if Salinas River water is not available for dilution and (2) if salinity control crop management practices are not implemented to maintain yield. In practice, the potential loss of crop value would be ameliorated by the implementation of standard strategies and management practices to address higher salinity levels in irrigation water sources.

The farming enterprise is a dynamic industry with constant revision of policies, practices and procedures to meet changing environmental and input variables, including irrigation water quality. Over the 17-year period of using recycled water for irrigation in the CSIP service area, large tracts of salt-tolerant artichoke have been converted to growing salt-sensitive, but far more profitable, strawberries. This conversion attests to the ingenuity of local growers and their ability and willingness to adapt real-time to water quality variations and economic realities.

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# Appendix A

**Table A-1 Predicted Composition of Source Water Blends under Various Scenarios**

| Phase | Scenario | Source of Water | Average Flow, mgd | Percentage from Each Source | Maximim Monthly Flow, mgd | Percentage from Each Source |
|---|---|---|---|---|---|---|
| Phase A | Normal/Wet - Building Reserve | Municipal WW | 17.8 | 82% | 18.4 | 65% |
| | | Ag Wash | 2.8 | 13% | 6.8 | 24% |
| | | Blanco Drain | 0.6 | 3% | 1.9 | 7% |
| | | El Estero | 0.0 | 0% | 0.0 | 0% |
| | | Tembladero Slough | 0.0 | 0% | 0.0 | 0% |
| | | Rec Ditch | 0.5 | 2% | 1.2 | 4% |
| | Normal/Wet - Full Reserve | Municipal WW | 17.8 | 82% | 18.4 | 65% |
| | | Ag Wash | 2.8 | 13% | 6.8 | 24% |
| | | Blanco Drain | 0.6 | 3% | 1.9 | 7% |
| | | El Estero | 0.0 | 0% | 0.0 | 0% |
| | | Tembladero Slough | 0.0 | 0% | 0.0 | 0% |
| | | Rec Ditch | 0.5 | 2% | 1.2 | 4% |
| | Drought | Municipal WW | 17.8 | 79% | 18.4 | 62% |
| | | Ag Wash | 2.6 | 11% | 6.7 | 22% |
| | | Blanco Drain | 1.1 | 5% | 1.9 | 6% |
| | | El Estero | 0.0 | 0% | 0.0 | 0% |
| | | Tembladero Slough | 0.5 | 2% | 1.5 | 5% |
| | | Rec Ditch | 0.6 | 3% | 1.2 | 4% |
| Phase B | Normal/Wet - Building Reserve | Municipal WW | 17.8 | 82% | 18.4 | 64% |
| | | Ag Wash | 2.8 | 13% | 6.8 | 24% |
| | | Blanco Drain | 0.4 | 2% | 1.6 | 6% |
| | | El Estero | 0.0 | 0% | 0.0 | 0% |
| | | Tembladero Slough | 0.0 | 0% | 0.0 | 0% |
| | | Rec Ditch | 0.8 | 4% | 2.0 | 7% |
| | Normal/Wet - Full Reserve | Municipal WW | 17.8 | 82% | 18.4 | 64% |
| | | Ag Wash | 2.8 | 13% | 6.8 | 23% |
| | | Blanco Drain | 0.6 | 3% | 2.1 | 7% |
| | | El Estero | 0.0 | 0% | 0.0 | 0% |
| | | Tembladero Slough | 0.0 | 0% | 0.0 | 0% |
| | | Rec Ditch | 0.6 | 3% | 1.8 | 6% |
| | Drought | Municipal WW | 17.8 | 77% | 18.4 | 59% |
| | | Ag Wash | 2.6 | 11% | 6.7 | 21% |
| | | Blanco Drain | 1.4 | 6% | 3.0 | 9% |
| | | El Estero | 0.0 | 0% | 0.0 | 0% |
| | | Tembladero Slough | 0.4 | 2% | 1.5 | 5% |
| | | Rec Ditch | 0.8 | 4% | 1.8 | 6% |

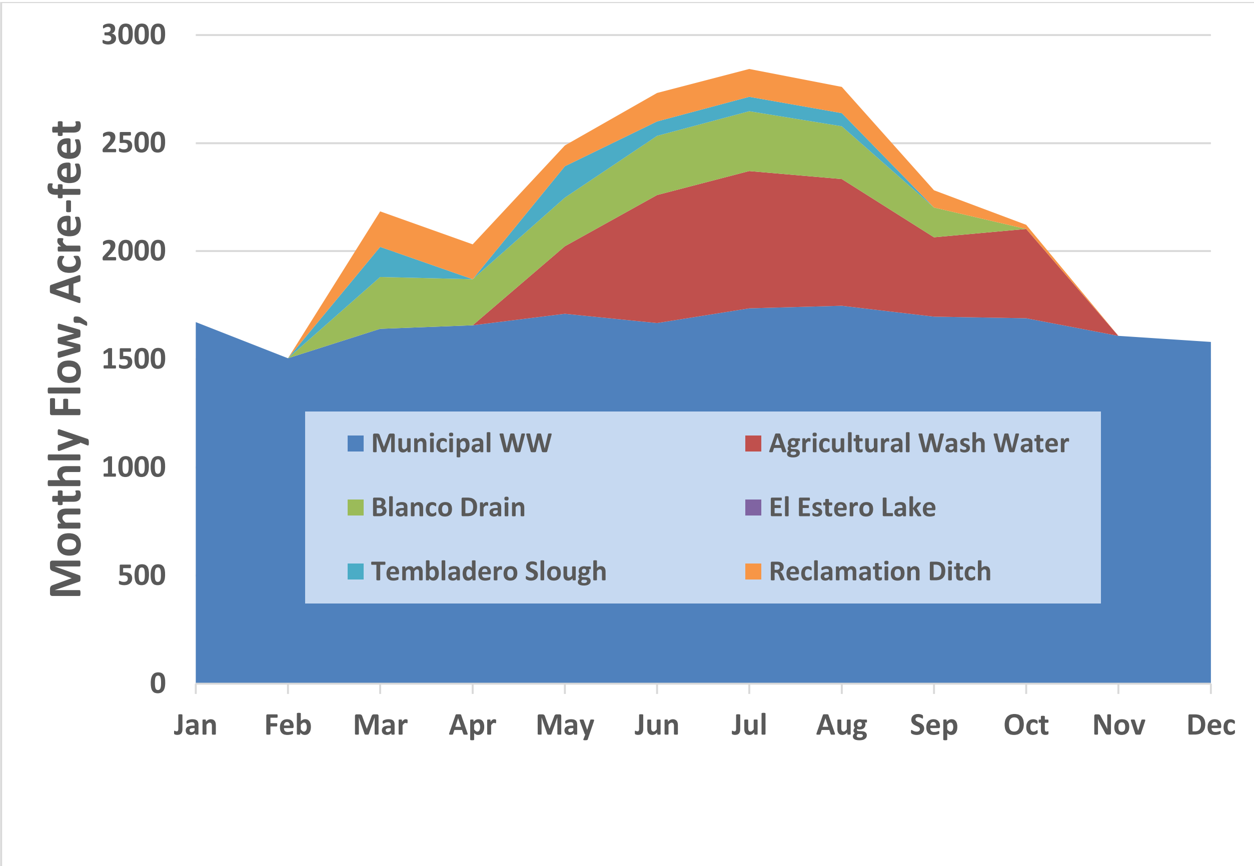


**Figure A-1 Monthly Blend Composition from Various Source Waters under Phase B, Drought Scenario—Worst-Case Condition for Salinity**

# Appendix T

# MRWPCA GWR Discharge Dilution Analysis

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**Flow Science Incorporated**
48 S. Chester Ave., Suite 200, Pasadena, CA 91106
**(626) 304-1134 □FAX (626) 304-9427**

# TECHNICAL MEMORANDUM

**DATE:** November 10, 2014

**TO:** Robert Holden
Monterey Regional Water Pollution Control Agency (MRWPCA)

**FROM:** Gang Zhao, Ph.D., P.E., Aaron Mead, P.E., E. John List, Ph.D., P.E.

**SUBJECT:** **MRWPCA GWR Discharge Dilution Analysis**
**FSI 144082**

## 1. Introduction

As part of the preparation process for the Monterey Peninsula Groundwater Replenishment Project (GWR Project), Flow Science Incorporated (Flow Science) was retained by Monterey Regional Water Pollution Control Agency (MRWPCA) to analyze characteristics of the plume resulting from the discharge of effluent (comprised of secondary effluent from the Regional Treatment Plant (RTP), truck hauled brine, and brine concentrate produced by the Advanced Water Treatment Facility (AWTF) for the proposed Pure Water Monterey Groundwater Replenishment Project (GWR Project)) through the existing MRWPCA ocean outfall.

In October 2014, Flow Science performed a dilution analysis of the proposed GWR Project effluent for six (6) selected discharge scenarios, as summarized in **Table 1**. These scenarios were selected based on the results of a dilution analysis for fourteen (14) prescreening scenarios, as listed in **Appendix C**. Scenarios in **Appendix C** were selected to cover a wide range of discharge conditions, and to provide preliminary knowledge of the various factors affecting dilution of the effluent. For each scenario in **Table 1**, temperature of the combined flow was assumed to be 20 °C, and effluent dilution was analyzed for three seasonal conditions: Davidson (January), Upwelling (July) and Oceanic (September). Zero ocean current was used for all scenarios consistent with the California Ocean Plan (State Water Resources Control Board, SWRCB, 2012).

**Table 1 – Diffuser scenarios modeled**

| Scenario | Flow Assumptions (mgd) | | | | TDS Assumptions (mg/L) | | | |
|---|---|---|---|---|---|---|---|---|
| | Wastewater | Hauled Brine | GWR Brine | Total Flow | Wastewater | Hauled Brine | GWR brine | Combined |
| 1 | 0.2 | 0.1 | 0.94 | 1.24 | 1100 | 40,000 | 5,800 | 7800 |
| 2 | 0.4 | 0.1 | 0.94 | 1.44 | 1100 | 40,000 | 5,800 | 6869 |
| 3 | 0.6 | 0.1 | 0.94 | 1.64 | 1100 | 40,000 | 5,800 | 6166 |
| 4 | 0.8 | 0.1 | 0.94 | 1.84 | 1100 | 40,000 | 5,800 | 5615 |
| 5 | 1.0 | 0.1 | 0.94 | 2.04 | 1100 | 40,000 | 5,800 | 5173 |
| 6 | 1.2 | 0.1 | 0.94 | 2.24 | 1100 | 40,000 | 5,800 | 4809 |

mgd = million gallons per day, mg/L = milligrams per liter, TDS = total dissolved solids.

This Technical Memorandum (TM) summarizes the analysis Flow Science completed for the scenarios presented in **Table 1** and describes the input data, methods and results of Flow Science's analysis.

## 2. Analysis Input Data

### Diffuser Configuration

The existing MRWPCA diffuser has 172 ports. Half of the ports discharge horizontally from one side of the diffuser and half discharge horizontally from the other side of the diffuser in an alternating pattern. Since Visual Plumes, the model used to analyze effluent dilution in this analysis, does not have the capability to model ports on alternating sides of a diffuser, all ports were modeled to be on one side of the diffuser. This assumption leads to conservative model results because the plumes from individual ports overlap more quickly under modeled conditions than in reality, and so modeled effluent dilutions are somewhat lower than would be reflected in reality.

According to MRWPCA, the fifty-two (52) ports nearest to the shore (i.e., the shallowest ports) are currently closed. In this analysis, Flow Science calculated dilution of effluent discharged through the 120 open ports for Scenarios 1 through 6. A typical section of the current diffuser is shown in **Figure 1**, although the actual cross-sectional profile of the pipe ballast may have changed over time. The ports are approximately 6 inches above the rock bedding of the diffuser pipeline, and drawings[1] (see **Figure 1**) indicate that they are located approximately 3.9 feet above the seafloor[2]. The gravel bedding dimensions are nominal, as shown in **Figure 1**, and therefore, the port height above the seafloor is not known with high accuracy. Momentum and buoyancy of the effluent are the key factors in determining the dilution within the zone of initial dilution (ZID). Toward the end of the ZID, the plume slows down and mixing is not as strong as at the beginning of the ZID. Therefore, the dilution results are not likely to change by much if the port height is not precisely known and, considering the overall uncertainty in the analysis, it is not critical to determine the diffuser port height with high accuracy. In this analysis, it was assumed that effluent plumes do not interact with the ballast, which is supported by the plume dimensions computed. Details of the current diffuser configuration are summarized in **Table 2**.

**Table 2 – Current diffuser configuration.**

| Parameter | Value |
|---|---|
| Diffuser length | 1368 feet (417 m) |
| Depth of diffuser ports | 95 to 109 feet below MSL |
| Number of open ports | 120 |
| Port spacing | 8 feet (2.44 m) |
| Port diameter | 2 inches (0.051 m) |
| Port exit condition | Tideflex Series 35 4-inch duckbill valves |
| Port vertical angle | $0^{\circ}$ (horizontal) |
| Port elevation above sea floor | 3.9 feet (1.19 m) |

m = meters, MSL = mean sea level

[1] Section F, Drawing P-0.03, Contract Documents Volume 1 of 1: Ocean Outfall Contract No. 2.1, January 1982 by Engineering Science for MRWPCA.
[2] The 3.9 feet (ft) above seafloor used in this analysis is slightly higher than the 3.5 ft used in previous analyses for the desalination brine because the thickness of the pipe wall (about 5 inches) is included. All effluent plumes in this analysis are positively buoyant, and therefore, this change has no impact on the results of this analysis.

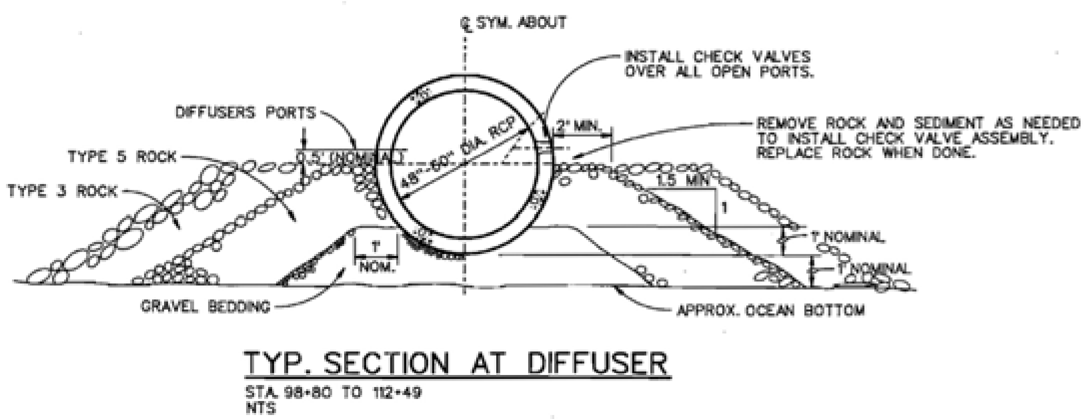


**Figure 1. Typical diffuser section (currently in place).**

The 120 ports that are currently open are fitted with Tideflex "duckbill" check valves, as shown in **Figure 2**. The shape of the duckbill valve opening is elliptic and the area of the opening depends on the discharge flow rate. The valve opening area in this analysis was determined from an effective open area curve provided by Tideflex Technologies (included as **Appendix A**). Although the ports were modeled as round openings with the same opening area as the "duckbill" valves, because of the oblateness of the actual port opening, the actual dilution will be slightly higher than the dilution computed assuming circular ports. This is because the perimeter of ellipse, which is where the entrainment of diluting water occurs, is larger than that of a circle having the same area.

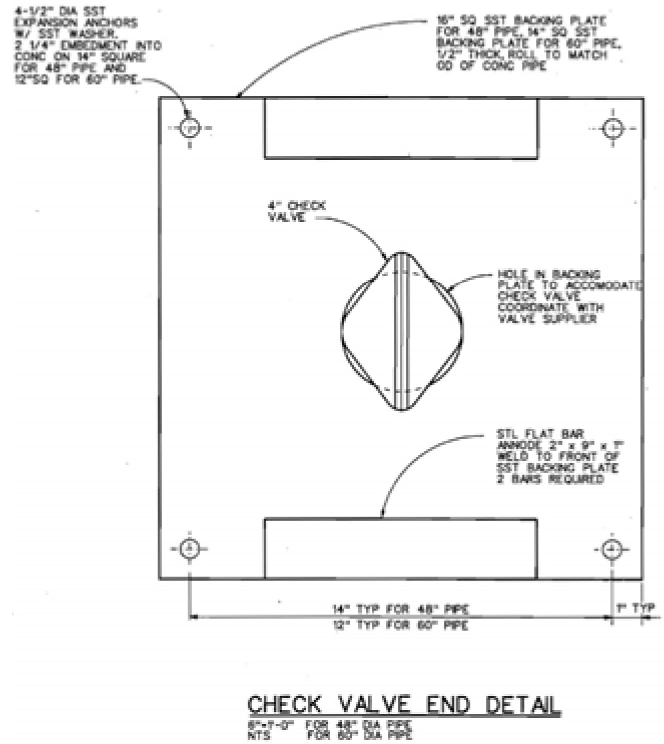


**Figure 2. Typical "duckbill" valve detail (shown closed, i.e., with no flow).**

## Discharge Characteristics

Total Dissolved Solids (TDS) and temperature data for the proposed GWR Project brine concentrate, hauled brine and the MRWPCA wastewater have been compiled and provided by Trussell Technologies, Inc. (Trussell Tech). TDS is a measure of water salinity, and salinity and temperature are used to calculate the density of the effluent and ambient ocean water, which are important parameters in dilution analyses.

Discharge rate, temperature, and TDS data, provided by Trussell Tech and presented in **Table 3**, were used in the analysis for all three seasonal conditions. For the combined proposed GWR Project brine concentrate, trucked brine, and wastewater flow scenarios, the concentrate was assumed to be fully mixed with the wastewater. Thus, the temperature and TDS of the combined flow were calculated as the flow-weighted average temperature and salinity of the brine and wastewater.

All scenarios summarized in **Table 3** were analyzed for zero ocean current velocity conditions, which represent worst-case conditions since any ocean current only increases dilution. Ocean currents increase the amount of dilution that occurs because they increase the flow of ambient water past the diffuser (i.e., increase the amount of ambient water available for mixing with the discharge). Although ocean currents increase effluent dilution, the California Ocean Plan (State Water Resources Control Board, SWRCB, 2012) requires that the no-current condition should be used in initial dilution calculations.

**Table 3 – Summary of input for analyzed scenarios.**

| Scenario | Combined Flow (mgd) | Combined TDS (mg/L) | Combined Temp. ($^oC$) | Number of Diffuser Ports | Effective Port Diameter (inches) |
|---|---|---|---|---|---|
| 1 | 1.24 | 7800 | 20 | 120 | 0.93 |
| 2 | 1.44 | 6869 | 20 | 120 | 0.97 |
| 3 | 1.64 | 6166 | 20 | 120 | 1.01 |
| 4 | 1.84 | 5615 | 20 | 120 | 1.05 |
| 5 | 2.04 | 5173 | 20 | 120 | 1.09 |
| 6 | 2.24 | 4809 | 20 | 120 | 1.12 |

**Receiving Water Profiles**

Representative ocean receiving water profile data (temperature and salinity) for the three months corresponding to the selected seasonal conditions (July, January, and September) used in a previous dilution study (Flow Science, 2014) for the proposed Monterey Peninsula Water Supply Project Desalination Plant were also used in this analysis. Receiving water profile data were collected by the Monterey Bay Aquarium Research Institute (MBARI) at station C1 at the head of Monterey Canyon, approximately five miles northwest of the MRWPCA wastewater ocean outfall (see **Figure 3**). This location has been occupied since 1988 by MBARI. Monthly conductivity, temperature, and depth (CTD) profiles have been collected since 2002. The proximity of the location to the MRWPCA ocean outfall and the long data record make this the most appropriate and useful data set to characterize the ambient conditions for the brine discharge analysis. Vertical profiles of temperature and salinity were analyzed for the upper 50 meters of the water column for the years 2002-2012, and a single representative profile was selected for each of the three ocean seasons. The appropriate profiles were selected based on which were most complete, i.e., which profiles had data for the entire water column (in some cases profiles did not extend over the entire depth of the water column), and to ensure that the profiles represented typical conditions of the seasonal ocean profiles. For the July model run, temperature and salinity profiles from 2011 were selected. For the September model run, profiles from 2004 were selected. For the January model runs, a temperature profile from 2004 and a salinity profile from 2011 were selected. Profile data are shown in tabular form in **Appendix B**. Maximum and minimum values for each profile are shown in **Table 4**.

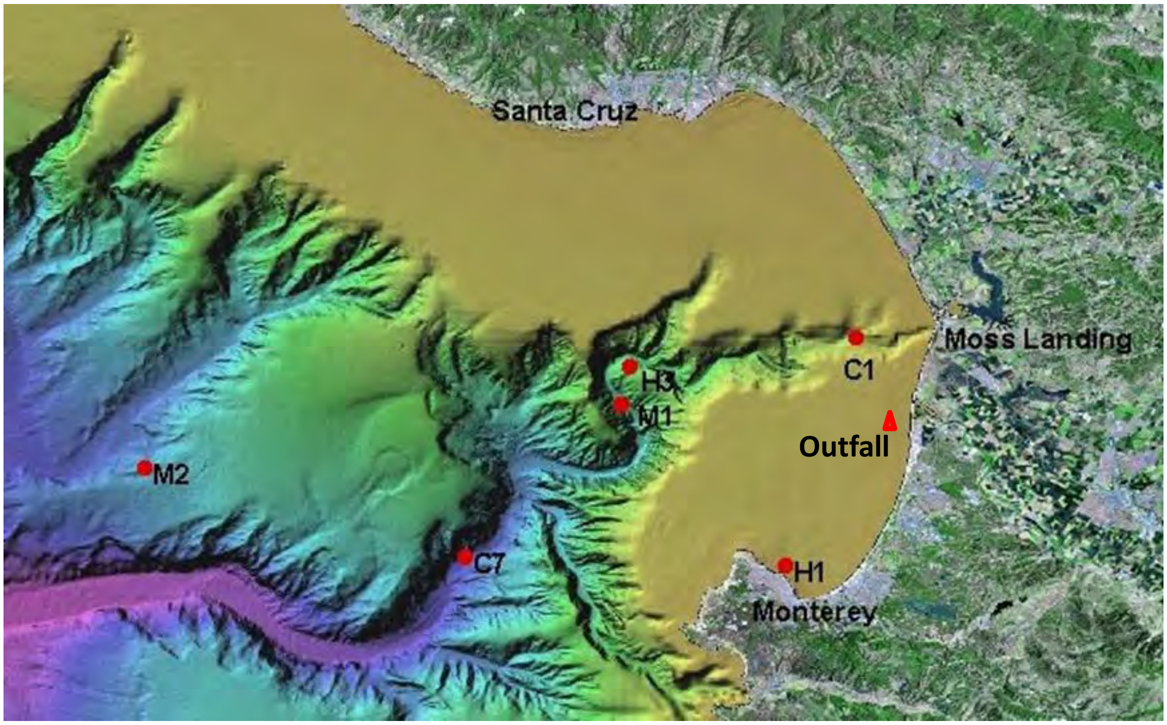


**Figure 3. Location map, MBARI ocean monitoring stations and MRWPCA outfall.**

**Table 4 – Maximum and minimum ocean profile data.**

| Parameter | Season | Minimum | Maximum |
|---|---|---|---|
| Salinity (ppt) | Upwelling (July) | 33.7 | 33.9 |
| | Davidson (January) | 33.2 | 33.5 |
| | Oceanic (September) | 33.5 | 33.6 |
| Temperature ($C^o$) | Upwelling (July) | 10.0 | 13.0 |
| | Davidson (January) | 10.7 | 12.7 |
| | Oceanic (September) | 10.6 | 15.8 |

Source: ESA (2013); Appendix B.

## Receiving water flow conditions

As detailed in **Figure 1**, the existing diffuser ports are located just above the mid-point of the outfall pipe (i.e., below the crown of the outfall pipe), about 6 inches above the top of the ballast used to anchor the diffuser to the seafloor. Because the outfall rises above the seafloor, it will influence the patterns of currents (receiving water flow velocity) at the ports, and the current velocity at each individual port will be a complex function of the local geometry. Local field data collection would be required to characterize the actual current conditions at the diffuser ports, which was beyond the scope and budget of this analysis. To simplify the analysis, effluent dilution was analyzed for a uniform 0.0 foot per second (fps) current, which amounts to a "worst case," stagnant (no current) receiving water condition. Stagnant conditions are typically used as the basis for developing NPDES permits, and the California Ocean Plan (SWRCB, 2012) requires the no-current condition be used in initial dilution calculations.

## 3. Plume Analysis Method

The UM3 model—part of the U.S. Environmental Protection Agency (US EPA) Visual Plumes diffuser modeling package—was used to simulate the discharge of GWR Project effluent and wastewater from the existing MRWPCA ocean diffuser. Visual Plumes is a mixing zone computer model developed from a joint effort led by US EPA. Visual Plumes can simulate both single and merging submerged plumes, and stratified ambient flow can be specified by the user. Visual Plumes can be used to compute the plume dilution, trajectory, diameter, and other plume variables (US EPA, 2003).

The UM3 model is based on the projected area entrainment hypothesis, which assumes ambient fluid is entrained into the plume through areas projected in directions along the plume centerline and perpendicular to the centerline (US EPA, 1994). In addition, shear entrainment is included. The plume envelope is assumed to be in steady state, and as a plume element moves through the envelope, the element radius changes in response to velocity convergence or divergence, and entrainment of ambient fluid. Conservation equations of mass, momentum and energy are used to calculate plume mass and concentrations.

The actual depth of the diffuser ports varies between 95 and 109 feet below mean sea level (MSL) since the diffuser is quite long and is situated on a sloping portion of the ocean floor. However, since Visual Plumes cannot model a sloping diffuser, an average depth of 104 feet below MSL was used for the 120-port scenarios (the deepest 120 ports on the diffuser are assumed to discharge in this case, thereby increasing the average port depth). Modeled ocean conditions are summarized in **Table 5**.

Visual Plumes assumes circular discharge ports, so the actual elliptical discharge area was calculated for each port (**Appendix A**) and then converted to an effective circular discharge diameter for use in Visual Plumes.

**Table 5 – Visual Plumes modeled seasonal ocean conditions.**

| Depth (m) | Upwelling (July) | | Davidson (January) | | Oceanic (September) | |
|---|---|---|---|---|---|---|
| | Temp. ($^oC$) | Salinity (ppt) | Temp. ($^oC$) | Salinity (ppt) | Temp. ($^oC$) | Salinity (ppt) |
| 0 | 12.98 | 33.78 | 12.65 | 33.20 | 15.75 | 33.46 |
| 2 | 12.87 | 33.77 | 12.65 | 33.22 | 15.75 | 33.46 |
| 4 | 12.64 | 33.74 | 12.65 | 33.22 | 15.75 | 33.46 |
| 6 | 11.97 | 33.71 | 12.65 | 33.23 | 15.53 | 33.46 |
| 8 | 11.61 | 33.70 | 12.74 | 33.24 | 14.46 | 33.46 |
| 10 | 11.34 | 33.70 | 12.57 | 33.26 | 13.81 | 33.46 |
| 12 | 11.10 | 33.73 | 12.50 | 33.28 | 13.17 | 33.46 |
| 14 | 10.84 | 33.75 | 12.42 | 33.30 | 12.27 | 33.46 |
| 16 | 10.51 | 33.78 | 12.33 | 33.30 | 11.83 | 33.46 |
| 18 | 10.38 | 33.79 | 12.24 | 33.30 | 11.52 | 33.46 |
| 20 | 10.38 | 33.80 | 12.22 | 33.28 | 11.19 | 33.46 |
| 22 | 10.38 | 33.80 | 12.07 | 33.30 | 11.06 | 33.46 |
| 24 | 10.38 | 33.82 | 12.05 | 33.30 | 11.22 | 33.49 |
| 26 | 10.38 | 33.82 | 11.90 | 33.30 | 11.39 | 33.50 |
| 28 | 10.38 | 33.84 | 11.81 | 33.32 | 11.39 | 33.50 |
| 30 | 10.38 | 33.84 | 11.71 | 33.34 | 11.31 | 33.50 |
| 32 | 10.37 | 33.84 | 11.71 | 33.37 | 11.23 | 33.50 |
| 34 | 10.31 | 33.84 | 11.63 | 33.39 | 11.22 | 33.50 |
| 36 | 10.30 | 33.84 | 11.63 | 33.42 | 11.05 | 33.50 |
| 38 | 10.30 | 33.84 | 11.54 | 33.43 | 10.97 | 33.50 |

Source: Interpolated from ESA | Water (2013) ocean profile data, Appendix B.

The UM3 model was used to calculate the size of the plume and dilution of the discharged effluent within the ZID. The ZID is defined as the zone immediately adjacent to a discharge where momentum and buoyancy-driven mixing produces rapid dilution of the discharge. For a positively buoyant (rising) effluent plume, the ZID ends at the point where the effluent plume reaches the water surface or attains a depth level where the density of the diluted effluent plume becomes the same as the density of ambient water (i.e., the "trap" level). Typically, within the ZID, which is limited in size, constituent concentrations are permitted to exceed water quality standards. A discharge is generally required to meet the relevant water quality standards at the edge of the ZID.

Analysis of the buoyant (rising) plume within and beyond the "trap" level would require additional analysis methods. In the analysis presented here the spreading of the effluent within and beyond the trap level and the subsequent additional dilution that would ensue, has not been analyzed. Flow Science recommends that the computed dilution at the trap level, (i.e., at the end of the ZID), be used as the basis for any NPDES permitting activities and to analyze impacts.

## 4. Dilution Results

Several key results for the effluent plumes are reported at the edge of the ZID. As noted above, the ZID is defined as the zone immediately adjacent to a discharge where momentum and buoyancy-driven mixing produces rapid dilution of the discharge. Results for positively buoyant plumes presented in this Technical Memorandum were taken at the point where the plumes just reached the trap level, which is the depth level where the density of the diluted plume becomes the same as ambient seawater. Horizontal spreading of plumes at their trap levels was not included in this analysis. Results from each scenario generally include the following quantities:

- the minimum dilution of the plume at the point at which the plume reaches the trap level or sea surface;
- an estimate of the size of the plume (diameter) at the trap level or sea surface (i.e., at the edge of the ZID);
- the horizontal distance from the diffuser port to the point at which the plume reaches the trap level or sea surface;
- the height of the trap level above diffuser ports.

**Figure 4** shows a sample schematic graphic of the trajectory of a positively buoyant plume from a horizontal discharge drawn approximately to scale, and the analysis results described in the list above are illustrated. As the effluent travels away from the discharge port, it entrains ambient seawater, which increases the diameter of the plume and decreases the effluent concentration.

**Table 6** presents analysis results for the six (6) modeled scenarios for the selected three seasonal conditions. Effluent plumes are positively buoyant for all analyzed scenarios, and all plumes reach trap levels below sea surface. The calculated minimum dilution value is 218 for all scenarios under all three seasonal conditions.

**Figure 5** illustrates the trajectory and shape of the buoyant plumes just reaching the trap level, as computed from Visual Plumes for Scenario 4. Plumes computed for other scenarios have similar trajectories and shape as shown in the figure.

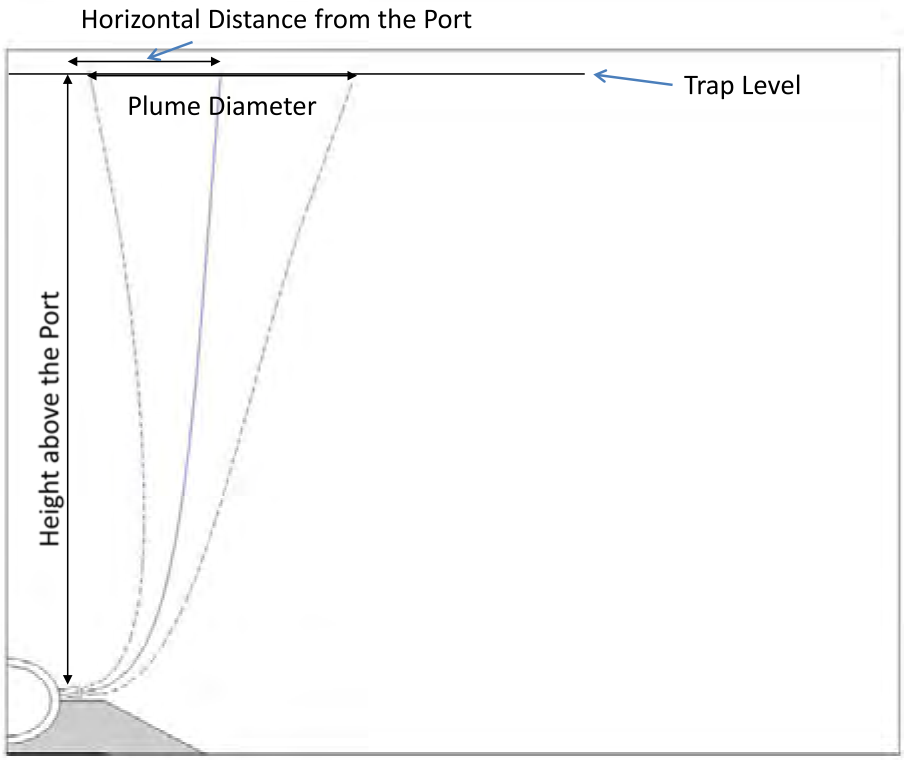


**Figure 4. Sample graphic showing the trajectory of a rising plume.**

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**Table 6– Analysis results.**

| Scenario | Total Flow (MGD) | Combined TDS (mg/L) | Number of Open Ports | Davidson (Jan.) | | | | Upwelling (July) | | | | Oceanic (Sept.) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Plume Diam. (ft) | Minimum Dilution | Horiz. Distance from Port (ft) | Height above Port (ft) | Plume Diam. (ft) | Minimum Dilution | Horiz. Distance from Port (ft) | Height above Port (ft) | Plume Diam. (ft) | Minimum Dilution | Horiz. Distance from Port (ft) | Height above Port (ft) |
| 1 | 1.24 | 7800 | 120 | 8 | 218 | 6 | 26 | 13 | 541 | 7 | 49 | 11 | 474 | 7 | 42 |
| 2 | 1.44 | 6869 | 120 | 11 | 285 | 7 | 34 | 13 | 512 | 7 | 50 | 11 | 439 | 7 | 43 |
| 3 | 1.64 | 6166 | 120 | 11 | 274 | 7 | 35 | 13 | 483 | 8 | 50 | 11 | 418 | 7 | 43 |
| 4 | 1.84 | 5615 | 120 | 11 | 263 | 8 | 35 | 13 | 453 | 8 | 50 | 11 | 396 | 8 | 44 |
| 5 | 2.04 | 5173 | 120 | 11 | 252 | 8 | 35 | 13 | 440 | 8 | 51 | 11 | 373 | 8 | 44 |
| 6 | 2.24 | 4809 | 120 | 11 | 242 | 8 | 36 | 14 | 426 | 9 | 52 | 11 | 362 | 8 | 45 |

Analysis results are at plume trap levels.

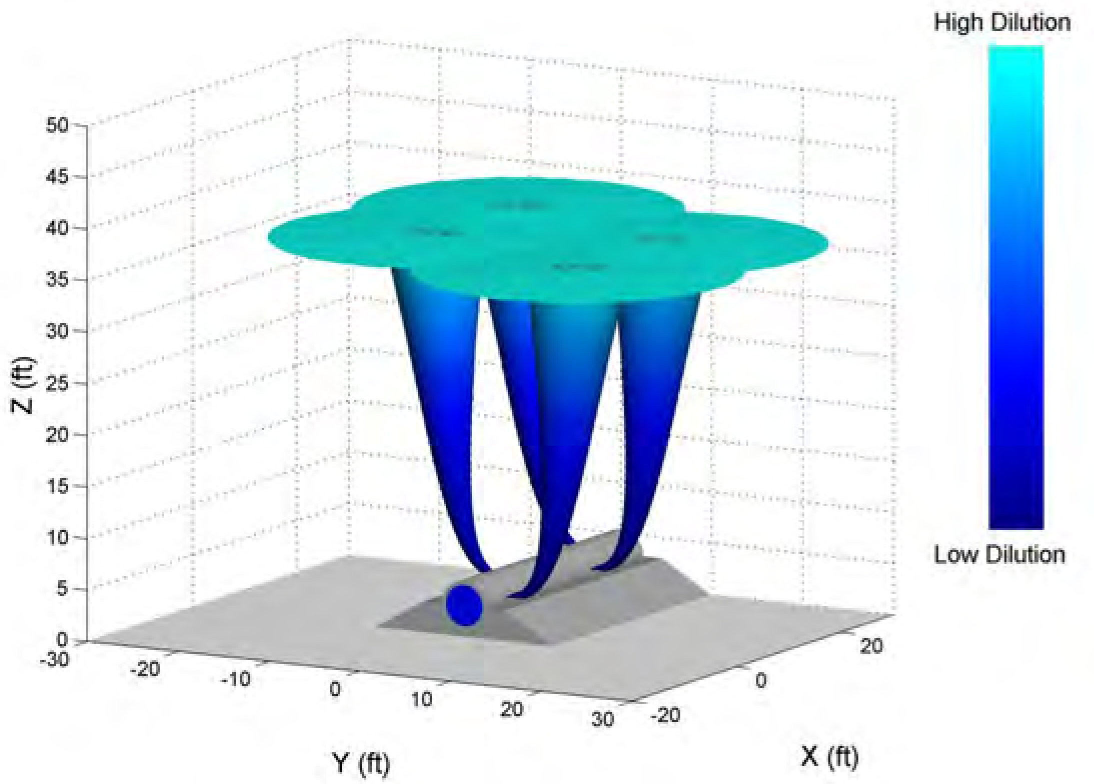


**Figure 5. Plume computed from VP for Scenario 4.**

## 5. References

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# APPENDIX A – DUCKBILL VALVE, EFFECTIVE OPEN AREA

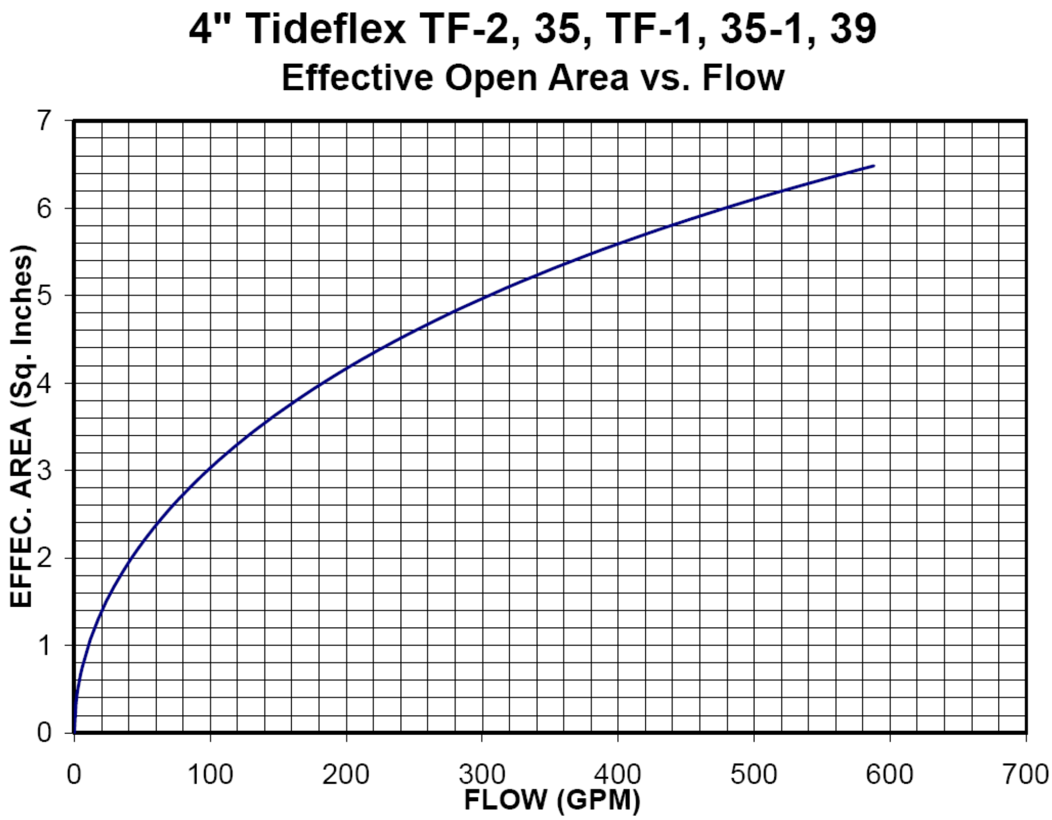


Chart provided by Tideflex Technologies.

# APPENDIX B – AMBIENT OCEAN PROFILE DATA

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## Table B1- Ambient ocean profile data, MBARI station C1 (Source: ESA)

| Upwelling (July) | | | | Transition-Oceanic (Sept) | | | | Davidson (Jan) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2011 Profile | | 2011 Profile | | 2004.2 Profile | | 2004.1 Profile | | 2011 Profile | | 2004 Profile | |
| S (ppt) | Z (m) | T (°C) | Z (m) | S (ppt) | Z (m) | T (°C) | Z (m) | S (ppt) | Z (m) | T (°C) | Z (m) |
| 33.78 | -0.93 | 12.98 | -0.59 | 33.46 | -3.30 | 15.83 | -4.22 | 33.20 | -0.41 | 12.65 | -2.35 |
| 33.76 | -1.97 | 12.91 | -1.63 | 33.46 | -4.29 | 15.66 | -4.22 | 33.22 | -0.40 | 12.65 | -2.35 |
| 33.78 | -1.98 | 12.84 | -2.68 | 33.46 | -5.28 | 15.66 | -5.22 | 33.22 | -1.44 | 12.65 | -3.34 |
| 33.78 | -3.03 | 12.77 | -2.68 | 33.46 | -6.28 | 15.75 | -6.21 | 33.22 | -2.47 | 12.65 | -4.33 |
| 33.76 | -4.06 | 12.77 | -3.73 | 33.46 | -7.27 | 15.83 | -6.21 | 33.22 | -3.51 | 12.65 | -5.32 |
| 33.74 | -4.05 | 12.70 | -3.73 | 33.46 | -8.27 | 15.75 | -6.21 | 33.22 | -4.54 | 12.65 | -6.31 |
| 33.72 | -4.04 | 12.63 | -4.78 | 33.46 | -9.26 | 15.66 | -6.21 | 33.22 | -5.57 | 12.65 | -7.30 |
| 33.74 | -5.10 | 12.56 | -4.78 | 33.46 | -10.25 | 15.23 | -6.21 | 33.22 | -6.61 | 12.74 | -7.30 |
| 33.72 | -5.09 | 12.35 | -4.80 | 33.46 | -11.25 | 15.15 | -6.21 | 33.24 | -6.60 | 12.74 | -8.29 |
| 33.70 | -6.13 | 12.28 | -4.80 | 33.46 | -12.24 | 15.06 | -6.21 | 33.24 | -7.63 | 12.65 | -8.29 |
| 33.70 | -7.17 | 12.21 | -4.80 | 33.46 | -13.23 | 14.98 | -7.21 | 33.26 | -8.65 | 12.57 | -9.29 |
| 33.70 | -8.22 | 12.14 | -4.81 | 33.46 | -14.23 | 14.89 | -7.21 | 33.26 | -9.69 | 12.57 | -10.28 |
| 33.70 | -9.27 | 12.07 | -5.85 | 33.46 | -15.22 | 14.81 | -7.21 | 33.28 | -10.71 | 12.57 | -11.27 |
| 33.70 | -10.32 | 12.00 | -5.86 | 33.46 | -16.22 | 14.72 | -7.21 | 33.28 | -11.74 | 12.48 | -12.27 |
| 33.72 | -11.37 | 11.93 | -5.86 | 33.46 | -17.21 | 14.64 | -7.21 | 33.30 | -12.77 | 12.48 | -13.26 |
| 33.74 | -12.43 | 11.86 | -6.91 | 33.46 | -18.20 | 14.55 | -7.21 | 33.30 | -13.80 | 12.39 | -14.26 |
| 33.74 | -13.48 | 11.79 | -6.91 | 33.46 | -19.20 | 14.47 | -8.20 | 33.30 | -14.83 | 12.39 | -15.25 |
| 33.74 | -14.52 | 11.72 | -6.92 | 33.46 | -20.19 | 14.38 | -8.20 | 33.30 | -15.87 | 12.31 | -16.24 |
| 33.76 | -14.53 | 11.65 | -7.97 | 33.46 | -21.18 | 14.30 | -8.20 | 33.30 | -16.90 | 12.31 | -17.23 |
| 33.78 | -15.59 | 11.58 | -7.97 | 33.46 | -22.18 | 14.21 | -9.19 | 33.30 | -17.93 | 12.22 | -18.23 |
| 33.78 | -16.64 | 11.51 | -9.02 | 33.46 | -23.17 | 14.12 | -9.19 | 33.30 | -18.97 | 12.22 | -19.22 |
| 33.78 | -17.69 | 11.44 | -9.02 | 33.50 | -24.16 | 14.04 | -9.19 | 33.28 | -20.01 | 12.22 | -20.21 |
| 33.80 | -18.74 | 11.36 | -10.07 | 33.50 | -25.16 | 13.95 | -9.19 | 33.28 | -21.05 | 12.14 | -21.21 |
| 33.80 | -19.79 | 11.29 | -10.07 | 33.50 | -26.15 | 13.87 | -10.19 | 33.30 | -22.07 | 12.05 | -22.20 |
| 33.80 | -20.84 | 11.29 | -11.11 | 33.50 | -27.14 | 13.78 | -10.19 | 33.30 | -23.10 | 12.05 | -23.19 |
| 33.80 | -21.89 | 11.22 | -11.12 | 33.50 | -28.14 | 13.70 | -10.19 | 33.30 | -24.14 | 12.05 | -24.19 |
| 33.80 | -22.93 | 11.15 | -11.12 | 33.50 | -29.13 | 13.61 | -10.19 | 33.30 | -25.17 | 11.97 | -25.18 |
| 33.82 | -23.99 | 11.08 | -11.13 | 33.50 | -30.12 | 13.53 | -11.18 | 33.30 | -26.20 | 11.88 | -26.18 |
| 33.82 | -25.04 | 11.08 | -12.17 | 33.50 | -31.12 | 13.44 | -11.18 | 33.32 | -27.23 | 11.88 | -27.17 |
| 33.82 | -26.08 | 11.01 | -13.22 | 33.50 | -32.11 | 13.36 | -12.17 | 33.32 | -28.26 | 11.80 | -28.16 |
| 33.82 | -27.13 | 10.94 | -13.22 | 33.50 | -33.11 | 13.27 | -12.17 | 33.34 | -29.28 | 11.80 | -29.16 |
| 33.84 | -28.19 | 10.87 | -13.22 | 33.50 | -34.10 | 13.19 | -12.17 | 33.34 | -30.32 | 11.71 | -29.16 |
| 33.84 | -29.24 | 10.80 | -14.27 | 33.50 | -35.09 | 13.10 | -12.17 | 33.36 | -31.34 | 11.71 | -30.15 |
| 33.84 | -30.28 | 10.73 | -15.32 | 33.50 | -36.09 | 13.02 | -12.17 | 33.38 | -32.36 | 11.71 | -31.14 |
| 33.84 | -31.33 | 10.66 | -15.32 | 33.50 | -37.08 | 12.93 | -12.17 | 33.38 | -33.40 | 11.71 | -32.13 |
| 33.84 | -32.38 | 10.59 | -15.33 | 33.50 | -38.07 | 12.85 | -12.17 | 33.40 | -34.42 | 11.63 | -33.13 |
| 33.84 | -33.42 | 10.52 | -15.33 | 33.50 | -39.07 | 12.76 | -13.17 | 33.42 | -35.44 | 11.63 | -34.12 |
| 33.84 | -34.47 | 10.45 | -16.38 | 33.50 | -40.06 | 12.67 | -13.17 | 33.42 | -36.48 | 11.63 | -35.11 |
| 33.84 | -35.52 | 10.38 | -17.42 | 33.50 | -41.06 | 12.59 | -13.17 | 33.42 | -37.51 | 11.63 | -36.10 |
| 33.84 | -36.57 | 10.38 | -18.46 | 33.50 | -42.05 | 12.50 | -13.17 | 33.44 | -38.53 | 11.54 | -37.10 |
| 33.84 | -37.61 | 10.38 | -19.51 | 33.50 | -43.04 | 12.42 | -13.17 | 33.44 | -39.57 | 11.54 | -38.09 |
| 33.84 | -38.66 | 10.38 | -20.55 | 33.54 | -44.03 | 12.33 | -14.16 | 33.44 | -40.60 | 11.46 | -39.09 |
| 33.84 | -39.71 | 10.38 | -21.59 | 33.54 | -45.03 | 12.25 | -14.16 | 33.44 | -41.64 | 11.37 | -40.08 |
| 33.84 | -40.75 | 10.38 | -22.63 | 33.54 | -46.02 | 12.16 | -14.16 | 33.46 | -42.66 | 11.29 | -41.08 |
| 33.84 | -41.80 | 10.38 | -23.67 | 33.54 | -47.01 | 12.08 | -14.16 | 33.46 | -43.69 | 11.20 | -42.07 |
| 33.84 | -42.85 | 10.38 | -24.71 | 33.54 | -48.01 | 11.99 | -15.16 | 33.46 | -44.73 | 11.20 | -43.06 |
| 33.84 | -43.90 | 10.38 | -25.76 | 33.57 | -49.00 | 11.91 | -15.16 | 33.46 | -45.76 | 11.20 | -44.05 |
| 33.84 | -44.94 | 10.38 | -26.80 | 33.57 | -49.99 | 11.82 | -15.16 | 33.46 | -46.79 | 11.12 | -45.05 |

## Table B1 (continued)

| Upwelling (July) | | | | Transition-Oceanic (Sept) | | | | Davidson (Jan) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2011 Profile | | 2011 Profile | | 2004.2 Profile | | 2004.1 Profile | | 2011 Profile | | 2004 Profile | |
| S (ppt) | Z (m) | T ($^{o}$C) | Z (m) | S (ppt) | Z (m) | T ($^{o}$C) | Z (m) | S (ppt) | Z (m) | T ($^{o}$C) | Z (m) |
| 33.84 | -45.99 | 10.38 | -27.84 | | | 11.82 | -16.15 | 33.48 | -47.82 | 11.03 | -46.05 |
| 33.86 | -47.05 | 10.38 | -28.88 | | | 11.74 | -17.14 | 33.50 | -48.84 | 11.03 | -47.04 |
| 33.86 | -48.09 | 10.38 | -29.92 | | | 11.65 | -18.14 | 33.50 | -49.87 | 10.95 | -48.03 |
| 33.86 | -49.14 | 10.38 | -30.97 | | | 11.57 | -18.14 | 33.51 | -50.90 | 10.86 | -49.03 |
| 33.86 | -50.19 | 10.37 | -32.01 | | | 11.48 | -18.14 | 33.51 | -51.93 | 10.86 | -50.02 |
| 33.86 | -51.23 | 10.37 | -33.05 | | | 11.39 | -18.14 | 33.53 | -52.95 | 10.77 | -51.01 |
| 33.86 | -52.28 | 10.30 | -34.09 | | | 11.31 | -18.14 | 33.53 | -53.99 | 10.77 | -52.01 |
| | | 10.30 | -35.14 | | | 11.22 | -19.13 | | | 10.77 | -53.00 |
| | | 10.30 | -36.18 | | | 11.22 | -20.12 | | | 10.69 | -53.99 |
| | | 10.30 | -37.22 | | | 11.14 | -20.12 | | | 10.69 | -54.98 |
| | | 10.30 | -38.26 | | | 11.14 | -21.12 | | | | |
| | | 10.30 | -39.30 | | | 11.05 | -21.12 | | | | |
| | | 10.30 | -40.34 | | | 11.05 | -22.11 | | | | |
| | | 10.30 | -41.39 | | | 11.14 | -23.11 | | | | |
| | | 10.30 | -42.43 | | | 11.22 | -24.10 | | | | |
| | | 10.23 | -43.47 | | | 11.31 | -25.09 | | | | |
| | | 10.23 | -44.52 | | | 11.39 | -26.09 | | | | |
| | | 10.16 | -45.56 | | | 11.39 | -27.08 | | | | |
| | | 10.16 | -46.60 | | | 11.39 | -28.07 | | | | |
| | | 10.16 | -47.65 | | | 11.39 | -29.07 | | | | |
| | | 10.09 | -48.69 | | | 11.31 | -30.06 | | | | |
| | | 10.09 | -49.73 | | | 11.31 | -31.06 | | | | |
| | | 10.09 | -50.78 | | | 11.22 | -32.05 | | | | |
| | | 10.02 | -51.82 | | | 11.22 | -33.04 | | | | |
| | | | | | | 11.22 | -34.04 | | | | |
| | | | | | | 11.14 | -35.03 | | | | |
| | | | | | | 11.05 | -36.02 | | | | |
| | | | | | | 11.05 | -37.02 | | | | |
| | | | | | | 10.97 | -38.01 | | | | |
| | | | | | | 10.88 | -39.01 | | | | |
| | | | | | | 10.88 | -40.00 | | | | |
| | | | | | | 10.88 | -40.99 | | | | |
| | | | | | | 10.88 | -41.99 | | | | |
| | | | | | | 10.80 | -42.98 | | | | |
| | | | | | | 10.79 | -43.98 | | | | |
| | | | | | | 10.79 | -44.97 | | | | |
| | | | | | | 10.71 | -45.96 | | | | |
| | | | | | | 10.71 | -46.96 | | | | |
| | | | | | | 10.62 | -47.95 | | | | |
| | | | | | | 10.62 | -48.94 | | | | |
| | | | | | | 10.62 | -49.94 | | | | |
| | | | | | | 10.62 | -50.93 | | | | |
| | | | | | | 10.62 | -51.93 | | | | |
| | | | | | | 10.62 | -52.92 | | | | |
| | | | | | | 10.62 | -53.91 | | | | |

# APPENDIX C – ANALYSIS RESULTS FOR ADDITIONAL SCENARIOS

FLOW SCIENCE®

## Table C1- Analysis results for additional scenarios

| NO. | Flow Assumptions (mgd) | | | | TDS Assumptions (mg/L) | | | | Davidson (Jan.) | | | | Upwelling (July) | | | | Oceanic (Sept.) | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | WW | Hauled Brine | GWR Brine | Total Flow | WW | Hauled Brine | GWR brine | Total | Plume diam. (ft) | Min. Dilution | Horiz. Dist. from port (ft) | Height above port (ft) | Plume diam. (ft) | Min. Dilution | Horiz. Dist. from port (ft) | Height above port (ft) | Plume diam. (ft) | Min. Dilution | Horiz. Dist. from port (ft) | Height above port (ft) |
| ***Wastewater at design capacity*** | | | | | | | | | | | | | | | | | | | | |
| 1a | 29.6 | 0.1 | 0 | 29.7 | 800 | 40,000 | 4,000 | 932 | 23 | 143 | 34 | 75 | 19 | 136 | 31 | 64 | 17 | 126 | 30 | 58 |
| 1b | 24.7 | 0.1 | 0.94 | 25.7 | 800 | 40,000 | 4,000 | 1069 | 22 | 152 | 31 | 73 | 18 | 144 | 28 | 63 | 17 | 134 | 28 | 57 |
| ***Sensitivity Analysis: GWR Brine Flow*** | | | | | | | | | | | | | | | | | | | | |
| 2a | 0 | 0.1 | 0.41 | 0.51 | 800 | 40,000 | 4,000 | 11059 | 6 | 240 | 4 | 20 | 12 | 718 | 5 | 41 | 10 | 776 | 5 | 41 |
| 2b | 0 | 0.1 | 0.82 | 0.92 | 800 | 40,000 | 4,000 | 7913 | 7 | 231 | 5 | 24 | 13 | 636 | 6 | 48 | 10 | 560 | 6 | 42 |
| 2c | 0 | 0.1 | 0.3 | 0.4 | 800 | 40,000 | 4,000 | 13000 | 6 | 240 | 4 | 19 | 9 | 567 | 4 | 32 | 10 | 863 | 4 | 40 |
| ***Sensitivity Analysis: Hauled Waste Flow*** | | | | | | | | | | | | | | | | | | | | |
| 3a | 0 | 0 | 0.94 | 0.94 | 800 | 40,000 | 4,000 | 4000 | 8 | 254 | 5 | 26 | 13 | 651 | 6 | 48 | 10 | 583 | 5 | 42 |
| 3b | 0 | 1 | 0.94 | 1.94 | 800 | 40,000 | 4,000 | 22557 | 7 | 111 | 10 | 21 | 14 | 318 | 12 | 46 | 11 | 291 | 11 | 42 |
| 3c | 3 | 0 | 0.94 | 3.94 | 800 | 40,000 | 4,000 | 1563 | 11 | 209 | 10 | 39 | 14 | 336 | 11 | 54 | 12 | 283 | 10 | 47 |
| 3d | 3 | 0.1 | 0.94 | 4.04 | 800 | 40,000 | 4,000 | 2515 | 12 | 206 | 11 | 40 | 14 | 331 | 11 | 55 | 12 | 279 | 11 | 47 |
| 3e | 3 | 1 | 0.94 | 4.94 | 800 | 40,000 | 4,000 | 9344 | 12 | 168 | 13 | 38 | 14 | 277 | 13 | 54 | 12 | 231 | 13 | 47 |
| ***Sensitivity Analysis: GWR TDS*** | | | | | | | | | | | | | | | | | | | | |
| 4a | 0 | 0.1 | 0.94 | 1.04 | 800 | 40,000 | 4,000 | 7462 | 8 | 226 | 6 | 25 | 13 | 597 | 6 | 48 | 10 | 532 | 6 | 42 |
| 4b | 0 | 0.1 | 0.94 | 1.04 | 1100 | 40,000 | 5,800 | 9088 | 8 | 218 | 6 | 25 | 13 | 592 | 6 | 49 | 10 | 523 | 6 | 42 |
| 4c | 3 | 0.1 | 0.94 | 4.04 | 1100 | 40,000 | 5,800 | 3156 | 11 | 201 | 11 | 39 | 14 | 334 | 11 | 55 | 12 | 271 | 11 | 46 |
| ***Sensitivity Analysis: Hauled Waste TDS*** | | | | | | | | | | | | | | | | | | | | |
| 5a | 0 | 0.1 | 0.94 | 1.04 | 800 | 63,000 | 4,000 | 9673 | 7 | 214 | 6 | 24 | 13 | 576 | 6 | 48 | 10 | 509 | 6 | 42 |

All scenarios were analyzed using a 20 °C temperature for the combined flow discharging from 120 open ports. Analysis results are at plume trap levels.

# Appendix U

# Ocean Plan Compliance Assessment for the Pure Water Monterey Groundwater Replenishment Project

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# Appendix U1

# Ocean Plan Compliance Assessment for the Pure Water Monterey Groundwater Replenishment Project

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# Ocean Plan Compliance Assessment for the Pure Water Monterey Groundwater Replenishment Project

**Technical Memorandum**

February 2015

***Prepared for:***

Partners for Pure Water Solutions

MRWPCA

Monterey Peninsula Water Management District


Trussell Technologies Inc

1939 Harrison Street, Suite 600

Oakland, CA 94612

# Ocean Plan Compliance Assessment for the Pure Water Monterey Groundwater Replenishment Project

## Technical Memorandum

Pure Water Monterey
A Groundwater Replenishment Project

**February 2015**


Prepared By:

**Trussell Technologies, Inc.**
Gordon Williams, Ph.D., P.E.

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# 1 Introduction

The Monterey Regional Water Pollution Control Agency (MRWPCA) and the Monterey Peninsula Water Management District ("Project Partners") are in the process of developing the Pure Water Monterey Groundwater Replenishment Project ("Proposed Project"). The Proposed Project involves treating secondary effluent from the MRWPCA Regional Treatment Plant (RTP) through the proposed Advanced Water Treatment Facility (AWT Facility) and then injecting this highly purified recycled water into the Seaside Groundwater Basin, later extracting it for replacement of existing municipal water supplies. The Proposed Project will also provide additional tertiary recycled water for agricultural irrigation in northern Salinas Valley as part of the Castroville Seawater Intrusion Project (CISP). A waste stream, known as the reverse osmosis concentrate ("RO concentrate"), would be generated by the AWT Facility and discharged through the existing MRWPCA ocean outfall. The goal of this technical memorandum is to analyze whether the discharge of the Proposed Project's RO concentrate to the ocean through the existing outfall would impact marine water quality, and thus, human health, marine biological resources, or beneficial uses of the receiving waters.

## 1.1 Treatment through the RTP and AWT Facility

The existing MRWPCA RTP treatment process includes screening, primary sedimentation, secondary biological treatment through trickling filters (TFs), followed by a solids contactor (*i.e.*, bio-flocculation), and then clarification (Figure 1). Much of the secondary effluent undergoes tertiary treatment (granular media filtration and disinfection) to produce recycled water used for agricultural irrigation. The unused secondary effluent is discharged to the Monterey Bay through the MRWPCA Outfall. MRWPCA also accepts trucked brine waste for ocean disposal, which is stored in a pond and mixed with secondary effluent for disposal.

The proposed AWT Facility would include several advanced treatment technologies for purifying the secondary effluent water: ozone ($O_3$), biologically active filtration (BAF) (this is an optional unit process), membrane filtration (MF), reverse osmosis (RO), and an advanced oxidation process (AOP) using UV-hydrogen peroxide. The Project Partners conducted a pilot-scale study of the ozone, MF, and RO elements of the AWT Facility from December 2013 through July 2014, successfully demonstrating the ability of the various treatment processes to produce highly-purified recycled water that complies with the California Groundwater Replenishment Using Recycled Water Regulations (Groundwater Replenishment Regulations) and Central Coast Water Quality Control Plan (Basin Plan) standards, objectives and guidelines for groundwater.

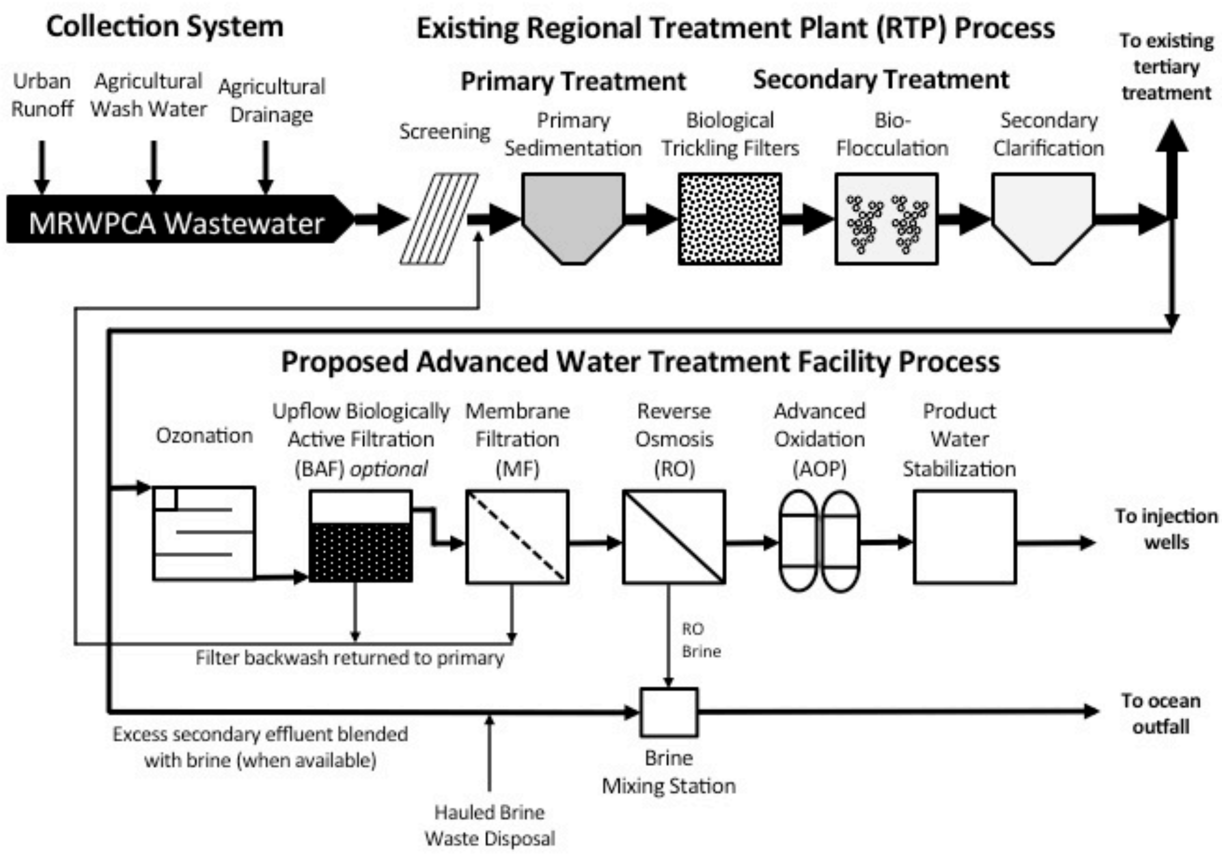


**Figure 1 – Simplified diagram of existing MRWPCA RTP and proposed AWT Facility treatment**

Reverse osmosis is an excellent removal process, separating out most dissolved constituents from the recycled water. The dissolved constituents removed through RO are concentrated into a waste stream known as the RO concentrate. Unlike the waste streams from the BAF and MF, the RO concentrate cannot be recycled back to the RTP headworks and would be discharged through the MRWPCA Outfall. Discharges through the outfall are subject to National Pollution Discharge Elimination System (NPDES) permitting, which is based on the California State Water Resources Control Board 2012 Ocean Plan ("Ocean Plan"). Monitoring of the RO concentrate was conducted during the Proposed Project's pilot-scale study.

## 1.2 California Ocean Plan

The Ocean Plan sets forth water quality objectives for ocean discharges with the intent of preserving the quality of the ocean water for beneficial uses, including the protection of both human and aquatic ecosystem health (SWRCB, 2012). For typical wastewater discharges, when released from an outfall, the wastewater and ocean water undergo rapid mixing due to the momentum and buoyancy of the discharge.[1] The mixing occurring in the rising plume is affected

[1] Municipal wastewater effluent, being effectively fresh water, is less dense than seawater and thus rises (due to buoyancy) while it mixes with ocean water.

by the buoyancy and momentum of the discharge, a process referred to as initial dilution (NRC, 1993). The Ocean Plan objectives are to be met after the initial dilution of the discharge into the ocean. The initial dilution occurs in an area known as the zone of initial dilution (ZID). The extent of dilution in the ZID is quantified as the minimum probable initial dilution ($D_m$). The water quality objectives established in the Ocean Plan are adjusted by the $D_m$ to derive the NPDES ocean discharge limits for a wastewater discharge prior to ocean dilution.

The current MRWPCA wastewater discharge is governed by NPDES permit R3-2014-0013 issued by the Central Coast Regional Water Quality Control Board (RWQCB). Because the existing NPDES permit for the MRWPCA ocean outfall must be amended to discharge the RO concentrate, comparing future discharge concentrations to current NPDES permit limits would not be an appropriate metric or threshold for determining whether the Proposed Project would have a significant impact on marine water quality. Instead, compliance with the Ocean Plan objectives was selected as an appropriate threshold for determining whether or not the Proposed Project would result in a significant impact requiring mitigation. Modeling of the Proposed Project ocean discharge was conducted by FlowScience, Inc. to determine $D_m$ values for the various discharge scenarios. The ocean modeling results were combined with projected discharge water quality to assess compliance with the Ocean Plan.

## 1.3 Objective of Technical Memorandum

Trussell Technologies, Inc. (Trussell Tech) estimated worst-case water quality for the Proposed Project ocean discharge water in-pipe (*i.e.*, prior to being discharged through the outfall and diluted in the ocean) and used the FlowScience ocean discharge modeling results to provide an assessment of whether the Proposed Project would consistently meet Ocean Plan water quality objectives. The purpose of this technical memorandum is to summarize the assumptions, methodology, results and conclusions of the Ocean Plan compliance assessment.

# 2 Methodology for Ocean Plan Compliance

To analyze impacts due to ocean discharge of RO concentrate, the Proposed Project technical team (Trussell Tech with MRWPCA staff) conducted a thorough water quality and flow characterization of the proposed sources of water to be diverted into the wastewater collection system that, after primary and secondary treatment, will be used as influent to the AWT Facility. The team collected all available water quality data for secondary effluent and water quality monitoring results for the Proposed Project new source waters.[2] Using the full suite of data, the team was able to estimate the future worst-case water quality of the combined ocean discharge. With the results of ocean modeling, concentrations at the edge of the ZID were estimated to determine the ability of the Proposed Project to comply with the Ocean Plan. The purpose of this section is to outline the methodology used to make this determination. A summary of the methodology is presented in Figure 2.

## 2.1 Methodology for Determination of Discharge Water Quality

Water quality data for three types of discharge waters were used to estimate the future combined water quality in the ocean outfall discharge under Proposed Project conditions: (1) the RTP secondary effluent, (2) hauled brine waste (discussed in Section 2.1.3), and (3) the Proposed Project RO concentrate. First, Trussell Tech estimated the potential influence of the new source waters (*e.g.*, agricultural wash water and agricultural drainage waters) on the worst-case water quality for each of the three types of discharge water. The volumetric contribution of each new source water would change under the different flow scenarios that could occur under the Proposed Project. MRWPCA staff estimated the volume that would be collected from source water for each month of the different types of operational years for the Proposed Project (Bob Holden, Source Water Scenarios Spreadsheet, October 16, 2014)[3]. All of the different flow scenarios were considered in developing the assumed worst-case concentrations for the Ocean Plan constituents in the secondary effluent. This conservative approach used the highest observed concentrations from all data sources for each source water in the analysis[4]. Once the estimated worst-case water quality was determined for the RTP secondary effluent, these values were used in estimating the worst-case water qualities for the hauled brine waste and the

[2] A one-year monitoring program from July 2013 to June 2014 was conducted for five of the potential source waters. Regular monthly and quarterly sampling was carried out for the RTP secondary effluent, agricultural wash water, and Blanco Drain drainage water. Limited sampling of stormwater from Lake El Estero was performed due to seasonal availability, and there was one sampling event for the Tembladero Slough drainage water.

[3] The monthly flows for each source water were estimated by MRWPCA staff for three types of operational years: (1) wet/normal years where a drought reserve is being built, (2) wet/normal years where the drought reserve has been met, and (3) a drought year. Further, two phases of the Proposed Project have been defined for each of these types of years (Phase A and Phase B).

[4] The exception to this statement is cyanide. Only cyanide data collected from April 2005 through January 2011, as part of the NPDES monitoring program, were used in the analysis. In mid-2011, Monterey Bay Analytical Service (MBAS) began performing the cyanide analysis on the RTP effluent, at which time the reported values increased by an order of magnitude. Because no operational or source water composition changes took place at this time that would result in such an increase, it is reasonable to conclude the increase is an artifact of the change in analysis method and therefore the results were questionable. Therefore, although the cyanide concentrations reported by MBAS are presented separately; they are not used in the analysis for evaluating compliance with the Ocean Plan objectives for the EIR.

Proposed Project RO concentrate, as appropriate. The methodology for each type of water is further described in this section.

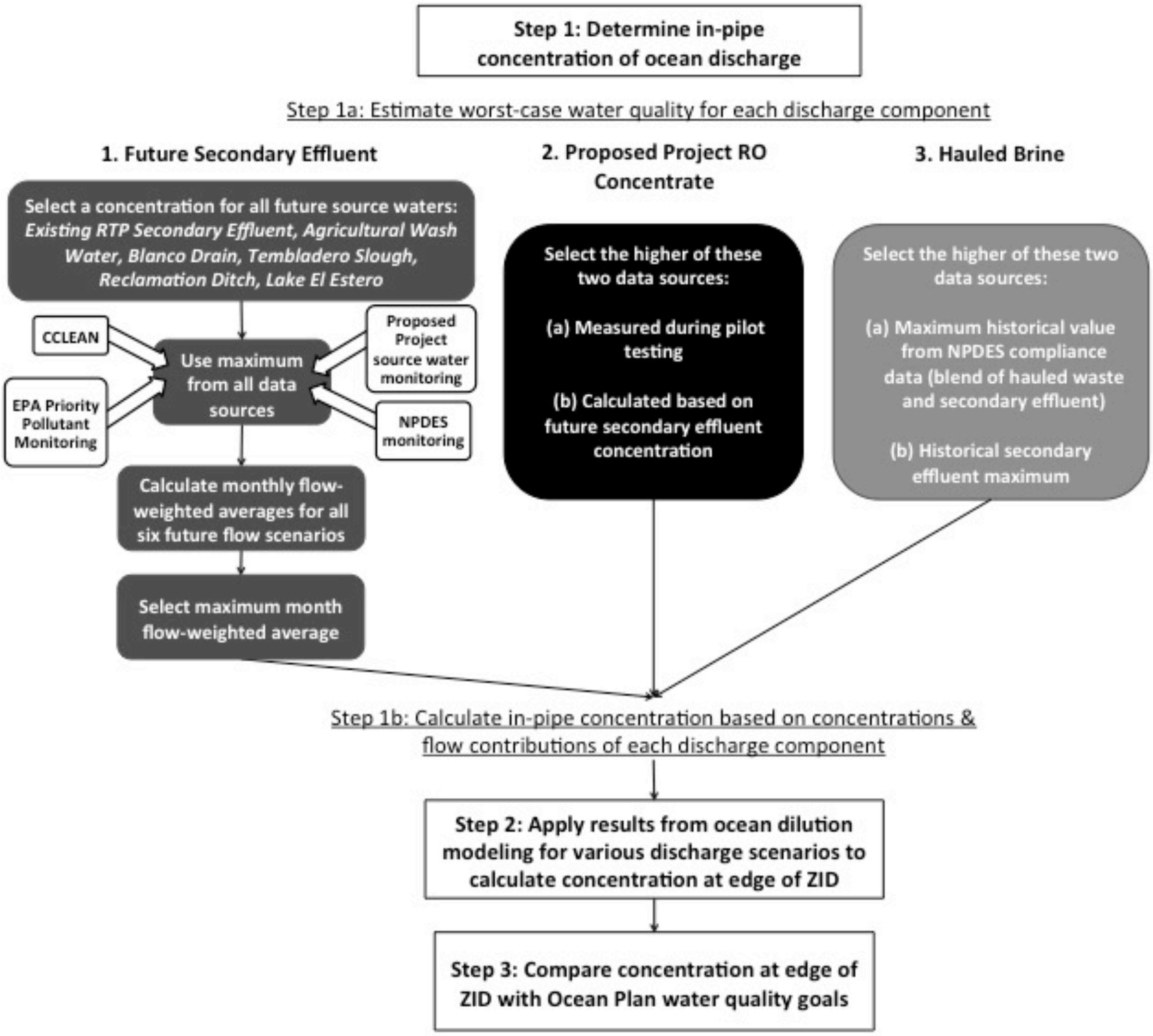


**Figure 2 – Logic flow-chart for determination of project compliance with the Ocean Plan objectives**

### 2.1.1 Future Secondary Effluent

Because the Proposed Project involves bringing new source waters into the RTP, the water quality of those source waters as well as the existing secondary effluent needed to be taken into account to estimate the water quality of the future secondary effluent. The following sources of data were considered for selecting an existing secondary effluent concentration for each constituent in the analysis:

- Source water monitoring conducted for the Proposed Project from July 2013 through June 2014
- Historical NPDES compliance data collected semi-annually by MRWPCA (2005-2014)

- Historical Priority Pollutant data collected annually by MRWPCA (2004-2014)
- Data collected by the Central Coast Long-Term Environmental Assessment Network (CCLEAN) (2008-2013)

The existing secondary effluent concentration for each constituent selected for the analysis was the maximum reported value from the above sources.

Only one data source was available for several of the new source waters (*i.e.*, agricultural wash water, Blanco Drain, Tembladero Slough, and the Reclamation Ditch[5]), namely, data collected during the source water monitoring conducted for the Proposed Project. From these data, the maximum observed concentration was selected for each source water.

Source water flows used for calculation of blended future secondary effluent concentrations were taken from the six projected operational conditions prepared by MRWPCA staff – Phase A and B for the three conditions: (a) normal/wet year, building reserve, (b) normal/wet year, full reserve, and (c) drought year[6]. For each constituent, a total of 72 future concentrations were calculated – 12 months of the year for the 6 projected future source water flow contributions. Of these concentrations, a maximum monthly flow-weighted concentration was selected for each constituent to be used for the Ocean Plan compliance analysis.

When a constituent cannot be quantified or is not detected, it is reported as less than the Method Reporting Limit (<MRL).[7] Because the actual concentration could be any value equal to or less than the MRL, the conservative approach is to use the value of the MRL in the flow-weighting calculations. In some cases, constituents were not detected in any of the source waters; in this case, the values are reported as ND(<X), where X is the MRL. For some non-detected constituents, the MRL exceeds the Ocean Plan objective, and thus no compliance determination can be made[8].

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[5] For the Reclamation Ditch, water quality data related to the Ocean Plan were not available. Concentrations for the Reclamation Ditch were conservatively assumed to be the higher of either the Blanco Drain or Tembladero Slough concentration.

[6] An alternative scenario exists in which all reasonably available source waters are diverted to the RTP regardless of whether there is demand for recycled water (spreadsheet provided by Larry Hampson, October 17, 2014). This scenario was not evaluated here because it would represent an unlikely flow scenario in which there would be RTP effluent discharged to the ocean in the summer months. Trussell Technologies performed an analysis using this alternative scenario and estimated that the concentrations of the Ocean Plan constituents would be less than or equal to the estimated concentrations of the primary scenarios used in this memorandum, and thus further analysis of the alternative scenario is not included.

[7] The lowest amount of an analyte in a sample that can be quantitatively determined with stated, acceptable precision and accuracy under stated analytical conditions (*i.e.*, the lower limit of quantitation). Therefore, acceptable quality control and quality assurance procedures are calibrated to the MRL, or lower. To take into account day-to-day fluctuations in instrument sensitivity, analyst performance, and other factors, the MRL is established at three times the Method Detection Limit (or greater). The Method Detection Limit is the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. (40 Code of Federal Regulations Section136 Appendix B).

[8] This phenomenon is common in the implementation of the Ocean Plan where for some constituents, suitable analytical methods are not capable of measuring low enough to quantify the minimum toxicologically relevant concentrations. For these constituents, a discharge is considered compliant if the monitoring results are less than the MRL.

The following approaches were used for addressing the cases where a constituent was reported as less than the MRL:

- **Aggregate constituents with multiple congeners or sub-components:** Some Ocean Plan constituents are a combination of multiple congeners or sub-components (*e.g.*, chlordane, PAHs, PCBs, and TCDD equivalents). Per the Ocean Plan, if individual congeners or sub-components are below the MRL, they are assumed to be zero for the purposes of calculating the aggregate parameter.
- **Combining different types of waters:** The same approach to constituents that were below the MRL was used for both combining different source waters (*i.e.*, predicting future secondary effluent concentrations based on source water contributions) *and* for combining the different discharge components (*i.e.*, RTP secondary effluent, hauled brine, and RO concentrate). For each constituent:
    - ***When all waters had maximum values reported above the MRL*:** The flow-weighted average of the maximum detected concentrations was used when all water had values reported above the MRL.
    - ***When some waters had maximum values reported as less than the MRL*:**
        - When the MRL was *more* than two orders of magnitude greater (*i.e.*, more than 100 times greater) than the highest detected value from the other waters, the waters with maximum concentrations below the MRL were ignored (*i.e.* treated as having a concentration of zero). This case is exclusive to times when CCLEAN data were reported as detections for the RTP secondary effluent, and all of the other source waters were below the MRL[9]. The analytical methods used for CCLEAN are capable of detecting concentrations many orders of magnitude below the detection limits for traditional methods, and thus to include the <MRL from the other methods would overshadow the CCLEAN data. Additionally, in cases where the traditional analytical method had an MRL greater than the Ocean Plan objective, performing the analysis using the high MRL from the non-CCLEAN methods would result in an inability to make a compliance determination for these constituents.
        - When the MRL was *within* two orders of magnitude or less (*i.e.*, less than 100 times greater) than the highest detected value from the other waters, the constituents that were reported as less than the MRL and were assumed to have a concentration at the MRL for the purposes of calculating a flow-weighted average.
    - ***All waters had maximum values reported as less than the MRL*:** A flow-weighted average MRL was calculated for the constituent and the result was reported as less than this combined MRL. For constituents where multiple MRLs exist for the same water (due to different laboratory analysis methods or dilutions), the lowest MRL was used.

[9] Specifically, this case applies to endrin, chlordane, heptachlor epoxide, hexachlorobenzene, hexachlorobutadiene, PCBs, and toxaphene.

### 2.1.2 GWR RO Concentrate

Two potential worst-case concentrations were available for the Proposed Project RO concentrate:

- Measured in the concentrate during pilot testing
- Calculated from the blended future secondary effluent concentration, using the following treatment assumptions[10]:
  - No removal prior to the RO process (*i.e.*, at the RTP or AWT Facility ozone or MF)
  - 81% RO recovery (*i.e.*, of the water feeding into the RO system, 81% is product water, also known as permeate, and 19% is the RO concentrate)
  - Complete rejection of each constituent by the RO membrane

The higher of these two values was selected as the final concentration of the RO concentrate for all constituents, except as noted in the Appendix footnotes.

### 2.1.3 Hauled Brine

Currently, small volumes of brine water are trucked to the RTP and blended with secondary effluent in a brine pond. The waste from this pond ("hauled brine") is then discharged along with the secondary effluent bound for ocean discharge (if there is any). For the Proposed Project, the hauled brine would be discharged with both secondary effluent and RO concentrate (see Figure 1). The point at which the hauled brine is added to the ocean discharge water is downstream of the AWT Facility intake, and thus it would not impact the quality of the Proposed Project product water or the RO concentrate. Currently, all sampling of the hauled brine takes place after dilution by secondary effluent in the brine pond, and so the data represent a mix of secondary effluent and brine water. It is appropriate to use these data for the hauled brine quality since the practice of diluting with secondary effluent will continue in the future. Two potential values were available for the hauled brine concentration:

- Historical NPDES compliance data collected semi-annually by MRWPCA (2005-2013) of hauled brine water diluted with existing secondary effluent
- Future secondary effluent concentration, as previously described

The higher of these two values was selected for all constituents; because the hauled brine is diluted by secondary effluent prior to discharge, it is also appropriate to use future secondary effluent concentrations to represent the concentration within hauled brine. Even if a constituent were not present in the hauled brine, if it is present in the secondary effluent it would be present in the combined discharge.

### 2.1.4 Combined Ocean Discharge Concentrations

Having calculated the worst-case future concentrations for each of the three discharge components, the combined concentration prior to discharge was determined as a flow-weighted average of the contributions of each of the three discharge components. As discussed in Section 3.1, a range of secondary effluent flow conditions was considered.

[10] Based on the treatment assumptions, the RO concentrate would equal 5.3 times the AWT Facility influent (*i.e.*, blended future secondary effluent) concentration.

## 2.2 Ocean Modeling and Ocean Plan Compliance Analysis Methodology

In order to determine Ocean Plan compliance, Trussell Tech used the following information: (1) the in-pipe (*i.e.*, pre-ocean dilution) concentration of a constituent ($C_{\text{in-pipe}}$) that was developed as discussed in the previous section, (2) the minimum probable dilution for the ocean mixing ($D_m$) for the relevant discharge flow scenarios that was modeled by FlowScience (FlowScience, 2014), and (3) the background concentration of the constituent in the ocean ($C_{Background}$) that is specified in the Ocean Plan's "Table 3". With this information the concentration at the edge of the zone of initial dilution ($C_{ZID}$) was calculated using the following equation:

$$C_{ZID} = \frac{C_{In-pipe} + D_m * C_{Background}}{1 + D_m} \qquad (1)$$

The $C_{ZID}$ was then compared to the Ocean Plan objectives[11] in the Ocean Plan's "Table 1" (SWRCB, 2012). As described previously, the in-pipe concentration was estimated as a flow-weighted average of the future secondary effluent, Proposed Project RO concentrate, and hauled brine with the concentrations determined as discussed above. The $D_m$ values for various flow scenarios were determined by modeling (see FlowScience, 2014). Note that this approach could not be applied for some constituents (*e.g.*, acute toxicity, chronic toxicity, and radioactivity[12]). The assumptions used by FlowScience for the ocean discharge dilution modeling are as follows:

- **Flow**: A sensitivity analysis of relationship between $D_m$ and flow rate was performed for the various discharges types. The greatest $D_m$ sensitivity to flow changes was to variations in the RTP secondary effluent flow. To simplify the analysis, the flow scenarios used in the compliance analysis only considered the maximum flows for the hauled brine and the RO concentrate, because these flows result in the lowest $D_m$, thus making the analysis conservative. The flows considered for each discharge type are as follows:
  - ***Secondary effluent*****:** a range of conditions was modeled that reflect realistic future discharge scenarios (minimum flow, moderate flow, and maximum flow).
  - ***Proposed Project RO concentrate*****:** 0.94 million gallons per day (mgd), which would be the resulting RO concentrate flow when the AWT Facility is producing

[11] Note that the Ocean Plan (see Ocean Plan Table 2) also defines effluent limitations for oil and grease, suspended solids, settable solids, turbidity, and pH; however, it was not necessary to evaluate these parameters in this assessment. If necessary, the pH of the water would be adjusted to be within acceptable limits prior to discharge. Oil and grease, suspended solids, settable solids, and turbidity do not need to be considered in this analysis as the RO concentrate would be significantly better than the secondary effluent with regards to these parameters. Prior to the RO treatment, the process flow would be treated by MF, which will reduce these parameters, and the waste stream from the MF will be returned to RTP headworks.

[12] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based on the nature of the constituent. These constituents were measured individually for the secondary effluent and RO concentrate, and these individual concentrations would comply with the Ocean Plan objectives (Trussell Technologies, 2014 and 2015). See section 3.4.

4.0 mgd of highly-purified recycled water (corresponds to treating 5.49 mgd of RTP secondary effluent); although the AWT Facility will not be operated at this influent flowrate year round, this is the highest potential RO concentrate flow
    - ***Hauled brine:*** 0.1 mgd, which is the maximum anticipated value (blend of secondary effluent and hauled brine) anticipated by MRWPCA.
- **Total Dissolved Solids (TDS)**: the greatest dilution is achieved when the salinity of the discharge water is the most different from the ambient salinity; therefore, the most conservative TDS will be the highest (*i.e.*, closest to ambient salinity) of:
    - ***Secondary effluent:*** 1,100 milligram per liter (mg/L), which is the maximum expected future TDS, taking into account the flow contribution of each source water and the maximum observed TDS value from each source water
    - ***Proposed Project RO concentrate*****:** 5,800 mg/L, which is the maximum expected future TDS based on the maximum expected future secondary effluent TDS and the RO treatment assumptions listed in the section above (*i.e.* in a drought year).
    - ***Hauled brine***: 40,000 mg/L, which is the maximum anticipated value (blend of secondary effluent and hauled brine) from MRWPCA.
- **Ambient salinity**: 33,500 mg/L
- **Temperature**: 20°C

An additional consideration of the ocean dilution modeling is the variation in ocean conditions throughout the year. Three conditions were modeled for all flow scenarios: Davidson (November to March), Upwelling (April to August), and Oceanic (September to October)[13]. In order to conservatively demonstrate Ocean Plan compliance, the lowest $D_m$ from the applicable ocean conditions was used for each flow scenario.

Ocean dilution modeling covered a range of secondary effluent flowrates between 0 and 24.7 mgd[14], and the results showed that Ocean Plan compliance would be achieved when considering all potential secondary effluent flowrates. To simplify the calculation and presentation of these results, representative flowrate ranges were chosen. In order to select the representative flow scenarios to use for the compliance assessment, the balance between in-pipe dilution and dilution through the outfall needed to be taken into account. In general, higher secondary effluent flows being discharged to the ocean would provide dilution of the Proposed Project RO concentrate; however, greater dilution due to ocean water mixing would be provided at lower wastewater discharge flows. The balance of these influences was considered in determining compliance under the five representative discharge conditions that are described in Section 3.2 for the Proposed Project.

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[13] Note that these ranges assign the transitional months to the ocean condition that is typically more restrictive at relevant discharge flows.

[14] The 24.7 mgd represents the secondary effluent flow if the RTP is operating at its design capacity of 29.6 mgd, and there is a net flow of 4.9 mgd to the AWT Facility (a total flow of approximately 5.46 mgd would be sent to the AWT Facility, but 0.55 mgd of MF backwash water is returned to the RTP headworks from the AWT Facility).

# 3 Ocean Plan Compliance Results

## 3.1 Water Quality of Combined Discharge

As described above, the first step in the Ocean Plan compliance analysis was to estimate the worst-case water quality for each of the three future discharge components: future RTP effluent, Proposed Project RO concentrate, and hauled brine waste. A summary of the estimated water qualities of these components is given in Table 1. Additional considerations and assumptions for each constituent are documented in the Table 1 notes section.

**Table 1 – Summary of estimated worst-case water quality for the three waters that would be discharged through the ocean outfall**

| Constituent | Units | Secondary Effluent | Hauled Brine | RO Concentrate | Notes |
|---|---|---|---|---|---|
| ***Ocean Plan water quality objectives for protection of marine aquatic life*** | | | | | |
| Arsenic | µg/L | 45 | 45 | 12 | 1,12 |
| Cadmium | µg/L | 1.2 | 1.2 | 6.4 | 2,11 |
| Chromium (Hexavalent) | µg/L | 2.7 | 130 | 14 | 2,11 |
| Copper | µg/L | 25.9 | 39 | 136 | 2,11 |
| Lead | µg/L | 0.82 | 0.82 | 4.3 | 2,11 |
| Mercury | µg/L | 0.089 | 0.089 | 0.510 | 5,12 |
| Nickel | µg/L | 13.1 | 13.1 | 69 | 2,11 |
| Selenium | µg/L | 6.5 | 75 | 34 | 2,11 |
| Silver | µg/L | *ND(<1.59)* | ND(<1.59) | ND(<0.19) | 4,14 |
| Zinc | µg/L | 48.4 | 48.4 | 255 | 2,11 |
| Cyanide (MBAS data) | µg/L | 89.5 | 89.5 | 143 | 2,12,13,16 |
| Cyanide | µg/L | 7.2 | 46 | 38 | 6,11,16 |
| Total Chlorine Residual | µg/L | *ND(<200)* | *ND(<200)* | *ND(<200)* | 10 |
| Ammonia (as N), 6-month median | µg/L | 36,400 | 36,400 | 191,579 | 1,11 |
| Ammonia (as N), daily maximum | µg/L | 49,000 | 49,000 | 257,895 | 1,11 |
| Acute Toxicity | TUa | 2.3 | 2.3 | 0.77 | 7,12,13 |
| Chronic Toxicity | TUc | 40 | 40 | 100 | 7,12,13 |
| Phenolic Compounds (non-chlorinated) | µg/L | 69 | 69 | 363 | 1,9,11 |
| Chlorinated Phenolics | µg/L | *ND(<20)* | *ND(<20)* | ND(<20) | 4,14 |
| Endosulfan | µg/L | 0.048 | 0.048 | 0.25 | 5,9,11 |
| Endrin | µg/L | 0.000079 | 0.000079 | 0.00 | 3,11 |
| HCH (Hexachlorocyclohexane) | µg/L | 0.060 | 0.060 | 0.314 | 11 |
| Radioactivity (Gross Beta) | pCi/L | 32 | 307 | 34.8 | 1,7,12,13 |
| Radioactivity (Gross Alpha) | pCi/L | 18 | 457 | 14.4 | 1,7,12,13 |
| ***Objectives for protection of human health - noncarcinogens*** | | | | | |
| Acrolein | µg/L | 9.0 | 9.0 | 47 | 2,11 |
| Antimony | µg/L | 0.79 | 0.79 | 4 | 1,11 |
| Bis (2-chloroethoxy) methane | µg/L | *ND(<4.2)* | *ND(<4.2)* | *ND(<1)* | 4,14 |
| Bis (2-chloroisopropyl) ether | µg/L | *ND(<4.2)* | *ND(<4.2)* | *ND(<1)* | 4,14 |
| Chlorobenzene | µg/L | *ND(<0.5)* | *ND(<0.5)* | *ND(<0.5)* | 4,14 |
| Chromium (III) | µg/L | 7.3 | 87 | 38 | 1,11 |
| Di-n-butyl phthalate | µg/L | *ND(<7)* | ND(<7) | *ND(<1)* | 4,14 |
| Dichlorobenzenes | µg/L | *1.6* | *1.6* | *8* | 1,11 |
| Diethyl phthalate | µg/L | *ND(<5)* | *ND(<5)* | *ND(<1)* | 4,14 |
| Dimethyl phthalate | µg/L | *ND(<2)* | *ND(<2)* | *ND(<0.5)* | 4,14 |
| 4,6-dinitro-2-methylphenol | µg/L | *ND(<20)* | *ND(<20)* | *ND(<5)* | 4,14 |
| 2,4-dinitrophenol | µg/L | *ND(<13)* | *ND(<13)* | *ND(<5)* | 4,14 |

| Constituent | Units | Secondary Effluent | Hauled Brine | RO Concentrate | Notes |
|---|---|---|---|---|---|
| Ethylbenzene | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.5) | 4,14 |
| Fluoranthene | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.1) | 4,14 |
| Hexachlorocyclopentadiene | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.05) | 4,14 |
| Nitrobenzene | µg/L | ND(<2.3) | ND(<2.3) | ND(<1) | 4,14 |
| Thallium | µg/L | 0.69 | 0.69 | 3.7 | 2,11 |
| Toluene | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.5) | 4,14 |
| Tributyltin | µg/L | ND(<0.05) | ND(<0.05) | ND(<0.02) | 8,14 |
| 1,1,1-trichloroethane | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.5) | 4,14 |
| ***Objectives for protection of human health - carcinogens*** | | | | | |
| Acrylonitrile | µg/L | 2.5 | 2.5 | 13 | 2,11 |
| Aldrin | µg/L | ND(<0.007) | ND(<0.007) | ND(<0.01) | 4,14 |
| Benzene | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.5) | 4,14 |
| Benzidine | µg/L | ND(<19.8) | ND(<19.8) | ND(<0.05) | 4,14 |
| Beryllium | µg/L | ND(<0.69) | 0.0052 | ND(<0.5) | 4,14 |
| Bis(2-chloroethyl)ether | µg/L | ND(<4.2) | ND(<4.2) | ND(<1) | 4,14 |
| Bis(2-ethyl-hexyl)phthalate | µg/L | 78 | 78 | 411 | 1,11 |
| Carbon tetrachloride | µg/L | 0.5 | 0.5 | 2.7 | 2,11 |
| Chlordane | µg/L | 0.000735 | 0.000735 | 0.00387 | 3,9,11 |
| Chlorodibromomethane | µg/L | 2.4 | 2.4 | 13 | 2,11 |
| Chloroform | µg/L | 39 | 39 | 204 | 2,11 |
| DDT | µg/L | 0.0011 | 0.022 | 0.035 | 2,9,11 |
| 1,4-dichlorobenzene | µg/L | 1.6 | 1.6 | 8.4 | 1,11 |
| 3,3-dichlorobenzidine | µg/L | ND(<19) | ND(<19) | ND(<2) | 4,14 |
| 1,2-dichloroethane | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.5) | 4,14 |
| 1,1-dichloroethylene | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.5) | 4,14 |
| Dichlorobromomethane | µg/L | 2.6 | 2.6 | 14 | 2,11 |
| Dichloromethane (methylenechloride) | µg/L | 0.64 | 0.64 | 3.4 | 2,11 |
| 1,3-dichloropropene | µg/L | 0.56 | 0.56 | 3.0 | 2,11 |
| Dieldrin | µg/L | 0.0005 | 0.0056 | 0.0029 | 2,11 |
| 2,4-dinitrotoluene | µg/L | ND(<2) | ND(<2) | ND(<0.1) | 4,14 |
| 1,2-diphenylhydrazine (azobenzene) | µg/L | ND(<4.2) | ND(<4.2) | ND(<1) | 4,14 |
| Halomethanes | µg/L | 1.4 | 1.4 | 7.5 | 2,9,11 |
| Heptachlor | µg/L | ND(<0.01) | ND(<0.01) | ND(<0.01) | 4,14 |
| Heptachlor epoxide | µg/L | 0.000059 | 0.000059 | 0.000311 | 3,11 |
| Hexachlorobenzene | µg/L | 0.000078 | 0.000078 | 0.000411 | 3,11 |
| Hexachlorobutadiene | µg/L | 0.000009 | 0.000009 | 0.000047 | 3,11 |
| Hexachloroethane | µg/L | ND(<2.3) | ND(<2.3) | ND(<0.5) | 4,14 |
| Isophorone | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.5) | 4,14 |
| N-Nitrosodimethylamine | µg/L | 0.096 | 0.096 | 0.150 | 2,12,13 |
| N-Nitrosodi-N-Propylamine | µg/L | 0.076 | 0.076 | 0.019 | 1,12,13 |
| N-Nitrosodiphenylamine | µg/L | ND(<2.3) | ND(<2.3) | ND(<1) | 4,14 |
| PAHs | µg/L | 0.0529 | 0.0529 | 0.278 | 3,9,11 |
| PCBs | µg/L | 0.000679 | 0.000679 | 0.00357 | 3,9,11 |
| TCDD Equivalents | µg/L | 1.54E-07 | 1.54E-07 | 8.09E-07 | 8,9,11 |
| 1,1,2,2-tetrachloroethane | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.5) | 4,14 |
| Tetrachloroethylene | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.5) | 4,14 |
| Toxaphene | µg/L | 0.00709 | 0.00709 | 3.73E-02 | 3,11 |
| Trichloroethylene | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.5) | 4,14 |
| 1,1,2-trichloroethane | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.5) | 4,14 |
| 2,4,6-trichlorophenol | µg/L | ND(<2.3) | ND(<2.3) | ND(<1) | 4,14 |
| Vinyl chloride | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.5) | 4,14 |

## Table 1 Notes:

***RTP Effluent and Hauled Brine Data***

[1] Existing RTP effluent exceeds concentrations observed in other proposed source waters; the value reported is the existing secondary effluent value.
[2] The proposed new source waters may increase the secondary effluent concentration; the value reported is based on predicted source water blends.
[3] RTP effluent value is based on CCLEAN data; no other source waters were considered due to MRL differences.
[4] MRL provided represents the maximum flow-weighted MRL based on the blend of source waters.
[5] The only water with a detected concentration was the RTP effluent, however the flow-weighted concentration increases due to higher MRLs for the proposed new source waters.
[6] Additional source water data are not available; the reported value is for RTP effluent.
[7] Calculation of the flow-weighted concentration was not feasible due to constituent and the maximum observed value reported.
[8] Agricultural Wash Water data are based on an aerated sample, instead of a raw water sample.
[9] This value in the Ocean Plan is an aggregate of several congeners or compounds. Per the approach described in the Ocean Plan, for cases where the individual congeners/compounds were less than the MRL, a value of 0 is assumed in calculating the aggregate value, as the MRLs span different orders of magnitude.
[10] For all waters, it is assumed that dechlorination will be provided when needed such that the total chlorine residual will be below detection.

***RO Concentrate Data***

[11] The value presented represents a calculated value assuming no removal prior to RO, complete rejection through RO membrane, and an 81% RO recovery.
[12] The value represents the maximum value observed during the pilot testing study.
[13] The calculated value for the RO concentrate data (described in note 11) was not used in the analysis because it was not considered representative. It is expected that the value would increase as a result of treatment through the AWT Facility (*e.g.* formation of N-Nitrosodimethylamine as a disinfection by-product), or that it will not concentrate linearly through the RO (*e.g.* toxicity and radioactivity).
[14] The MRL provided represents the limit from the source water and pilot testing monitoring programs.
[15] The value presented represents a calculated value assuming 20% removal through primary and secondary treatment, 70% and 90% removal through ozone for DDT and dieldrin, respectively (based on Oram, 2008), complete rejection through the RO membrane, and an 81% RO recovery. The assumed RTP concentrations for Dieldrin and DDT do not include contributions from the agricultural drainage waters. This is because in all but one flow scenario (Scenario 4, described later), either the agricultural drainage waters are not being brought into the RTP because there is sufficient water from other sources (*e.g.* during wet and normal precipitation years), or the RTP effluent is not being discharged to the outfall (*e.g.*, summer months). In this one scenario (Scenario 4), there is a minimal discharge of secondary effluent to the ocean during a drought year under Davidson ocean conditions; for this flow scenario only, different concentrations are assumed for the RTP effluent. DDT and dieldrin concentrations of 0.022 μg/L and 0.0056 μg/L were used for Scenario 4 in the analysis.

***Cyanide Data***

[16] In mid-2011, MBAS began performing the cyanide analysis on the RTP effluent, at which time the reported values increased by an order of magnitude. Because no operational or source water composition changes took place at this time that would result in such an increase, it is reasonable to conclude the increase is an artifact of the change in analysis method and therefore questionable. Therefore, the cyanide values as measured by MBAS are listed separately from other cyanide values, and the MBAS data were not be used in the analysis for evaluating compliance with the Ocean Plan objectives for the EIR.

## 3.2 Ocean Modeling Results

FlowScience performed modeling of various discharges that include combinations of RTP secondary effluent, hauled brine waste, and Proposed Project RO concentrate (FlowScience, 2014). Year-round compliance with the Ocean Plan objectives was assessed through the evaluation of five representative discharge scenarios. All scenarios assume the maximum flow rates for the RO concentrate and hauled brine waste, which is a conservative assumption in terms of constituent loading and minimum dilution. Various secondary effluent flows were used in the compliance analysis, which represent the different types of future discharge compositions.

The five scenarios used for the compliance assessment in terms of secondary effluent flows to be discharged with the other discharges are shown in Table 2, and include:

(1) **RTP Design Capacity:** maximum flows for the Proposed Project with all 172 discharge ports open[15]. The Oceanic ocean condition was used as it represents the worst-case dilution for this flow scenario. This scenario represents the maximum (NPDES) permitted wastewater flow (with the Proposed Project in operation).

(2) **Maximum Flow under Current Port Configuration:** the maximum flow that can be discharged with the current ports configuration (130 of the 172 ports open)[16]. The Oceanic ocean condition was used as it represents the worst-case dilution for this flow scenario. This scenario was chosen as it represents the maximum wastewater flow under the existing diffuser conditions.

(3) **Minimum Wastewater Flow (Oceanic/Upwelling):** the maximum influence of the Proposed Project RO concentrate on the ocean discharge under Oceanic/Upwelling ocean conditions (*i.e.*, no secondary effluent discharged). The Oceanic ocean condition was used as it represents the worst-case dilution for this flow scenario.

(4) **Minimum Wastewater Flow (Davidson):** the maximum influence of the Proposed Project RO concentrate on the ocean discharge under Davidson ocean condition (*i.e.*, the minimum wastewater flow). Observed historic wastewater flows generally exceed 0.4 mgd during Davidson oceanic conditions. Additional source waters would be brought into the RTP if necessary to maintain the 0.4 mgd minimum.

(5) **Moderate Wastewater Flow:** conditions with a moderate wastewater flow when the Proposed Project RO concentrate has a greater influence to the water quality than in Scenarios 1 and 2, but where the ocean dilution ($D_m$) is reduced due to the higher overall discharge flow (*i.e.*, compared to Scenarios 2 and 3). The Davidson ocean condition was used as it represents the worst-case dilution for this flow scenario.

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[15] Note that this scenario would only apply if wastewater flows increased to the point that MRWPCA took action to open the 42 discharge ports that are currently closed. Scenario 2 is the maximum discharge flow under the current port configuration.

[16] For Scenarios 2 through 5, ocean modeling was performed assuming 120 ports open, which would yield more conservative $D_m$ values than 130 ports, as dilution increases with increasing numbers of open ports.

**Table 2 – Flow scenarios and modeled $D_m$ values used for Ocean Plan compliance analysis**

| No. | Discharge Scenario (Ocean Condition) | Flows (mgd) | | | $D_m$ |
|---|---|---|---|---|---|
| | | Secondary effluent | RO concentrate | Hauled brine | |
| 1 | RTP Design Capacity (Oceanic) | 24.7 | 0.94 | 0.1 | 150 |
| 2 | RTP Capacity with Current Port Configuration (Oceanic) | 23.7 | 0.94 | 0.1 | 137 |
| 3 | Minimum Wastewater Flow (Oceanic) | 0 | 0.94 | 0.1 | 523 |
| 4 | Minimum Wastewater Flow (Davidson) | 0.4 | 0.94 | 0.1 | 285 |
| 5 | Moderate Wastewater Flow Condition (Davidson) | 3 | 0.94 | 0.1 | 201 |

## 3.3 Ocean Plan Compliance Results

The flow-weighted in-pipe concentration for each constituent was then calculated for each discharge scenario using the water quality presented in Table 1 and the flows presented in Table 2. The in-pipe concentration was then used to calculate the concentration at the edge of the ZID using the $D_m$ values presented in Table 2. The resulting concentrations for each constituent in each scenario were compared to the Ocean Plan objective to assess compliance. The estimated concentrations for all five flow-scenarios are presented as concentrations at the edge of the ZID (Table 3) and as a percentage of the Ocean Plan objective (Table 4). As shown, none of the constituents are expected to exceed 80% of their Ocean Plan objective[17].

**Table 3 – Predicted concentrations of Ocean Plan constituents at the edge of the ZID**

| Constituent | Units | Ocean Plan Objective | Estimated Concentrations at Edge of ZID by Discharge Scenario | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| ***Objectives for protection of marine aquatic life*** | | | | | | | |
| Arsenic | ug/L | 8 | 3.3 | 3.3 | 3.0 | 3.1 | 3.2 |
| Cadmium | ug/L | 1 | 0.009 | 0.01 | 0.01 | 0.02 | 0.01 |
| Chromium (Hexavalent) | ug/L | 2 | 0.02 | 0.03 | 0.05 | 0.07 | 0.04 |
| Copper | ug/L | 3 | 2.2 | 2.2 | 2.2 | 2.3 | 2.2 |
| Lead | ug/L | 2 | 0.006 | 0.007 | 0.008 | 0.011 | 0.008 |
| Mercury | ug/L | 0.04 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 |
| Nickel | ug/L | 5 | 0.1 | 0.1 | 0.1 | 0.2 | 0.1 |
| Selenium | ug/L | 15 | 0.05 | 0.06 | 0.07 | 0.10 | 0.07 |
| Silver | ug/L | 0.7 | <0.17 | <0.17 | <0.16 | <0.16 | <0.17 |
| Zinc | ug/L | 20 | 8.3 | 8.3 | 8.4 | 8.6 | 8.4 |
| Cyanide (MBAS data) | ug/L | 1 | 0.61 | 0.66 | 0.26 | 0.44 | 0.50 |
| Cyanide | ug/L | 1 | 0.056 | 0.062 | 0.074 | 0.105 | 0.076 |
| Total Chlorine Residual | ug/L | 2 | <1.3 | <1.4 | <0.4 | <0.7 | <1.0 |
| Ammonia (as N) - 6-mo median | ug/L | 600 | 279 | 306 | 337 | 481 | 359 |
| Ammonia (as N) - Daily Max | ug/L | 2,400 | 375 | 413 | 454 | 648 | 483 |

[17] Aldrin, benzidine, 3,3-dichlorobenzidine and heptachlor were not detected in any source waters, however their MRLs are greater than the Ocean Plan objective. Therefore, no percentages are presented Table 4 as no compliance conclusions can be drawn for these constituents. This is a typical occurrence for ocean discharges since the MRL is higher than the ocean plan objective for some constituents.

| Constituent | Units | Ocean Plan Objective | Estimated Concentrations at Edge of ZID by Discharge Scenario | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| Acute Toxicity[a] | TUa | 0.3 | | | | | |
| Chronic Toxicity[a] | TUc | 1 | | | | | |
| Phenolic Compounds (non-chlorinated) | ug/L | 30 | 0.53 | 0.58 | 0.64 | 0.91 | 0.68 |
| Chlorinated Phenolics | ug/L | 1 | <0.13 | <0.14 | <0.04 | <0.07 | <0.10 |
| Endosulfan | ug/L | 0.009 | 0.00037 | 0.00040 | 0.00045 | 0.00064 | 0.00047 |
| Endrin | ug/L | 0.002 | 6.0E-07 | 6.7E-07 | 7.3E-07 | 1.0E-06 | 7.8E-07 |
| HCH (Hexachlorocyclohexane) | ug/L | 0.004 | 0.00046 | 0.00050 | 0.00055 | 0.00079 | 0.00059 |
| Radioactivity (Gross Beta)[a] | pci/L | – | | | | | |
| Radioactivity (Gross Alpha)[a] | pci/L | – | | | | | |
| ***Objectives for protection of human health - noncarcinogens*** | | | | | | | |
| Acrolein | ug/L | 220 | 0.07 | 0.08 | 0.08 | 0.1 | 0.09 |
| Antimony | ug/L | 1200 | 0.0060 | 0.0066 | 0.0073 | 0.010 | 0.0078 |
| Bis (2-chloroethoxy) methane | ug/L | 4.4 | <0.03 | <0.03 | <0.002 | <0.007 | <0.02 |
| Bis (2-chloroisopropyl) ether | ug/L | 1200 | <0.03 | <0.03 | <0.002 | <0.007 | <0.02 |
| Chlorobenzene | ug/L | 570 | <0.003 | <0.004 | <0.001 | <0.002 | <0.002 |
| Chromium (III) | ug/L | 190000 | 0.058 | 0.064 | 0.082 | 0.116 | 0.082 |
| Di-n-butyl phthalate | ug/L | 3500 | <0.04 | <0.05 | <0.003 | <0.01 | <0.03 |
| Dichlorobenzenes | ug/L | 5100 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 |
| Diethyl phthalate | ug/L | 33000 | <0.03 | <0.04 | <0.003 | <0.008 | <0.02 |
| Dimethyl phthalate | ug/L | 820000 | <0.01 | <0.01 | <0.001 | <0.004 | <0.008 |
| 4,6-dinitro-2-methylphenol | ug/L | 220 | <0.1 | <0.1 | <0.01 | <0.04 | <0.08 |
| 2,4-Dinitrophenol | ug/L | 4.0 | <0.08 | <0.09 | <0.01 | <0.03 | <0.06 |
| Ethylbenzene | ug/L | 4100 | <0.003 | <0.004 | <0.001 | <0.002 | <0.002 |
| Fluoranthene | ug/L | 15 | <0.003 | <0.004 | <0.0003 | <0.001 | <0.002 |
| Hexachlorocyclopentadiene | ug/L | 58 | <0.003 | <0.003 | <0.0002 | <0.001 | <0.002 |
| Nitrobenzene | ug/L | 4.9 | <0.01 | <0.02 | <0.002 | <0.005 | <0.01 |
| Thallium | ug/L | 2 | 0.005 | 0.006 | 0.006 | 0.009 | 0.007 |
| Toluene | ug/L | 85000 | <0.003 | <0.004 | <0.001 | <0.002 | <0.002 |
| Tributyltin | ug/L | 0.0014 | <0.0003 | <0.0004 | <0.00004 | <0.0001 | <0.0002 |
| 1,1,1-Trichloroethane | ug/L | 540000 | <0.003 | <0.004 | <0.001 | <0.002 | <0.002 |
| ***Objectives for protection of human health - carcinogens*** | | | | | | | |
| Acrylonitrile | ug/L | 0.10 | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 |
| Aldrin[b] | ug/L | 0.000022 | <0.00005 | <0.00005 | <0.00002 | <0.00003 | <0.00004 |
| Benzene | ug/L | 5.9 | <0.003 | <0.004 | <0.001 | <0.002 | <0.002 |
| Benzidine[b] | ug/L | 0.000069 | <0.1 | <0.1 | <0.004 | <0.02 | <0.08 |
| Beryllium | ug/L | 0.033 | 0.005 | 0.005 | 0.001 | 0.002 | 0.003 |
| Bis(2-chloroethyl)ether | ug/L | 0.045 | <0.03 | <0.03 | <0.002 | <0.007 | <0.02 |
| Bis(2-ethyl-hexyl)phthalate | ug/L | 3.5 | 0.60 | 0.66 | 0.72 | 1.03 | 0.77 |
| Carbon tetrachloride | ug/L | 0.90 | 0.004 | 0.004 | 0.005 | 0.007 | 0.005 |
| Chlordane | ug/L | 0.000023 | 5.6E-06 | 6.2E-06 | 6.8E-06 | 9.7E-06 | 7.2E-06 |
| Chlorodibromomethane | ug/L | 8.6 | 0.02 | 0.02 | 0.02 | 0.03 | 0.02 |
| Chloroform | ug/L | 130 | 0.3 | 0.3 | 0.4 | 0.5 | 0.4 |
| DDT | ug/L | 0.00017 | 1.6E-05 | 1.8E-05 | 6.4E-05 | 1.1E-04 | 4.7E-05 |
| 1,4-Dichlorobenzene | ug/L | 18 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 |
| 3,3-Dichlorobenzidine[b] | ug/L | 0.0081 | <0.1 | <0.1 | <0.01 | <0.03 | <0.1 |
| 1,2-Dichloroethane | ug/L | 28 | <0.003 | <0.004 | <0.001 | <0.002 | <0.002 |
| 1,1-Dichloroethylene | ug/L | 0.9 | 0.003 | 0.004 | 0.001 | 0.002 | 0.002 |
| Dichlorobromomethane | ug/L | 6.2 | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 |
| Dichloromethane (methylenechloride) | ug/L | 450 | 0.005 | 0.01 | 0.01 | 0.01 | 0.01 |
| 1,3-dichloropropene | ug/L | 8.9 | 0.004 | 0.005 | 0.01 | 0.01 | 0.01 |
| Dieldrin | ug/L | 0.00004 | 4.0E-06 | 4.5E-06 | 6.1E-06 | 1.3E-05 | 5.9E-06 |
| 2,4-Dinitrotoluene | ug/L | 2.6 | <0.01 | <0.01 | <0.001 | <0.003 | <0.01 |
| 1,2-Diphenylhydrazine (azobenzene) | ug/L | 0.16 | <0.03 | <0.03 | <0.002 | <0.01 | <0.02 |

| Constituent | Units | Ocean Plan Objective | Estimated Concentrations at Edge of ZID by Discharge Scenario | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| Halomethanes | ug/L | 130 | 0.011 | 0.012 | 0.013 | 0.019 | 0.014 |
| Heptachlor[b] | ug/L | 0.00005 | <0.0001 | <0.0001 | <0.00002 | <0.00003 | <0.00005 |
| Heptachlor Epoxide | ug/L | 0.00002 | 4.5E-07 | 5.0E-07 | 5.5E-07 | 7.8E-07 | 5.8E-07 |
| Hexachlorobenzene | ug/L | 0.00021 | 6.0E-07 | 6.6E-07 | 7.2E-07 | 1.0E-06 | 7.7E-07 |
| Hexachlorobutadiene | ug/L | 14 | 6.9E-08 | 7.6E-08 | 8.3E-08 | 1.2E-07 | 8.9E-08 |
| Hexachloroethane | ug/L | 2.5 | <0.01 | <0.02 | <0.001 | <0.004 | <0.01 |
| Isophorone | ug/L | 730 | <0.003 | <0.004 | <0.001 | <0.002 | <0.002 |
| N-Nitrosodimethylamine | ug/L | 7.3 | 0.001 | 0.001 | 0.0003 | 0.0005 | 0.001 |
| N-Nitrosodi-N-Propylamine | ug/L | 0.38 | 0.0005 | 0.001 | 0.00005 | 0.0001 | 0.0003 |
| N-Nitrosodiphenylamine | ug/L | 2.5 | <0.01 | <0.02 | <0.002 | <0.01 | <0.01 |
| PAHs | ug/L | 0.0088 | 0.00041 | 0.00045 | 0.00049 | 0.00070 | 0.00052 |
| PCBs | ug/L | 0.000019 | 5.20E-06 | 5.72E-06 | 6.29E-06 | 8.98E-06 | 6.70E-06 |
| TCDD Equivalents | ug/L | 3.9E-09 | 1.18E-09 | 1.30E-09 | 1.42E-09 | 2.03E-09 | 1.52E-09 |
| 1,1,2,2-Tetrachloroethane | ug/L | 2.3 | <0.003 | <0.004 | <0.001 | <0.002 | <0.002 |
| Tetrachloroethylene | ug/L | 2.0 | <0.003 | <0.004 | <0.001 | <0.002 | <0.002 |
| Toxaphene | ug/L | 2.1E-04 | 5.43E-05 | 5.97E-05 | 6.57E-05 | 9.38E-05 | 6.99E-05 |
| Trichloroethylene | ug/L | 27 | <0.003 | <0.004 | <0.001 | <0.002 | <0.002 |
| 1,1,2-Trichloroethane | ug/L | 9.4 | <0.003 | <0.004 | <0.001 | <0.002 | <0.002 |
| 2,4,6-Trichlorophenol | ug/L | 0.29 | <0.01 | <0.02 | <0.002 | <0.01 | <0.01 |
| Vinyl chloride | ug/L | 36 | <0.003 | <0.004 | <0.001 | <0.002 | <0.002 |

[a] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based the nature of the constituent. These constituents were measured individually for the secondary effluent and RO concentrate, and these individual concentrations would comply with the Ocean Plan objectives.

[b] All observed values from all data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.

**Table 4 – Predicted concentrations of all COP constituents, expressed as percent of Ocean Plan Objective**

| Constituent | Units | Ocean Plan Objective | Estimated Percentage of Ocean Plan Objective at Edge of ZID by Discharge Scenario[c] | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| ***Objectives for protection of marine aquatic life*** | | | | | | | |
| Arsenic | ug/L | 8 | 41% | 41% | 38% | 38% | 40% |
| Cadmium | ug/L | 1 | 1% | 1% | 1% | 2% | 1% |
| Chromium (Hexavalent) | ug/L | 2 | 1% | 1% | 2% | 3% | 2% |
| Copper | ug/L | 3 | 73% | 73% | 75% | 78% | 75% |
| Lead | ug/L | 2 | 0.3% | 0.3% | 0.4% | 0.5% | 0.4% |
| Mercury | ug/L | 0.04 | 14% | 14% | 15% | 16% | 15% |
| Nickel | ug/L | 5 | 2% | 2% | 2% | 3% | 3% |
| Selenium | ug/L | 15 | 0.3% | 0.4% | 0.5% | 0.7% | 0.5% |
| Silver | ug/L | 0.7 | <24% | <24% | <23% | <23% | <24% |
| Zinc | ug/L | 20 | 42% | 42% | 42% | 43% | 42% |
| Cyanide (MBAS data) | ug/L | 1 | 61% | 66% | 26% | 44% | 50% |
| Cyanide | ug/L | 1 | 6% | 6% | 7% | 10% | 8% |
| Total Chlorine Residual | ug/L | 2 | - | - | - | - | - |
| Ammonia (as N) - 6-mo median | ug/L | 600 | 46% | 51% | 56% | 80% | 60% |
| Ammonia (as N) - Daily Max | ug/L | 2,400 | 16% | 17% | 19% | 27% | 20% |
| Acute Toxicity[a] | TUa | 0.3 | | | | | |
| Chronic Toxicity[a] | TUc | 1 | | | | | |
| Phenolic Compounds (non-chlorinated) | ug/L | 30 | 2% | 2% | 2% | 3% | 2% |
| Chlorinated Phenolics | ug/L | 1 | <13% | <14% | <4% | <7% | <10% |
| Endosulfan | ug/L | 0.009 | 4% | 4% | 5% | 7% | 5% |
| Endrin | ug/L | 0.002 | 0.03% | 0.03% | 0.04% | 0.05% | 0.04% |
| HCH (Hexachlorocyclohexane) | ug/L | 0.004 | 11% | 13% | 14% | 20% | 15% |
| Radioactivity (Gross Beta)[a] | pci/L | – | | | | | |
| Radioactivity (Gross Alpha)[a] | pci/L | – | | | | | |
| ***Objectives for protection of human health - noncarcinogens*** | | | | | | | |
| Acrolein | ug/L | 220 | 0.03% | 0.03% | 0.04% | 0.05% | 0.04% |
| Antimony | ug/L | 1200 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Bis (2-chloroethoxy) methane | ug/L | 4.4 | <0.61% | <0.67% | <0.06% | <0.17% | <0.39% |
| Bis (2-chloroisopropyl) ether | ug/L | 1200 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Chlorobenzene | ug/L | 570 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Chromium (III) | ug/L | 190000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Di-n-butyl phthalate | ug/L | 3500 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Dichlorobenzenes | ug/L | 5100 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Diethyl phthalate | ug/L | 33000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Dimethyl phthalate | ug/L | 820000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| 4,6-dinitro-2-methylphenol | ug/L | 220 | <0.06% | <0.06% | <0.01% | <0.02% | <0.04% |
| 2,4-Dinitrophenol | ug/L | 4.0 | <2.10% | <2.30% | <0.28% | <0.68% | <1.38% |
| Ethylbenzene | ug/L | 4100 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Fluoranthene | ug/L | 15 | <0.02% | <0.02% | <0.01% | <0.01% | <0.01% |
| Hexachlorocyclopentadiene | ug/L | 58 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Nitrobenzene | ug/L | 4.9 | <0.30% | <0.33% | <0.04% | <0.10% | <0.20% |
| Thallium | ug/L | 2 | 0.27% | 0.29% | 0.32% | 0.46% | 0.34% |
| Toluene | ug/L | 85000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Tributyltin | ug/L | 0.0014 | <23% | <25% | <3% | <8% | <15% |
| 1,1,1-Trichloroethane | ug/L | 540000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| ***Objectives for protection of human health - carcinogens*** | | | | | | | |
| Acrylonitrile | ug/L | 0.10 | 20% | 21% | 24% | 34% | 25% |
| Aldrin[b] | ug/L | 0.000022 | – | – | – | – | – |
| Benzene | ug/L | 5.9 | <0.06% | <0.06% | <0.02% | <0.03% | <0.04% |
| Benzidine[b] | ug/L | 0.000069 | – | – | – | – | – |
| Beryllium | ug/L | 0.033 | 14% | 15% | 3% | 5% | 9% |

| Constituent | Units | Ocean Plan Objective | Estimated Percentage of Ocean Plan Objective at Edge of ZID by Discharge Scenario[c] | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| Bis(2-chloroethyl)ether | ug/L | 0.045 | <60% | <66% | <6% | <16% | <38% |
| Bis(2-ethyl-hexyl)phthalate | ug/L | 3.5 | 17% | 19% | 21% | 29% | 22% |
| Carbon tetrachloride | ug/L | 0.90 | 0.4% | 0.5% | 0.5% | 0.7% | 0.6% |
| Chlordane | ug/L | 0.000023 | 24% | 27% | 30% | 42% | 32% |
| Chlorodibromomethane | ug/L | 8.6 | 0.2% | 0.2% | 0.3% | 0.4% | 0.3% |
| Chloroform | ug/L | 130 | 0.2% | 0.3% | 0.3% | 0.4% | 0.3% |
| DDT | ug/L | 0.00017 | 9% | 10% | 37% | 62% | 27% |
| 1,4-Dichlorobenzene | ug/L | 18 | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% |
| 3,3-Dichlorobenzidine[b] | ug/L | 0.0081 | – | – | – | – | – |
| 1,2-Dichloroethane | ug/L | 28 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| 1,1-Dichloroethylene | ug/L | 0.9 | 0.4% | 0.4% | 0.1% | 0.2% | 0.3% |
| Dichlorobromomethane | ug/L | 6.2 | 0.3% | 0.4% | 0.4% | 0.6% | 0.4% |
| Dichloromethane (methylenechloride) | ug/L | 450 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| 1,3-dichloropropene | ug/L | 8.9 | 0.05% | 0.05% | 0.06% | 0.08% | 0.06% |
| Dieldrin | ug/L | 0.00004 | 10% | 11% | 15% | 34% | 15% |
| 2,4-Dinitrotoluene | ug/L | 2.6 | <0.5% | <0.5% | <0.02% | <0.1% | <0.3% |
| 1,2-Diphenylhydrazine (azobenzene) | ug/L | 0.16 | <17% | <18% | <2% | <5% | <11% |
| Halomethanes | ug/L | 130 | 0.01% | 0.01% | 0.01% | 0.01% | 0.01% |
| Heptachlor[b] | ug/L | 0.00005 | – | – | <38% | <70% | – |
| Heptachlor Epoxide | ug/L | 0.00002 | 2% | 2% | 3% | 4% | 3% |
| Hexachlorobenzene | ug/L | 0.00021 | 0.3% | 0.3% | 0.3% | 0.5% | 0.4% |
| Hexachlorobutadiene | ug/L | 14 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Hexachloroethane | ug/L | 2.5 | <0.6% | <0.6% | <0.1% | <0.2% | <0.4% |
| Isophorone | ug/L | 730 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| N-Nitrosodimethylamine | ug/L | 7.3 | 0.01% | 0.01% | <0.01% | 0.01% | 0.01% |
| N-Nitrosodi-N-Propylamine | ug/L | 0.38 | 0.13% | 0.14% | 0.01% | 0.04% | 0.08% |
| N-Nitrosodiphenylamine | ug/L | 2.5 | <0.6% | <0.7% | <0.1% | <0.2% | <0.4% |
| PAHs | ug/L | 0.0088 | 5% | 5% | 6% | 8% | 6% |
| PCBs | ug/L | 0.000019 | 27% | 30% | 33% | 47% | 35% |
| TCDD Equivalents | ug/L | 3.9E-09 | 30% | 33% | 37% | 52% | 39% |
| 1,1,2,2-Tetrachloroethane | ug/L | 2.3 | <0.1% | <0.2% | <0.04% | <0.1% | <0.1% |
| Tetrachloroethylene | ug/L | 2.0 | <0.2% | <0.2% | <0.05% | <0.1% | <0.1% |
| Toxaphene | ug/L | 2.1E-04 | 26% | 28% | 31% | 45% | 33% |
| Trichloroethylene | ug/L | 27 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| 1,1,2-Trichloroethane | ug/L | 9.4 | <0.04% | <0.04% | <0.01% | <0.02% | <0.03% |
| 2,4,6-Trichlorophenol | ug/L | 0.29 | <5% | <6% | <1% | <2% | <3% |
| Vinyl chloride | ug/L | 36 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |

[a] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based the nature of the constituent. These constituents were measured individually for the secondary effluent and RO concentrate, and these individual concentrations would comply with the Ocean Plan objectives (see Section 3.4).
[b] All observed values from all data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.
[c] Note that if the percentage as determined by using the MRL was less than 0.01 percent, then a minimum value is shown as "<0.01%" (*e.g.*, if the MRL indicated the value was <0.000001%, for simplicity, it is displayed as <0.01%).

## 3.4 Toxicity

The NPDES permit includes daily maximum effluent limitations for acute and chronic toxicity that are based on the current allowable $D_m$ of 145. The acute toxicity effluent limitation is 4.7 TUa (acute toxicity units) and the chronic toxicity effluent limitation is 150 TUc (chronic toxicity units). The permit requires that toxicity testing be conducted twice per year, with one sample collected during the wet season when the discharge is primarily secondary effluent and once during the dry season when the discharge is primarily trucked brine waste. The MRWPCA ocean discharge has consistently complied with these toxicity limits (CCRWQCB, 2014).

Toxicity testing of RO concentrate generated by the pilot testing was conducted in support of the Proposed Project (Trussell Technologies, 2015). On April 9, 2014, a sample of RO concentrate was sent to Pacific EcoRisk for acute and chronic toxicity analysis. Based on these results (RO concentrate values presented in Table 1), the Proposed Project concentrate requires a minimum $D_m$ of 16:1 and 99:1 for acute and chronic toxicity, respectively, to meet the Ocean Plan objectives. These $D_m$ values were compared to predicted $D_m$ values for the discharge of concentrate only from the Proposed Project's full-scale AWT Facility and the discharge of concentrate combined with secondary effluent from the RTP. The minimum dilution modeled for the various Proposed Project discharge scenarios was 137:1, which is when the secondary effluent discharge is at the maximum possible flow under the current port configuration (FlowScience, 2014). Given that the lowest expected $D_m$ value for the various Proposed Project ocean discharge scenarios is greater than the required dilution factor for compliance with the Ocean Plan toxicity objectives, this sample illustrates that the discharge scenarios would comply with Ocean Plan objectives.

# 4 Conclusions

The purpose of the analysis documented in this technical memorandum was to assess the ability of the Proposed Project to comply with the Ocean Plan objectives. Trussell Tech used a conservative approach to estimate the water qualities of the RTP secondary effluent, RO concentrate, and hauled brine waste for the Proposed Project. These water quality data were then combined for various discharge scenarios, and a concentration at the edge of the ZID was calculated for each constituent and scenario. Compliance assessments could not be made for selected constituents, as noted, due to analytical limitations, but this is a typical occurrence for these Ocean Plan constituents. Based on the data, assumptions, modeling, and analytical methodology presented in this technical memorandum, the Proposed Project would comply with the Ocean Plan objectives.

# 5 References

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# Appendix U2

# Addendum Report to Ocean Plan Compliance Assessment Reports

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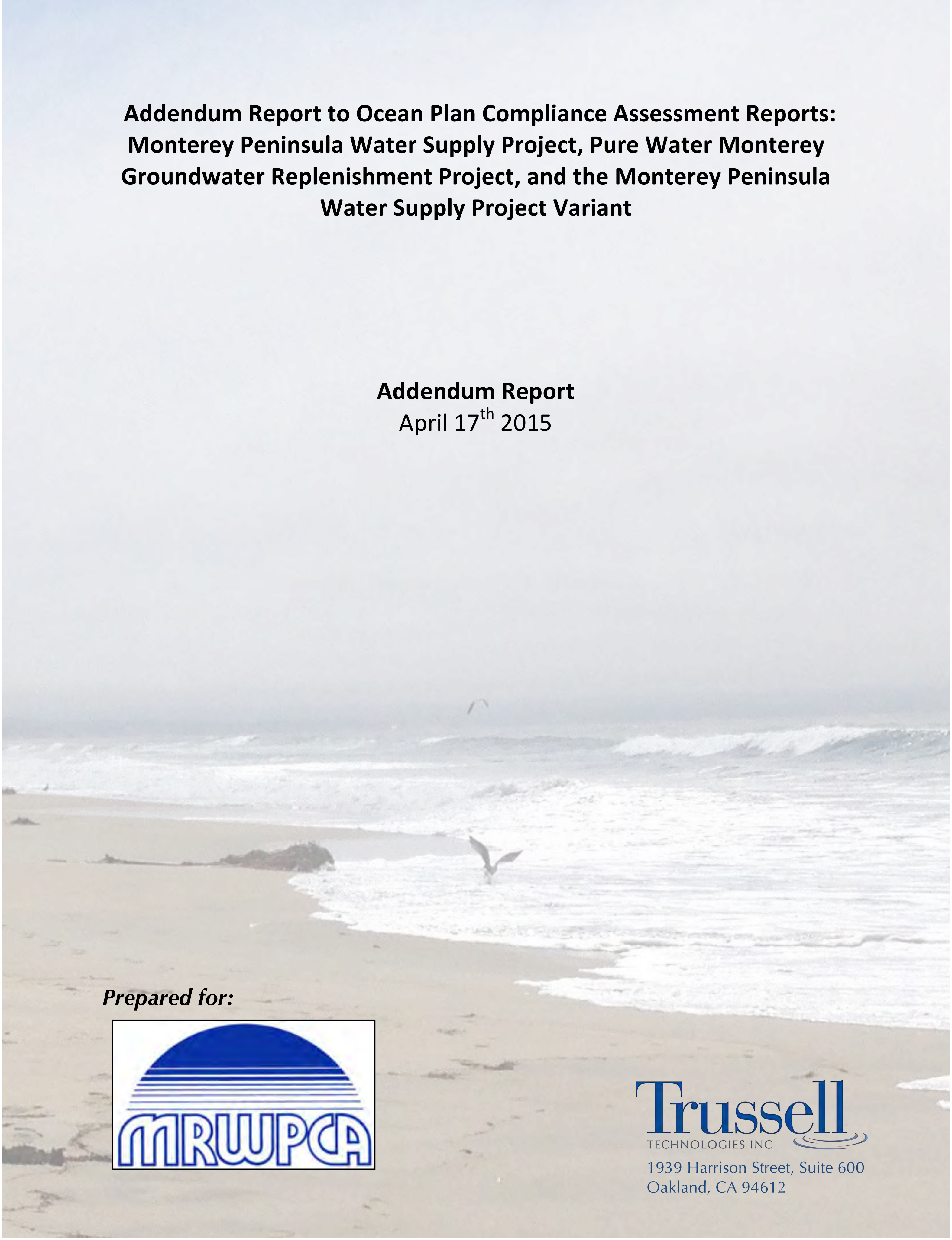

# Addendum Report to Ocean Plan Compliance Assessment Reports: Monterey Peninsula Water Supply Project, Pure Water Monterey Groundwater Replenishment Project, and the Monterey Peninsula Water Supply Project Variant

**Addendum Report**

April 17th 2015

***Prepared for:***

MRWPCA

Trussell
TECHNOLOGIES INC
1939 Harrison Street, Suite 600
Oakland, CA 94612

# Addendum Report to Ocean Plan Compliance Assessment Reports: Monterey Peninsula Water Supply Project, Pure Water Monterey Groundwater Replenishment Project, and the Monterey Peninsula Water Supply Project Variant

## Addendum Report

**April 17th 2015**

Prepared By:

**Trussell Technologies, Inc.**
Gordon Williams, Ph.D., P.E.

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# 1 Introduction

Trussell Technologies, Inc. (Trussell Tech) previously prepared two Technical Memoranda to assess compliance of the following three proposed projects with the California Ocean Plan (SWRCB, 2012):

1. **Monterey Peninsula Water Supply Project ("MPWSP")**, which would include a seawater desalination plant capable of producing 9.6 million gallons per day (mgd) of drinking water (Ocean Plan compliance assessment described in Trussell Tech, 2015b).
2. **Pure Water Monterey Groundwater Replenishment Project ("GWR Project"),** which would include an Advanced Water Treatment facility ("AWT Facility") capable of producing an average flow of 3.3 mgd of highly purified recycled water for injection into the Seaside Groundwater Basin (Ocean Plan compliance assessment described in Trussell Tech, 2015a). The AWT Facility source water would be secondary treated wastewater ("secondary effluent") from the Monterey Regional Water Pollution Control Agency's (MRWPCA's) Regional Treatment Plant (RTP).
3. **Monterey Peninsula Water Supply Project Variant or "Variant Project"**, which would be a combination of a smaller seawater desalination plant capable of producing 6.4 mgd of drinking water along with the GWR Project (Ocean Plan compliance assessment described in Trussell Tech, 2015b).

Both the proposed desalination facility and the proposed AWT Facility would employ reverse osmosis (RO) membranes to purify the waters, and as a result, both projects would produce RO concentrate waste streams that would be disposed through the existing MRWPCA ocean outfall: the RO concentrate from the desalination facility ("Desal Brine"), and the RO concentrate from the AWT Facility ("GWR Concentrate"). Additional details regarding the project backgrounds, assessment methodologies, results, and conclusions for discharge of these waste streams are described in the previous Technical Memoranda (Trussell Tech, 2015a and 2015b).

The Ocean Plan objectives are to be met after initial dilution of the discharge in the ocean. The initial dilution occurs in an area known as the zone of initial dilution (ZID). The extent of dilution in the ZID is quantified and referred to as the minimum probable initial dilution ($D_m$). The water quality objectives established in the Ocean Plan are adjusted by the $D_m$ to derive the National Pollutant Discharge Elimination System (NPDES) permit limits for a treated wastewater discharge prior to ocean dilution.

Part of the methodology for estimating the concentration of a constituent for the Ocean Plan is estimating the $D_m$ based on ocean modeling. FlowScience, Inc. ("FlowScience") conducted modeling of mixing in the ocean for various discharge scenarios related to the proposed projects to determine $D_m$ values for the key discharge scenarios. Recently, additional modeling by FlowScience (FlowScience, 2015) was performed to (1) update the number of currently open discharge ports in the MRWPCA ocean outfall from 120 to 130 open ports, (2) update the GWR RO concentrate flow from 0.73 to 0.94 mgd and account for the hauled brine[1] for the MPWSP

[1] The hauled brine is waste that is trucked to the RTP and blended with secondary effluent prior to being discharged. The maximum anticipated flow of this stream is 0.1 mgd (blend of brine and secondary effluent).

and Variant Project discharge scenarios, and (3) model additional key discharge scenarios that were missing from the initial ocean modeling for the MPWSP and Variant Project.

The purpose of this Addendum Report is to provide an understanding of the impact of the updated ocean discharge modeling on the previous Ocean Plan compliance assessments for the various proposed projects.

# 2 Modeling Update Results

FlowScience performed additional ocean discharge modeling for key discharge scenarios (see Appendix A) and Trussell Tech used these modeling results to perform an updated analysis of Ocean Plan compliance for the various proposed projects. Results from these analyses are presented in the following subsections: the MPWSP in Section 2.1; the Variant Project in Section 2.2; and the GWR Project in Section 2.3. Note that the results for the GWR Project in Section 2.3 are also applicable to the Variant Project. Not all previously modeled scenarios were repeated; the scenarios selected for updating were chosen to demonstrate the impact of the updated model input parameters (*i.e.*, number of open ports, inclusion of the hauled waste flow, and GWR Concentrate flow update). In addition, some new scenarios were added to ensure that the worst-case discharge conditions were considered for all of the proposed projects.

## 2.1 Updated Results for the MPWSP

The following discharge scenarios related to the MPWSP were modeled using 130 open ports for the MRWPCA ocean outfall:

1. **Desal Brine with no secondary effluent (*updated scenario*):** The maximum influence of the Desal Brine on the overall discharge (*i.e.*, no secondary effluent discharged) would be when there is no secondary effluent discharged. This scenario would be representative of conditions when demand for recycled water is highest (*e.g.*, during summer months), and all of the RTP secondary effluent is recycled through the Salinas Valley Reclamation Project (SVRP) for agricultural irrigation. The hauled waste is also included in this discharge scenario.
2. **Desal Brine with moderate secondary effluent flow (*new scenario*):** Desal Brine discharged with a relatively moderate secondary effluent flow that results in a plume with slightly negative buoyancy. This scenario represents times when demand for recycled water is low or the secondary effluent flow is low, and there is excess secondary effluent that is discharged to the ocean.

The updated $D_m$ values for these two discharge scenarios are provided in Table 1. The net impact of using 130 open ports and including the hauled waste was a slight increase (approximately 6%) in the amount of dilution associated with ocean mixing. This confirms that previously modeled MPWSP discharge scenarios with Desal Brine included in Trussell 2015b were conservative (*i.e.* the previous analysis slightly over-estimated the ZID concentration for the Ocean Plan constituents).

**Table 1 – Updated minimum probable dilution ($D_m$) values for select MPWSP discharge scenarios**

| No. | Discharge Scenario (Ocean Condition) | Discharge flows (mgd) | | | Previously Reported $D_m$ (120 ports)[a] | Updated $D_m$ (130 ports) |
|---|---|---|---|---|---|---|
| | | Secondary effluent | Hauled Waste | Desal Brine | | |
| 1 | Desal Brine with no secondary effluent flow (Davidson) | 0 | 0.1 | 13.98 | 16 | 17 |
| 2 | Desal Brine with moderate secondary effluent flow (Davidson) | 9 | 0.1 | 13.98 | n/a [b] | 22 |

[a] The previously reported $D_m$ was used in the analysis presented in Trussell 2015b, and was determined with the assumption that 120 ports on the outfall were open and did not consider the hauled waste flow.
[b] Not applicable, as Discharge Scenario 2, consisting of Desal Brine and a moderate secondary effluent flow, was not previously modeled.

The $D_m$ values reported in Table 1 were used to assess the Ocean Plan compliance for MPWSP Scenarios 1 and 2 using the same methodology and water quality assumptions previously described (Trussell, 2015b). The estimated concentrations at the edge of the ZID for constituents that are expected to exceed the Ocean Plan objective are provided in Table 2. A new exceedance was identified in MPWSP Scenario 2, where the ammonia concentration at the edge of the ZID was predicted to exceed the 6-month median Ocean Plan objective. A list of estimated concentrations for these two scenarios for all Ocean Plan constituents is provided in Appendix B (Table A1).

**Table 2 - Predicted concentration at the edge of the ZID expressed for constituents of interest in the MPWSP as both a concentration and percentage of Ocean Plan Objective [a]**

| Constituent | Units | Ocean Plan Objective | MPWSP Ocean Discharge Scenario | | | |
|---|---|---|---|---|---|---|
| | | | Estimated Concentration at Edge of ZID | | Estimated Percentage of Ocean Plan objective at Edge of ZID | |
| | | | 1 | 2 | 1 | 2 |
| Ammonia (as N) – 6-mo median | ug/L | 600 | 19 | 626 | 3% | 104% |
| PCBs | ug/L | 1.9E-05 | 1.2E-04 | 6.7E-05 | 609% | 351% |

[a] Red shading indicates constituent is expected to exceed the ocean plan objective for that discharge scenario.

## 2.2 Updated Results for the Variant Project

The following discharge scenarios related to the Variant Project were modeled using 130 open ports for the MRWPCA ocean outfall:

1. **Desal Brine without secondary effluent or GWR Concentrate (*updated scenario*):** Desal Brine discharged without secondary effluent or GWR Concentrate. This scenario would be representative of conditions when the smaller (6.4 mgd) desalination facility is in operation, but the AWT Facility is not operating (*e.g.*, offline for maintenance), and all of the secondary effluent is recycled through the SVRP (*e.g.*, during high irrigation water demand summer months). The hauled waste is also included in this discharge scenario.
2. **Desal Brine with moderate secondary effluent flow and no GWR concentrate (*new scenario*):** Desal Brine discharged with a relatively moderate secondary effluent flow, but no GWR Concentrate, which results in a plume with slightly negative buoyancy. This

scenario represents times when demand for recycled water is low or the secondary effluent flow is low, and there is excess secondary effluent that is discharged to the ocean. The hauled waste is also included in this discharge scenario.

3. **Desal Brine with GWR Concentrate and no secondary effluent (*updated scenario*):** Desal Brine discharged with GWR Concentrate and no secondary effluent. This scenario would be representative of the condition where both the desalination facility and the AWT Facility are in operation, and there is the highest demand for recycled water through the SVRP (*e.g.*, during summer months). The hauled waste is also included in this discharge scenario.
4. **Desal Brine with GWR Concentrate and a moderate secondary effluent flow (*new scenario*):** Desal Brine discharged with GWR Concentrate and a relatively moderate secondary effluent flow that results in a plume with slightly negative buoyancy. This scenario represents times when both the desalination facility and the AWT Facility are operating, but demand for recycled water is low and there is excess secondary effluent discharged to the ocean. The hauled waste is also included in this discharge scenario.

- **Variant conditions with no Desal Brine contribution**: All scenarios described for the GWR Project are also applicable to the Variant Project. See Section 2.3 for these additional scenarios.

The updated $D_m$ values for these two discharge scenarios are provided in Table 3. Similar to the MPWSP modeling, the net impact of using 130 open ports, including the hauled waste, and using a GWR concentrate flow of 0.94 mgd (instead of 0.73 mgd) was a slight increase (approximately 6%) in the amount of dilution associated with the ocean mixing for the Variant Project discharge scenarios. This confirms that previously modeled Variant discharge scenarios with Desal Brine included in Trussell 2015b were conservative (*i.e.* the previous analysis slightly over-estimated the ZID concentration for the Ocean Plan constituents).

**Table 3 – Updated minimum probable dilution ($D_m$) values for select MPWSP discharge scenarios**

| No. | Discharge Scenario (Ocean Condition) | Discharge flows (mgd) | | | | Previously Reported $D_m$ (120 ports)[a] | Updated $D_m$ (130 ports) |
|---|---|---|---|---|---|---|---|
| | | Secondary effluent | Hauled Waste | GWR Concentrate | Desal Brine | | |
| 1 | Desal Brine with no secondary effluent and no GWR Conc. (Upwelling) | 0 | 0.1 | 0 | 8.99 | 15 | 16 |
| 2 | Desal Brine with moderate secondary effluent flow and no GWR Conc. (Davidson) | 5.8 | 0.1 | 0 | 8.99 | n/a [b] | 22 |
| 3 | Desal Brine and GWR Conc. with no secondary effluent flow (Upwelling) | 0 | 0.1 | 0.94 | 8.99 | 17 | 18 |
| 4 | Desal Brine and GWR Conc. with moderate secondary effluent flow (Upwelling) | 5.3 | 0.1 | 0.94 | 8.99 | n/a [b] | 24 |

[a] The previously reported $D_m$ was used in the analysis presented in Trussell 2015b, and was performed with 120 open ports on the outfall, did not consider the hauled waste flow, and assumed a GWR Concentrate flow of 0.73 instead of 0.94 mgd.

[b] Not applicable, as Discharge Scenarios 2 and 4, with moderate secondary effluent flows, were not previously modeled.

The $D_m$ values reported in Table 3 were used to assess the Ocean Plan compliance for Variant Project Scenarios 1 through 4 using the same methodology and water quality assumptions previously described (Trussell, 2015b). The estimated concentrations at the edge of the ZID for constituents that are expected to exceed the Ocean Plan objective are provided in Table 4. For the updated scenarios (Variant Project Scenarios 1 and 3), the changes to the underlying modeling parameters increased the amount of dilution in the ocean mixing, thus the resulting ZID concentrations decreased slightly. For the new scenarios (Variant Project Scenarios 2 and 4), ammonia was identified as an exceedance in Variant Scenario 2 when there is no GWR Concentrate in the combined discharge. This had not been shown in the previous analysis. A list of estimated concentrations for these four scenarios for all Ocean Plan constituents is provided in Appendix B (Table A2).

**Table 4 - Predicted concentration at the edge of the ZID expressed for constituents of interest in the MPWSP as both a concentration and percentage of Ocean Plan Objective [a]**

| Constituent | Units | Ocean Plan Objective | Variant Project Ocean Discharge Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Estimated Concentration at Edge of ZID | | | | Estimated Percentage of Ocean Plan objective at Edge of ZID | | | |
| | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| ***Objectives for protection of marine aquatic life*** | | | | | | | | | | |
| Copper | ug/L | 3 | 2.1 | 2.4 | 2.7 | 2.7 | 70% | 81% | 91% | 90% |
| Ammonia (as N) – 6-mo median | ug/L | 600 | 29 | 629 | 968 | 985 | 4.8% | 105% | 161% | 164% |
| ***Objectives for protection of human health - carcinogens*** | | | | | | | | | | |
| Chlordane | ug/L | 2.3E-05 | 1.2E-05 | 1.8E-05 | 2.9E-05 | 2.4E-05 | 52% | 77% | 125% | 106% |
| DDT | ug/L | 1.7E-04 | 4.6E-05 | 3.9E-05 | 2.1E-04 | 1.2E-04 | 27% | 23% | 122% | 70% |
| PCBs | ug/L | 1.9E-05 | 1.2E-04 | 6.7E-05 | 1.2E-04 | 6.7E-05 | 643% | 351% | 614% | 355% |
| TCDD Equivalents | ug/L | 3.9E-09 | 1.0E-10 | 2.7E-09 | 4.1E-09 | 4.2E-09 | 2.6% | 68% | 104% | 107% |
| Toxaphene | ug/L | 2.1E-04 | 8.0E-05 | 1.6E-04 | 2.5E-04 | 2.2E-04 | 38% | 74% | 119% | 106% |

[a] Shading indicates constituent is expected to be greater than 80 percent (orange shading) or exceed (red shading) the Ocean Plan objective for that discharge scenario.

## 2.3 Updated Results for the GWR Project

The proposed Variant Project is inclusive of the proposed GWR Project, such that the analysis in this section is also part of the Variant Project. The following discharge scenarios related to the GWR Project were modeled using 130 open ports for the MRWPCA ocean outfall:

1. **Maximum Flow under Current Port Configuration (*updated scenario*):** the maximum flow that can be discharged with the current port configuration (130 of the 172 ports open). The Oceanic ocean condition was used as it represents the worst-case dilution for this flow scenario. This scenario was chosen because it represents the maximum secondary effluent flow under existing diffuser conditions.
2. **Minimum Secondary effluent Flow - Oceanic/Upwelling (*updated scenario*):** the maximum influence of the GWR Concentrate on the ocean discharge under Oceanic and Upwelling ocean conditions (*i.e.*, no secondary effluent discharged). The Oceanic ocean condition was used as it represents less dilution for this flow scenario compared to the Upwelling condition.

3. **Minimum Secondary effluent Flow – Davidson (*updated scenario*):** the maximum influence of the GWR Concentrate on the ocean discharge under Davidson ocean condition (*i.e.*, the minimum secondary effluent flow). Observed historic secondary effluent flows generally exceed 0.4 mgd during Davidson oceanic conditions. Additional source waters would be brought into the RTP if necessary to maintain the 0.4 mgd minimum.
4. **Low Secondary effluent Flow (*updated scenario*):** conditions with a relatively low secondary effluent flow of 3 mgd when the GWR Concentrate has a greater influence on the water quality than in Scenarios 1, but where the $D_m$ is reduced due to the higher overall discharge flow (*i.e.*, compared to Scenarios 2 and 3). The Davidson ocean condition was used as it represents the worst-case dilution for this flow scenario.
5. **Moderate Secondary effluent Flow (*new scenario*):** conditions with a relatively moderate secondary effluent flow of 8 mgd when the GWR Concentrate has a greater influence on the water quality than in Scenario 1, but where the ocean dilution is reduced due to the higher overall discharge flow (*i.e.*, compared to Scenarios 2 through 4). The Davidson ocean condition was used as it represents the worst-case dilution for this flow scenario.

The updated $D_m$ values for these five discharge scenarios are provided in Table 5. Similar to the modeling for the MPWSP and Variant Project, the impact of using 130 open ports was a slight increase (approximately 4%) in the amount of dilution associated with the ocean mixing for the GWR Project discharge scenarios. This confirms that previously modeled GWR Project discharge scenarios included in Trussell 2015a were conservative (*i.e.* the previous analysis slightly over-estimated the ZID concentration for the Ocean Plan constituents).

**Table 5 – Updated minimum probable dilution ($D_m$) values for select MPWSP discharge scenarios**

| No. | Discharge Scenario (Ocean Condition) | Discharge flows (mgd) | | | Previously Reported $D_m$ (120 ports)[a] | Updated $D_m$ (130 ports) |
|---|---|---|---|---|---|---|
| | | Secondary effluent | Hauled Waste | GWR Concentrate | | |
| 1 | Maximum flow with GWR Concentrate with current port configuration (Oceanic) | 23.7 | 0.1 | 0.94 | 137 | 142 |
| 2 | GWR Concentrate with no secondary effluent (Oceanic) | 0 | 0.1 | 0.94 | 523 | 540 |
| 3 | GWR Concentrate with minimum secondary effluent flow (Davidson) | 0.4 | 0.1 | 0.94 | 285 | 295 |
| 4 | GWR Concentrate with low secondary effluent flow (Davidson) | 3 | 0.1 | 0.94 | 201 | 208 |
| 5 | GWR Concentrate with moderate secondary effluent flow (Davidson) | 8 | 0.1 | 0.94 | n/a [b] | 228 |

[a] The previously reported $D_m$ was used in the analysis presented in Trussell 2015a, and was performed with 120 open ports on the outfall.
[b] Not applicable, as Discharge Scenarios 5, with 8 mgd of secondary effluent flow, was not previously modeled.

The $D_m$ values reported in Table 5 were used to assess Ocean Plan compliance for GWR Project Scenarios 1 through 5 using the same methodology and water quality assumptions previously described (Trussell, 2015a). For the updated scenarios (GWR Project Scenarios 1 through 4), the changes to the underlying modeling parameters increased the amount of dilution from ocean mixing. Thus, as previously shown, none of the GWR Project scenarios resulted in an estimated exceedance of the Ocean Plan objectives. For the new scenario (GWR Project Scenario 5), it was estimated that none of the Ocean Plan objectives would be exceeded. Tables with the estimated Ocean Plan constituent concentrations at the edge of the ZID for the GWR Project discharge Scenarios 1 through 5 are provided in Appendix B as concentrations (Table A3) and as a percentage of the Ocean Plan objective (Table A4).

# 3 Conclusions

Additional modeling of the ocean discharges of various scenarios for the MPWSP, Variant Project, and GWR project were performed, including updating previous modeling to reflect changes in the baseline assumptions and key discharge scenarios that were absent from the previous analyses. Two primary conclusions can be drawn from these efforts: (1) all conclusions from the previously modeled discharge conditions remain the same, and (2) ammonia was identified as a potential exceedance for both the MPWSP and the Variant Project when the Desal Brine is discharged with a moderate flow of secondary effluent.

For the updated scenarios, three changes were made with respect to modeling of the ocean discharge: (1) there are currently 130 open discharge ports, which is more than the 120 ports used in the previous analysis; (2) for the MPWSP and Variant Project scenarios, the hauled waste flow was added; and (3) for the Variant Project scenarios, a GWR Concentrate flow 0.94 mgd was used instead of 0.73 mgd. In all cases, the impact of making these changes to the ocean mixing was minor and resulted in slightly greater dilution of the ocean discharges and thus slightly lower concentrations of constituents at the edge of the ZID. These changes were minimal and do not alter the previous conclusions.

Results from the newly modeled scenarios have implications with respect to Ocean Plan compliance. Previously, two types of exceedance were identified: (1) exceedance of PCBs for discharges with a high fraction of Desal Brine flow, and (2) exceedance of several parameters (ammonia, chlordane, DDT, PCBs, TCDD equivalents, and toxaphene) when discharging Desal Brine and GWR Concentrate with little or no secondary effluent. In this most recent analysis, a third type of exceedance was identified—when the discharge contains both the Desal Brine and a moderate secondary effluent flow there may be an exceedance of the Ocean Plan 6-month median objective for ammonia. This type of exceedance was shown for both the MPWSP (Scenario 2) and the Variant Projects (Scenarios 2 and 4) and is a result of the combination of having high ammonia in the treated wastewater with the high salinity (i.e., higher density) of the Desal Brine.

As previously shown, ammonia is not an issue when discharging secondary effluent and GWR Concentrate without Desal Brine, or when the dense Desal Brine[2] is discharged with sufficient secondary effluent, such that the combined discharge results in a rising plume with relatively

[2] Compared to the ambient seawater (33,000 to 34,000 mg/L of TDS), the Desal Brine is denser (~57,500 mg/L of TDS) and when discharged on its own would sink, whereas the secondary effluent (~1,000 mg/L of TDS) and GWR Concentrate (~5,000 mg/L) are relatively light and would rise when discharged. In the combined discharge, the secondary effluent and GWR Concentrate would dilute the salinity of the desalination brine and thus reduce the density. With sufficient dilution, the combined discharge would be less dense than the ambient ocean water, resulting in a rising plume with more dilution in the ZID.

high ocean mixing in the ZID. This potential Ocean Plan exceedance emerges when there is *not* sufficient secondary effluent to dilute the Desal Brine, and thus the combined discharge is denser than the ambient seawater. This negatively buoyant discharge sinks, resulting in relatively low mixing in the ZID. Similarly, as previously shown, ammonia is not an issue when the Desal Brine is discharged with a low secondary effluent flow, where even though there is relatively low ocean mixing in the ZID, the ammonia concentration in the discharge is less because the secondary effluent is a smaller fraction of the overall combined discharge. The worst-case scenario occurs near the point where the Desal Brine is discharged with the highest flow of secondary effluent that still results in a sinking plume. This secondary effluent flow ends up being a moderate flow: approximately 9 mgd when combined with the Desal Brine from the MPWSP or 5.3 mgd of Desal Brine in the case of the Variant Project.

It should be noted that ammonia was already identified as a potential exceedance (along with several other constituents) when the Desal Brine is discharged with the GWR Concentrate with little or no secondary effluent; however, as illustrated by the Variant Scenario 4, these exceedances also apply when there is a moderate flow of secondary effluent (approximately 5.3 mgd).

# 4 References

FlowScience, 2015. "Results of dilution analysis FSI 144082". *Transmittal from Gang Zhao*. April 17, 2015 (see Appendix A)

State Water Resources Control Board, California Environmental Protection Agency (SWRCB), 2012. *California Ocean Plan: Water Quality Control Plan, Ocean Waters of California*.

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Trussell Technologies, Inc (Trussell Tech), 2015b. "Ocean Plan Compliance Assessment for the Monterey Peninsula Water Supply Project and Project Variant." *Technical Memorandum prepared for MRWPCA*. March.

# Appendix A – Updated Ocean Discharge Modeling Results

FlowScience, 2015. “Results of dilution analysis FSI 144082”. *Transmittal from Gang Zhao*. April 17, 2015

**Flow Science Incorporated**
48 S. Chester Avenue, Suite 200, Pasadena, CA 91106
**(626) 304-1134 FAX (626) 304-9427**

# Transmittal Letter

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| **To:** | Gordon Williams Ph.D., PE.<br>Trussell Technologies Inc. | **Subject:** | Results of dilution analysis<br>FSI 144082 |
| **From:** | Gang Zhao Ph.D., PE.<br>Flow Science Inc. | **Date:** | April 17, 2015 |

Dear Dr. Williams,

Please find attached the Excel® spreadsheet containing results of the latest round of dilution analyses for effluent discharged through the Monterey Regional Water Pollution Control Agency's ocean outfall. The method used in the Visual Plumes (VP) model is capable of handling slightly negatively buoyant conditions and produces reasonable results. In addition, the VP model results are conservative for the slightly negatively buoyant scenarios in that the VP predicted dilution ratios are lower than those obtained from the semi-empirical method. Therefore, the semi-empirical method was not used for all slightly negatively buoyant scenarios.

Please feel free to contact me if you have any questions.

Gang Zhao Ph.D., PE.
Principal Engineer
Flow Science Incorporated
48 South Chester Ave., Suite 200
Pasadena, CA 91106
Tel: 626-304-1134
Fax: 626-304-9427
email: gzhao@flowscience.com

**MPWSP, Variant Project, and GWR Project Discharge Scenarios Update**

From: Flow Science Inc. (FSI 144082)

| Scenario Description | | Flow (mgd) | | | | | Combined TDS (mg/L) | Combined Temp (°C) | Ocean Condition | | | Number of Open Discharge Ports | VP | | | Semi-EMP | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RTP Secondary Effluent | Hauled Waste | GWR Concentrate | Desal Brine | Total Discharge Flow (MGD) | | | Davidson | Upwelling | Oceanic | | Plume diam. (inch) | Min. Dilution | Horiz. Distance from port (ft) | Plume diam. (inch) | Min. Dilution | Horiz. Distance from port (ft) |
| ***MPWSP Scenarios (Large desal)*** | | | | | | | | | | | | | | | | | | |
| **M.1** | Desal Brine with no WW flow | 0 | 0.1 | | 13.98 | **14.08** | 58,101 | 11.7 | | X | | 130 | | | | 37 | 17 | 12 |
| **M.2** | Desal Brine with Moderate WW flow | 9 | 0.1 | | 13.98 | **23.08** | 35,254 | 14.9 | X | | | 130 | 84 | 22 | 17 | | | |
| **M.3** | Desal Brine with Moderate WW flow | 9.5 | 0.1 | | 13.98 | **23.58** | 34,523 | 15.0 | X | | | 130 | 90 | 23 | 18 | 84 | 34 | 9 |
| **M.4** | Desal Brine with Moderate WW flow | 10 | 0.1 | | 13.98 | **24.08** | 33,823 | 15.1 | X | | | 130 | 100 | 25 | 20 | | | |
| **M.5** | Desal Brine with Moderate WW flow | 12 | 0.1 | | 13.98 | **26.08** | 31,290 | 15.5 | X | | | 130 | 192 | 54 | 41 | | | |
| ***MPWSP Variant Scenarios (Small desal + AWT Facility RO Conc.)*** | | | | | | | | | | | | | | | | | | |
| **Var.1** | Desal Brine with no WW and no GWR flow | 0 | 0.1 | 0 | 8.99 | **9.09** | 58,029 | 10.0 | | X | | 130 | | | | 32 | 16 | 10 |
| **Var.2** | Desal Brine with Moderate WW flow | 5.8 | 0.1 | 0 | 8.99 | **14.89** | 35,353 | 14.9 | X | | | 130 | 79 | 22 | 16 | | | |
| **Var.3** | Desal Brine with Moderate WW flow | 6.2 | 0.1 | 0 | 8.99 | **15.29** | 34,457 | 15.1 | X | | | 130 | 89 | 25 | 18 | 82 | 37 | 9 |
| **Var.4** | Desal Brine with Moderate WW flow | 6.7 | 0.1 | 0 | 8.99 | **15.79** | 33,401 | 15.2 | X | | | 130 | 172 | 51 | 36 | | | |
| **Var.5** | Desal Brine and GWR Conc. with no WW flow | 0 | 0.1 | 0.94 | 8.99 | **10.03** | 53,135 | 10.9 | | X | | 130 | | | | 35 | 18 | 11 |
| **Var.6** | Desal Brine and GWR Conc. with moderate WW flow | 5.3 | 0.1 | 0.94 | 8.99 | **15.33** | 35,145 | 14.1 | | X | | 130 | 86 | 24 | 18 | | | |
| **Var.7** | Desal Brine and GWR Conc. with moderate WW flow | 5.6 | 0.1 | 0.94 | 8.99 | **15.63** | 34,491 | 14.2 | | X | | 130 | 99 | 28 | 20 | | | |
| **Var.8** | Desal Brine and GWR Conc. with moderate WW flow | 9 | 0.1 | 0.94 | 8.99 | **19.03** | 28,133 | 16.0 | X | | | 130 | 161 | 56 | 33 | | | |
| ***Variant (when no Brine and GWR Only)*** | | | | | | | | | | | | | | | | | | |
| **GWR.1** | Minimum wastewater flow (Oceanic/Upwelling) | 0 | 0.1 | 0.94 | | **1.04** | 9,088 | 20.0 | | | X | 130 | 124 | 540 | 6 | | | |
| **GWR.2** | Minimum wastewater flow (Davidson) | 0.4 | 0.1 | 0.94 | | **1.44** | 6,869 | 20.0 | X | | | 130 | 128 | 295 | 6 | | | |
| **GWR.3** | Minimum wastewater flow (Oceanic) | 0.4 | 0.1 | 0.94 | | **1.44** | 6,869 | 20.0 | | | X | 130 | 126 | 454 | 6 | | | |
| **GWR.4** | Low wastewater flow | 3 | 0.1 | 0.94 | | **4.04** | 3,156 | 20.0 | X | | | 130 | 136 | 208 | 10 | | | |
| **GWR.5** | Moderate Wastewater flow | 8 | 0.1 | 0.94 | | **9.04** | 2,019 | 20.0 | X | | | 130 | 208 | 228 | 17 | | | |
| **GWR.6** | Max flow under current port configuration | 23.7 | 0.1 | 0.94 | | **24.74** | 1,436 | 20.0 | | | X | 130 | 200 | 142 | 26 | | | |

# Appendix B – Estimated Concentrations of All Ocean Plan Constituents

**Table A1 – MPWSP complete list of Ocean Plan constituents at the edge of the ZID as estimated concentration and as a percentage of the Ocean Plan objective [a]**

| Constituent | Units | Ocean Plan Objective | MPWSP Ocean Discharge Scenario | | | |
|---|---|---|---|---|---|---|
| | | | Estimated Concentration at Edge of ZID | | Estimated Percentage of Ocean Plan objective at Edge of ZID | |
| | | | 1 | 2 | 1 | 2 |
| ***Objectives for protection of marine aquatic life*** | | | | | | |
| Arsenic | ug/L | 8 | 4.9 | 4.6 | 62% | 58% |
| Cadmium | ug/L | 1 | 0.44 | 0.23 | 44% | 23% |
| Chromium (Hexavalent) | ug/L | 2 | 0.051 | 0.058 | 2.6% | 2.9% |
| Copper | ug/L | 3 | 2.1 | 2.2 | 69% | 72% |
| Lead | ug/L | 2 | 0.35 | 0.18 | 18% | 8.8% |
| Mercury | ug/L | 0.04 | 0.021 | 0.013 | 53% | 33% |
| Nickel | ug/L | 5 | 0.48 | 0.32 | 10% | 6.3% |
| Selenium | ug/L | 15 | 3.1 | 1.5 | 20% | 10% |
| Silver | ug/L | 0.7 | 0.15 | 0.16 | 22% | 23% |
| Zinc | ug/L | 20 | 9.5 | 8.9 | 47% | 45% |
| Cyanide | ug/L | 1 | 0.49 | 0.36 | 49% | 36% |
| Total Chlorine Residual [d] | ug/L | 2 | -- | -- | – | – |
| Ammonia (as N) - 6-mo median | ug/L | 600 | 19 | 626 | 3.2% | 104% |
| Ammonia (as N) - Daily Max | ug/L | 2,400 | 24 | 842 | 1.0% | 35% |
| Acute Toxicity [b] | TUa | 0.3 | | | | |
| Chronic Toxicity [b] | TUc | 1 | | | | |
| Phenolic Compounds (non-chlorinated) | ug/L | 30 | 0.027 | 1.2 | 0.09% | 3.9% |
| Chlorinated Phenolics | ug/L | 1 | <0.0079 | <0.34 | <0.8% | <34% |
| Endosulfan | ug/L | 0.009 | 9.6E-06 | 2.6E-04 | 0.1% | 2.9% |
| Endrin | ug/L | 0.002 | 1.6E-06 | 2.1E-06 | 0.08% | 0.1% |
| HCH (Hexachlorocyclohexane) | ug/L | 0.004 | 5.1E-05 | 6.0E-04 | 1.3% | 15% |
| Radioactivity (Gross Beta) [b] | pci/L | – | | | | |
| Radioactivity (Gross Alpha) [b] | pci/L | – | | | | |
| ***Objectives for protection of human health – non carcinogens*** | | | | | | |
| Acrolein | ug/L | 220 | <0.0020 | <0.086 | <0.01% | <0.04% |
| Antimony | ug/L | 1200 | 0.91 | 0.45 | 0.08% | 0.04% |
| Bis (2-chloroethoxy) methane | ug/L | 4.4 | <2.0E-04 | <0.0086 | <0.01% | <0.2% |
| Bis (2-chloroisopropyl) ether | ug/L | 1200 | <2.0E-04 | <0.0086 | <0.01% | <0.01% |
| Chlorobenzene | ug/L | 570 | <2.0E-04 | <0.0086 | <0.01% | <0.01% |
| Chromium (III) | ug/L | 190000 | 5.9 | 2.9 | <0.01% | <0.01% |
| Di-n-butyl phthalate | ug/L | 3500 | <0.0020 | <0.086 | <0.01% | <0.01% |
| Dichlorobenzenes | ug/L | 5100 | 6.3E-04 | 0.027 | <0.01% | <0.01% |
| Diethyl phthalate | ug/L | 33000 | <0.0020 | <0.086 | <0.01% | <0.01% |
| Dimethyl phthalate | ug/L | 820000 | <7.9E-04 | <0.034 | <0.01% | <0.01% |
| 4,6-dinitro-2-methylphenol | ug/L | 220 | <2.0E-04 | <0.0086 | <0.01% | <0.01% |
| 2,4-Dinitrophenol | ug/L | 4.0 | <2.0E-04 | <0.0086 | <0.01% | <0.2% |
| Ethylbenzene | ug/L | 4100 | <2.0E-04 | <0.0086 | <0.01% | <0.01% |
| Fluoranthene | ug/L | 15 | 1.0E-04 | 4.9E-05 | <0.01% | 0.00% |
| Hexachlorocyclopentadiene | ug/L | 58 | <2.0E-04 | <0.0086 | <0.01% | <0.01% |
| Nitrobenzene | ug/L | 4.9 | <2.0E-04 | <0.0086 | <0.01% | <0.2% |
| Thallium | ug/L | 2 | <0.094 | <0.053 | <4.7% | <2.7% |
| Toluene | ug/L | 85000 | <0.050 | <0.032 | <0.01% | <0.0% |
| Tributyltin | ug/L | 0.0014 | <2.0E-05 | <8.6E-04 | <1.4% | <61% |
| 1,1,1-Trichloroethane | ug/L | 540000 | <0.050 | <0.032 | <0.01% | <0.01% |
| ***Objectives for protection of human health - carcinogens*** | | | | | | |
| Acrylonitrile | ug/L | 0.10 | <7.9E-04 | <0.034 | <0.8% | <34% |

| Constituent | Units | Ocean Plan Objective | MPWSP Ocean Discharge Scenario | | | |
|---|---|---|---|---|---|---|
| | | | Estimated Concentration at Edge of ZID | | Estimated Percentage of Ocean Plan objective at Edge of ZID | |
| | | | 1 | 2 | 1 | 2 |
| Aldrin [c] | ug/L | 0.000022 | <2.0E-05 | <8.6E-04 | – | – |
| Benzene | ug/L | 5.9 | <0.050 | <0.032 | <0.8% | <0.5% |
| Benzidine [c] | ug/L | 0.000069 | <2.0E-04 | <0.0086 | – | – |
| Beryllium | ug/L | 0.033 | 2.1E-06 | 0.0085 | <0.01% | 26% |
| Bis(2-chloroethyl)ether | ug/L | 0.045 | <2.0E-04 | <0.0086 | <0.4% | <19% |
| Bis(2-ethyl-hexyl)phthalate | ug/L | 3.5 | 0.086 | 1.4 | 2.5% | 39% |
| Carbon tetrachloride | ug/L | 0.90 | <0.028 | <0.022 | <3.1% | <2.4% |
| Chlordane | ug/L | 0.000023 | 1.1E-05 | 1.8E-05 | 48% | 77% |
| Chlorodibromomethane | ug/L | 8.6 | <2.0E-04 | <0.0086 | <0.01% | <0.10% |
| Chloroform | ug/L | 130 | 7.9E-04 | 0.034 | <0.01% | 0.03% |
| DDT | ug/L | 0.00017 | 3.1E-05 | 3.3E-05 | 18% | 20% |
| 1,4-Dichlorobenzene | ug/L | 18 | 0.050 | 0.051 | 0.3% | 0.3% |
| 3,3-Dichlorobenzidine | ug/L | 0.0081 | <9.9E-06 | <4.3E-04 | <0.1% | <5.3% |
| 1,2-Dichloroethane | ug/L | 28 | <0.050 | <0.032 | <0.2% | <0.1% |
| 1,1-Dichloroethylene | ug/L | 0.9 | 0.050 | 0.032 | 5.5% | 3.6% |
| Dichlorobromomethane | ug/L | 6.2 | <2.0E-04 | <0.0086 | <0.01% | <0.1% |
| Dichloromethane | ug/L | 450 | 0.050 | 0.033 | 0.01% | <0.01% |
| 1,3-dichloropropene | ug/L | 8.9 | <0.050 | <0.032 | <0.6% | <0.4% |
| Dieldrin | ug/L | 0.00004 | 5.0E-06 | 1.1E-05 | 13% | 27% |
| 2,4-Dinitrotoluene | ug/L | 2.6 | <7.9E-04 | <0.034 | <0.03% | <1.3% |
| 1,2-Diphenylhydrazine (azobenzene) | ug/L | 0.16 | <2.0E-04 | <0.0086 | <0.1% | <5.4% |
| Halomethanes | ug/L | 130 | 2.9E-04 | 0.0093 | <0.01% | <0.01% |
| Heptachlor | ug/L | 0.00005 | 4.8E-07 | 2.3E-07 | 1.0% | 0.5% |
| Heptachlor Epoxide | ug/L | 0.00002 | 2.3E-08 | 1.0E-06 | 0.1% | 5.1% |
| Hexachlorobenzene | ug/L | 0.00021 | 3.1E-08 | 1.3E-06 | 0.01% | 0.6% |
| Hexachlorobutadiene | ug/L | 14 | 3.6E-09 | 1.5E-07 | <0.01% | <0.01% |
| Hexachloroethane | ug/L | 2.5 | <2.0E-04 | <0.0086 | <0.01% | <0.3% |
| Isophorone | ug/L | 730 | <2.0E-04 | <0.0086 | <0.01% | <0.01% |
| N-Nitrosodimethylamine | ug/L | 7.3 | 1.7E-04 | 3.7E-04 | <0.01% | <0.01% |
| N-Nitrosodi-N-Propylamine | ug/L | 0.38 | 2.0E-04 | 0.0014 | 0.05% | 0.4% |
| N-Nitrosodiphenylamine | ug/L | 2.5 | <2.0E-04 | <0.0086 | <0.01% | <0.3% |
| PAHs | ug/L | 0.0088 | 6.8E-04 | 0.0012 | 7.7% | 14% |
| PCBs | ug/L | 0.000019 | 1.2E-04 | 6.7E-05 | 609% | 351% |
| TCDD Equivalents | ug/L | 3.9E-09 | 6.0E-11 | 2.6E-09 | 1.5% | 67% |
| 1,1,2,2-Tetrachloroethane | ug/L | 2.3 | <0.050 | <0.032 | <2.2% | <1.4% |
| Tetrachloroethylene | ug/L | 2.0 | <0.050 | <0.032 | <2.5% | <1.6% |
| Toxaphene | ug/L | 2.1E-04 | 7.5E-05 | 1.6E-04 | 35% | 74% |
| Trichloroethylene | ug/L | 27 | <0.050 | <0.032 | <0.2% | <0.1% |
| 1,1,2-Trichloroethane | ug/L | 9.4 | <0.050 | <0.032 | <0.5% | <0.3% |
| 2,4,6-Trichlorophenol | ug/L | 0.29 | <2.0E-04 | <0.0086 | <0.07% | <3.0% |
| Vinyl chloride | ug/L | 36 | <0.028 | <0.022 | <0.08% | <0.06% |

[a] Note that if the percentage as determined by using the MRL was less than 0.01 percent, then a minimum value is shown as "<0.01%" (*e.g.*, if the MRL indicated the value was <0.000001%, for simplicity, it is displayed as <0.01%). Also, shading indicates constituent is expected to be greater than 80 percent (orange shading) or exceed (red shading) the ocean plan objective for that discharge scenario.

[b] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based on the nature of the constituent. These constituents were measured for the secondary effluent and those concentrations would comply with the Ocean Plan objectives.

[c] All observed values from all data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.

[d] For total chlorine residual, any waste streams containing a free-chlorine residual would be dechlorinated prior to discharge.

**Table A2 – Variant Project list of predicted concentrations of Ocean Plan constituents at the edge of the ZID as a concentration and as a percentage of the Ocean Plan objective [a]**

| Constituent | Units | Ocean Plan Objective | Variant Project Ocean Discharge Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Estimated Concentration at Edge of ZID | | | | Estimated Percentage of Ocean Plan objective at Edge of ZID | | | |
| | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| ***Objectives for protection of marine aquatic life*** | | | | | | | | | | |
| Arsenic | ug/L | 8 | 5.1 | 4.6 | 4.7 | 4.4 | 63% | 58% | 59% | 55% |
| Cadmium | ug/L | 1 | 0.46 | 0.23 | 0.41 | 0.22 | 46% | 23% | 41% | 22% |
| Chromium (Hexavalent) | ug/L | 2 | 0.084 | 0.083 | 0.14 | 0.11 | 4.2% | 4.2% | 6.9% | 5.3% |
| Copper | ug/L | 3 | 2.1 | 2.4 | 2.7 | 2.7 | 70% | 81% | 91% | 90% |
| Lead | ug/L | 2 | 0.37 | 0.18 | 0.32 | 0.17 | 19% | 9.1% | 16% | 8.6% |
| Mercury | ug/L | 0.04 | 0.022 | 0.014 | 0.021 | 0.014 | 56% | 35% | 54% | 36% |
| Nickel | ug/L | 5 | 0.51 | 0.45 | 0.75 | 0.56 | 10% | 9.0% | 15% | 11% |
| Selenium | ug/L | 15 | 3.3 | 1.6 | 2.8 | 1.5 | 22% | 10.5% | 19% | 10% |
| Silver | ug/L | 0.7 | 0.16 | 0.18 | 0.16 | 0.18 | 22% | 26% | 22% | 25% |
| Zinc | ug/L | 20 | 9.6 | 9.4 | 10.5 | 9.8 | 48% | 47% | 53% | 49% |
| Cyanide | ug/L | 1 | 0.53 | 0.36 | 0.62 | 0.41 | 53% | 36% | 62% | 41% |
| Total Chlorine Residual [d] | ug/L | 2 | -- | -- | -- | -- | -- | -- | – | – |
| Ammonia (as N); 6-mo median | ug/L | 600 | 29 | 629 | 968 | 985 | 4.8% | 105% | 161% | 164% |
| Ammonia (as N); Daily Max | ug/L | 2,400 | 37 | 846 | 1302 | 1325 | 1.5% | 35% | 54% | 55% |
| Acute Toxicity [b] | TUa | 0.3 | | | | | | | | |
| Chronic Toxicity [b] | TUc | 1 | | | | | | | | |
| Phenolic Compounds (non-chlorinated) | ug/L | 30 | 0.045 | 1.2 | 1.8 | 1.9 | 0.1% | 4.0% | 6.1% | 6.2% |
| Chlorinated Phenolics | ug/L | 1 | <0.013 | <0.34 | <0.11 | <0.33 | <1.3% | <34% | <11% | <33% |
| Endosulfan | ug/L | 0.009 | 3.5E-05 | 8.3E-04 | 0.0013 | 0.0013 | 0.4% | 9.2% | 14% | 14% |
| Endrin | ug/L | 0.002 | 1.7E-06 | 2.1E-06 | 3.4E-06 | 2.8E-06 | 0.08% | 0.10% | 0.2% | 0.1% |
| HCH (Hexachlorocyclohexane) | ug/L | 0.004 | 7.8E-05 | 0.0010 | 0.0016 | 0.0016 | 2.0% | 26% | 40% | 41% |
| Radioactivity (Gross Beta) [b] | pci/L | – | 5.1 | 4.6 | 4.7 | 4.4 | 63% | 58% | 59% | 55% |
| Radioactivity (Gross Alpha) [b] | pci/L | – | 0.46 | 0.23 | 0.41 | 0.22 | 46% | 23% | 41% | 22% |
| ***Objectives for protection of human health – non carcinogens*** | | | | | | | | | | |
| Acrolein | ug/L | 220 | 0.0058 | 0.16 | 0.24 | 0.24 | <0.01% | 0.07% | 0.1% | 0.1% |
| Antimony | ug/L | 1200 | 0.96 | 0.45 | 0.80 | 0.41 | 0.08% | 0.04% | 0.07% | 0.03% |
| Bis (2-chloroethoxy) methane | ug/L | 4.4 | <0.0027 | <0.072 | <0.0071 | <0.062 | <0.06% | <1.64% | <0.2% | <1.40% |
| Bis (2-chloroisopropyl) ether | ug/L | 1200 | <0.0027 | <0.072 | <0.0071 | <0.062 | <0.01% | <0.01% | <0.01% | <0.01% |
| Chlorobenzene | ug/L | 570 | <3.2E-04 | <0.0086 | <0.0027 | <0.0083 | <0.01% | <0.01% | <0.01% | <0.01% |
| Chromium (III) | ug/L | 190000 | 6.3 | 3.0 | 5.3 | 2.7 | <0.01% | <0.01% | <0.01% | <0.01% |
| Di-n-butyl phthalate | ug/L | 3500 | <0.0045 | <0.12 | <0.0086 | <0.10 | <0.01% | <0.01% | <0.01% | <0.01% |
| Dichlorobenzenes | ug/L | 5100 | 0.0010 | 0.028 | 0.042 | 0.043 | <0.01% | <0.01% | <0.01% | <0.01% |
| Diethyl phthalate | ug/L | 33000 | <0.0032 | <0.086 | <0.0076 | <0.073 | <0.01% | <0.01% | <0.01% | <0.01% |
| Dimethyl phthalate | ug/L | 820000 | <0.0013 | <0.034 | <0.0035 | <0.029 | <0.01% | <0.01% | <0.01% | <0.01% |
| 4,6-dinitro-2-methylphenol | ug/L | 220 | <0.013 | <0.34 | <0.035 | <0.29 | <0.01% | <0.2% | <0.02% | <0.1% |
| 2,4-Dinitrophenol | ug/L | 4.0 | <0.0084 | <0.22 | <0.031 | <0.20 | <0.2% | <5.6% | <0.8% | <4.9% |
| Ethylbenzene | ug/L | 4100 | <3.2E-04 | <0.0086 | <0.0027 | <0.0083 | <0.01% | <0.01% | <0.01% | <0.01% |
| Fluoranthene | ug/L | 15 | 1.1E-04 | 4.9E-05 | 5.8E-04 | 2.9E-04 | <0.01% | <0.01% | <0.01% | 0.05% |
| Hexachlorocyclopentadiene | ug/L | 58 | <3.2E-04 | <0.0086 | <5.1E-04 | <0.0072 | <0.01% | <0.01% | <0.01% | <0.01% |
| Nitrobenzene | ug/L | 4.9 | <0.0015 | <0.040 | <0.0061 | <0.035 | <0.03% | <0.8% | <0.1% | <0.7% |
| Thallium | ug/L | 2 | 0.10 | 0.057 | 0.10 | 0.059 | 5.0% | 2.8% | 4.9% | 2.9% |
| Toluene | ug/L | 85000 | <0.053 | <0.032 | <0.045 | <0.029 | <0.01% | <0.01% | <0.01% | <0.01% |
| Tributyltin | ug/L | 0.0014 | <3.2E-05 | <8.6E-04 | <1.2E-04 | <7.5E-04 | <2.3% | <62% | <8.9% | <54% |
| 1,1,1-Trichloroethane | ug/L | 540000 | <0.053 | <0.032 | <0.045 | <0.029 | <0.01% | <0.01% | <0.01% | <0.01% |
| ***Objectives for protection of human health - carcinogens*** | | | | | | | | | | |
| Acrylonitrile | ug/L | 0.10 | 0.0016 | 0.044 | 0.067 | 0.069 | 1.6% | 44% | 67% | 69% |
| Aldrin [c] | ug/L | 0.000022 | <4.5E-06 | <1.2E-04 | <5.3E-05 | <1.2E-04 | <21% | – | – | – |
| Benzene | ug/L | 5.9 | <0.053 | <0.032 | <0.045 | <0.029 | <0.9% | <0.5% | <0.8% | <0.5% |
| Benzidine [c] | ug/L | 0.000069 | <0.013 | <0.34 | <0.011 | <0.28 | – | – | – | – |

| Constituent | Units | Ocean Plan Objective | Variant Project Ocean Discharge Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Estimated Concentration at Edge of ZID | | | | Estimated Percentage of Ocean Plan objective at Edge of ZID | | | |
| | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Beryllium | ug/L | 0.033 | 3.4E-06 | 1.5E-06 | 0.0025 | 0.0012 | 0.01% | <0.0% | 7.5% | 3.7% |
| Bis(2-chloroethyl)ether [c] | ug/L | 0.045 | <0.0027 | <0.072 | <0.0071 | <0.062 | <6.0% | – | <16% | – |
| Bis(2-ethyl-hexyl)phthalate | ug/L | 3.5 | 0.11 | 1.4 | 2.1 | 2.1 | 3.1% | 39% | 60% | 61% |
| Carbon tetrachloride | ug/L | 0.90 | 0.029 | 0.022 | 0.037 | 0.025 | 3.3% | 2.4% | 4.1% | 2.8% |
| Chlordane | ug/L | 0.000023 | 1.2E-05 | 1.8E-05 | 2.9E-05 | 2.4E-05 | 52% | 77% | 125% | 106% |
| Chlorodibromomethane | ug/L | 8.6 | 0.0016 | 0.042 | 0.065 | 0.066 | 0.02% | 0.5% | 0.8% | 0.8% |
| Chloroform | ug/L | 130 | 0.025 | 0.67 | 1.0 | 1.0 | 0.02% | 0.5% | 0.8% | 0.8% |
| DDT | ug/L | 0.00017 | 4.6E-05 | 3.9E-05 | 2.1E-04 | 1.2E-04 | 27% | 23% | 122% | 70% |
| 1,4-Dichlorobenzene | ug/L | 18 | 0.053 | 0.051 | 0.085 | 0.064 | 0.3% | 0.3% | 0.5% | 0.4% |
| 3,3-Dichlorobenzidine [c] | ug/L | 0.0081 | <0.012 | <0.33 | <0.020 | <0.27 | – | – | – | – |
| 1,2-Dichloroethane | ug/L | 28 | <0.053 | <0.032 | <0.045 | <0.029 | <0.2% | <0.1% | <0.2% | <0.1% |
| 1,1-Dichloroethylene | ug/L | 0.9 | 0.053 | 0.032 | 0.045 | 0.029 | 5.9% | 3.6% | 5.0% | 3.3% |
| Dichlorobromomethane | ug/L | 6.2 | 0.0017 | 0.045 | 0.069 | 0.071 | 0.03% | 0.7% | 1.1% | 1.1% |
| Dichloromethane | ug/L | 450 | 0.053 | 0.035 | 0.060 | 0.038 | 0.01% | <0.0% | 0.01% | <0.01% |
| 1,3-dichloropropene | ug/L | 8.9 | 0.053 | 0.033 | 0.057 | 0.036 | 0.6% | 0.4% | 0.6% | 0.4% |
| Dieldrin | ug/L | 0.00004 | 8.7E-06 | 1.2E-05 | 2.2E-05 | 1.8E-05 | 22% | 31% | 54% | 44% |
| 2,4-Dinitrotoluene | ug/L | 2.6 | <0.0013 | <0.034 | <0.0015 | <0.028 | <0.05% | <1.3% | <0.06% | <1.1% |
| 1,2-Diphenylhydrazine | ug/L | 0.16 | <0.0027 | <0.072 | <0.0071 | <0.062 | <1.7% | <45% | <4.5% | <39% |
| Halomethanes | ug/L | 130 | 9.2E-04 | 0.025 | 0.038 | 0.038 | <0.01% | 0.02% | 0.03% | 0.03% |
| Heptachlor | ug/L | 0.00005 | 5.0E-07 | 2.3E-07 | 4.1E-07 | 2.0E-07 | 1.0% | 0.5% | 0.8% | 0.4% |
| Heptachlor Epoxide | ug/L | 0.00002 | 3.8E-08 | 1.0E-06 | 1.6E-06 | 1.6E-06 | 0.2% | 5.1% | 7.8% | 8.0% |
| Hexachlorobenzene | ug/L | 0.00021 | 5.0E-08 | 1.3E-06 | 2.1E-06 | 2.1E-06 | 0.02% | 0.6% | 1.0% | 1.0% |
| Hexachlorobutadiene | ug/L | 14 | 5.8E-09 | 1.6E-07 | 2.4E-07 | 2.4E-07 | <0.01% | <0.01% | <0.01% | <0.01% |
| Hexachloroethane | ug/L | 2.5 | <0.0015 | <0.040 | <0.0037 | <0.034 | <0.06% | <1.6% | <0.1% | <1.3% |
| Isophorone | ug/L | 730 | <3.2E-04 | <0.0086 | <0.0027 | <0.0083 | <0.01% | <0.01% | <0.01% | <0.01% |
| N-Nitrosodimethylamine | ug/L | 7.3 | 2.4E-04 | 0.0017 | 9.3E-04 | 0.0018 | <0.01% | 0.02% | 0.01% | 0.02% |
| N-Nitrosodi-N-Propylamine | ug/L | 0.38 | 2.2E-04 | 0.0014 | 2.8E-04 | 0.0012 | 0.06% | 0.4% | 0.07% | 0.3% |
| N-Nitrosodiphenylamine | ug/L | 2.5 | <0.0015 | <0.040 | <0.0061 | <0.035 | <0.06% | <1.6% | <0.2% | <1.4% |
| PAHs | ug/L | 0.0088 | 7.3E-04 | 0.0012 | 0.0020 | 0.0017 | 8.3% | 14% | 22% | 19% |
| PCBs | ug/L | 0.000019 | 1.2E-04 | 6.7E-05 | 1.2E-04 | 6.7E-05 | 643% | 351% | 614% | 355% |
| TCDD Equivalents | ug/L | 3.9E-09 | 1.0E-10 | 2.7E-09 | 4.1E-09 | 4.2E-09 | 2.6% | 68% | 104% | 107% |
| 1,1,2,2-Tetrachloroethane | ug/L | 2.3 | <0.053 | <0.032 | <0.045 | <0.029 | <2.3% | <1.4% | <2.0% | <1.3% |
| Tetrachloroethylene | ug/L | 2.0 | <0.053 | <0.032 | <0.045 | <0.029 | <2.6% | <1.6% | <2.3% | <1.5% |
| Toxaphene | ug/L | 2.1E-04 | 8.0E-05 | 1.6E-04 | 2.5E-04 | 2.2E-04 | 38% | 74% | 119% | 106% |
| Trichloroethylene | ug/L | 27 | <0.053 | <0.032 | <0.045 | <0.029 | <0.2% | <0.1% | <0.2% | <0.1% |
| 1,1,2-Trichloroethane | ug/L | 9.4 | <0.053 | <0.032 | <0.045 | <0.029 | <0.6% | <0.3% | <0.5% | <0.3% |
| 2,4,6-Trichlorophenol | ug/L | 0.29 | <0.0015 | <0.040 | <0.0061 | <0.035 | <0.5% | <14% | <2.1% | <12% |
| Vinyl chloride | ug/L | 36 | <0.029 | <0.022 | <0.026 | <0.020 | <0.08% | <0.06% | <0.07% | <0.06% |

[a] Note that if the percentage as determined by using the MRL was less than 0.01 percent, then a minimum value is shown as "<0.01%" (*e.g.*, if the MRL indicated the value was <0.000001%, for simplicity, it is displayed as <0.01%). Also, Shading indicates constituent is expected to be greater than 80 percent (orange shading) or exceed (red shading) the ocean plan objective for that discharge scenario.

[b] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based on the nature of the constituent. These constituents were measured individually for the secondary effluent and GWR concentrate, and these individual concentrations would comply with the Ocean Plan objectives.

[c] All observed values from all data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.

[d] For total chlorine residual, any waste streams containing a free-chlorine residual would be dechlorinated prior to discharge.

**Table A3 – GWR Project complete list of predicted concentrations of Ocean Plan constituents at the edge of the ZID for updated scenarios**

| Constituent | Units | Ocean Plan Objective | Estimated Concentration at Edge of ZID by Discharge Scenario | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| ***Objectives for protection of marine aquatic life*** | | | | | | | |
| Arsenic | ug/L | 8 | 3.3 | 3.0 | 3.1 | 3.2 | 3.2 |
| Cadmium | ug/L | 1 | 0.010 | 0.011 | 0.016 | 0.012 | 0.0077 |
| Chromium (Hexavalent) | ug/L | 2 | 0.025 | 0.046 | 0.064 | 0.040 | 0.023 |
| Copper | ug/L | 3 | 2.2 | 2.2 | 2.3 | 2.2 | 2.2 |
| Lead | ug/L | 2 | 0.0066 | 0.0073 | 0.010 | 0.0078 | 0.0051 |
| Mercury | ug/L | 0.04 | 0.0057 | 0.0059 | 0.0062 | 0.0059 | 0.0056 |
| Nickel | ug/L | 5 | 0.11 | 0.12 | 0.17 | 0.12 | 0.083 |
| Selenium | ug/L | 15 | 0.055 | 0.071 | 0.10 | 0.070 | 0.045 |
| Silver | ug/L | 0.7 | <0.17 | <0.16 | <0.16 | <0.17 | <0.17 |
| Zinc | ug/L | 20 | 8.3 | 8.4 | 8.6 | 8.4 | 8.3 |
| Cyanide | ug/L | 1 | 0.060 | 0.072 | 0.10 | 0.073 | 0.047 |
| Total Chlorine Residual [c] | ug/L | 2 | – | – | – | – | – |
| Ammonia (as N) - 6-mo median | ug/L | 600 | 295 | 326 | 465 | 346 | 230 |
| Ammonia (as N) - Daily Max | ug/L | 2,400 | 398 | 439 | 626 | 466 | 309 |
| Acute Toxicity [a] | TUa | 0.3 | | | | | |
| Chronic Toxicity [a] | TUc | 1 | | | | | |
| Phenolic Compounds (non-chlorinated) | ug/L | 30 | 0.56 | 0.62 | 0.88 | 0.66 | 0.44 |
| Chlorinated Phenolics | ug/L | 1 | <0.14 | <0.037 | <0.068 | <0.10 | <0.087 |
| Endosulfan | ug/L | 0.009 | 3.9E-04 | 4.3E-04 | 6.1E-04 | 4.6E-04 | 3.0E-04 |
| Endrin | ug/L | 0.002 | 6.4E-07 | 7.1E-07 | 1.0E-06 | 7.5E-07 | 5.0E-07 |
| HCH (Hexachlorocyclohexane) | ug/L | 0.004 | 4.8E-04 | 5.4E-04 | 7.6E-04 | 5.7E-04 | 3.8E-04 |
| Radioactivity (Gross Beta) [a] | pci/L | – | | | | | |
| Radioactivity (Gross Alpha) [a] | pci/L | – | | | | | |
| ***Objectives for protection of human health – non-carcinogens*** | | | | | | | |
| Acrolein | ug/L | 220 | 0.073 | 0.081 | 0.12 | 0.086 | 0.057 |
| Antimony | ug/L | 1200 | 0.0064 | 0.0071 | 0.010 | 0.0075 | 0.0050 |
| Bis (2-chloroethoxy) methane | ug/L | 4.4 | <0.028 | <0.0024 | <0.0071 | <0.017 | <0.017 |
| Bis (2-chloroisopropyl) ether | ug/L | 1200 | <0.028 | <0.0024 | <0.0071 | <0.017 | <0.017 |
| Chlorobenzene | ug/L | 570 | <0.0035 | <9.2E-04 | <0.0017 | <0.0024 | <0.0022 |
| Chromium (III) | ug/L | 190000 | 0.061 | 0.079 | 0.11 | 0.079 | 0.050 |
| Di-n-butyl phthalate | ug/L | 3500 | <0.047 | <0.0029 | <0.010 | <0.027 | <0.028 |
| Dichlorobenzenes | ug/L | 5100 | 0.013 | 0.014 | 0.020 | 0.015 | 0.010 |
| Diethyl phthalate | ug/L | 33000 | <0.034 | <0.0026 | <0.0081 | <0.019 | <0.020 |
| Dimethyl phthalate | ug/L | 820000 | <0.014 | <0.0012 | <0.0034 | <0.0079 | <0.0081 |
| 4,6-dinitro-2-methylphenol | ug/L | 220 | <0.14 | <0.012 | <0.034 | <0.079 | <0.081 |
| 2,4-Dinitrophenol | ug/L | 4.0 | <0.089 | <0.011 | <0.026 | <0.053 | <0.053 |
| Ethylbenzene | ug/L | 4100 | <0.0035 | <9.2E-04 | <0.0017 | <0.0024 | <0.0022 |
| Fluoranthene | ug/L | 15 | <0.0034 | <2.6E-04 | <8.1E-04 | <0.002 | <0.002 |
| Hexachlorocyclopentadiene | ug/L | 58 | <0.0034 | <1.7E-04 | <7.0E-04 | <0.0019 | <0.0020 |
| Nitrobenzene | ug/L | 4.9 | <0.016 | <0.0021 | <0.0049 | <0.010 | <0.0095 |
| Thallium | ug/L | 2 | 0.0056 | 0.0062 | 0.0089 | 0.0066 | 0.0044 |
| Toluene | ug/L | 85000 | <0.0035 | <9.2E-04 | <0.0017 | <0.0024 | <0.0022 |
| Tributyltin | ug/L | 0.0014 | <3.4E-04 | <4.2E-05 | <1.0E-04 | <2.1E-04 | <2.0E-04 |
| 1,1,1-Trichloroethane | ug/L | 540000 | <0.0035 | <9.2E-04 | <0.0017 | <0.0024 | <0.0022 |
| ***Objectives for protection of human health - carcinogens*** | | | | | | | |
| Acrylonitrile | ug/L | 0.10 | 0.021 | 0.023 | 0.033 | 0.024 | 0.016 |
| Aldrin [b] | ug/L | 0.000022 | <5.0E-05 | <1.8E-05 | <3.0E-05 | <3.7E-05 | <3.2E-05 |
| Benzene | ug/L | 5.9 | <0.0035 | <9.2E-04 | <0.0017 | <0.0024 | <0.0022 |
| Benzidine [b] | ug/L | 0.000069 | <0.13 | <0.0036 | <0.023 | <0.073 | <0.078 |
| Beryllium | ug/L | 0.033 | 0.0047 | 8.4E-04 | 0.0018 | 0.0030 | 0.0029 |
| Bis(2-chloroethyl)ether | ug/L | 0.045 | <0.028 | <0.0024 | <0.0071 | <0.017 | <0.017 |

| Constituent | Units | Ocean Plan Objective | Estimated Concentration at Edge of ZID by Discharge Scenario | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| Bis(2-ethyl-hexyl)phthalate | ug/L | 3.5 | 0.63 | 0.70 | 1.0 | 0.74 | 0.49 |
| Carbon tetrachloride | ug/L | 0.90 | 0.0041 | 0.0045 | 0.0064 | 0.0048 | 0.0032 |
| Chlordane | ug/L | 0.000023 | 6.0E-06 | 6.6E-06 | 9.4E-06 | 7.0E-06 | 4.6E-06 |
| Chlorodibromomethane | ug/L | 8.6 | 0.020 | 0.022 | 0.031 | 0.023 | 0.015 |
| Chloroform | ug/L | 130 | 0.31 | 0.35 | 0.50 | 0.37 | 0.24 |
| DDT | ug/L | 0.00017 | 1.7E-05 | 6.2E-05 | 8.2E-05 | 4.5E-05 | 2.1E-05 |
| 1,4-Dichlorobenzene | ug/L | 18 | 0.013 | 0.014 | 0.020 | 0.015 | 0.010 |
| 3,3-Dichlorobenzidine [b] | ug/L | 0.0081 | <0.13 | <0.0067 | <0.027 | <0.072 | <0.075 |
| 1,2-Dichloroethane | ug/L | 28 | <0.0035 | <9.2E-04 | <0.0017 | <0.0024 | <0.0022 |
| 1,1-Dichloroethylene | ug/L | 0.9 | 0.0035 | 9.2E-04 | 0.0017 | 0.0024 | 0.0022 |
| Dichlorobromomethane | ug/L | 6.2 | 0.021 | 0.023 | 0.033 | 0.025 | 0.017 |
| Dichloromethane | ug/L | 450 | 0.0052 | 0.0058 | 0.0082 | 0.0061 | 0.0041 |
| 1,3-dichloropropene | ug/L | 8.9 | 0.0046 | 0.0050 | 0.0072 | 0.0053 | 0.0035 |
| Dieldrin | ug/L | 0.00004 | 4.3E-06 | 5.9E-06 | 8.2E-06 | 5.7E-06 | 3.5E-06 |
| 2,4-Dinitrotoluene | ug/L | 2.6 | <0.013 | <5.2E-04 | <0.0026 | <0.0074 | <0.0079 |
| 1,2-Diphenylhydrazine | ug/L | 0.16 | <0.028 | <0.0024 | <0.0071 | <0.017 | <0.017 |
| Halomethanes | ug/L | 130 | 0.012 | 0.013 | 0.018 | 0.014 | 0.0090 |
| Heptachlor [b] | ug/L | 0.00005 | <7.0E-05 | <1.8E-05 | <3.4E-05 | <4.8E-05 | <4.4E-05 |
| Heptachlor Epoxide | ug/L | 0.00002 | 4.8E-07 | 5.3E-07 | 7.5E-07 | 5.6E-07 | 3.7E-07 |
| Hexachlorobenzene | ug/L | 0.00021 | 6.3E-07 | 7.0E-07 | 1.0E-06 | 7.4E-07 | 4.9E-07 |
| Hexachlorobutadiene | ug/L | 14 | 7.3E-08 | 8.1E-08 | 1.2E-07 | 8.6E-08 | 5.7E-08 |
| Hexachloroethane | ug/L | 2.5 | <0.016 | <0.0012 | <0.0038 | <0.0090 | <0.0092 |
| Isophorone | ug/L | 730 | <0.0035 | <9.2E-04 | <0.0017 | <0.0024 | <0.0022 |
| N-Nitrosodimethylamine | ug/L | 7.3 | 6.9E-04 | 2.7E-04 | 4.4E-04 | 5.2E-04 | 4.5E-04 |
| N-Nitrosodi-N-Propylamine | ug/L | 0.38 | 5.2E-04 | 4.5E-05 | 1.3E-04 | 3.0E-04 | 3.1E-04 |
| N-Nitrosodiphenylamine | ug/L | 2.5 | <0.016 | <0.0021 | <0.0049 | <0.010 | <0.0095 |
| PAHs | ug/L | 0.0088 | 4.3E-04 | 4.7E-04 | 6.8E-04 | 5.0E-04 | 3.3E-04 |
| PCBs | ug/L | 0.000019 | 5.5E-06 | 6.1E-06 | 8.7E-06 | 6.5E-06 | 4.3E-06 |
| TCDD Equivalents | ug/L | 3.9E-09 | 1.2E-09 | 1.4E-09 | 2.0E-09 | 1.5E-09 | 9.7E-10 |
| 1,1,2,2-Tetrachloroethane | ug/L | 2.3 | <0.0035 | <9.2E-04 | <0.0017 | <0.0024 | <0.0022 |
| Tetrachloroethylene | ug/L | 2.0 | <0.0035 | <9.2E-04 | <0.0017 | <0.0024 | <0.0022 |
| Toxaphene | ug/L | 2.1E-04 | 5.8E-05 | 6.4E-05 | 9.1E-05 | 6.7E-05 | 4.5E-05 |
| Trichloroethylene | ug/L | 27 | <0.0035 | <9.2E-04 | <0.0017 | <0.0024 | <0.0022 |
| 1,1,2-Trichloroethane | ug/L | 9.4 | <0.0035 | <9.2E-04 | <0.0017 | <0.0024 | <0.0022 |
| 2,4,6-Trichlorophenol | ug/L | 0.29 | <0.016 | <0.0021 | <0.0049 | <0.010 | <0.0095 |
| Vinyl chloride | ug/L | 36 | <0.0035 | <9.2E-04 | <0.0017 | <0.0024 | <0.0022 |

[a] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based on the nature of these constituents. These constituents were measured individually for the secondary effluent and RO concentrate, and these individual concentrations would comply with the Ocean Plan objectives.

[b] All observed values from all data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.

[c] For total chlorine residual, any waste streams containing a free-chlorine residual would be dechlorinated prior to discharge.

**Table A4 – GWR Project complete list of predicted concentrations of Ocean Plan constituents at the edge of the ZID as a percentage of the Ocean Plan objective for updated scenarios [a]**

| Constituent | Units | Ocean Plan Objective | Estimated Concentration at Edge of ZID by Discharge Scenario | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| ***Objectives for protection of marine aquatic life*** | | | | | | | |
| Arsenic | ug/L | 8 | 41% | 38% | 38% | 40% | 40% |
| Cadmium | ug/L | 1 | 1.0% | 1.1% | 1.6% | 1.2% | 0.8% |
| Chromium (Hexavalent) | ug/L | 2 | 1.3% | 2.3% | 3.2% | 2.0% | 1.1% |
| Copper | ug/L | 3 | 73% | 74% | 78% | 75% | 72% |
| Lead | ug/L | 2 | 0.3% | 0.4% | 0.5% | 0.4% | 0.3% |
| Mercury | ug/L | 0.04 | 14% | 15% | 16% | 15% | 14% |
| Nickel | ug/L | 5 | 2.1% | 2.4% | 3.3% | 2.5% | 1.7% |
| Selenium | ug/L | 15 | 0.4% | 0.5% | 1% | 0.5% | 0.3% |
| Silver | ug/L | 0.7 | <24% | <23% | <23% | <24% | <24% |
| Zinc | ug/L | 20 | 42% | 42% | 43% | 42% | 41% |
| Cyanide | ug/L | 1 | 6.0% | 7.2% | 10% | 7.3% | 4.7% |
| Total Chlorine Residual [d] | ug/L | 2 | – | – | – | – | – |
| Ammonia (as N) - 6-mo median | ug/L | 600 | 49% | 54% | 78% | 58% | 38% |
| Ammonia (as N) - Daily Max | ug/L | 2,400 | 17% | 18% | 26% | 19% | 13% |
| Acute Toxicity [b] | TUa | 0.3 | | | | | |
| Chronic Toxicity [b] | TUc | 1 | | | | | |
| Phenolic Compounds (non-chlorinated) | ug/L | 30 | 1.9% | 2.1% | 2.9% | 2.2% | 1.5% |
| Chlorinated Phenolics | ug/L | 1 | <14% | <3.7% | <6.8% | <9.6% | <8.7% |
| Endosulfan | ug/L | 0.009 | 4.3% | 4.8% | 6.8% | 5.1% | 3.4% |
| Endrin | ug/L | 0.002 | 0.03% | 0.04% | 0.05% | 0.04% | 0.02% |
| HCH (Hexachlorocyclohexane) | ug/L | 0.004 | 12% | 13% | 19% | 14% | 9% |
| Radioactivity (Gross Beta) [b] | pci/L | – | | | | | |
| Radioactivity (Gross Alpha) [b] | pci/L | – | | | | | |
| ***Objectives for protection of human health – non-carcinogens*** | | | | | | | |
| Acrolein | ug/L | 220 | 0.03% | 0.04% | 0.05% | 0.04% | 0.03% |
| Antimony | ug/L | 1200 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Bis (2-chloroethoxy) methane | ug/L | 4.4 | <0.6% | <0.05% | <0.2% | <0.4% | <0.4% |
| Bis (2-chloroisopropyl) ether | ug/L | 1200 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Chlorobenzene | ug/L | 570 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Chromium (III) | ug/L | 190000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Di-n-butyl phthalate | ug/L | 3500 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Dichlorobenzenes | ug/L | 5100 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Diethyl phthalate | ug/L | 33000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Dimethyl phthalate | ug/L | 820000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| 4,6-dinitro-2-methylphenol | ug/L | 220 | <0.06% | <0.01% | <0.02% | <0.04% | <0.04% |
| 2,4-Dinitrophenol | ug/L | 4.0 | <2.2% | <0.3% | <0.7% | <1.3% | <1.3% |
| Ethylbenzene | ug/L | 4100 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Fluoranthene | ug/L | 15 | <0.02% | <0.01% | <0.01% | <0.01% | <0.01% |
| Hexachlorocyclopentadiene | ug/L | 58 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Nitrobenzene | ug/L | 4.9 | <0.3% | <0.04% | <0.1% | <0.2% | <0.2% |
| Thallium | ug/L | 2 | 0.3% | 0.3% | 0.4% | 0.3% | 0.2% |
| Toluene | ug/L | 85000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Tributyltin | ug/L | 0.0014 | <24% | <3.0% | <7.3% | <15% | <15% |
| 1,1,1-Trichloroethane | ug/L | 540000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| ***Objectives for protection of human health - carcinogens*** | | | | | | | |
| Acrylonitrile | ug/L | 0.10 | 21% | 23% | 33% | 24% | 16% |
| Aldrin [c] | ug/L | 0.000022 | – | – | – | – | – |
| Benzene | ug/L | 5.9 | <0.06% | <0.02% | <0.03% | <0.04% | <0.04% |
| Benzidine [c] | ug/L | 0.000069 | – | – | – | – | – |
| Beryllium | ug/L | 0.033 | 0.4% | 2.5% | 3.3% | 1.7% | 0.7% |
| Bis(2-chloroethyl)ether | ug/L | 0.045 | <63% | <5.4% | <16% | <37% | <38% |
| Bis(2-ethyl-hexyl)phthalate | ug/L | 3.5 | 18% | 20% | 28% | 21% | 14% |

| Constituent | Units | Ocean Plan Objective | Estimated Concentration at Edge of ZID by Discharge Scenario | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| Carbon tetrachloride | ug/L | 0.90 | 0.5% | 0.5% | 0.7% | 0.5% | 0.4% |
| Chlordane | ug/L | 0.000023 | 26% | 29% | 41% | 30% | 20% |
| Chlorodibromomethane | ug/L | 8.6 | 0.2% | 0.3% | 0.4% | 0.3% | 0.2% |
| Chloroform | ug/L | 130 | 0.2% | 0.3% | 0.4% | 0.3% | 0.2% |
| DDT | ug/L | 0.00017 | 10% | 36% | 49% | 26% | 12% |
| 1,4-Dichlorobenzene | ug/L | 18 | 0.07% | 0.08% | 0.1% | 0.08% | 0.06% |
| 3,3-Dichlorobenzidine [c] | ug/L | 0.0081 | – | – | – | – | – |
| 1,2-Dichloroethane | ug/L | 28 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| 1,1-Dichloroethylene | ug/L | 0.9 | 0.4% | 0.1% | 0.2% | 0.3% | 0.2% |
| Dichlorobromomethane | ug/L | 6.2 | 0.3% | 0.4% | 0.5% | 0.4% | 0.3% |
| Dichloromethane | ug/L | 450 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| 1,3-dichloropropene | ug/L | 8.9 | 0.05% | 0.06% | 0.08% | 0.06% | 0.04% |
| Dieldrin | ug/L | 0.00004 | 11% | 15% | 21% | 14% | 8.9% |
| 2,4-Dinitrotoluene | ug/L | 2.6 | <0.5% | <0.02% | <0.10% | <0.3% | <0.3% |
| 1,2-Diphenylhydrazine | ug/L | 0.16 | <18% | <1.5% | <4.5% | <10% | <11% |
| Halomethanes | ug/L | 130 | <0.01% | <0.01% | 0.01% | 0.01% | <0.01% |
| Heptachlor [c] | ug/L | 0.00005 | – | <37% | <68% | – | – |
| Heptachlor Epoxide | ug/L | 0.00002 | 2.4% | 2.6% | 3.8% | 2.8% | 1.9% |
| Hexachlorobenzene | ug/L | 0.00021 | 0.3% | 0.3% | 0.5% | 0.4% | 0.2% |
| Hexachlorobutadiene | ug/L | 14 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Hexachloroethane | ug/L | 2.5 | <0.6% | <0.05% | <0.2% | <0.4% | <0.4% |
| Isophorone | ug/L | 730 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| N-Nitrosodimethylamine | ug/L | 7.3 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| N-Nitrosodi-N-Propylamine | ug/L | 0.38 | 0.1% | 0.01% | 0.03% | 0.08% | 0.08% |
| N-Nitrosodiphenylamine | ug/L | 2.5 | <0.6% | <0.08% | <0.2% | <0.4% | <0.4% |
| PAHs | ug/L | 0.0088 | 4.9% | 5.4% | 7.7% | 5.7% | 3.8% |
| PCBs | ug/L | 0.000019 | 29% | 32% | 46% | 34% | 23% |
| TCDD Equivalents | ug/L | 3.9E-09 | 32% | 35% | 50% | 38% | 25% |
| 1,1,2,2-Tetrachloroethane | ug/L | 2.3 | <0.2% | <0.04% | <0.07% | <0.1% | <0.09% |
| Tetrachloroethylene | ug/L | 2.0 | <0.2% | <0.05% | <0.08% | <0.1% | <0.1% |
| Toxaphene | ug/L | 2.1E-04 | 27% | 30% | 43% | 32% | 21% |
| Trichloroethylene | ug/L | 27 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| 1,1,2-Trichloroethane | ug/L | 9.4 | <0.04% | <0.01% | <0.02% | <0.03% | <0.02% |
| 2,4,6-Trichlorophenol | ug/L | 0.29 | <5.4% | <0.7% | <1.7% | <3.3% | <3.3% |
| Vinyl chloride | ug/L | 36 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |

[a] Note that if the percentage as determined by using the MRL was less than 0.01 percent, then a minimum value is shown as "<0.01%" (*e.g.*, if the MRL indicated the value was <0.000001%, for simplicity, it is displayed as <0.01%).

[b] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based on the nature of these constituents. These constituents were measured individually for the secondary effluent and RO concentrate, and these individual concentrations would comply with the Ocean Plan objectives.

[c] All observed values from all data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.

[d] For total chlorine residual, any waste streams containing a free-chlorine residual would be dechlorinated prior to discharge.

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# Appendix V

# Ocean Plan Compliance Assessment for the Monterey Peninsula Water Supply Project and Project Variant

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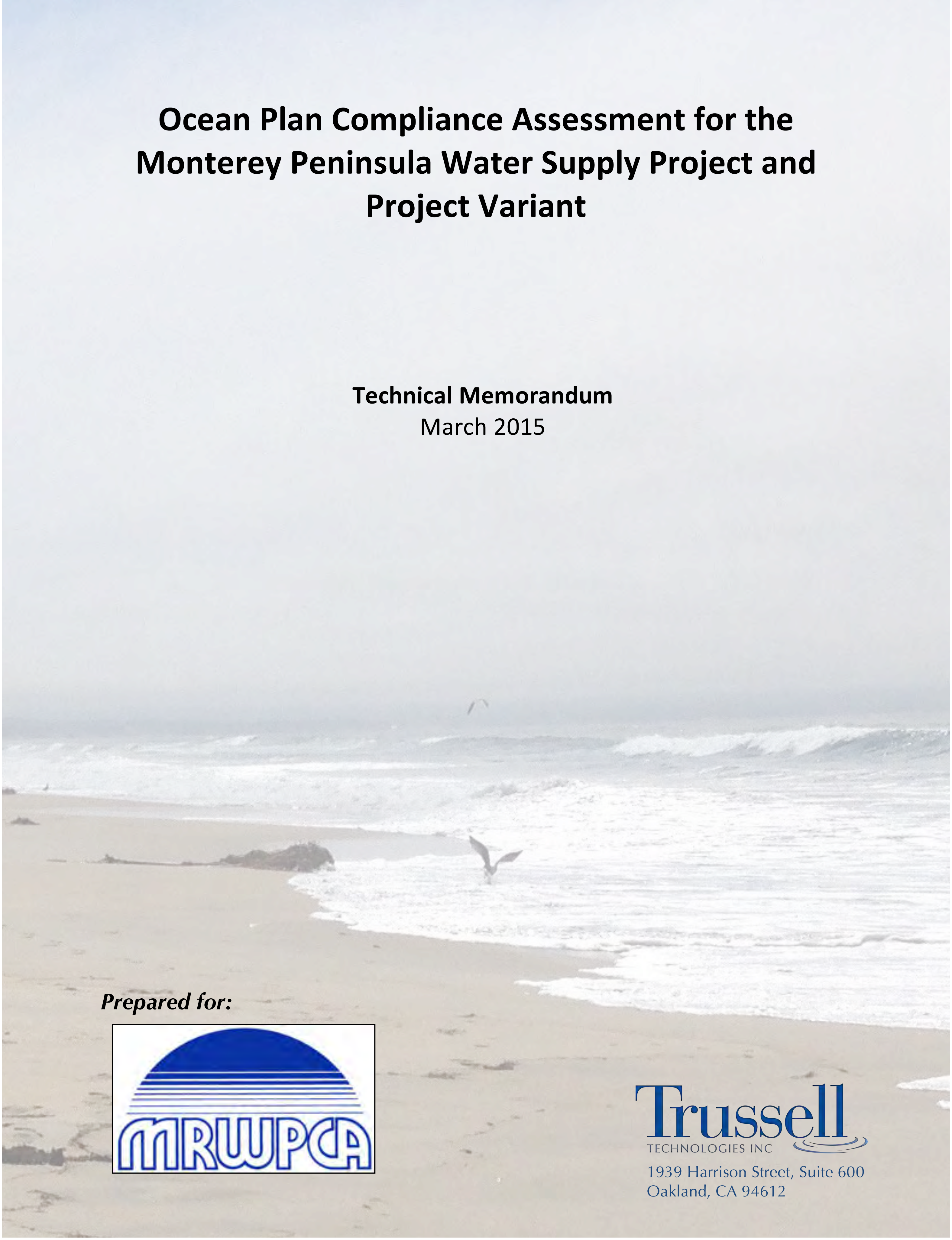
# Ocean Plan Compliance Assessment for the Monterey Peninsula Water Supply Project and Project Variant

**Technical Memorandum**

March 2015



***Prepared for:***

MRWPCA

Trussell
TECHNOLOGIES INC
1939 Harrison Street, Suite 600
Oakland, CA 94612

# Ocean Plan Compliance Assessment for the Monterey Peninsula Water Supply Project and Project Variant

## Technical Memorandum

Pure Water Monterey
A Groundwater Replenishment Project

**March 2015**


Prepared By:

**Trussell Technologies, Inc.**
Gordon Williams, Ph.D., P.E.
Brie Webber

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# 1 Introduction

In response to State Water Resources Control Board (SWRCB) Water Rights Orders WR 95-10 and WR 2009-0060, two proposed projects are in development on the Monterey Peninsula to provide potable water to offset pending reductions of Carmel River water diversions: (1) a seawater desalination project known as the **Monterey Peninsula Water Supply Project (“MPWSP”)**, and (2) a groundwater replenishment project known as the **Pure Water Monterey Groundwater Replenishment Project (“GWR Project”)**. The capacity of the MPWSP is dependent on whether the GWR Project is ultimately constructed. For the MPWSP, California American Water (“CalAm”) would build a seawater desalination facility capable of producing 9.6 million gallons per day (mgd) of drinking water. In a variation of that project, known as the **Monterey Peninsula Water Supply Project Variant (“Variant”)**, CalAm would build a smaller desalination facility capable of producing 6.4 mgd of drinking water, and a partnership between the Monterey Peninsula Water Management District (“MPWMD”) and the Monterey Regional Water Pollution Control Agency (“MRWPCA”) would build an advanced water treatment facility (“AWT Facility”) capable of producing up to 3,700 acre-feet per year (AFY) (3.3 mgd)[1] of highly purified recycled water to enable CalAm to extract 3,500 AFY (3.1 mgd) from the Seaside Groundwater Basin for delivery to their customers. The AWT Facility would purify secondary-treated wastewater (*i.e.*, secondary effluent) from MRWPCA’s Regional Treatment Plant (“RTP”), and this highly purified recycled water would be injected into the Seaside Groundwater Basin and later extracted for municipal water supplies. Both the proposed desalination facility and the proposed AWT Facility would employ reverse osmosis (RO) membranes to purify the waters, and as a result, both projects would produce RO concentrate waste streams that would be disposed through the existing MRWPCA ocean outfall: the brine concentrate from the desalination facility (“Desal Brine”), and the RO concentrate from the AWT Facility (“GWR Concentrate”).

The goal of this technical memorandum is to analyze whether the discharges from the proposed projects to the ocean through the existing outfall would impact marine water quality, and thus, human health, marine biological resources, or beneficial uses of the receiving waters. A similar assessment of the GWR Project on its own was previously performed (Trussell Tech, 2015, see Appendix B), and thus this document is focused on the MPWSP and the Variant projects.

## 1.1 Treatment through the Proposed CalAm Desalination Facility

This section describes the proposed treatment train for the MPWSP desalination facility. Seawater from the Monterey Bay would be extracted through subsurface slant wells beneath the ocean floor and piped to a new CalAm-owned desalination facility. This facility would consist of granular media pressure filters, cartridge filters, a two-pass RO membrane system, RO product-water stabilization (for corrosion control), and disinfection (Figure 1). The RO process is expected to recover 42 percent of the influent seawater flow as product water, while the remainder of the concentrated influent water becomes the Desal Brine. The MPWSP product

[1] One million gallons per day is equal to 1,121 acre-feet per year. The AWT Facility would be capable of producing up to 4 mgd of highly-purified recycled water on a daily basis, but production would fluctuate throughout the year, such that the average annual production would be 3.3 mgd (3,700 AFY) in a non-drought year.

water (desalinated water) would be used for municipal drinking water, while the Desal Brine would be blended with available RTP secondary effluent, brine that is trucked and stored at the RTP, and GWR Concentrate (for the Variant project only), before it is discharged to the ocean through the existing MRWPCA ocean outfall. The volume of Desal Brine is dependent on the project size: 13.98 and 8.99 mgd for the MPWSP and Variant projects, respectively.

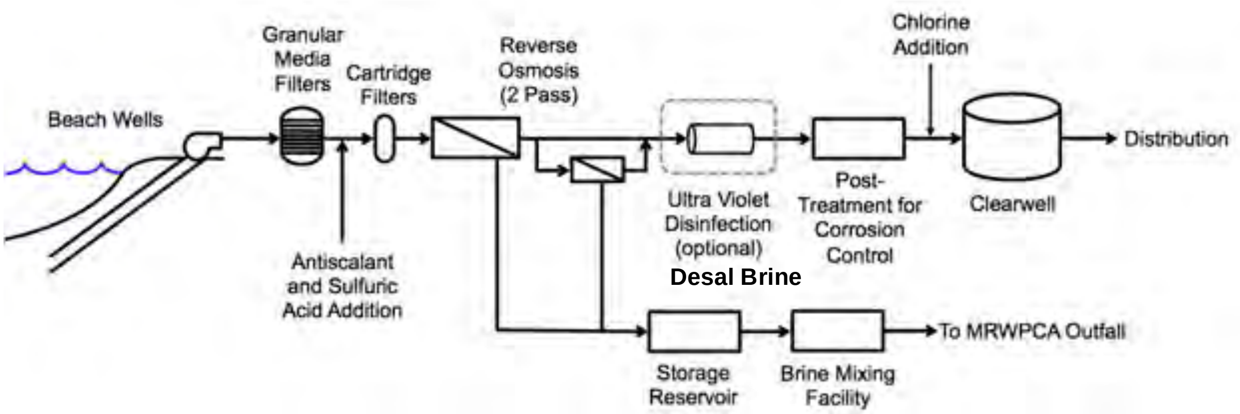


**Figure 1 – Simplified diagram of CalAm desalination facilities**

## 1.2 Treatment through the RTP and Proposed AWT Facilities

The existing MRWPCA RTP treatment process includes screening, primary sedimentation, secondary biological treatment through trickling filters, followed by a solids contactor (*i.e.*, bio-flocculation), and then clarification (Figure 2). Much of the secondary effluent undergoes tertiary treatment (granular media filtration and disinfection) to produce recycled water used for agricultural irrigation. The unused secondary effluent is discharged to the Monterey Bay through the MRWPCA outfall. MRWPCA also accepts trucked brine waste for ocean disposal ("hauled brine"), which is stored in a pond and mixed with secondary effluent for disposal.

The proposed AWT Facility would include several advanced treatment technologies for purifying the secondary effluent: ozone ($O_3$), biologically active filtration (BAF) (this is an optional unit process), membrane filtration (MF), RO, and an advanced oxidation process (AOP) using UV-hydrogen peroxide. MRWPCA and the MPWMD conducted a pilot-scale study of the ozone, MF, and RO elements of the AWT Facility from December 2013 through July 2014, successfully demonstrating the ability of the various treatment processes to produce highly-purified recycled water that complies with the California Groundwater Replenishment Using Recycled Water Regulations (Groundwater Replenishment Regulations),[2] the State Water Resource Control Board's Anti-degradation and Recycled Water Policies,[3] and Central Coast Water Quality Control Plan (Basin Plan)[4] standards, objectives and guidelines for groundwater. Monitoring of the concentrate from the RO was also conducted during the pilot-scale study.

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[2] SWRCB (2014) Water Recycling Criteria. Title 22, Division 4, Chapter 3, California Code of Regulations.

[3] See http://www.swrcb.ca.gov/plans_policies/

[4] See http://www.waterboards.ca.gov/centralcoast/publications_forms/publications/basin_plan/docs/basin_plan_2011.pdf

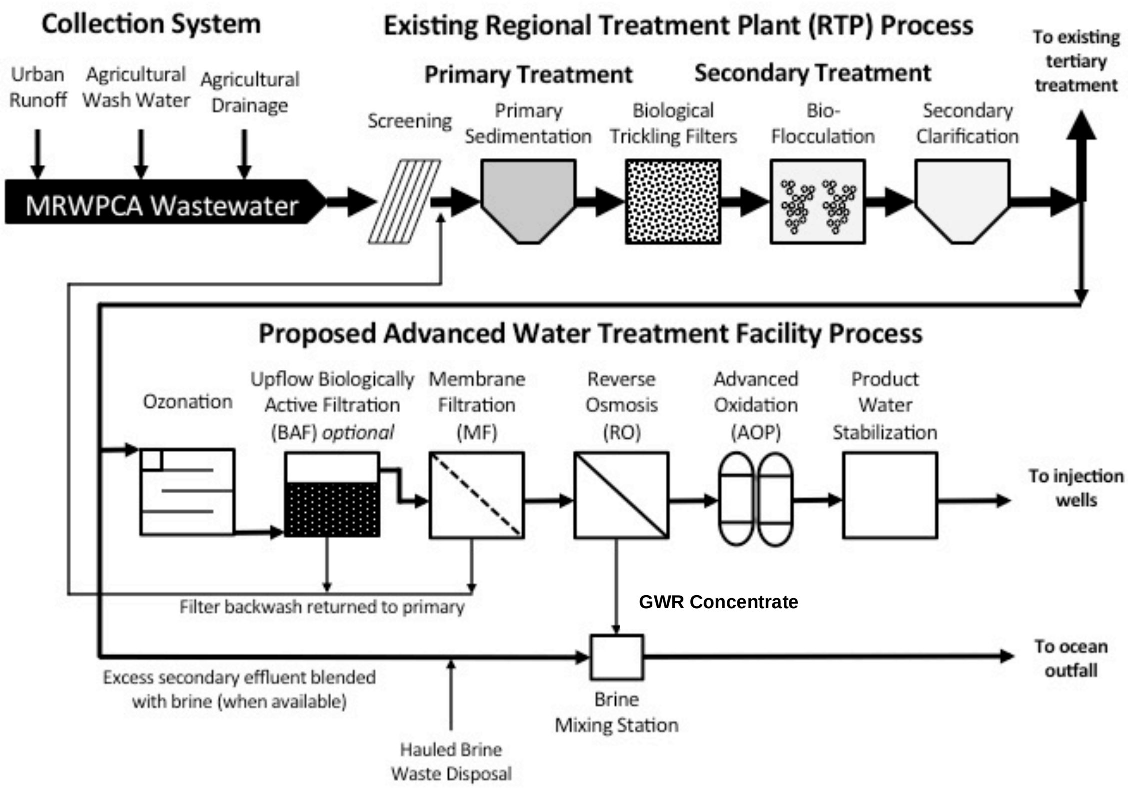


**Figure 2 – Simplified diagram of existing MRWPCA RTP and proposed AWT Facility treatment**

## 1.3 California Ocean Plan

The State Water Resources Control Board 2012 Ocean Plan ("Ocean Plan") sets forth water quality objectives for ocean discharges with the intent of preserving the quality of the ocean water for beneficial uses, including the protection of both human and aquatic ecosystem health (SWRCB, 2012). When municipal wastewater flows are released from an outfall, the wastewater and ocean water undergo rapid mixing due to the momentum and buoyancy of the discharge.[5] The mixing occurring in the rising plume is affected by the buoyancy and momentum of the discharge, a process referred to as initial dilution (NRC, 1993). For rising plumes, the Ocean Plan defines the initial dilution as complete when "the diluting wastewater ceases to rise in the water column and first begins to spread horizontally." For more saline discharges, a sinking plume can form when the mixture of seawater and discharge is denser than the ambient water (also known as a negatively buoyant plume). In the case of negatively buoyant plumes, the Ocean Plan defines the initial dilution as complete when "the momentum induced velocity of the discharge ceases to produce significant mixing of the waste, or the diluting plume reaches a fixed

[5] Municipal wastewater effluent, being effectively fresh water, is less dense than seawater and thus rises (due to buoyancy) while it mixes with ocean water. GWR Concentrate whether by itself or mixed with municipal wastewater effluent is less dense than seawater and also rises (due to buoyancy) while it mixes with ocean water.

distance from the discharge to be specified by the Regional Board, whichever results in the lower estimate for initial dilution."

The Ocean Plan objectives are to be met after the initial dilution of the discharge into the ocean. The initial dilution occurs in an area known as the zone of initial dilution (ZID). The extent of dilution in the ZID is quantified and referred to as the minimum probable initial dilution ($D_m$). The water quality objectives established in the Ocean Plan are adjusted by the $D_m$ to derive the National Pollutant Discharge Elimination System (NPDES) permit limits for a wastewater discharge prior to ocean dilution.

The current MRWPCA wastewater discharge is governed by NPDES permit R3-2014-0013 issued by the Central Coast Regional Water Quality Control Board ("RWQCB"). Because the existing NPDES permit for the MRWPCA ocean outfall must be amended to discharge Desal Brine, comparing future discharge concentrations to the current NPDES permit limits would not be an appropriate metric or threshold for determining whether the proposed projects would have a significant impact on marine water quality. Instead, compliance with the Ocean Plan objectives was selected as an appropriate threshold for determining whether or not the proposed projects would result in a significant impact requiring mitigation. FlowScience, Inc. ("FlowScience") conducted modeling of the ocean discharge for various discharge scenarios involving the proposed projects to determine $D_m$ values for the various discharge scenarios. These ocean modeling results were combined with projected discharge water quality to assess compliance with the Ocean Plan.

## 1.4 Future Ocean Discharges

A summary schematic of the MPWSP and Variant projects is presented in Figure 3. For the MPWSP, 23.58 mgd of ocean water (design capacity) would be treated in the desalination facility; an RO recovery of 42% would lead to an MPWSP Desal Brine flow of 13.98 mgd that would be discharged through the outfall. Secondary effluent from the RTP would also be discharged through the outfall, although the flow would be variable depending on both the influent flow and the proportion being processed through the tertiary treatment system at the Salinas Valley Reclamation Project (SVRP) to produce recycled water for agricultural irrigation. The final discharge component is hauled brine that is trucked to the RTP and blended with secondary effluent prior to being discharged. The maximum anticipated flow of this stream is 0.1 mgd (blend of brine and secondary effluent). These three discharge components (Desal Brine, secondary effluent, and hauled brine) would be mixed at the proposed Brine Mixing Facility prior to ocean discharge.

For the Variant project, 15.93 mgd of ocean water (design capacity) would be pumped to the desalination facility, and an RO recovery of 42% would result in a Variant Desal Brine flow of 8.99 mgd. The Variant would include the GWR Project, which involves the addition of new source waters to the RTP, which could alter the water quality of the secondary effluent produced by the RTP. The secondary effluent in the Variant is referred to as "Variant secondary effluent," and would be different in quality from the MPWSP secondary effluent. Under the GWR Project, a portion of the secondary effluent would be fed to the AWT Facility, and the resultant GWR Concentrate (maximum 0.94 mgd) would be discharged through the outfall. The hauled brine received at the RTP would continue to be blended with secondary effluent prior to discharge, the quality of the blended brine and secondary effluent will change as a result of the change in secondary effluent quality; the hauled brine for the Variant is referred to as "Variant hauled brine."

## 1.5 Objective of Technical Memorandum

Trussell Tech estimated worst-case in-pipe water quality for the various ocean discharge scenarios (*i.e.*, prior to dilution through ocean mixing) for the proposed projects. FlowScience ocean discharge modeling and the results of the water quality analysis were then used to provide an assessment of whether the proposed projects would consistently meet Ocean Plan water quality objectives. The objective of this technical memorandum is to summarize the assumptions, methodology, results and conclusions of the Ocean Plan compliance assessment for the MPWSP and Variant projects.

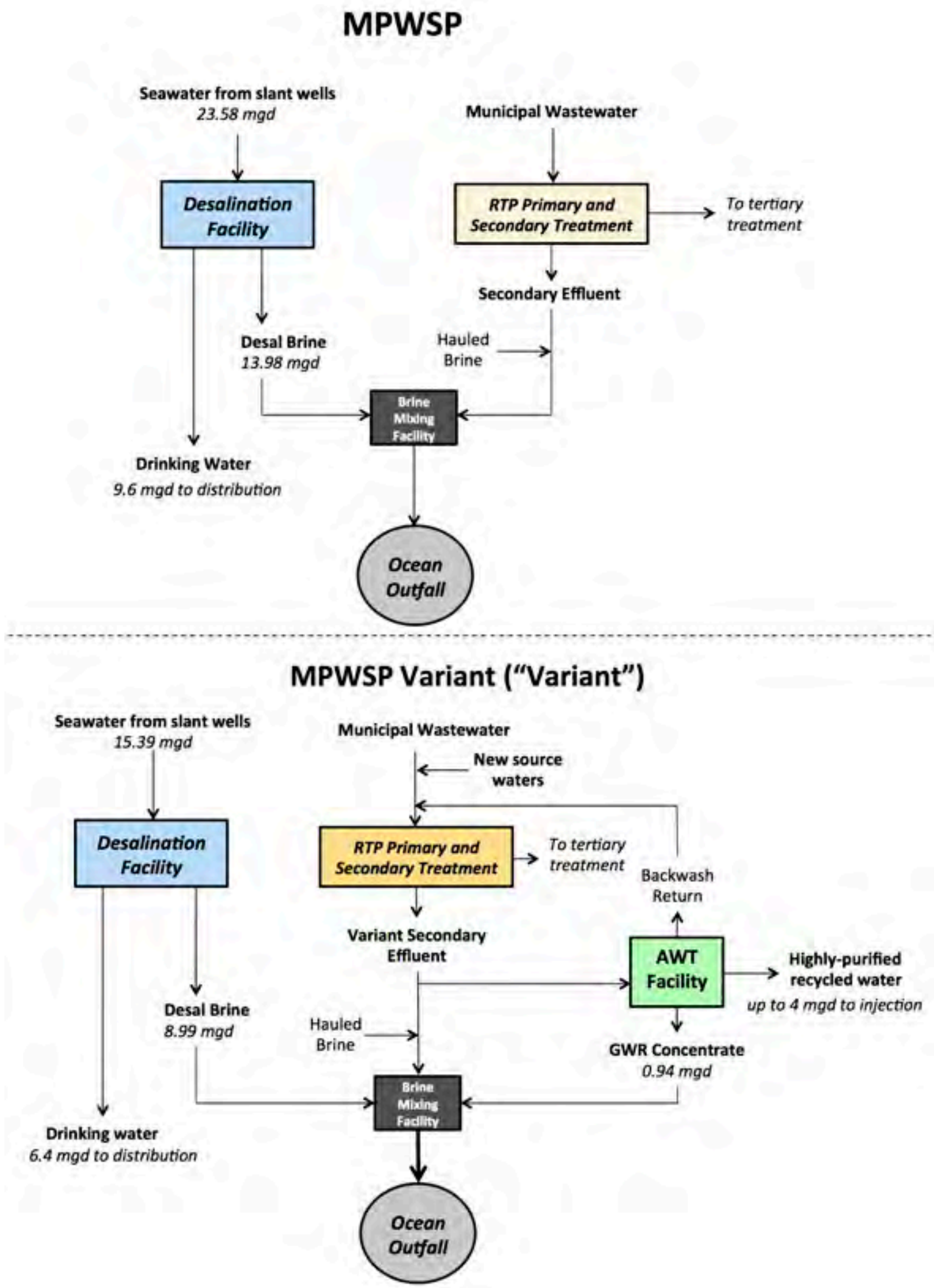


**Figure 3 – Simplified flow schematics for the MPWSP and Variant projects (specified flow rates are at design capacity)**

# 2 Methodology for Ocean Plan Compliance

Water quality data from various sources for the different treatment process influent and waste streams were compiled. Trussell Tech combined these data for different flow scenarios and used ocean modeling results to assess compliance of the different discharge scenarios with the Ocean Plan objectives. This section documents the data sources and provides further detail on the methodology used to perform this analysis. A summary of the methodology is presented in Figure 4.

## 2.1 Methodology for Determination of Discharge Water Quality

As previously discussed, the amounts and combinations of various wastewaters that would be disposed through the MRWPCA Outfall will vary depending on the capacity, seasonal and daily flow characteristics, and extent and timing of implementation of the proposed projects. The discharge components for the MPWSP and Variant are summarized in Table 1.

**Table 1 – Discharge waters Included in each analysis**

| Project | Desal Brine | Secondary Effluent | Variant Secondary Effluent | Hauled Brine | Variant Hauled Brine [a] | GWR Concentrate |
|---|---|---|---|---|---|---|
| MPWSP | ✓ | ✓ | | ✓ | | |
| Variant | ✓ | | ✓ | | ✓ | ✓ |

[a]This is placed in a separate category because it contains some Variant secondary effluent.

Detailed discussions about the methods used to determine the discharge water qualities related to the GWR Project were previously discussed and can be found in Appendix B. This previous analysis included water quality estimates of the secondary effluent and Variant secondary effluent, the hauled brine and Variant hauled brine, and the GWR Concentrate (*i.e.,* all of the discharges except for the Desal Brine). In the previous analysis, Trussell Tech assumed that the highest observed values for the various Ocean Plan constituents within each type of water flowing to and treated at the RTP, including the AWT Facility as applicable, to be the worst-case water quality[6], and these same data were used in the analysis described in this memorandum. Use of these worst-case water quality concentrations ensure that the analysis in both the Appendix B Ocean Plan compliance technical memorandum and this memorandum are conservative related to the Ocean Plan compliance assessment (and thus, the impact analysis for the projects' environmental review processes).

To determine the impact of the MPWSP and Variant Projects, the worst-case water quality of the Desal Brine was estimated using available data for ocean water quality (discussed further below). In all cases, the highest observed concentrations from all data sources were used for the analysis.

[6] The exception to this statement is cyanide. In mid-2011, Monterey Bay Analytical Service (MBAS) began performing the cyanide analysis on the RTP secondary effluent, at which time the reported values increased by an order of magnitude. Because no operational or source water composition changes took place at this time that would result in such an increase, it is reasonable to conclude the increase is an artifact of the change in analysis method and therefore the results were questionable. Therefore, although the cyanide concentrations reported by MBAS are presented, they are not used in the analysis for evaluating compliance with the Ocean Plan objectives for the EIR.

The methodology for determining the water quality of the Desal Brine and secondary effluent is further described in this section (the methodology for all other discharge waters can be found in Appendix B). A summary of which discharge waters are considered for both the MPWSP and Variant, and which data sources were used in the determination of the water quality for each discharge stream is shown in Figure 4.

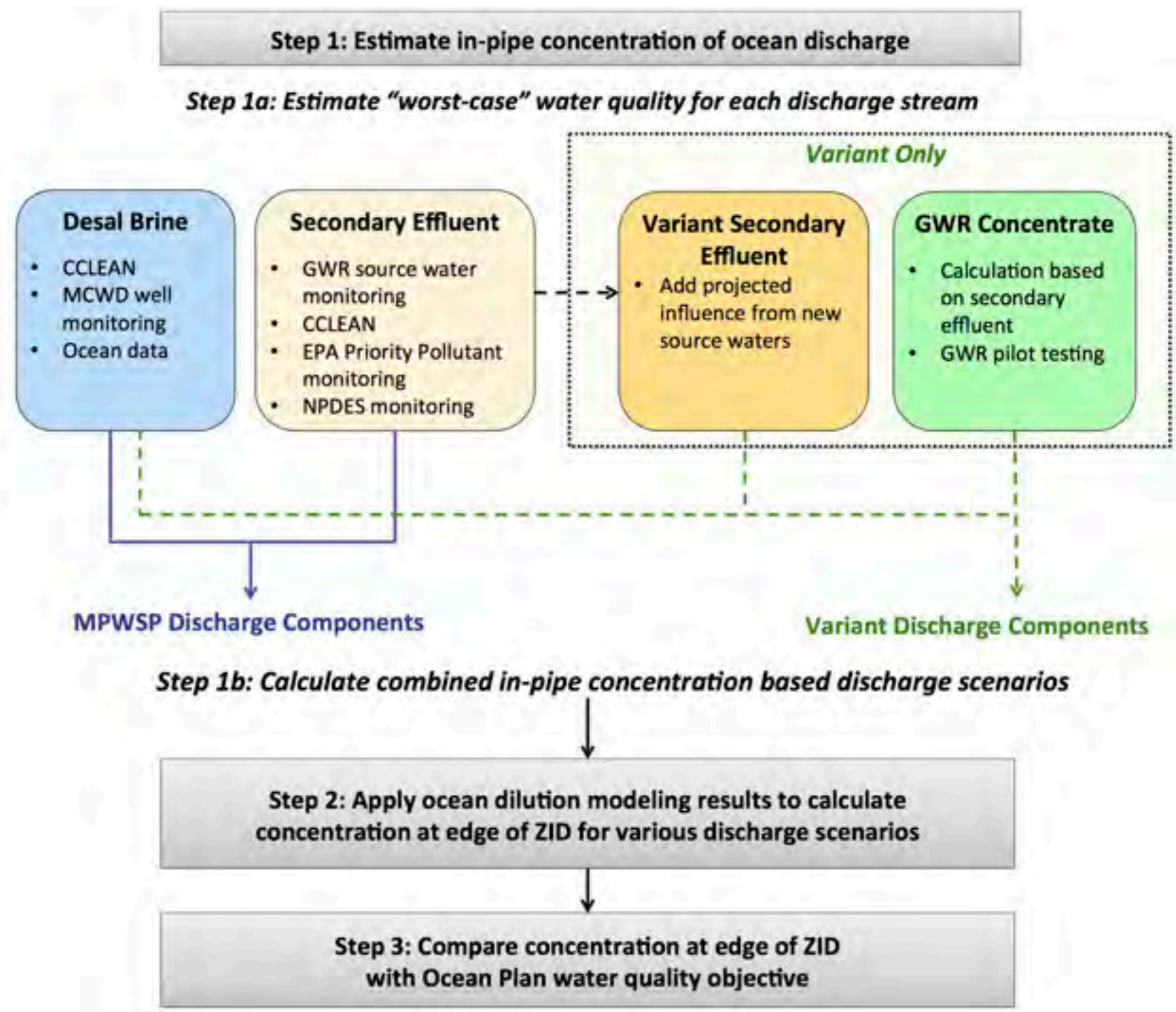


**Figure 4 – Logic flow chart for determination of MPWSP and Variant compliance with Ocean Plan objectives.**

### 2.1.1 Secondary Effluent

For the MPWSP Project, the discharged secondary effluent would not be impacted by additional source waters that would be brought in for the Variant project; therefore, the existing secondary effluent quality was used in the analysis. The following sources of data were considered for selecting an existing secondary effluent concentration for each constituent in the analysis:

- Secondary effluent water quality monitoring conducted for the GWR Project from July 2013 through June 2014
- Historical NPDES compliance data collected semi-annually by MRWPCA (2005-2014)

- Historical Priority Pollutant data collected annually by MRWPCA (2004-2014)
- Data collected by the Central Coast Long-Term Environmental Assessment Network (CCLEAN) (2008-2013)

The existing secondary effluent concentration for each constituent selected for the analysis was the maximum reported value from the above sources. In cases where the analysis of a constituent could not be quantified or it was not detected, the result is reported as less than the Method Reporting Limit (<MRL).[7] Because the actual concentration could be any value equal to or less than the MRL, the conservative approach is to use the value of the MRL in the flow-weighting calculations. In some cases, constituents were not detected ("ND") in any of the source waters; in this case, the values are reported as ND(<X), where X is the MRL. For some non-detected constituents, the MRL exceeds the Ocean Plan objective, and thus no compliance determination can be made[8]. A detailed discussion of the cases where a constituent was reported as less than the MRL is included in the previous technical memorandum in Appendix B.

### 2.1.2 Desal Brine

Only limited data were available for characterizing the Desal Brine water quality. Trussell Tech used the following three sources of data for the Desal Brine water quality assessment:

- Data generated by the CCLEAN program (2008-2013) for samples collected in the Monterey Bay (provided by Asavari Devadiga of ESA via e-mail on November 12, 2014).
- Water quality data collected quarterly in 2009 from a Marina Coast Water District (MCWD) monitoring well (DMW-2)
- Ocean monitoring data for copper and silver from outside the Golden Gate Bridge, collected sporadically from 1993 to 2013, and provided by Dane Hardin of Applied Marine Sciences (transmitted via e-mail on December 29, 2014).

With the exception of copper and silver, the maximum value observed in any of the data sources was assumed to be the "worst-case" water quality for the raw seawater feeding the desalination facility. For copper and silver, each was detected in one sample in the MCWD monitoring well data at an uncharacteristically high concentration (all other samples for the MCWD monitoring program were below detection), and issues related to well sampling technique are suspected (*e.g.*, inadequate flushing). Thus, the ocean monitoring data provided by Dane Hardin was used instead of the MCWD data, as it was considered to be more representative. A Desal Brine concentration was conservatively estimated for each constituent by using a concentration factor

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[7] The lowest amount of an analyte in a sample that can be quantitatively determined with stated, acceptable precision and accuracy under stated analytical conditions (*i.e*., the lower limit of quantitation). Therefore, acceptable quality control and quality assurance procedures are calibrated to the MRL, or lower. To take into account day-to-day fluctuations in instrument sensitivity, analyst performance, and other factors, the MRL is established at three times the Method Detection Limit (or greater). The Method Detection Limit is the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. (40 Code of Federal Regulations Section136 Appendix B).

[8] This phenomenon is common in the implementation of the Ocean Plan where for some constituents, suitable analytical methods are not capable of measuring low enough to quantify the minimum toxicologically relevant concentrations. For these constituents, a discharge is considered compliant if the monitoring results are less than the MRL.

of 1.73, which was calculated assuming complete constituent rejection and a 42 percent recovery through the seawater RO membranes.

Data limitations were such that no data were available for several Ocean Plan constituents. For constituents that lacked Desal Brine data, a concentration of zero was assumed for the analysis, such that the partial influence of the other discharge streams could still be assessed. Thus, a complete "worst-case" assessment for these constituents was not possible. A list of Ocean Plan constituents for which no Desal Brine or seawater data were available is provided in Appendix A, Table A1.

### 2.1.3 Combined Ocean Discharge Concentrations

Having calculated the worst-case future concentrations for each of the possible discharge components, the combined concentration prior to discharge was determined as a flow-weighted average of the contributions of each of the discharge components appropriate for the MPWSP and Variant (see Figure 4).

## 2.2 Ocean Modeling Methodology

In order to determine Ocean Plan compliance, Trussell Tech used the following information: (1) the in-pipe (*i.e.*, pre-ocean dilution) concentration of a constituent ($C_{\text{in-pipe}}$) that was developed as discussed in the previous section, (2) the minimum probable dilution for the ocean mixing ($D_m$) for the discharge flow scenarios that were modeled by FlowScience (FlowScience, 2014a and 2014b), and (3) the background concentration of the constituent in the ocean ($C_{\text{Background}}$) that is specified in the Table 3 of the Ocean Plan (SWRCB, 2012). With this information the concentration at the edge of the zone of initial dilution ($C_{ZID}$) was calculated using the following equation:

$$C_{ZID} = \frac{C_{\text{In-pipe}} + D_m * C_{\text{Background}}}{1 + D_m} \quad (1)$$

The $C_{ZID}$ was then compared to the Ocean Plan water quality objectives[9] in Table 1 of the Ocean Plan (SWRCB, 2012). For each discharge scenario, if the $C_{ZID}$ was below the Ocean Plan objective, then it was assumed that the discharge would comply with the Ocean Plan. However, if the $C_{ZID}$ exceeds the Ocean Plan objective, then it was concluded that the discharge scenario could violate the Ocean Plan objective. Note that this approach could not be applied for some constituents (*e.g.*, acute toxicity, chronic toxicity, and radioactivity[10]).

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[9] Note that the Ocean Plan (see Ocean Plan Table 2) also defines effluent limitations for oil and grease, suspended solids, settable solids, turbidity, and pH; however, it was not necessary to evaluate these parameters in this assessment. If necessary, the pH of the water would be adjusted to be within acceptable limits prior to discharge. Oil and grease, suspended solids, settable solids, and turbidity do not need to be considered in this analysis as the GWR Concentrate would be significantly better than the secondary effluent with regards to these parameters. Prior to the AWT Facility RO treatment process, the process flow would be treated by MF, which will reduce these parameters, and the waste stream from the MF will be returned to RTP headworks.

[10] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based the nature of the constituent. These constituents were measured individually for the secondary effluent and GWR Concentrate, and these individual concentrations would comply with the Ocean Plan

FlowScience performed modeling of a limited number of discharge scenarios for the MPWSP and Variant that include combinations of Desal Brine, secondary effluent, GWR Concentrate, and hauled brine (FlowScience, 2014a and 2014b). All scenarios assume the maximum flow rates for the GWR Concentrate, Desal Brine and hauled brine, which is a conservative assumption in terms of constituent loading and minimum dilution.

### 2.2.1 Ocean Modeling Scenarios

The modeled scenarios are summarized in Tables 2 and 3 for the MPWSP and the Variant projects, respectively. The Variant discharge scenarios that have no Desal Brine (*i.e.* Scenarios 5 through 9) have already been analyzed and found to comply with the Ocean Plan (Trussell Tech 2015, see Appendix B); these scenarios are shown in Table 3 for completeness, but for simplicity, the analysis of these scenarios is not repeated in Section 3.

**Table 2 - Modeled flow scenarios for the MPWSP**

| No. | Discharge Scenario (Ocean Condition) | Discharge flows (mgd) | | |
|---|---|---|---|---|
| | | Secondary effluent | Desal Brine | Hauled brine [a] |
| 1 | RTP design capacity without Desal Brine | 29.6 | 0 | 0.1 |
| 2 | Desal Brine with no secondary effluent | 0 | 13.98 | 0.1 |
| 3 | Desal Brine with low secondary effluent | 2 | 13.98 | 0.1 |
| 4 | Desal Brine with high secondary effluent [b] | 19.68 | 13.98 | 0.1 |

[a] Hauled brine was not included in the modeling of MPWSP flow scenarios; however, the change in both flow and TDS from the addition of hauled brine is less then 1% and thus is expected to have a negligible impact on the modeled $D_m$.

[b] Note that RTP wastewater flows have been declining in recent years as a result of water conservation; while 19.68 mgd is higher than current RTP wastewater flows, this is expected to be a conservative scenario with respect to ocean modeling, compared to using the current wastewater flows of 16 to 18 mgd.

**MPWSP Flow Scenarios:**

(1) **RTP design capacity without Desal Brine**: Design flow for the RTP, with no discharge of Desal Brine. This scenario could occur if the RTP facility was operated at the peak dry weather flow and the desalination facility was offline. This scenario is similar to discharge conditions used as the basis for the current MRWPCA NPDES discharge permit.

(2) **Desal Brine with no secondary effluent:** The maximum influence of the Desal Brine on the overall discharge (*i.e.*, no secondary effluent discharged). This scenario would be representative of conditions when demand for recycled water is highest (*e.g.*, during summer months), and all of the RTP secondary effluent is recycled through the SVRP for agricultural irrigation.

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objectives. No radioactivity or toxicity data were available for the seawater, and thus no determination could be made for these parameters for scenarios involving the Desal Brine.

(3) **Desal Brine with low secondary effluent:** Desal Brine discharged with a relatively low amount of secondary effluent, resulting in a negatively buoyant plume. This scenario represents times when demand for recycled water is high, but there is excess secondary effluent that is discharged to the ocean.

(4) **Desal Brine with high secondary effluent:** Desal Brine discharged with a relatively high amount of secondary effluent, resulting in a positively buoyant plume. This scenario would be representative of conditions when demand for recycled water is lowest (*e.g.*, during winter months), and the SVRP is not operational.

**Table 3 – Modeled flow scenarios for the Variant project**

| No. | Discharge Scenario (Ocean Condition) | Discharge Flows (mgd) | | | |
|---|---|---|---|---|---|
| | | Secondary Effluent | Desal Brine | GWR Concentrate | Hauled Brine [a] |
| 1 | Desal Brine only | 0 | 8.99 | 0 | 0.1 |
| 2 | Desal Brine with high secondary effluent [b] | 19.68 | 8.99 | 0 | 0.1 |
| 3 | Desal Brine with GWR Concentrate and high secondary effluent | 15.92 | 8.99 | 0.94[c] | 0.1 |
| 4 | Desal Brine with GWR Concentrate and no secondary effluent | 0 | 8.99 | 0.94[c] | 0.1 |
| 5 | RTP design capacity with GWR Concentrate [d] | 24.7 | 0 | 0.94 | 0.1 |
| 6 | RTP capacity with GWR Concentrate with current port configuration [d] | 23.7 | 0 | 0.94 | 0.1 |
| 7 | Minimum secondary effluent flow with GWR Concentrate [d] | 0 | 0 | 0.94 | 0.1 |
| 8 | Minimum secondary effluent flow with GWR Concentrate during Davidson oceanic conditions [d] | 0.4 | 0 | 0.94 | 0.1 |
| 9 | Moderate secondary effluent flow with GWR concentrate [d] | 3 | 0 | 0.94 | 0.1 |

[a] Hauled brine was not included in the modeling of Variant scenarios involving discharge of desalination brine. However, the change in both flow and TDS from the addition of hauled brine is less than 1% and thus is expected to have a negligible impact on the modeled $D_m$.
[b] Note that RTP wastewater flows are have been declining in recent years as a result of conservation; while 19.68 mgd is higher than current RTP wastewater flows, this is expected to be a conservative scenario with respect to ocean modeling, compared to using the current wastewater flows of 16 to 18 mgd.
[c] The actual modeled GWR Concentrate flow was 0.73 mgd (based on an older design for the AWT Facility). This change is not expected to have a significant impact on the modeled $D_m$. Future updates to modeling results would include the updated GWR Concentrate flow of 0.94 mgd.
[d] Scenarios 5 through 9 were analyzed as part of a previous analysis (see Appendix B), and based on the documented assumptions, the GWR Concentrate would comply with the Ocean Plan objectives; therefore, these scenarios are not discussed further in this memorandum.

**Variant Project Flow Scenarios:**

(1) **Desal Brine only:** Desal Brine discharged without secondary effluent or GWR Concentrate. This scenario would be representative of conditions when the smaller (6.4 mgd) desalination facility is in operation, but the AWT Facility is not operating

(*e.g.*, offline for maintenance), and all of the secondary effluent is recycled through the SVRP (*e.g.*, during high irrigation water demand summer months).

(2) **Desal Brine with high secondary effluent:** Desal Brine discharged with a relatively high flow of secondary effluent, resulting in a positively buoyant plume. This scenario would be representative of conditions when demand for recycled water is lowest (*e.g.*, during winter months), and neither the SVRP nor the AWT Facility are operational.

(3) **Desal Brine with GWR Concentrate and high secondary effluent:** Desal Brine discharged with GWR Concentrate and a relatively high flow of secondary effluent. The reduction of secondary effluent flow between Scenario 2 and this scenario is a result of the AWT Facility operation. This would be a typical discharge scenario when there is no demand for tertiary recycled water (*e.g.*, during winter months).

(4) **Desal Brine with GWR Concentrate and no secondary effluent:** Desal Brine discharge with GWR Concentrate and no secondary effluent. This scenario would be representative of the condition where both the desalination facility and the AWT Facility are in operation, and there is the highest demand for recycled water through the SVRP (*e.g.*, during summer months).

(5-9) **Variant conditions with no Desal Brine contribution**: These scenarios represent a range of conditions that would exist when the CalAm desalination facilities were offline for any reason. These conditions were previously evaluated (Trussell Tech, 2015) and thus are not discussed further in this technical memorandum.

The discharge scenarios presented in Tables 2 and 3 are the most representative scenarios that have been modeled for the proposed projects, however, it should be noted that some key discharge scenarios have yet to be modeled. Specifically, a discharge scenario where a moderate secondary effluent flow (*e.g.*, between 4 and 10 mgd) is discharged along with the Desal Brine, such that the combined discharge still results in a negatively buoyant plume[11]. Therefore, the results presented in Section 3 should be viewed as partial findings. A separate technical memorandum is in the process of being prepared to amend the work in this report to include the analysis recommended in this paragraph. It is anticipated for completion by late March 2015.

### 2.2.2 Ocean Modeling Assumptions

FlowScience documented the modeling assumptions and results in two technical memoranda (FlowScience, 2014a and 2014b). The modeling assumptions were specific to the oceanic condition: Davidson (November to March), Upwelling (April to August), and Oceanic (September to October)[12]. In order to conservatively demonstrate Ocean Plan compliance, the

[11] This scenario has the potential to be the "worst-case" discharge scenario, because it represents the case where there is a confluence of higher contaminant loading from the secondary effluent with the lower ocean mixing dilution that results from negatively buoyant discharge plumes. For cases where there is little or no secondary effluent discharged along with the Desal Brine, the ocean mixing is still low but, in general, there is a lower contaminant load. Conversely, in cases where there is a relatively high secondary effluent discharge flow, the contaminant loading is higher, but the Desal Brine salinity is diluted to the point that the discharge plume is positively buoyant and greater mixing is achieved within the ZID.

[12] Note that these ranges assign the transitional months to the ocean condition that is typically more restrictive at relevant discharge flows.

lowest $D_m$ from the applicable ocean conditions was used for each flow scenario. It should also be noted that for all scenarios except one[13], the ocean modeling was performed assuming 120 of the 172 diffuser ports were open. After the modeling was performed, it was discovered that there are actually 130 open ports. An increase in the number of ports decreases the port discharge velocity, which would tend to increase the dilution; however, this is not always the case[14]. Ocean modeling using 130 open ports will be included in the aforementioned analysis that is anticipated for completion by late March 2015.

For negatively buoyant plumes, FlowScience modeled the ocean mixing using two methods: (1) a Semi-Empirical Analysis method, and (2) EPA's Visual Plume method. While results were provided from both methods, FlowScience indicated that there is greater confidence in Semi-Empirical Analysis results for negatively buoyant plumes. Thus, the Semi-Empirical Analysis results were used in this analysis for the discharges with a negatively buoyant plume.

# 3 Ocean Plan Compliance Results

## 3.1 Water Quality of Combined Discharge

As described above, the first step in the Ocean Plan compliance analysis was to estimate the worst-case water quality for the future wastewater discharge components (*i.e.*, Desal Brine, Secondary Effluent, Hauled Brine and GWR Concentrate). The estimated water quality for each type of discharge is provided in Table 4. Specific assumptions and data sources for each constituent are documented in the Table 4 footnotes.

**Table 4 – Estimated worst-case water quality for the various discharge waters**

| Constituent | Units | Desal Brine | Secondary Effluent | | Hauled Brine | | GWR Concentrate | Footnotes |
|---|---|---|---|---|---|---|---|---|
| | | | *MPWSP* | *Variant* | *MPWSP* | *Variant* | | |
| ***Objectives for protection of marine aquatic life*** | | | | | | | | |
| Arsenic | µg/L | 37.9 | 45 | 45 | 45 | 45 | 12 | 2,6,16,21 |
| Cadmium | µg/L | 7.9 | 1 | 1.2 | 1 | 1.2 | 6.4 | 1,7,15,21 |
| Chromium (Hexavalent) | µg/L | – | ND(<2) | 2.7 | 130 | 130 | 14 | 3,7,15,24 |
| Copper | µg/L | 3.07 | 10 | 25.9 | 39 | 39 | 136 | 1,7,15,22 |
| Lead | µg/L | 6.4 | ND(<0.5) | 0.82 | 0.76 | 0.82 | 4.3 | 1,3,7,15,21 |
| Mercury | µg/L | ND(<0.3) | 0.019 | 0.089 | 0.044 | 0.089 | 0.510 | 1,10,16,21 |
| Nickel | µg/L | ND(<8.6) | 5.2 | 13.1 | 5.2 | 13.1 | 69 | 1,7,15,21 |
| Selenium | µg/L | 55.2 | 3 | 6.5 | 75 | 75 | 34 | 2,7,15,21 |
| Silver | µg/L | 0.064 | ND(<0.19) | ND(<1.59) | ND(<0.19) | ND(<1.59) | ND(<0.19) | 3,9,18,22 |
| Zinc | µg/L | ND(<35) | 20 | 48.4 | 20 | 48.4 | 255 | 1,7,15,21 |
| Cyanide (MBAS data) | µg/L | ND(<8.6) | 81 | 89.5 | 81 | 89.5 | 143 | 1,7,16,17,20,21 |
| Cyanide | µg/L | ND(<8.6) | 7.2 | 7.2 | 46 | 46 | 38 | 1,11,15,20,21 |
| Total Chlorine Residual | µg/L | ND(<200) | ND(<200) | ND(<200) | ND(<200) | ND(<200) | ND(<200) | 5 |
| Ammonia (as N) | µg/L | ND(<86.2) | 36,400 | 36,400 | 36,400 | 36,400 | 191,579 | 1,6,15,21 |
| Ammonia (as N) | µg/L | ND(<86.2) | 49,000 | 49,000 | 49,000 | 49,000 | 257,895 | 1,6,15,21 |
| Acute Toxicity | TUa | – | 2.3 | 2.3 | 2.3 | 2.3 | 0.77 | 1,12,16,17,24 |
| Chronic Toxicity | TUc | – | 40 | 40 | 80 | 40 | 100 | 1,12,16,17,24 |
| Phenolic Compounds (non-chlorinated) | µg/L | – | 69 | 69 | 69 | 69 | 363 | 1,6,14,15,24 |
| Chlorinated Phenolics | µg/L | – | *ND(<20)* | *ND(<20)* | *ND(<20)* | *ND(<20)* | ND(<20) | 3,9,18,24 |
| Endosulfan | µg/L | 6.7E-05 | 0.015 | 0.048 | 0.015 | 0.048 | 0.25 | 1,10,14,15,23 |

13 In MPWSP Scenario 1 (RTP design capacity), the ocean modeling was performed with all discharge ports open.

14 For some Desal Brine dominated discharges, a decrease in dilution was observed as the discharge flow decreased.

| Constituent | Units | Desal Brine | Secondary Effluent | | Hauled Brine | | GWR Concentrate | Footnotes |
|---|---|---|---|---|---|---|---|---|
| | | | MPWSP | Variant | MPWSP | Variant | | |
| Endrin | µg/L | 2.8E-05 | 0.000079 | 0.000079 | 0.000079 | 0.000079 | 0.00 | 4,8,15,23 |
| HCH (Hexachlorocyclohexane) | µg/L | 0.00068 | 0.034 | 0.060 | 0.034 | 0.060 | 0.314 | 1,15,23 |
| Radioactivity (Gross Beta) | pCi/L | – | 32 | 32 | 307 | 307 | 34.8 | 1,6,12,16,17,24 |
| Radioactivity (Gross Alpha) | pCi/L | – | 18 | 18 | 457 | 457 | 14.4 | 1,6,12,16,17,24 |
| ***Objectives for protection of human health – non carcinogens*** | | | | | | | | |
| Acrolein | µg/L | – | ND(<5) | 9.0 | ND(<5) | 9.0 | 47 | 3,7,15,24 |
| Antimony | µg/L | 16.6 | 0.65 | 0.79 | 0.65 | 0.79 | 4 | 1,6,15,21 |
| Bis (2-chloroethoxy) methane | µg/L | – | ND(<0.5) | ND(<4.2) | ND(<0.5) | ND(<4.2) | ND(<1) | 3,9,18,24 |
| Bis (2-chloroisopropyl) ether | µg/L | – | ND(<0.5) | ND(<4.2) | ND(<0.5) | ND(<4.2) | ND(<1) | 3,9,18,24 |
| Chlorobenzene | µg/L | – | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | 3,9,18,24 |
| Chromium (III) | µg/L | 106.9 | 3.0 | 7.3 | 87 | 87 | 38 | 2,6,15,21 |
| Di-n-butyl phthalate | µg/L | – | ND(<5) | ND(<7) | ND(<5) | ND(<7) | ND(<1) | 3,9,18,24 |
| Dichlorobenzenes | µg/L | – | 1.6 | 1.6 | 1.6 | 1.6 | 8 | 1,6,15,24 |
| Diethyl phthalate | µg/L | – | ND(<5) | ND(<5) | ND(<5) | ND(<5) | ND(<1) | 3,9,18,24 |
| Dimethyl phthalate | µg/L | – | ND(<2) | ND(<2) | ND(<2) | ND(<2) | ND(<0.5) | 3,9,18,24 |
| 4,6-dinitro-2-methylphenol | µg/L | – | ND(<0.5) | ND(<20) | ND(<0.5) | ND(<20) | ND(<5) | 3,9,18,24 |
| 2,4-dinitrophenol | µg/L | – | ND(<0.5) | ND(<13) | ND(<0.5) | ND(<13) | ND(<5) | 3,9,18,24 |
| Ethylbenzene | µg/L | – | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | 3,9,18,24 |
| Fluoranthene | µg/L | 0.0019 | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.1) | 3,9,18,23 |
| Hexachlorocyclopentadiene | µg/L | – | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.05) | 3,9,18,24 |
| Nitrobenzene | µg/L | – | ND(<0.5) | ND(<2.3) | ND(<0.5) | ND(<2.3) | ND(<1) | 3,9,18,24 |
| Thallium | µg/L | ND(<1.7) | ND(<0.5) | 0.69 | ND(<0.5) | 0.69 | 3.7 | 3,7,15,21 |
| Toluene | µg/L | ND(<0.9) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | 3,9,18,21 |
| Tributyltin | µg/L | – | ND(<0.05) | ND(<0.05) | ND(<0.05) | ND(<0.05) | ND(<0.02) | 3,13,18,24 |
| 1,1,1-trichloroethane | µg/L | ND(<0.9) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | 3,9,18,21 |
| ***Objectives for protection of human health - carcinogens*** | | | | | | | | |
| Acrylonitrile | µg/L | – | ND(<2) | 2.5 | ND(<2) | 2.5 | 13 | 3,7,15,24 |
| Aldrin | µg/L | – | ND(<0.05) | ND(<0.007) | ND(<0.05) | ND(<0.007) | ND(<0.01) | 3,9,18,23 |
| Benzene | µg/L | ND(<0.9) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | 3,9,18,21 |
| Benzidine | µg/L | – | ND(<0.5) | ND(<19.8) | ND(<0.5) | ND(<19.8) | ND(<0.05) | 3,9,18,24 |
| Beryllium | µg/L | ND(<1.7) | ND(<0.5) | ND(<0.69) | 0.0052 | 0.0052 | ND(<0.5) | 3,9,18,21 |
| Bis(2-chloroethyl)ether | µg/L | – | ND(<0.5) | ND(<4.2) | ND(<0.5) | ND(<4.2) | ND(<1) | 3,9,18,24 |
| Bis(2-ethyl-hexyl)phthalate | µg/L | ND(<1.0) | 78 | 78 | 78 | 78 | 411 | 2,6,15,21 |
| Carbon tetrachloride | µg/L | ND(<0.5) | ND(<0.5) | 0.50 | ND(<0.5) | 0.50 | 2.66 | 3,7,15,21 |
| Chlordane | µg/L | 0.0002 | 0.00074 | 0.00074 | 0.00074 | 0.00074 | 0.0039 | 4,8,14,15,23 |
| Chlorodibromomethane | µg/L | – | ND(<0.5) | 2.4 | ND(<0.5) | 2.4 | 13 | 3,7,15,24 |
| Chloroform | µg/L | – | 2 | 39 | 2 | 39 | 204 | 2,7,15,24 |
| DDT | µg/L | 0.00055 | 0.001 | 0.001 | 0.001 | 0.022 | 0.035 | 4,7,14,15,19,23 |
| 1,4-dichlorobenzene | µg/L | ND(<0.9) | 1.6 | 1.6 | 1.6 | 1.6 | 8.4 | 1,6,15,21 |
| 3,3-dichlorobenzidine | µg/L | – | ND(<0.025) | ND(<19) | ND(<0.025) | ND(<19) | ND(<2) | 3,9,18,24 |
| 1,2-dichloroethane | µg/L | ND(<0.9) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | 3,9,18,21 |
| 1,1-dichloroethylene | µg/L | ND(<0.9) | ND(<0.5) | ND(<0.5) | 0.5 | 0.5 | ND(<0.5) | 3,9,18,21 |
| Dichlorobromomethane | µg/L | – | ND(<0.5) | 2.6 | ND(0.5) | 2.6 | 14 | 3,7,15,24 |
| Dichloromethane | µg/L | ND(<0.9) | 0.55 | 0.64 | 0.55 | 0.64 | 3.4 | 1,7,15,21 |
| 1,3-dichloropropene | µg/L | ND(<0.9) | ND(<0.5) | 0.56 | ND(<0.5) | 0.56 | 3.0 | 3,7,15,21 |
| Dieldrin | µg/L | 8.8E-05 | 0.0006 | 0.0006 | 0.0006 | 0.0056 | 0.0029 | 4,7,15,19,23 |
| 2,4-dinitrotoluene | µg/L | – | ND(<2) | ND(<2) | ND(<2) | ND(<2) | ND(<0.1) | 3,9,18,24 |
| 1,2-diphenylhydrazine | µg/L | – | ND(<0.5) | ND(<4.2) | ND(<0.5) | ND(<4.2) | ND(<1) | 3,9,18,24 |
| Halomethanes | µg/L | – | 0.54 | 1.4 | 0.73 | 1.4 | 7.5 | 2,7,14,15,24 |
| Heptachlor | µg/L | 8.6E-06 | ND(<0.01) | ND(<0.01) | ND(<0.01) | ND(<0.01) | ND(<0.01) | 3,9,18,23 |
| Heptachlor epoxide | µg/L | ND(<0.02) | 0.000059 | 0.000059 | 0.000059 | 0.000059 | 0.000311 | 4,8,15,21 |
| Hexachlorobenzene | µg/L | ND(<0.09) | 0.000078 | 0.000078 | 0.000078 | 0.000078 | 0.000411 | 4,8,15,21 |
| Hexachlorobutadiene | µg/L | – | 0.000009 | 0.000009 | 0.000009 | 0.000009 | 0.000047 | 4,8,15,24 |
| Hexachloroethane | µg/L | – | ND(<0.5) | ND(<2.3) | ND(<0.5) | ND(<2.3) | ND(<0.5) | 3,9,18,24 |
| Isophorone | µg/L | – | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | 3,9,18,24 |
| N-Nitrosodimethylamine | µg/L | ND(<0.003) | 0.017 | 0.096 | 0.017 | 0.096 | 0.150 | 2,7,16,17,21 |
| N-Nitrosodi-N-Propylamine | µg/L | ND(<0.003) | 0.076 | 0.076 | 0.076 | 0.076 | 0.019 | 2,6,16,17,21 |
| N-Nitrosodiphenylamine | µg/L | – | ND(<0.5) | ND(<2.3) | ND(<0.5) | ND(<2.3) | ND(<1) | 3,9,18,24 |
| PAHs | µg/L | 0.012 | 0.05 | 0.05 | 0.05 | 0.05 | 0.28 | 4,8,14,15,23 |
| PCBs | µg/L | 0.002 | 0.00068 | 0.00068 | 0.00068 | 0.00068 | 0.00357 | 4,8,14,15,23 |
| TCDD Equivalents | µg/L | – | 0.00000015 | 0.00000015 | 0.00000015 | 0.00000015 | 0.00000081 | 4,13,14,15,24 |
| 1,1,2,2-tetrachloroethane | µg/L | ND(<0.9) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | 3,9,18,21 |
| Tetrachloroethylene | µg/L | ND(<0.9) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | 3,9,18,21 |
| Toxaphene | µg/L | ND(<0.0013) | 0.0071 | 0.0071 | 0.0071 | 0.0071 | 0.0373 | 4,8,15,23 |

| Constituent | Units | Desal Brine | Secondary Effluent | | Hauled Brine | | GWR Concentrate | Footnotes |
|---|---|---|---|---|---|---|---|---|
| | | | *MPWSP* | *Variant* | *MPWSP* | *Variant* | | |
| Trichloroethylene | µg/L | ND(<0.9) | *ND(<0.5)* | *ND(<0.5)* | *ND(<0.5)* | *ND(<0.5)* | *ND(<0.5)* | 3,9,18,21 |
| 1,1,2-trichloroethane | µg/L | ND(<0.9) | *ND(<0.5)* | *ND(<0.5)* | *ND(<0.5)* | *ND(<0.5)* | *ND(<0.5)* | 3,9,18,21 |
| 2,4,6-trichlorophenol | µg/L | – | *ND(<0.5)* | *ND(<2.3)* | *ND(<0.5)* | *ND(<2.3)* | *ND(<1)* | 3,9,18,24 |
| Vinyl chloride | µg/L | ND(<0.5) | *ND(<0.5)* | *ND(<0.5)* | *ND(<0.5)* | *ND(<0.5)* | *ND(<0.5)* | 3,9,18,21 |

**Table 4 Footnotes:**

***MPWSP Secondary Effluent and Hauled Brine***

[1] The value reported is based on MRWPCA historical data.
[2] The value reported is based on secondary effluent data collected during the GWR Project source water monitoring programs (not impacted by the proposed new source waters), and are representative of future water quality under the MPWSP scenario.
[3] The MRL provided represents the limit from NPDES monitoring data for secondary effluent and hauled waste. In cases where constituents had varying MRLs, where in general, the lowest MRL is reported.
[4] RTP effluent value presented based on CCLEAN data.

***Total Chlorine Residual***

[5] For all waters, it is assumed that dechlorination will be provided such that the total chlorine residual will be below detection.

***Variant Secondary Effluent and Hauled Brine***

[6] Existing RTP effluent exceeds concentrations observed in other proposed source waters; the value reported is the existing secondary effluent value.
[7] The proposed new source waters may increase the secondary effluent concentration; the value reported is based on predicted source water blends.
[8] RTP effluent value is based on CCLEAN data; no other source waters were considered due to MRL differences.
[9] MRL provided represents the maximum flow-weighted MRL based on the blend of source waters.
[10] The only water with a detected concentration was the RTP effluent, however the flow-weighted concentration increases due to higher MRLs for the proposed new source waters.
[11] Additional source water data are not available; the reported value is for RTP effluent.
[12] Calculation of the flow-weighted concentration was not feasible due to constituent and the maximum observed value reported.
[13] Agricultural Wash Water data are based on an aerated sample, instead of a raw water sample.
[14] This value in the Ocean Plan is an aggregate of several congeners or compounds. Per the approach described in the Ocean Plan, for cases where the individual congeners/compounds were less than the MRL, a value of 0 is assumed in calculating the aggregate value, as the MRLs span different orders of magnitude.

***GWR Concentrate Data***

[15] The value presented represents a calculated value assuming no removal prior to RO, complete rejection through RO membrane, and an 81% RO recovery.
[16] The value represents the maximum value observed during the pilot testing study.
[17] The calculated value for the AWT Facility data (described in note 15) was not used in the analysis because it was not considered representative. It is expected that the value would increase as a result of treatment through the AWT Facility (*e.g.* formation of N-Nitrosodimethylamine as a disinfection by-product), or that it will not concentrate linearly through the RO (*e.g.* toxicity and radioactivity).
[18] The MRL provided represents the limit from the source water and pilot testing monitoring programs.
[19] The value presented represents a calculated value assuming 20% removal through primary and secondary treatment, 70% and 90% removal through ozone for DDT and dieldrin, respectively (based on Oram, 2008), complete rejection through the RO membrane, and an 81% RO recovery. The assumed RTP concentrations for Dieldrin and DDT do not include contributions from the agricultural drainage waters. This is because in all but one flow scenario (Scenario 4, described later), either the agricultural drainage waters are not being brought into the RTP because there is sufficient water from other sources (*e.g.* during wet and normal precipitation years), or the RTP effluent is not being discharged to the outfall (*e.g.*, summer months). In this one scenario (Scenario 4), there is a minimal discharge of secondary effluent to the ocean during a drought year under Davidson ocean conditions; for

this flow scenario only, different concentrations are assumed for the RTP effluent. DDT and dieldrin concentrations of 0.022 µg/L and 0.0056 µg/L were used for Scenario 4 in the analysis.

***Cyanide Data***
[20] In mid-2011, MBAS began performing the cyanide analysis on the RTP effluent, at which time the reported values increased by an order of magnitude. Because no operational or source water composition changes took place at this time that would result in such an increase, it is reasonable to conclude the increase is an artifact of the change in analysis method and therefore questionable. Therefore, the cyanide values as measured by MBAS are listed separately from other cyanide values, and the MBAS data were not be used in the analysis for evaluating compliance with the Ocean Plan objectives for the EIR.

***Desal Brine Data***
[21] Reported Desal Brine value is based on data from 2009 monitoring data from a Marina Coast Water District monitoring well, adjusted by assuming completed contaminant rejection through the seawater RO membranes with an overall 42% recovery.
[22] Reported Desal Brine value is based on data ocean data from the Golden Gate area provided by Dane Hardin (transmitted via e-mail on December 29, 2014).
[23] Reported Desal Brine value presented based on CCLEAN data.
[24] No data were available to estimate the Desal Brine concentration.

## 3.2 Ocean Modeling Results

The predicted minimum probable dilution ($D_m$) for each discharge scenario is presented in Tables 5 and 6. For discharge scenarios that were modeled with more than one oceanic condition, the lowest $D_m$ (*i.e.*, most conservative) is reported in the tables below. For the MPWSP, the flow scenarios in which little or no secondary effluent was discharged (Scenarios 2 and 3) resulted in lowest $D_m$ values as a result of the discharge plume being negatively buoyant. At higher secondary effluent flows, the discharge plume would be positively buoyant, resulting in an increased $D_m$, as evidenced in Scenario 4. The same trend was observed for Variant scenarios.

**Table 5 – Flow scenarios and modeled $D_m$ values used for Ocean Plan compliance analysis for MPWSP**

| No. | Discharge Scenario (Ocean Condition) | Flows (mgd) | | | $D_m$ |
|---|---|---|---|---|---|
| | | Secondary Effluent | Desal Brine | Hauled Brine [a] | |
| 1 | RTP design capacity without Desal Brine | 29.6 | 0 | 0.1 | 145 |
| 2 | Desal Brine with no secondary effluent | 0 | 13.98 | 0.1 | 16 |
| 3 | Desal Brine with low secondary effluent | 2 | 13.98 | 0.1 | 19 |
| 4 | Desal Brine with high secondary effluent | 19.68 | 13.98 | 0.1 | 68 |

[a] Hauled brine was not included in the modeling of MPWSP flow scenarios; however, the change in both flow and TDS from the addition of hauled brine is less than 1% and thus is expected to have a negligible impact on the modeled $D_m$.

**Table 6 – Flow scenarios and modeled $D_m$ values used for Ocean Plan compliance analysis for Variant**

| No. | Discharge Scenario (Ocean Condition) | Flows (mgd) | | | | $D_m$ |
|---|---|---|---|---|---|---|
| | | Variant Secondary Effluent | Desal Brine | GWR Concentrate | Variant Hauled Brine[a] | |
| 1 | Desal Brine only | 0 | 8.99 | 0 | 0.1 | 15 |
| 2 | Desal Brine with high secondary effluent | 19.68 | 8.99 | 0 | 0.1 | 84 |
| 3 | Desal Brine with GWR concentrate and high secondary effluent | 15.92 | 8.99 | 0.94 [b] | 0.1 | 82 |
| 4 | Desal Brine with GWR concentrate and no secondary effluent | 0 | 8.99 | 0.94 [b] | 0.1 | 17 |

[a] Hauled brine was not included in the modeling of Variant scenarios involving discharge of desalination brine. However, the change in both flow and TDS from the addition of hauled brine is less than 1% and thus is expected to have a negligible impact on the modeled $D_m$.
[b] The actual modeled GWR Concentrate flow was 0.73 mgd (based on an older design for the AWT Facility). This change is not expected to have a significant impact on the modeled $D_m$. Updated modeling results will include the correct GWR Concentrate flow of 0.94 mgd.

## 3.3 Ocean Plan Compliance Results

The flow-weighted in-pipe concentration for each constituent was calculated for each modeled discharge scenario using the water quality presented in Table 4 and the discharge flows presented in Tables 2 and 3. The in-pipe concentration was then used to calculate the concentration at the edge of the ZID using the $D_m$ values presented in Tables 5 and 6. The resulting concentrations for each constituent in each scenario were compared to the Ocean Plan objective to assess compliance. The estimated concentrations for the eight flow scenarios (four each for the MPWSP and Variant projects) for all constituents are presented as concentrations at the edge of the ZID (Appendix A, Table A2) and as a percentage of the Ocean Plan objective (Appendix A, Table A3). It was identified that some constituents are estimated to exceed the Ocean Plan objective for some discharge scenarios. A list of the constituents that may be an issue[15] are shown as predicted concentration at the edge of the ZID in Table 7, and as the concentration at the edge of the ZID as a percentage of the Ocean Plan objective in Table 8.

The first issue that was identified is related to polychlorinated biphenyls (PCBs). The maximum concentration of PCBs observed in the ocean water through the CCLEAN program, 1.21 nanograms per liter (ng/L), is already greater than the Ocean Plan objective of 0.019 ng/L (CCLEAN, 2014). Assuming a concentration factor of 1.73 through the desalination facility, a Desal Brine PCB concentration of 2.09 ng/L was calculated. This concentration of Desal Brine PCB would result in Ocean Plan exceedances under several of the MPSWP and Variant scenarios. However, if one puts these data in the context of the existing ambient seawater

[15] Note that aldrin, benzidine, beryllium, 3,3-dichlorobenzidine, heptachlor, heptachlor epoxide, and hexachlorobenzene had high MRLs, such that no compliance conclusions could be drawn for these constituents. This is a typical occurrence for ocean discharges since the MRL is often higher than the ocean plan objective for some constituents.

conditions, the worst-case increase of PCBs for the scenarios described in this memorandum would be a 4.6% increase at the edge of the ZID compared to ambient ocean conditions (*i.e.*, a concentration at the ZID of 1.27 ng/L compared to the ambient levels of 1.21 ng/L). Further, if the median ocean water PCB concentration from CCLEAN was used instead (0.043 ng/L), the assumed Desal Brine concentration would be 0.074 ng/L, and then the only expected scenario with a PCB Ocean Plan exceedance would be for Variant Scenario 4.

**Table 7 – Predicted concentrations at the edge of the ZID for Ocean Plan constituents of concern in the MPWSP and Variant projects**

| Constituent | Units | Ocean Plan Objective | Estimated Concentration at Edge of ZID by Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | MPWSP Project | | | | Variant | | | |
| | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| ***Objectives for protection of marine aquatic life*** | | | | | | | | | | |
| Copper | ug/L | 3 | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 | 2.2 | 2.2 | 2.8 |
| Ammonia (as N) – 6-mo median | ug/L | 600 | 249 | 20 | 241 | 310 | 30 | 295 | 355 | 1022 |
| ***Objectives for protection of human health - carcinogens*** | | | | | | | | | | |
| Chlordane | ug/L | 2.3E-05 | 5.0E-06 | 1.2E-05 | 1.3E-05 | 7.4E-06 | 1.3E-05 | 6.7E-06 | 8.0E-06 | 3.0E-05 |
| DDT | ug/L | 1.7E-04 | 7.5E-06 | 3.3E-05 | 3.1E-05 | 1.3E-05 | 4.9E-05 | 1.2E-05 | 2.6E-05 | 2.2E-04 |
| PCBs | ug/L | 1.9E-05 | 4.7E-06 | 1.2E-04 | 9.5E-05 | 1.8E-05 | 1.3E-04 | 1.3E-05 | 1.5E-05 | 1.2E-04 |
| TCDD Equivalents | ug/L | 3.9E-09 | 1.0E-09 | 6.4E-11 | 9.9E-10 | 1.3E-09 | 1.1E-10 | 1.2E-09 | 1.5E-09 | 4.3E-09 |
| Toxaphene | ug/L | 2.1E-04 | 4.9E-05 | 7.9E-05 | 1.0E-04 | 6.8E-05 | 8.5E-05 | 6.2E-05 | 7.4E-05 | 2.6E-04 |

[a] Shading indicates constituent is expected to be greater than 80 percent (orange shading) or exceed (red shading) the ocean plan objective for that discharge scenario.

**Table 8 – Predicted concentrations at the edge of the ZID expressed as percentage of Ocean Plan Objective for constituents of in the MPWSP and Variant projects [a]**

| Constituent | Units | Ocean Plan Objective | Est. Percentage of Ocean Plan objective at Edge of ZID by Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | MPWSP Project | | | | Variant | | | |
| | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| ***Objectives for protection of marine aquatic life*** | | | | | | | | | | |
| Copper | ug/L | 3 | 69% | 69% | 70% | 69% | 70% | 73% | 75% | 92% |
| Ammonia (as N) – 6-mo median | ug/L | 600 | 42% | 3% | 40% | 52% | 5% | 49% | 59% | 170% |
| ***Objectives for protection of human health - carcinogens*** | | | | | | | | | | |
| Chlordane | ug/L | 2.3E-05 | 22% | 51% | 58% | 32% | 55% | 29% | 35% | 132% |
| DDT | ug/L | 1.7E-04 | 4% | 19% | 18% | 7% | 29% | 7% | 16% | 129% |
| PCBs | ug/L | 1.9E-05 | 24% | 645% | 502% | 96% | 683% | 69% | 81% | 648% |
| TCDD Equivalents | ug/L | 3.9E-09 | 27% | 2% | 25% | 33% | 3% | 32% | 38% | 110% |
| Toxaphene | ug/L | 2.1E-04 | 23% | 38% | 49% | 32% | 41% | 30% | 35% | 125% |

[a] Shading indicates constituent is expected to be greater than 80 percent (orange shading) or exceed (red shading) the ocean plan objective for that discharge scenario.

The second issue identified is for one specific scenario, Variant Scenario 4. Variant Scenario 4 involves the discharge of Desal Brine and GWR concentrate only. The constituents of interest related to this scenario are copper, ammonia, chlordane, DDT, PCBs, TCDD equivalents, and toxaphene. Other than the previously discussed PCBs, ammonia is expected to be the constituent with the highest exceedance, being 1.7 times than the Ocean Plan objective. This scenario is problematic because constituents that have relatively high loadings in the secondary effluent are concentrated in the GWR Concentrate. This scenario assumes the GWR Concentrate flow is much smaller than the Desal Brine flow, such that the resulting discharge plume is negatively buoyant and achieves poor ocean mixing. It is likely that some mitigation strategy would be needed to address these constituents when operating under this discharge scenario. One potential mitigation strategy that has been identified to address this impact is Desal Brine storage. Desal Brine could be stored and released in batches, to take advantage of two phenomena: (1) when the Desal Brine is being stored, there would be an increase in ocean mixing due to the increased buoyancy of the discharge (*i.e.*, the Desal Brine discharge would need to be reduced to the point that the overall discharge is positively buoyant), and (2) when the Desal Brine batch is being released, there would be greater in-pipe dilution of copper, ammonia, chlordane, DDT, TCDD equivalents, and toxaphene (*i.e.* sufficient Desal Brine would need to be released to provide adequate dilution of the constituents of interest).

# 4 Conclusions

The purpose of this analysis was to assess the ability of the MPWSP and Variant Projects to comply with the Ocean Plan objectives. Trussell Tech used a conservative approach to estimate the water qualities of the secondary effluent, GWR Concentrate, Desal Brine and hauled brine for these projects. These water quality data were then combined for various discharge scenarios, and a concentration at the edge of the ZID was calculated for each constituent and scenario. Compliance assessments could not be made for selected constituents, as noted, due to analytical limitations, but this is a typical occurrence for these Ocean Plan constituents. Further, the results presented in this document should be viewed as partial findings, as certain key discharge scenarios were not included in the ocean modeling. Additional analyses are planned for the future to complete this analysis.

Based on the data, assumptions, modeling, and analytical methodology presented in this technical memorandum, the MPWSP and Variant Projects would require mitigation strategies to comply with the Ocean Plan objectives under some discharge scenarios. Specifically, two types of potential issues were identified: (1) PCBs, which are relatively high in the worst-case ocean water samples and were predicted to exceed the Ocean Plan objectives in several scenarios for both the MPWSP and Variant projects, and (2) the Variant discharge scenario where Desal Brine and GWR Concentrate are discharged without secondary effluent were predicted to exceed multiple Ocean Plan objectives, specifically those for ammonia, chlordane, DDT, PCBs, TCDD equivalents, and toxaphene.

# 5 References

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# Appendix A

## Additional Tables

**Table A1 – List of Ocean Plan parameters for which no Desal Brine or seawater data were available**

| Ocean Plan constituents that lack Desal Brine data | |
|---|---|
| Chromium (hexavalent) | Nitrobenzene |
| Acute toxicity | Tributyltin |
| Chronic toxicity | Acrylonitrile |
| Phenolic compounds (non-chlorinated) | Benzidine |
| Chlorinated phenolics | Bis(2-chloroethyl) ether |
| Radioactivity (gross beta) | Chlorodibromomethane |
| Radioactivity (gross alpha) | Chloroform |
| Acrolein | 3,3-dichlorobenzidine |
| Bis (2-chloroethoxy) methane | Dichlorobromomethane |
| Bis (2-chloroisopropyl) ether | 2,4-dinitrotoluene |
| Chlorobenzene | 1,2-diphenylhydrazine (azobenzene) |
| Di-n-butyl phthalate | Halomethanes |
| Dichlorobenzenes | Hexachlorobutadiene |
| Diethyl phthalate | Hexachloroethane |
| Dimethyl phthalate | Isophorone |
| 4,6-dinitro-2-methylphenol | N-Nitrosodiphenylamine |
| 2,4-dinitrophenol | TCDD equivalents |
| Ethylbenzene | 2,4,6-trichlorophenol |
| Hexachlorocyclopentadiene | |

**Table A2 – Complete list of predicted concentrations of Ocean Plan constituents at the edge of the ZID**

| Constituent | Units | Ocean Plan Objective | Estimated Concentration at Edge of ZID by Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | MPWSP Project | | | | Variant | | | |
| | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| ***Objectives for protection of marine aquatic life*** | | | | | | | | | | |
| Arsenic | ug/L | 8 | 3.3 | 5.1 | 4.8 | 3.6 | 5.2 | 3.5 | 3.5 | 4.8 |
| Cadmium | ug/L | 1 | 0.0 | 0.5 | 0.4 | 0.1 | 0.5 | 0.0 | 0.0 | 0.4 |
| Chromium (Hexavalent) | ug/L | 2 | 0.0 | 0.1 | 0.1 | 0.0 | 0.09 | 0.03 | 0.03 | 0.14 |
| Copper | ug/L | 3 | 2.1 | 2.1 | 2.1 | 2.1 | 2.1 | 2.2 | 2.2 | 2.8 |
| Lead | ug/L | 2 | 0.0 | 0.4 | 0.3 | 0.0 | 0.4 | 0.0 | 0.0 | 0.3 |
| Mercury | ug/L | 0.04 | 0.005 | 0.022 | 0.018 | 0.007 | 0.023 | 0.007 | 0.007 | 0.022 |
| Nickel | ug/L | 5 | 0.0 | 0.5 | 0.4 | 0.1 | 0.5 | 0.1 | 0.2 | 0.8 |
| Selenium | ug/L | 15 | 0.0 | 3.3 | 2.4 | 0.4 | 3.5 | 0.3 | 0.3 | 3.0 |
| Silver | ug/L | 0.7 | <0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 | 0.2 |
| Zinc | ug/L | 20 | 8.1 | 9.6 | 9.3 | 8.3 | 9.7 | 8.4 | 8.5 | 10.7 |
| Cyanide | ug/L | 1 | 0.1 | 0.5 | 0.4 | 0.1 | 0.6 | 0.1 | 0.1 | 0.7 |
| Total Chlorine Residual | ug/L | 2 | <1.4 | <11.8 | <10.0 | <2.9 | <12.5 | <2.4 | <2.4 | <11.1 |
| Ammonia (as N) - 6-mo median | ug/L | 600 | 249 | 20.2 | 241 | 310 | 30 | 295 | 355 | 1022 |
| Ammonia (as N) - Daily Max | ug/L | 2,400 | 336 | 25.5 | 324 | 417 | 39 | 397 | 477 | 1374 |
| Acute Toxicity[a] | TUa | 0.3 | | | | | | | | |
| Chronic Toxicity[a] | TUc | 1 | | | | | | | | |
| Phenolic Compounds (non-chlorinated) | ug/L | 30 | 0.5 | 0.0 | 0.5 | 0.6 | 0.0 | 0.6 | 0.7 | 1.9 |
| Chlorinated Phenolics | ug/L | 1 | <0.1 | <0.0 | <0.1 | <0.2 | <0.0 | <0.2 | <0.2 | <0.1 |
| Endosulfan | ug/L | 0.009 | 1.0E-04 | 1.0E-05 | 1.0E-04 | 1.3E-04 | 3.7E-05 | 3.9E-04 | 4.7E-04 | 1.4E-03 |

| Constituent | Units | Ocean Plan Objective | Estimated Concentration at Edge of ZID by Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | MPWSP Project | | | | Variant | | | |
| | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Endrin | ug/L | 0.002 | 5.4E-07 | 1.6E-06 | 1.7E-06 | 8.4E-07 | 1.8E-06 | 7.4E-07 | 8.8E-07 | 3.6E-06 |
| HCH (Hexachlorocyclohexane) | ug/L | 0.004 | 0.0002 | 0.0001 | 0.0003 | 0.0003 | 0.0001 | 0.0005 | 0.0006 | 0.0017 |
| Radioactivity (Gross Beta)[a] | pci/L | 0.0 | | | | | | | | |
| Radioactivity (Gross Alpha)[a] | pci/L | 0.0 | | | | | | | | |
| ***Objectives for protection of human health – non carcinogens*** | | | | | | | | | | |
| Acrolein | ug/L | 220 | <0.034 | <0.0021 | <0.033 | <0.042 | 0.01 | 0.1 | 0.1 | 0.3 |
| Antimony | ug/L | 1200 | 0.0045 | 0.97 | 0.72 | 0.10 | 1.02 | 0.07 | 0.08 | 0.85 |
| Bis (2-chloroethoxy) methane | ug/L | 4.4 | <0.0034 | <0.00021 | <0.0033 | <0.0042 | <0.003 | <0.034 | <0.032 | <0.008 |
| Bis (2-chloroisopropyl) ether | ug/L | 1200 | <0.0034 | <0.00021 | <0.0033 | <0.0042 | <0.003 | <0.034 | <0.032 | <0.008 |
| Chlorobenzene | ug/L | 570 | <0.0034 | <0.00021 | <0.0033 | <0.0042 | <0.0003 | <0.004 | <0.004 | <0.003 |
| Chromium (III) | ug/L | 190000 | 0.022 | 6.3 | 4.7 | 0.67 | 6.7 | 0.46 | 0.52 | 5.6 |
| Di-n-butyl phthalate | ug/L | 3500 | <0.034 | <0.0021 | <0.037 | <0.042 | <0.005 | <0.057 | <0.052 | <0.009 |
| Dichlorobenzenes | ug/L | 5100 | 0.011 | 0.0007 | 0.010 | 0.014 | 0.0014 | 0.013 | 0.016 | 0.045 |
| Diethyl phthalate | ug/L | 33000 | <0.034 | <0.002 | <0.033 | <0.042 | <0.003 | <0.040 | <0.038 | <0.008 |
| Dimethyl phthalate | ug/L | 820000 | <0.014 | <0.0008 | <0.013 | <0.017 | <0.001 | <0.016 | <0.015 | <0.004 |
| 4,6-dinitro-2-methylphenol | ug/L | 220 | <0.0034 | <0.00021 | <0.0033 | <0.0042 | <0.01 | <0.2 | <0.2 | <0.04 |
| 2,4-Dinitrophenol | ug/L | 4.0 | <0.0034 | <0.00021 | <0.0033 | <0.0042 | <0.01 | <0.1 | <0.10 | <0.03 |
| Ethylbenzene | ug/L | 4100 | <0.0034 | <0.00021 | <0.0033 | <0.0042 | <0.0003 | <0.004 | <0.004 | <0.003 |
| Fluoranthene | ug/L | 15 | <3.4E-03 | 1.1E-04 | 8.1E-05 | 1.1E-05 | 1.2E-04 | 6.8E-06 | 7.8E-06 | 9.3E-05 |
| Hexachlorocyclopentadiene | ug/L | 58 | <0.0034 | <0.00021 | <0.0033 | <0.0042 | <0.0003 | <0.004 | <0.004 | <0.001 |
| Nitrobenzene | ug/L | 4.9 | <0.0034 | <0.00021 | <0.0033 | <0.0042 | <0.002 | <0.019 | <0.018 | <0.006 |
| Thallium | ug/L | 2 | <0.0034 | <0.1 | <0.077 | <0.014 | 0.1 | 0.012 | 0.014 | 0.1 |
| Toluene | ug/L | 85000 | <0.0034 | <0.053 | <0.042 | <0.010 | <0.06 | <0.01 | <0.01 | <0.05 |
| Tributyltin | ug/L | 0.0014 | <3.4E-04 | <2.1E-05 | <3.3E-04 | <4.3E-04 | <3.4E-05 | <4.0E-04 | <3.8E-04 | <1.3E-04 |
| 1,1,1-Trichloroethane | ug/L | 540000 | <0.003 | <0.053 | <0.042 | <0.010 | <0.06 | <0.01 | <0.01 | <0.05 |
| ***Objectives for protection of human health - carcinogens*** | | | | | | | | | | |
| Acrylonitrile | ug/L | 0.10 | <0.014 | <0.001 | <0.013 | <0.017 | 0.002 | 0.021 | 0.025 | 0.071 |
| Aldrin[b] | ug/L | 0.000022 | <3.4E-04 | <2.1E-05 | <3.3E-04 | <4.3E-04 | <4.8E-06 | <5.7E-05 | <5.6E-05 | <5.6E-05 |
| Benzene | ug/L | 5.9 | <0.003 | <0.053 | <0.042 | <0.010 | <0.056 | <0.007 | <0.008 | <0.048 |
| Benzidine[b] | ug/L | 0.000069 | <0.003 | <0.000 | <0.003 | <0.004 | <0.014 | <0.160 | <0.147 | <0.011 |
| Beryllium | ug/L | 0.033 | 3.4E-03 | 2.2E-06 | 3.1E-03 | 4.2E-03 | 3.6E-06 | 2.1E-07 | 2.2E-04 | 2.6E-03 |
| Bis(2-chloroethyl)ether | ug/L | 0.045 | <0.0034 | <0.0002 | <0.0033 | <0.0042 | <0.003 | <0.034 | <0.03 | <0.01 |
| Bis(2-ethyl-hexyl)phthalate | ug/L | 3.5 | 0.53 | 0.09 | 0.55 | 0.67 | 0.1 | 0.6 | 0.8 | 2.2 |
| Carbon tetrachloride | ug/L | 0.90 | <0.003 | <0.029 | <0.025 | <0.007 | 0.031 | 0.006 | 0.007 | 0.039 |
| Chlordane | ug/L | 0.000023 | 5.0E-06 | 1.2E-05 | 1.3E-05 | 7.4E-06 | 1.3E-05 | 6.7E-06 | 8.0E-06 | 3.0E-05 |
| Chlorodibromomethane | ug/L | 8.6 | <0.003 | <0.0002 | <0.003 | <0.004 | 0.002 | 0.020 | 0.024 | 0.068 |
| Chloroform | ug/L | 130 | 0.014 | 0.001 | 0.013 | 0.017 | 0.03 | 0.3 | 0.4 | 1.1 |
| DDT | ug/L | 0.00017 | 7.5E-06 | 3.3E-05 | 3.1E-05 | 1.3E-05 | 4.9E-05 | 1.2E-05 | 2.7E-05 | 2.2E-04 |
| 1,4-Dichlorobenzene | ug/L | 18 | 0.011 | 0.05 | 0.050 | 0.019 | 0.06 | 0.0162 | 0.02 | 0.09 |
| 3,3-Dichlorobenzidine[b] | ug/L | 0.0081 | <1.7E-04 | <1.0E-05 | <1.6E-04 | <2.1E-04 | <0.01 | <0.15 | <0.14 | <0.02 |
| 1,2-Dichloroethane | ug/L | 28 | <0.003 | <0.053 | <0.042 | <0.010 | <0.06 | <0.01 | <0.01 | <0.05 |
| 1,1-Dichloroethylene | ug/L | 0.9 | 0.003 | 0.053 | 0.042 | 0.010 | 0.06 | 0.01 | 0.01 | 0.05 |
| Dichlorobromomethane | ug/L | 6.2 | <0.003 | <0.0002 | <0.0033 | <0.0042 | 0.00 | 0.02 | 0.03 | 0.07 |
| Dichloromethane | ug/L | 450 | 0.0038 | 0.053 | 0.043 | 0.010 | 0.06 | 0.01 | 0.01 | 0.06 |
| 1,3-dichloropropene | ug/L | 8.9 | <0.003 | <0.053 | <0.042 | <0.010 | 0.06 | 0.01 | 0.01 | 0.06 |
| Dieldrin | ug/L | 0.00004 | 3.4E-06 | 5.3E-06 | 7.1E-06 | 4.8E-06 | 9.3E-06 | 4.6E-06 | 5.6E-06 | 2.3E-05 |
| 2,4-Dinitrotoluene | ug/L | 2.6 | <0.014 | <0.001 | <0.013 | <0.017 | <0.001 | <0.016 | <0.015 | <0.002 |
| 1,2-Diphenylhydrazine | ug/L | 0.16 | <0.0034 | <0.0002 | <0.0033 | <0.0042 | <0.003 | <0.034 | <0.032 | <0.008 |
| Halomethanes | ug/L | 130 | 0.0037 | 0.0003 | 0.0036 | 0.0046 | 0.001 | 0.012 | 0.014 | 0.040 |
| Heptachlor[b] | ug/L | 0.00005 | <6.8E-05 | 5.0E-07 | 3.7E-07 | 5.2E-08 | 5.3E-07 | 3.2E-08 | 3.6E-08 | 4.3E-07 |
| Heptachlor Epoxide | ug/L | 0.00002 | 4.0E-07 | 2.5E-08 | 3.9E-07 | 5.0E-07 | 4.1E-08 | 4.8E-07 | 5.7E-07 | 1.6E-06 |
| Hexachlorobenzene | ug/L | 0.00021 | 5.3E-07 | 3.3E-08 | 5.1E-07 | 6.6E-07 | 5.4E-08 | 6.3E-07 | 7.6E-07 | 2.2E-06 |
| Hexachlorobutadiene | ug/L | 14 | 6.2E-08 | 3.8E-09 | 5.9E-08 | 7.6E-08 | 6.2E-09 | 7.3E-08 | 8.8E-08 | 2.5E-07 |
| Hexachloroethane | ug/L | 2.5 | <0.0034 | <0.0002 | <0.0033 | <0.0042 | <0.002 | <0.019 | <0.017 | <0.004 |

| Constituent | Units | Ocean Plan Objective | Estimated Concentration at Edge of ZID by Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | MPWSP Project | | | | Variant | | | |
| | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Isophorone | ug/L | 730 | <0.0034 | <0.0002 | <0.0033 | <0.0042 | <0.0003 | <0.004 | <0.004 | <0.003 |
| N-Nitrosodimethylamine | ug/L | 7.3 | 0.0001 | 0.0002 | 0.0002 | 0.0002 | 0.0003 | 0.001 | 0.001 | 0.001 |
| N-Nitrosodi-N-Propylamine | ug/L | 0.38 | 0.0005 | 0.0002 | 0.0006 | 0.0007 | 0.0002 | 0.001 | 0.001 | 0.0003 |
| N-Nitrosodiphenylamine | ug/L | 2.5 | <0.0034 | <0.0002 | <0.0033 | <0.0042 | <0.002 | <0.019 | <0.018 | <0.006 |
| PAHs | ug/L | 0.0088 | 3.6E-04 | 7.2E-04 | 8.6E-04 | 5.2E-04 | 7.7E-04 | 4.7E-04 | 5.6E-04 | 2.1E-03 |
| PCBs | ug/L | 0.000019 | 4.7E-06 | 1.2E-04 | 9.5E-05 | 1.8E-05 | 1.3E-04 | 1.3E-05 | 1.5E-05 | 1.2E-04 |
| TCDD Equivalents | ug/L | 3.9E-09 | 1.0E-09 | 6.4E-11 | 9.9E-10 | 1.3E-09 | 1.1E-10 | 1.3E-09 | 1.5E-09 | 4.3E-09 |
| 1,1,2,2-Tetrachloroethane | ug/L | 2.3 | <0.003 | <0.053 | <0.042 | <0.010 | <0.056 | <0.007 | <0.008 | <0.048 |
| Tetrachloroethylene | ug/L | 2.0 | <0.003 | <0.053 | <0.042 | <0.010 | <0.056 | <0.007 | <0.008 | <0.048 |
| Toxaphene | ug/L | 2.1E-04 | 4.9E-05 | 7.9E-05 | 1.0E-04 | 6.8E-05 | 8.5E-05 | 6.2E-05 | 7.4E-05 | 2.6E-04 |
| Trichloroethylene | ug/L | 27 | <0.003 | <0.053 | <0.042 | <0.010 | <0.056 | <0.007 | <0.008 | <0.048 |
| 1,1,2-Trichloroethane | ug/L | 9.4 | <0.003 | <0.053 | <0.042 | <0.010 | <0.056 | <0.007 | <0.008 | <0.048 |
| 2,4,6-Trichlorophenol | ug/L | 0.29 | <0.003 | <0.0002 | <0.0033 | <0.0042 | <0.002 | <0.019 | <0.018 | <0.006 |
| Vinyl chloride | ug/L | 36 | <0.003 | <0.029 | <0.025 | <0.007 | <0.031 | <0.006 | <0.006 | <0.028 |

[a] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based the nature of the constituent. These constituents were measured individually for the secondary effluent and GWR concentrate, and these individual concentrations would comply with the Ocean Plan objectives.
[b] All observed values from all data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.

**Table A3 – Complete list of predicted concentrations at the edge of the ZID expressed as a percentage of Ocean Plan[a]**

| Constituent | Units | Ocean Plan Objective | Est. Percentage of Ocean Plan objective at Edge of ZID by Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | MPWSP Project | | | | Variant | | | |
| | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| ***Objectives for protection of marine aquatic life*** | | | | | | | | | | |
| Arsenic | ug/L | 8 | 41% | 63% | 60% | 45% | 65% | 43% | 43% | 60% |
| Cadmium | ug/L | 1 | 1% | 46% | 35% | 6% | 49% | 4% | 4% | 43% |
| Chromium (Hexavalent) | ug/L | 2 | 1% | 3% | 3% | 1% | 4% | 1% | 2% | 7% |
| Copper | ug/L | 3 | 69% | 69% | 70% | 69% | 70% | 73% | 75% | 92% |
| Lead | ug/L | 2 | 0.2% | 19% | 14% | 2% | 20% | 2% | 2% | 17% |
| Mercury | ug/L | 0.04 | 13% | 56% | 45% | 17% | 58% | 17% | 18% | 56% |
| Nickel | ug/L | 5 | 1% | 10% | 8% | 2% | 11% | 3% | 3% | 16% |
| Selenium | ug/L | 15 | 0.1% | 22% | 16% | 2% | 23% | 2% | 2% | 20% |
| Silver | ug/L | 0.7 | <23% | <22% | <22% | <23% | <22% | <24% | <24% | <22% |
| Zinc | ug/L | 20 | 40% | 48% | 46% | 41% | 48% | 42% | 43% | 53% |
| Cyanide | ug/L | 1 | 5% | 52% | 43% | 11% | 56% | 9% | 11% | 65% |
| Total Chlorine Residual | ug/L | 2 | -- | -- | -- | -- | -- | -- | -- | -- |
| Ammonia (as N) - 6-mo median | ug/L | 600 | 42% | 3% | 40% | 52% | 5% | 49% | 59% | 170% |
| Ammonia (as N) - Daily Max | ug/L | 2,400 | 14% | 1% | 13% | 17% | 2% | 17% | 20% | 57% |
| Acute Toxicity[b] | TUa | 0.3 | | | | | | | | |
| Chronic Toxicity[b] | TUc | 1 | | | | | | | | |
| Phenolic Compounds (non-chlorinated) | ug/L | 30 | 2% | 0.1% | 2% | 2% | 0.2% | 2% | 2% | 6% |
| Chlorinated Phenolics | ug/L | 1 | <14% | <1% | <13% | <17% | <1% | <16% | <16% | <12% |
| Endosulfan | ug/L | 0.009 | 1% | 0.1% | 1% | 1% | 0.4% | 4% | 5% | 15% |
| Endrin | ug/L | 0.002 | 0.03% | 0.08% | 0.09% | 0.04% | 0.09% | 0.04% | 0.04% | 0.2% |

| Constituent | Units | Ocean Plan Objective | Est. Percentage of Ocean Plan objective at Edge of ZID by Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | MPWSP Project | | | | Variant | | | |
| | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| HCH (Hexachlorocyclohexane) | ug/L | 0.004 | 6% | 1% | 6% | 7% | 2% | 12% | 15% | 43% |
| Radioactivity (Gross Beta)[b] | pci/L | 0.0 | | | | | | | | |
| Radioactivity (Gross Alpha)[b] | pci/L | 0.0 | | | | | | | | |
| ***Objectives for protection of human health – non carcinogens*** | | | | | | | | | | |
| Acrolein | ug/L | 220 | <0.02% | <0.01% | <0.01% | <0.02% | <0.01% | 0.03% | 0.04% | 0.1% |
| Antimony | ug/L | 1200 | <0.01% | 0.1% | 0.1% | 0.01% | 0.1% | 0.01% | 0.01% | 0.1% |
| Bis (2-chloroethoxy) methane | ug/L | 4.4 | <0.08% | <0.01% | <0.07% | <0.10% | <0.07% | <0.77% | <0.72% | <0.17% |
| Bis (2-chloroisopropyl) ether | ug/L | 1200 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Chlorobenzene | ug/L | 570 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Chromium (III) | ug/L | 190000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Di-n-butyl phthalate | ug/L | 3500 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Dichlorobenzenes | ug/L | 5100 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Diethyl phthalate | ug/L | 33000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Dimethyl phthalate | ug/L | 820000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| 4,6-dinitro-2-methylphenol | ug/L | 220 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.1% | <0.1% | <0.02% |
| 2,4-Dinitrophenol | ug/L | 4.0 | <0.09% | <0.01% | <0.08% | <0.1% | <0.2% | <2.6% | <2.5% | <0.8% |
| Ethylbenzene | ug/L | 4100 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Fluoranthene | ug/L | 15 | <0.02% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Hexachlorocyclopentadiene | ug/L | 58 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Nitrobenzene | ug/L | 4.9 | <0.07% | <0.01% | <0.07% | <0.09% | <0.03% | <0.4% | <0.4% | <0.1% |
| Thallium | ug/L | 2 | <0.2% | <5.0% | <3.9% | <0.7% | 5.3% | 0.6% | 0.7% | 5.2% |
| Toluene | ug/L | 85000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Tributyltin | ug/L | 0.0014 | <24% | <1.5% | <23% | <30% | <2.5% | <29% | <27% | <9.4% |
| 1,1,1-Trichloroethane | ug/L | 540000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| ***Objectives for protection of human health - carcinogens*** | | | | | | | | | | |
| Acrylonitrile | ug/L | 0.10 | <14% | <1% | <13% | <17% | 2% | 21% | 25% | 71% |
| Aldrin[c] | ug/L | 0.000022 | -- | -- | -- | -- | <22% | -- | -- | -- |
| Benzene | ug/L | 5.9 | <0.1% | <1% | <1% | <0.2% | <1% | <0.1% | <0.1% | <1% |
| Benzidine[c] | ug/L | 0.000069 | -- | -- | -- | -- | -- | -- | -- | -- |
| Beryllium[c] | ug/L | 0.033 | 10% | <0.01% | 9% | 13% | 0.01% | <0.01% | 0.7% | 8% |
| Bis(2-chloroethyl)ether | ug/L | 0.045 | <8% | <0.01% | <7% | <9% | <6% | <75% | <70% | <17% |
| Bis(2-ethyl-hexyl)phthalate | ug/L | 3.5 | 15% | 3% | 16% | 19% | 3% | 18% | 22% | 64% |
| Carbon tetrachloride | ug/L | 0.90 | <0.4% | <3% | <3% | <1% | 3% | 1% | 1% | 4% |
| Chlordane | ug/L | 0.000023 | 22% | 51% | 58% | 32% | 55% | 29% | 35% | 132% |
| Chlorodibromomethane | ug/L | 8.6 | <0.04% | <0.01% | <0.04% | <0.05% | 0.02% | 0.2% | 0.3% | 0.8% |
| Chloroform | ug/L | 130 | 0.01% | <0.01% | 0.01% | 0.01% | 0.02% | 0.2% | 0.3% | 0.8% |
| DDT | ug/L | 0.00017 | 4% | 19% | 18% | 7% | 29% | 7% | 16% | 129% |
| 1,4-Dichlorobenzene | ug/L | 18 | 0.1% | 0.3% | 0.3% | 0.1% | 0.3% | 0.1% | 0.1% | 0.5% |
| 3,3-Dichlorobenzidine[c] | ug/L | 0.0081 | <2% | <0.1% | <2% | <3% | -- | -- | -- | -- |
| 1,2-Dichloroethane | ug/L | 28 | <0.01% | <0.2% | <0.2% | <0.03% | <0.2% | <0.03% | <0.03% | <0.2% |
| 1,1-Dichloroethylene | ug/L | 0.9 | 0.4% | 6% | 5% | 1% | 6% | 1% | 1% | 5% |
| Dichlorobromomethane | ug/L | 6.2 | <0.1% | <0.01% | <0.1% | <0.1% | 0.03% | 0.3% | 0.4% | 1.2% |
| Dichloromethane | ug/L | 450 | <0.01% | 0.01% | 0.01% | <0.01% | 0.01% | <0.01% | <0.01% | 0.01% |
| 1,3-dichloropropene | ug/L | 8.9 | <0.04% | <0.6% | <0.5% | <0.1% | 0.6% | 0.1% | 0.1% | 0.7% |
| Dieldrin | ug/L | 0.00004 | 9% | 13% | 18% | 12% | 23% | 12% | 14% | 57% |
| 2,4-Dinitrotoluene | ug/L | 2.6 | <1% | <0.03% | <1% | <1% | <1% | <1% | <1% | <0.06% |
| 1,2-Diphenylhydrazine | ug/L | 0.16 | <2% | <0.1% | <2% | <3% | <2% | <21% | <20% | <5% |
| Halomethanes | ug/L | 130 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | 0.01% | 0.01% | 0.03% |
| Heptachlor | ug/L | 0.00005 | -- | 1.0% | 0.7% | 0.1% | 1.1% | 0.06% | 0.07% | 0.9% |
| Heptachlor Epoxide[c] | ug/L | 0.00002 | 0.2% | 0.1% | 2% | 3% | 0.2% | 2% | 3% | 8% |
| Hexachlorobenzene[c] | ug/L | 0.00021 | 0.3% | 0.02% | 0.2% | 0.3% | 0.03% | 0.3% | 0.4% | 1% |

| Constituent | Units | Ocean Plan Objective | Est. Percentage of Ocean Plan objective at Edge of ZID by Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | MPWSP Project | | | | Variant | | | |
| | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Hexachlorobutadiene | ug/L | 14 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Hexachloroethane | ug/L | 2.5 | <0.1% | <0.01% | <0.1% | <0.2% | <0.06% | <0.7% | <0.7% | <0.2% |
| Isophorone | ug/L | 730 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| N-Nitrosodimethylamine | ug/L | 7.3 | 0.01% | 0.01% | 0.01% | 0.01% | 0.01% | 0.01% | 0.01% | 0.01% |
| N-Nitrosodi-N-Propylamine | ug/L | 0.38 | 0.1% | 0.1% | 0.2% | 0.2% | 0.1% | 0.2% | 0.2% | 0.1% |
| N-Nitrosodiphenylamine | ug/L | 2.5 | <0.1% | <0.01% | <0.1% | <0.2% | <0.1% | <0.7% | <0.7% | <0.3% |
| PAHs | ug/L | 0.0088 | 4% | 8 % | 10% | 6% | 9% | 5 % | 6 % | 24% |
| PCBs | ug/L | 0.000019 | 24% | 645% | 502 % | 96% | 683% | 69% | 81% | 648 % |
| TCDD Equivalents | ug/L | 3.9E-09 | 27% | 2% | 25 % | 33% | 3% | 32% | 38% | 110% |
| 1,1,2,2-Tetrachloroethane | ug/L | 2.3 | <0.2% | <2.3% | <1.8% | <0.4% | <2.4% | <0.3% | <0.3% | <2.0% |
| Tetrachloroethylene | ug/L | 2.0 | <0.2% | <3% | <2% | <0.5% | <3% | <0.4% | <0.4% | <2.4% |
| Toxaphene | ug/L | 2.1E-04 | 23% | 38% | 49% | 32% | 41% | 30% | 35% | 125% |
| Trichloroethylene | ug/L | 27 | <0.01% | <0.2% | <0.2% | <0.04% | <0.2% | <0.03% | <0.03% | <0.2% |
| 1,1,2-Trichloroethane | ug/L | 9.4 | <0.04% | <0.6% | <0.5% | <0.1% | <0.6% | <0.1% | <0.1% | <0.5% |
| 2,4,6-Trichlorophenol | ug/L | 0.29 | <1% | <0.07% | <1% | <1% | <1% | <6% | <6% | <2% |
| Vinyl chloride | ug/L | 36 | <0.01% | <0.1% | <0.1% | <0.02% | <0.1% | <0.02% | <0.02% | <0.1% |

[a] Note that if the percentage as determined by using the MRL was less than 0.01 percent, then a minimum value is shown as "<0.01%" (*e.g.*, if the MRL indicated the value was <0.000001%, for simplicity, it is displayed as <0.01%). Also, shading indicates constituent is expected to be greater than 80 percent (orange shading) or exceed (red shading) the ocean plan objective for that discharge scenario.

[b] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based the nature of the constituent. These constituents were measured individually for the secondary effluent and GWR concentrate, and these individual concentrations would comply with the Ocean Plan objectives.

[c] All observed values from all data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.

# Appendix B

Trussell Technologies, Inc (Trussell Tech), 2015. "Ocean Plan Compliance Assessment for the Pure Water Monterey Groundwater Replenishment Project." *Technical Memorandum prepared for MRWPCA and MPWMD*. Feb.

# Appendix W

# Pure Water Monterey Groundwater Replenishment Project Noise Study Report

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# *PURE WATER MONTEREY GROUNDWATER REPLENISHMENT PROJECT NOISE STUDY REPORT MONTEREY COUNTY, CALIFORNIA*

**March 16, 2015**

♦ ♦ ♦

**Prepared for:**

**Alison M. Imamura**
**Denise Duffy & Associates, Inc.**
**947 Cass Street, Suite 5**
**Monterey, CA 93940**

**Prepared by:**

**Michael S. Thill**
**Jordan L. Roberts**

***ILLINGWORTH & RODKIN, INC.***
**Acoustics · Air Quality**
**1 Willowbrook Court, Suite 120**
**Petaluma, CA 94954**
**(707) 794-0400**

**Job No.: 13-214**

## INTRODUCTION

The Pure Water Monterey Groundwater Replenishment Project is a water supply project that will serve northern Monterey County providing purified water for recharge of a groundwater basin that serves as drinking water supply, and recycled water to augment the existing Castroville Seawater Intrusion Project's crop irrigation supply. The GWR Project would be located within northern Monterey County and would include new facilities located within the unincorporated areas of the Salinas Valley and the cities of Salinas, Marina, Seaside, Monterey, and Pacific Grove.

This report evaluates the potential noise and vibration impacts that could result from implementation of the GWR Project both with regard to temporary impacts during construction and long-term impacts from operation. The report describes the existing noise environment, presents relevant noise and vibration regulations and standards, identifies sensitive receptors to noise and vibration that could be affected by the GWR Project, evaluates the potential effects of construction and operation on these receptors, and identifies mitigation measures as appropriate.

## SETTING

### Fundamentals of Environmental Noise and Vibration

#### *Noise*

Noise may be defined as unwanted sound. Noise is usually objectionable because it is disturbing or annoying. The objectionable nature of sound could be caused by its *pitch* or its *loudness*. *Pitch* is the height or depth of a tone or sound, depending on the relative rapidity (frequency) of the vibrations by which it is produced. Higher pitched signals sound louder to humans than sounds with a lower pitch. *Loudness* is intensity of sound waves combined with the reception characteristics of the ear. Intensity may be compared with the height of an ocean wave in that it is a measure of the amplitude of the sound wave.

In addition to the concepts of pitch and loudness, there are several noise measurement scales which are used to describe noise in a particular location. A *decibel* (*dB*) is a unit of measurement which indicates the relative amplitude of a sound. The zero on the decibel scale is based on the lowest sound level that the healthy, unimpaired human ear can detect. Sound levels in decibels are calculated on a logarithmic basis. An increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense, 30 decibels is 1,000 times more intense, etc. There is a relationship between the subjective noisiness or loudness of a sound and its intensity. Each 10 decibel increase in sound level is perceived as approximately a doubling of loudness over a fairly wide range of intensities. Technical terms are defined in Table 1.

There are several methods of characterizing sound. The most common in California is the *A-weighted sound level (dBA).* This scale gives greater weight to the frequencies of sound to which the human ear is most sensitive. Representative outdoor and indoor noise levels in units of dBA are shown in Table 2. Because sound levels can vary markedly over a short period of time, a method for describing either the average character of the sound or the statistical behavior of the variations must be utilized. Most commonly, environmental sounds are described in terms of an average level that has the same acoustical energy as the summation of all the time-varying events. This *energy-equivalent sound/noise descriptor* is called $L_{eq}$. The most common averaging period is hourly, but $L_{eq}$ can describe any series of noise events of arbitrary duration. The scientific instrument used to measure noise is the sound level meter. Sound level meters can accurately measure environmental noise levels to within about plus or minus 1 dBA. Various computer models are used to predict environmental noise levels from sources, such as roadways and airports. The accuracy of the predicted models depends upon the distance the receptor is from the noise source. Close to the noise source, the models are accurate to within about plus or minus 1 to 2 dBA.

Since the sensitivity to noise increases during the evening and at night -- because excessive noise interferes with the ability to sleep -- 24-hour descriptors have been developed that incorporate artificial noise penalties added to quiet-time noise events. The *Community Noise Equivalent Level* (*CNEL*) is a measure of the cumulative noise exposure in a community, with a 5 dB penalty added to evening (7:00 p.m. - 10:00 p.m.) and a 10 dB addition to nocturnal (10:00 p.m. - 7:00 a.m.) noise levels. The *Day/Night Average Sound Level* ($L_{dn}$) is essentially the same as CNEL, with the exception that the evening time period is dropped and all occurrences during this three-hour period are grouped into the daytime period.

***Vibration***

Ground vibration consists of rapidly fluctuating motions or waves with an average motion of zero. Several different methods are typically used to quantify vibration amplitude. One is the *Peak Particle Velocity (PPV)* and another is the *Root Mean Square (RMS)* velocity. The PPV is defined as the maximum instantaneous positive or negative peak of the vibration wave. The RMS velocity is defined as the average of the squared amplitude of the signal. The PPV and RMS vibration velocity amplitudes are used to evaluate human response to vibration. In this analysis, a PPV descriptor, with units of mm/sec or in/sec, is used to evaluate construction generated vibration for building damage and human complaints. Table 3 displays the reactions of people and the effects on buildings that continuous vibration levels produce. The annoyance levels shown in Table 3 should be interpreted with care since vibration may be found to be annoying at much lower levels than those shown, depending on the level of activity or the sensitivity of the individual. To sensitive individuals, vibrations approaching the threshold of perception can be annoying.

Low-level vibrations frequently cause irritating secondary vibration, such as a slight rattling of windows, doors, or stacked dishes. The rattling sound can give rise to exaggerated vibration complaints, even though there is very little risk of actual structural damage. In high noise environments, which are more prevalent where groundborne vibration approaches perceptible levels, this rattling phenomenon may also be produced by loud airborne environmental noise causing induced vibration in exterior doors and windows.

Construction activities can cause vibration that varies in intensity depending on several factors. The use of pile driving and vibratory compaction equipment typically generates the highest construction related groundborne vibration levels. Because of the impulsive nature of such activities, the use of the PPV descriptor has been routinely used to measure and assess groundborne vibration and almost exclusively to assess the potential of vibration to induce structural damage and the degree of annoyance for humans.

The two primary concerns with construction-induced vibration, the potential to damage a structure and the potential to interfere with the enjoyment of life, are evaluated against different vibration limits. Studies have shown that the threshold of perception for average persons is in the range of 0.008 to 0.012 in/sec PPV. Human perception to vibration varies with the individual and is a function of physical setting and the type of vibration. Persons exposed to elevated ambient vibration levels such as people in an urban environment may tolerate a higher vibration level.

Structural damage can be classified as cosmetic only, such as minor cracking of building elements, or may threaten the integrity of the building. Safe vibration limits that can be applied to assess the potential for damaging a structure vary by researcher and there is no general consensus as to what amount of vibration may pose a threat for structural damage to the building. Construction-induced vibration that can be detrimental to the building is very rare and has only been observed in instances where the structure is at a high state of disrepair and the construction activity occurs immediately adjacent to the structure.

**TABLE 1 Definitions of Acoustical Terms Used in this Report**

| **Term** | **Definition** |
|---|---|
| Decibel, dB | A unit describing, the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure. The reference pressure for air is 20 micro Pascals. |
| Sound Pressure Level | Sound pressure is the sound force per unit area, usually expressed in micro Pascals (or 20 micro Newtons per square meter), where 1 Pascal is the pressure resulting from a force of 1 Newton exerted over an area of 1 square meter. The sound pressure level is expressed in decibels as 20 times the logarithm to the base 10 of the ratio between the pressures exerted by the sound to a reference sound pressure (e.g., 20 micro Pascals). Sound pressure level is the quantity that is directly measured by a sound level meter. |
| Frequency, Hz | The number of complete pressure fluctuations per second above and below atmospheric pressure. Normal human hearing is between 20 Hz and 20,000 Hz. Infrasonic sound are below 20 Hz and Ultrasonic sounds are above 20,000 Hz. |
| A-Weighted Sound Level, dBA | The sound pressure level in decibels as measured on a sound level meter using the A-weighting filter network. The A-weighting filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. |
| Equivalent Noise Level, $L_{eq}$ | The average A-weighted noise level during the measurement period. |
| $L_{max}$, $L_{min}$ | The maximum and minimum A-weighted noise level during the measurement period. |
| $L_{01}$, $L_{10}$, $L_{50}$, $L_{90}$ | The A-weighted noise levels that are exceeded 1%, 10%, 50%, and 90% of the time during the measurement period. |
| Day/Night Noise Level, $L_{dn}$ or DNL | The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels to levels measured in the night between 10:00 p.m. and 7:00 a.m. |
| Community Noise Equivalent Level, CNEL | The average A-weighted noise level during a 24-hour day, obtained after addition of 5 decibels in the evening from 7:00 p.m. to 10:00 p.m. and after addition of 10 decibels to sound levels measured in the night between 10:00 p.m. and 7:00 a.m. |
| Ambient Noise Level | The composite of noise from all sources near and far. The normal or existing level of environmental noise at a given location. |
| Intrusive | That noise which intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, and time of occurrence and tonal or informational content as well as the prevailing ambient noise level. |

Source: Handbook of Acoustical Measurements and Noise Control, Harris, 1998.

**TABLE 2 Typical Noise Levels in the Environment**

| Common Outdoor Activities | Noise Level (dBA) | Common Indoor Activities |
|---|---|---|
| | 110 dBA | Rock band |
| Jet fly-over at 1,000 feet | | |
| | 100 dBA | |
| Gas lawn mower at 3 feet | | |
| | 90 dBA | |
| Diesel truck at 50 feet at 50 mph | | Food blender at 3 feet |
| | 80 dBA | Garbage disposal at 3 feet |
| Noisy urban area, daytime | | |
| Gas lawn mower, 100 feet | 70 dBA | Vacuum cleaner at 10 feet |
| Commercial area | | Normal speech at 3 feet |
| Heavy traffic at 300 feet | 60 dBA | |
| | | Large business office |
| Quiet urban daytime | 50 dBA | Dishwasher in next room |
| Quiet urban nighttime | 40 dBA | Theater, large conference room |
| Quiet suburban nighttime | | |
| | 30 dBA | Library |
| Quiet rural nighttime | | Bedroom at night, concert hall (background) |
| | 20 dBA | |
| | | Broadcast/recording studio |
| | 10 dBA | |
| | 0 dBA | |

Source: Technical Noise Supplement (TeNS), Caltrans, September 2013.

**TABLE 3-A Guideline Vibration Damage Potential Threshold Criteria**

| Structure and Condition | Maximum PPV (in/sec) | |
|---|---|---|
| | Transient Sources | Continuous/Frequent Intermittent Sources |
| Extremely fragile historic buildings, ruins, ancient monuments | 0.12 | 0.08 |
| Fragile buildings | 0.2 | 0.1* |
| Historic and some old buildings | 0.5 | 0.25 |
| Older residential structures | 0.5 | 0.3 |
| New residential structures | 1.0 | 0.5 |
| Modern industrial/commercial buildings | 2.0 | 0.5 |
| Note: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment. | | |
| * For damage to historic buildings, 0.12 PPV is used from Wilson, Ihrig & Associates et al., 2012 as discussed in Section 4.6.<br>Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, September 2013. | | |

**TABLE 3-B Guideline Vibration Annoyance Potential Criteria**

| Human Response | Maximum PPV (in/sec) | |
|---|---|---|
| | Transient Sources | Continuous/Frequent Intermittent Sources |
| Barely perceptible | 0.035 | 0.01 |
| Distinctly perceptible | 0.24 | 0.04 |
| Strongly perceptible | 0.9 | 0.10 |
| Severe | 2.0 | 0.4 |
| Note: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment. | | |
| Source: Transportation and Construction Vibration Guidance Manual, California Department of Transportation, September 2013. | | |

## Regulatory Background

Federal, State, and local governments and agencies regulate noise in the environment and industry. There are no federal or state laws or regulations that would apply to the noise resulting from the construction or operation of the GWR project. The California Environmental Quality Act (CEQA) outlines the questions that form the basis of the significance criteria presented later in this report. Applicable regulatory criteria established by the County of Monterey, City of Salinas, City of Marina, City of Seaside, and City of Monterey are as follows:

### *County of Monterey*

Monterey County's exterior noise exposure standards are based on parameters established by the California Department of Health, Office of Noise Control and are presented in Table 4. Based on these standards, noise levels of 60 dBA $L_{dn}$ or less at various noise-sensitive receptor locations, including single- and multi-family residences, schools, hospitals, churches, and nursing homes are considered "normally acceptable" and noise levels of 60 to 70 dBA $L_{dn}$ are considered "conditionally acceptable" with the incorporation of noise insulation and mitigation features (Monterey County, 1993).

> *Policy S-7.2:* Proposed development shall incorporate design elements necessary to minimize noise impacts on surrounding land uses and to reduce noise in indoor spaces to an acceptable level.
>
> *Policy S-7.4:* New noise generators may be allowed in areas where projected noise levels are "conditionally acceptable" only after a detailed analysis of the noise reduction requirements is made and needed noise mitigation features are included in project design.
>
> *Policy S-7.5:* New noise generators should generally be discouraged in areas identified as "normally unacceptable." Where such new noise generators are permitted, mitigation to reduce both the indoor and outdoor noise levels will be required.
>
> *Policy S-7.6:* Acoustical analysis shall be part of the environmental review process for projects when:
>
> a. Noise sensitive receptors are proposed in areas exposed to existing or projected noise levels that are "normally unacceptable" or higher according to Table S-2 (presented as Table 4).
>
> b. Proposed noise generators are likely to produce noise levels exceeding the levels shown in the adopted Community Noise Ordinance when received at existing or planned noise-sensitive receptors.
>
> *Policy S-7.8:* All discretionary projects which propose to use heavy construction equipment that has the potential to create vibrations that could cause structural damage to adjacent structures within 100 feet would be required to submit a pre-construction vibration study prior to the approval of a building permit. Specified measures and monitoring identified to reduce impacts would be incorporated into construction contracts. Pile driving or blasting are illustrative of the type of equipment that could be subject to this policy.
>
> *Policy S-7.9:* No construction activities pursuant to a County permit that exceed levels listed in Policy S-7.1 (herein Table 4) shall be allowed within 500 feet of a noise sensitive land use during the evening hours of Monday through Saturday, or anytime on Sunday or holidays shall be allowed prior to completion of a noise mitigation study. Noise protection measures, in the event of any identified impact, may include but not be limited to:
>
> - Constructing temporary barriers; or
> - Using quieter equipment than normal.
>
> *Policy S-7.10:* Standard noise protection measures shall be incorporated into all construction contracts. These measures shall include:

- Construction shall occur only during times allowed by ordinance/code unless such limits are waived for public convenience;
- All equipment shall have properly operating mufflers; and
- Lay-down yards and semi-stationary equipment such as pumps or generators shall be located as far from noise-sensitive land uses as practical.

In addition, the Monterey County Noise Control Ordinance (Chapter 10.60 of the County Code) prohibits the operation of any device, which produces a noise level exceeding 85 dBA at a distance of 50 feet from the source, but does not apply to aircraft or any machine or device that is operated in excess of 2,500 feet from any occupied dwelling unit. Additionally, section 10.60.040 of the County Code apply to nighttime noise, in which it is prohibited to make, assist in making, allow, continue, create, or cause to be made any loud and unreasonable sound any day of the week from 10:00 p.m. to 7:00 a.m. the following morning within the unincorporated area of the County of Monterey. During this time period, a loud and unreasonable sound includes any sound that exceeds the exterior noise level standards set forth below:

| | |
|---|---|
| Nighttime hourly equivalent sound level ($L_{eq}$ dBA) | 45 |
| Maximum level, dBA | 65 |

Noise levels shall be measured at or outside the property line of the property from which noise is emanating. Commercial agricultural operations, emergency vehicles, bells and chimes used for religious purposes or services, and specified outdoor gatherings are exempt from these requirements.

***City of Salinas***

**Noise Element of the City of Salinas General Plan**

The Noise Element of the Salinas General Plan sets forth goals and policies to protect citizens from the harmful and annoying effects of excessive noise. Policies established in the Noise Element of the General Plan that are applicable to the proposed project include:

**Goal N-1: Minimize the adverse effects of noise through proper land use planning.**

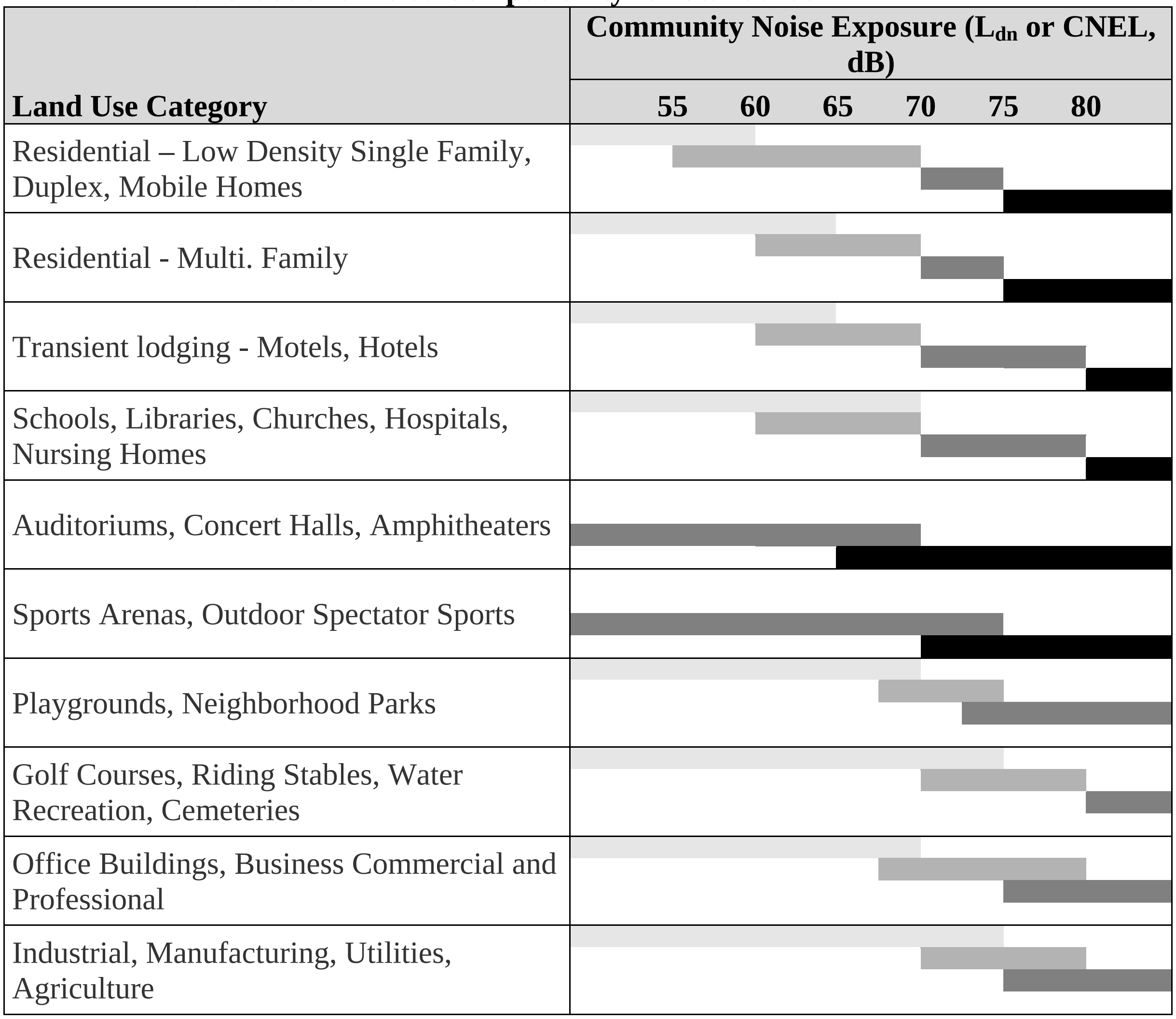
*Policy N-1.1:* Ensure that new development can be made compatible with the noise environment by using noise/land use compatibility standards Table N-3 (herein Table 5) and the Noise Contours Map (not included) as a guide for future planning and development decisions.

The following goal and policies address the noise created by non-transportation related sources.

**Goal N-3: Minimize non-transportation related noise impacts.**

*Policy N-3.1:* Enforce the City of Salinas Noise Ordinance to ensure stationary noise sources and noise emanating from construction activities, private developments/residences, and special events are minimized. The exterior noise standards are shown in Table 6.

**TABLE 4 Land Use and Noise Compatibility for Standards**




Source: County of Monterey, 2007.

***INTERPRETATION***

NORMALLY ACCEPTABLE: Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

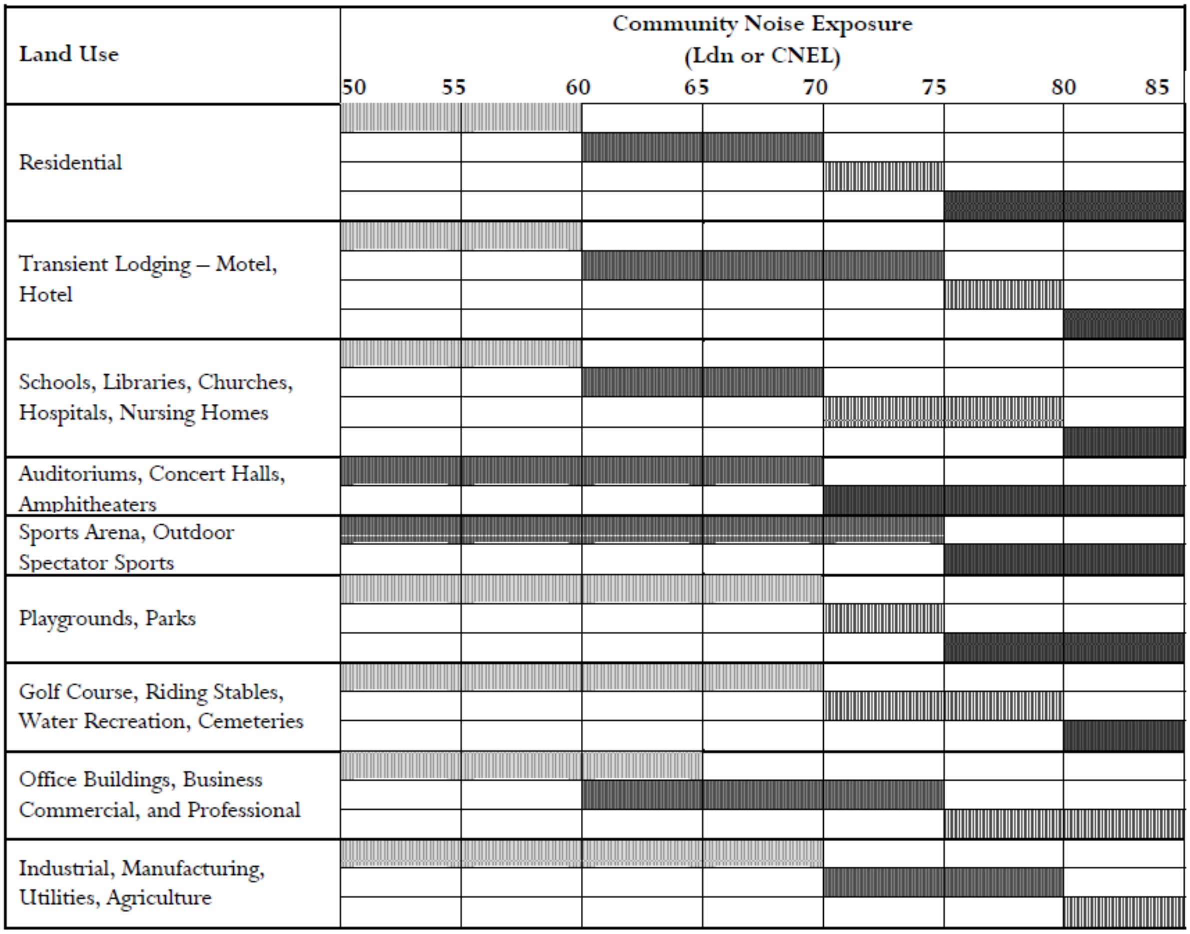
CONDITIONALLY ACCEPTABLE: New construction or development should be undertaken only after a detailed analysis of noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.

NORMALLY UNACCEPTABLE: New construction or development should generally be discouraged. If new development or construction does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

CLEARLY UNACCEPTABLE: New construction or development should generally not be undertaken.

## TABLE 5   City of Salinas General Plan Noise/Land Use Compatibility Matrix

**Table N-3**
**Noise/Land Use Compatibility Matrix**




Source: Modified by CBA from 1998 State of California General Plan Guidelines.

**ZONE A - Normally Acceptable:** Specified land use is satisfactory, based upon the assumption that any buildings involved meet conventional Title 24 construction standards. No special noise insulation requirements.

**ZONE B - Conditionally Acceptable:** New construction or development shall be undertaken only after a detailed noise analysis is made and noise reduction measures are identified and included in the project design.

**Zone C- Normally Unacceptable:** New construction or development is discouraged. If new construction is proposed, a detailed analysis is required, noise reduction measures must be identified, and noise insulation features included in the design.

**ZONE D- Clearly Unacceptable:** New construction or development clearly should not be undertaken.

**TABLE 6 City of Salinas General Plan Exterior Noise Standards**

| Designation/District of Property Receiving Noise | Maximum Noise Level, $L_{dn}$ or CNEL, dBA |
|---|---|
| Agricultural | 70 |
| Residential | 60 |
| Commercial | 65 |
| Industrial | 70 |
| Public and Semipublic | 60 |

**City of Salinas Zoning Ordinance**

Pursuant to section 37.50-180 of the Salinas Municipal Code, the following performance standards shall apply to all use classifications in all zoning districts:

> **(a) Noise:** No use shall create ambient noise levels which exceed the following standards (see Table 37-50.50, herein Table 7), as measured at the property boundary:
>
> *(1)Duration and Timing.* The noise standards in Table 37-50.50 shall be modified as follows to account for the effects of time and duration on the impact of noise levels:
>
> (A) In residential zones, the noise standard shall be 5.0 dBA lower between 9:00 p.m. and 7:00 a.m.
>
> (B) Noise that is produced for no more than a cumulative period of five minutes in any hour may exceed the standards above by 5.0 dBA.
>
> (C) Noise that is produced for no more than a cumulative period of one minute in any hour may exceed the standards above by 10.0 dBA.
>
> Note: The interior noise level in any residential dwelling unit located in a mixed use building or development shall not exceed a maximum of forty-five dBA from exterior ambient noise.

The city planner may require an acoustic study for any proposed project or use that has the potential to create a noise exposure greater than that deemed acceptable by the above standard, and require appropriate mitigation measures.

Chapter 21A of the Salinas Municipal Code prohibits unnecessary, excessive and annoying noise from specified noise sources, but does not specifically address construction noise.

**TABLE 7 City of Salinas Zoning Ordinance Noise Standards**

| Table 37-50.50 Maximum Noise Standards | |
|---|---|
| **Zone of Property Receiving Noise** | **Maximum Noise Level (CNEL, dBA)** |
| Agricultural District | 70 dBA |
| Residential Districts | 60 dBA |
| Commercial Districts | 65 dBA |
| Industrial Districts | 70 dBA |
| Mixed Use Districts | 65 dBA(A) |
| Parks/Open Space Districts | 70 dBA |
| Public/Semipublic District | 60 dBA |

***City of Marina***

**General Plan and Municipal Code**

The General Plan (Table 4.1) establishes the maximum allowable exterior and interior noise levels for different land use categories. The noise standards apply to the siting of new noise-sensitive receptors (in particular residences, schools, and parks), and the siting of new or improved arterials and collectors near noise-sensitive receptors. The General Plan of the City of Marina (Table 4.2) features noise standards for new or modified stationary noise sources that adjoin or are in close proximity to residential or other noise-sensitive uses (see Table 8).

**TABLE 8 City of Marina Noise Standards for Stationary Noise Sources**

| **Duration** | **Maximum Allowable Noise** | |
|---|---|---|
| | Day (7:00 a.m. to 10:00 p.m.) | Night (10:00 p.m. to 7:00 a.m.) |
| Hourly $L_{eq}$ in dB [1,2] | 50 | 45 |
| Maximum Level in dB [1,2] | 70 | 65 |
| Maximum Impulsive Noise in dB [1,3] | 65 | 60 |

[1]*As determined at the property line of the receptor. When determining the effectiveness of noise mitigation measures, the standards may be applied on the receptor side of noise barriers or other property-line noise mitigation measures.*
[2]*Sound level measurements shall be made with slow meter response.*
[3]*Sound level measurements shall be made with fast meter response.*

The City of Marina Municipal Code (Chapter 9.24) establishes noise regulations within Marina. Pursuant to section 9.24.040.D, operation or use of a range of tools and power equipment is limited to between the hours of 7 a.m. and 7 p.m. on Monday through Saturday, 10 a.m. and 7 p.m. on Sundays and holidays, and until 8 p.m. when daylight savings time is in effect. Excessive, unnecessary or unusually loud noise due to construction, demolition, and excavation that disturbs occupants of residential property also is considered in violation of the City's noise regulations pursuant to section 9.24.040E. However, section 9.24.050 exempts activities on or in publicly owned property and facilities, or by public employees or city franchisees, while in the authorized discharge of their responsibilities, provided that such activities have been authorized by the owner of such property or facilities or its agent.

Title 15 of the Marina Municipal Code (Buildings and Construction) also addresses construction noise. Section 15.04.055 prohibits any outside construction, repair work or related activities requiring a building, grading, demolition, use or other permit from the city when construction noise is produced adjacent to residential uses, including transient lodging, except between the hours of 7 a.m. and 7 p.m. (standard time), and on Sundays and holidays between the hours of 10 a.m. and 7 p.m. (standard time). During daylight savings time, the hours of construction may be extended to 8 p.m. This section of the Municipal code further indicates that during hours of construction, no construction, tools or equipment shall produce a noise level of more than 60 decibels for twenty-five percent of an hour during construction at any receiving property line.

***City of Seaside***

The City of Seaside provides goals and policies and plans regarding Noise and Land Use Planning and construction noise, as shown below:

**Policy N-1.1**: Ensure that new development and reuse/revitalization projects can be made compatible with the noise environment and existing development.

**Implementation Plan N-1.1.1: Compatible Development**

Review discretionary development proposals for potential on- and off-site stationary and vehicular noise impacts per CEQA. Any proposed development located within a 60 dB or higher noise contour shall be reviewed for potential noise impacts and compliance with the noise and land use compatibility standards. The thresholds established in the Zoning Ordinance, Noise Ordinance, the Noise Contours Map (not included here), and the Tables N-1 and N-2 (herein Tables 9 and 10) of the Noise Element will be used to determine the significance of impacts.

If potential impacts are identified, mitigation in the form of noise reduction designs/structures will be required to reduce the impact to a level less than significant. If the impact cannot be reduce to a level less than significant or avoided with accepted noise reduction methods, the proposed project will be determined “Clearly Unacceptable” and will not be approved.

**TABLE 9 City of Seaside Maximum Exterior and Interior Noise Standards**

| | **Noise Standard in CNEL** | |
|---|---|---|
| **Land Use** | Exterior (dBA) | Interior (dBA) |
| Residential | 65 | 45 |
| Mixed Use Residential | 70 | 45 |
| Commercial | 70 | --- |
| Office | 70 | 50 |
| Industrial | 75 | 55 |
| Public Facilities | 70 | 50 |
| Schools | 80 | 50 |

Source: City of Seaside, 2008.

**Implementation Plan N-3.1.3 Construction Noise Limits**

Require all construction activity to comply with the limits (maximum noise levels, hours, and days allowed activity) established in the City noise regulations (Title 24 California Code of Regulations, Zoning Ordinance and Chapter 21A of the Municipal Code).

**TABLE 10 City of Seaside Land Use Compatibility Guidelines**

| | Community Noise Equivalent Level (CNEL) | | | | | |
|---|---|---|---|---|---|---|
| **Land Use Category** | **55** | **60** | **65** | **70** | **75** | **80** |
| Residential – Single-Family, Multi-Family, and Duplex | A | B | B | C | - | - |
| Residential – Mobile homes | A | B | C | C | - | - |
| Transient Lodging - Hotels and Motels | A | B | B | C | C | |
| Hospitals, Libraries, Nursing Homes, Places of Worship, and Schools | A | B | C | C | - | - |
| Amphitheaters, Auditoriums, Concert Halls, and Meeting Halls | B | C | C | - | - | - |
| Amusement Parks, Outdoor Spectator Sports, and Sports Arenas | A | A | B | B | - | - |
| Neighborhood Parks and Playgrounds | A | A | B | C | - | - |
| Cemeteries, Golf Courses, and Riding Stables | A | A | A | B | C | C |
| Office and Professional Buildings | A | A | B | B | C | - |
| Banks, Commercial Retail, Restaurants, and Theaters | A | A | A | B | B | C |
| Industrial, Manufacturing, Service Stations, Utilities, and Wholesale | A | A | A | B | B | B |
| Agriculture | A | A | A | A | A | A |

Notes:
A = Normally Acceptable. Specified land use is satisfactory based on the assumption that any structures involved are normal conventional construction, without any special noise insulation requirements.
B = Conditionally Acceptable. New construction or development may be undertaken only after a detailed analysis of the noise requirements is made and needed noise insulation features as included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.
C = Normally Unacceptable. New construction or development shall generally be discouraged. If it does proceed, a detailed analysis of the noise reduction requirements shall be made and needed noise insulation features included in the design.
- = Clearly Unacceptable. New construction or development shall generally not be undertaken.

Source: City of Seaside, 2004 and 2008.

Chapter 9.12 of the City of Seaside Municipal Code establishes noise regulations within Seaside. Pursuant to section 9.12.030.D, operation or use of a range of tools and power equipment and any construction, demolition, excavation, erection, alteration, or repair activity is declared to be unlawful and a nuisance if it occurs before 7:00 a.m. or after 7:00 p.m. daily (except Saturday, Sunday, and holidays when the prohibited time shall be before 9:00 a.m. and after 7:00 p.m.)

unless authorized in writing by a building official. Written authorization may be issued in the case of an emergency, or where the building official determines that the peace, comfort and tranquility of the occupants of residential property will not be impaired because of the location or nature of the construction activity. Section 9.12.040.D exempts activity on or in publicly owned property and facilities, or by public employees or their franchisees, while in the authorized discharge of their responsibilities, provided such activities have been authorized by the owner of such property or facilities or its agency or by the employing authority.

Seaside's Municipal Code Section 17.30.060 of Title 17 (Zoning Ordinance) establishes noise standards to implement policies of the Noise Element of the General Plan and to protect the community health, safety and general welfare by limiting exposure to the unhealthful effects of noise. No "use, activity, or process shall exceed the maximum allowable noise levels" established in this section, except for "construction, maintenance, and/or repair operations by public agencies and/or utility companies or their contractors that are serving public interest and/or protecting the public health, safety, and general welfare" (section 17.30.060B.3). The maximum noise standards are included in this section as shown on Table 9. The section also indicates that Chapter 9.12 regulates the noise generated from all uses, activities and processes conducted within the City.

***City of Monterey***

The City of Monterey General Plan identifies the following goals for new development related to noise that may be applicable to the project (City of Monterey, 2005):

> **Goal d:** Allow new construction only where existing or projected noise levels are acceptable or can be mitigated.
>
> *Policy d.2:* Limit hours of noise generating construction activities. Include this requirement

City of Monterey Municipal Code Section 38-111 (A) identifies performance standards to be applied to all use classification in all zoning districts. Decibel levels are required to be compatible with neighboring uses, and no use shall create ambient noise levels which exceed the standards identified in Table 11. It should be noted that the Community Development Director may require an acoustic study for any proposed project that could have, or create, a noise exposure greater than that identified in the table.

**TABLE 11 CITY OF MONTEREY MAXIMUM NOISE STANDARDS**

| Zone of Property Receiving Noise | Maximum Noise Level (dBA) |
|---|---|
| OS - Open Space District | 60 |
| R - Residential Districts | 60 |
| PS - Public and Semi-Public District | 60 |
| C - Commercial District | 65 |
| I - Industrial Districts | 70 |
| PD - Planned Development | Study Required |
| Notes: These noise standards shall be modified as follows to account for the effects of time and duration on the impact of noise levels: In R districts, the noise standard shall be 5 dB lower between 10:00 p.m. and 7:00 a.m.; noise that is produced for no more than a cumulative period of five minutes in any hour may exceed the standards above by 5 dB; and noise that is produced for no more than a cumulative period of one minute in any hour may exceed the standards above by 10 dB. | |

Source: City of Monterey Municipal Code Section 38-111

Section 38-112.2 of the City's Municipal Code limits the hours of construction for activities authorized by a building permit to the following: Monday through Friday between the hours of 7:00 a.m. and 7:00 p.m., on Saturday between 8:00 a.m. and 6:00 p.m., and on Sunday between 10:00 a.m. and 5:00 p.m. Pursuant to this section, a permit may be issued by the Zoning Administrator for requests to conduct construction activity outside listed hours for unique circumstances.

**Existing Noise Environment**

The project will take place at several sites within northern Monterey County, California. A noise monitoring survey was performed between December 20, 2013 and December 27, 2013 to establish existing baseline noise levels at representative noise sensitive receptors located near project components. Some land uses are considered more sensitive to ambient noise levels than others. In general, residences, schools, hotels, hospitals, and nursing homes are considered to be the most sensitive to noise. Places such as churches, libraries, and cemeteries, where people tend to pray, study, and/or contemplate are also sensitive to noise. Commercial and industrial uses including agricultural lands are considered the least noise-sensitive.

*Sensitive Receptors*

The following paragraphs provide summary descriptions of the sensitive receptor locations in the vicinity of the several project sites.

<u>Regional Treatment Plant</u>: New facilities at the Regional Treatment Plant (RTP) would include pre-treatment, an Advanced Water Treatment (AWT) Facility, and concentrate disposal facilities. The nearest sensitive receptors are a farm house off Monte Road in Monterey County located about one mile to the northwest of the AWTP site, and residences along Cosky Drive in Marina located at a distance of about 5,400 feet to the southwest of the AWTP site.

Salinas Pump Station: New facilities at the Salinas Pump Station would include diversion structures and short pipelines to re-direct urban runoff and storm water, and agricultural wash water to the RTP for advanced water treatment. The nearest sensitive receptors are several farmhouses located in Monterey County, one about 1,400 feet north of the pump station along Blanco Road, one about 1,500 feet west of the pump station along S. Davis Road, and several residences located about 1,700 to 2,000 feet south of the pump station along Hitchcock Road. Residences in Salinas are located about 2,200 feet east of the pump station along Las Cruces Court and Las Cruces Way.

Salinas Industrial Wastewater Treatment Facility (Salinas Treatment Facility) Storage and Recovery: The proposed project would be located along the Salinas River south of Blanco Road and west of Davis Road, and includes improvements that would enable the agricultural wash water to be conveyed from the ponds at the Salinas Industrial Wastewater Treatment Facility to the Regional Treatment Plant for recycling. Components of the project include a wet well/diversion structure, flow meter, valves, and on-site surge tank, connecting pipelines, electrical cabinet, concrete lining of channel banks, and pipelines. The nearest sensitive receptors are residences located more than 2,500 feet southeast of the project site, across Davis Road

Reclamation Ditch Diversion Site: New facilities at the Reclamation Ditch Diversion site near Davis Road would include the diversion of surface water to a nearby manhole. Project components include a pump, electrical cabinet, flow meter and valves, and short connecting pipelines. The nearest sensitive receptors are residences located about 1,000 feet west of the new equipment. The site lies along the western border of Salinas, upstream of the Tembladero Slough.

Tembladero Slough Diversion: Improvements to divert water to the Regional Treatment Plant at the Tembladero Slough site would include the diversion of surface waters to an existing wet well. Project components include an electrical pump/cabinet, flow meter and valves, and short connecting pipelines. The nearest sensitive receptors are residences located about 750 feet north of the new equipment. Another residence is located across Highway 1, 850 feet east of the new equipment. The site lies west of Highway 1 near Watsonville Road, downstream of the Reclamation Ditch Diversion.

Blanco Drain Diversion Site: Proposed changes at the Blanco Drain Agricultural Land Runoff would include the diversion of surface waters from agricultural tile drains with a new pump station at the site. Project components include a diversion structure, flow meter and valves, an on-site surge tank, electrical cabinet, concrete lining, and approximately 8,500 LF of force main gravity pipeline from the site to the Regional Treatment Plant (SVRP modifications). The nearest sensitive receptor is a residence located more than 2,400 feet northeast of the new pump station. Additionally, a residence is located about 3,000 feet southeast of the proposed pipeline and a residential neighborhood is located more than a mile to the southwest of the pipeline and SVRP modifications. The site lies along the Salinas River, east of the Monterey Regional Waste Management District facility.

Lake El Estero Diversion Site: New facilities at El Estero would include either a column pump or a gravity system and motorized valve, and short connecting pipelines. The improvements would be in the existing structure or underground. The nearest sensitive receptor is the Monterey Bay Lodge located about 350 feet east-southeast of the facility and the nearest residential receptor is located about 500 feet southeast of the facility in the City of Monterey. The site lies within the El Estero recreation area.

New Booster Pump Station Sites: The proposed new Booster Pump Station would receive flow from the Product Water Conveyance Pipeline and pump the product water into one of the two proposed alternative alignments that merge to a single alignment along General Jim Moore Boulevard. Because of noise considerations, the pump motors and discharge piping would be housed in a split-faced block, or similar building with appropriate architectural treatments. There are two options for the site of the Booster Pump Station site depending upon the selected product water pipeline route, with RUWAP Option located along the Regional Urban Water Augmentation Project (RUWAP) alignment and Coastal Option along the Coastal alignment. The RUWAP Option is located in the City of Marina Corp Yard parking lot off 5th Avenue in Marina about 90 feet south of the building. The nearest sensitive receptors are the residents of the California State University Monterey Bay (CSUMB) campus housing located about 650 feet to the west of the Booster Pump Station site and the CSUMB classroom building located about 450 feet southwest of the site. The Coastal Option is located on CSUMB property at the southwest corner of the intersection of 2nd Avenue and Divarty Street. There are no residential receptors in the vicinity of the site. Abandoned buildings are located to the north across Divarty Street from the site. Vacant land is located to the west and south of the site. CSUMB recreation facilities are located to the east across 2nd Avenue. The nearest recreation facilities include a swimming pool located about 750 feet east of the Booster Pump Station site and a child development center located about 875 feet northeast of the site.

Project Water Pipeline Routes: The Proposed Project would include construction of a pipeline to convey the advanced treated product water from the proposed AWT Facility to the Seaside Groundwater Basin for injection, along one of two potential pipeline alignments. One option would generally follow the RUWAP recycled water pipeline route through the City of Marina, CSUMB, and the City of Seaside. The other option, referred to herein as the Coastal Alignment, would follow in parallel with a portion of the proposed new CalAm Monterey Peninsula Water Supply Project desalination product water pipeline along the eastern side of the Transportation Agency of Monterey County (Transportation Agency) railroad tracks. The southern portion of the Coastal Alignment would also be located in the former Fort Ord within CSUMB and the City of Seaside.

The RUWAP alignment would pass through open land and then follow Crescent Avenue south for about 4,000 feet, and then through several other local streets, including California Avenue and 5th Avenue, until eventually intersecting General Jim Moore Boulevard. The pipeline route would be along the eastern side of the right of way of General Jim Moore Boulevard approximately 2 miles, past the developed military housing area (called Fitch Park), through the open land around a water reservoir used by the nearby golf courses, connecting to Eucalyptus Road, then southerly to the Injection Well Facilities area (this portion of the conveyance system applies to both the Coastal and RUWAP Alignments). The Crescent Avenue to California Drive segment is in residential streets within the City of Marina until the intersection with Patton Parkway. South of Patton Parkway and South of the Booster Pump Station the alignment enters the City of Seaside and passes by CSUMB residential, classroom, student center, and dining facilities before continuing south down General Jim Moore Boulevard where sensitive receptors include residences, a church, recreation facilities, and mixed commercial/residential areas.

The Coastal Alignment would be located between 50 to 100 feet east of residences along Del Monte Boulevard and Marina Drive from Marina Green Drive where it enters developed area in Marina to Palm Avenue. South of Palm Avenue, the pipeline would be approximately 100 feet east of play fields associated with the Marina Del Mar Elementary School and would be approximately 350 feet east of the nearest building associated with this elementary school. The Coastal Alignment would continue south, under the Highway 1 overpass, past MRWPCA's Fort Ord Pump Station to Divarty Street. From this point, the Coastal Alignment would cease to parallel the proposed CalAm Monterey Peninsula Water Supply Project pipeline alignment. The GWR Coastal Alignment would cross under Highway One at the Divarty Street underpass. The pipeline would follow Divarty Street to Second Avenue, where the Booster Pump Station would be located. Land uses along 2nd Avenue include unoccupied buildings and open land. From the proposed Booster Pump Station site, the pipeline would turn south and follow on the west side of Second Avenue to Lightfighter Drive. At the intersection of Second Avenue and Lightfighter Drive the pipeline would be constructed under Lightfighter Drive by either directional drilling or bore and jack techniques to avoid disruption to this main thoroughfare. From this intersection the alignment would turn eastward and would be constructed on the south side of the Lightfighter Drive roadway, but off the pavement, up to the intersection with General Jim Moore Boulevard. The pipeline would follow the southbound ramp from Lightfighter Drive onto General Jim Moore Boulevard where it would merge to the same alignment as the RUWAP alignment. There are no sensitive receptors in the vicinity of the Coastal Alignment south of the Booster Pump Station site until it joins the RUWAP alignment.

<u>Injection Wells/Back-flush Facilities Site:</u> The proposed new Injection Well Facilities would be located east of General Jim Moore Boulevard, south of Eucalyptus Road in the City of Seaside, including a total of eight wells (four deep injection wells, four vadose zone wells), monitoring wells, and backflush facilities, at an area formerly referred to as the Inland Recharge Area. Each injection well would be equipped with a well pump to back-flush the well. Injection wells would require a permanent power supply to the site, including electrical equipment, two electrical control buildings for back-flush pumps, external electrical control cabinets at the well clusters, wiring and connections of electrical power, and instrumentation and control facilities. Other than the wellheads, small electric control cabinets would be the only above ground electrical components at the injection wells. The nearest sensitive receptors are residences located west of General Jim Moore Boulevard at distances of 500 to 700 feet from the nearest proposed well sites and about 1,200 feet from the proposed back-flush facility.

*Noise Survey*

The noise survey consisted of four unattended long-term noise measurements and two attended short-term noise measurements. Noise levels were monitored using Larson-Davis Laboratories Model 820 integrating sound level meters fitted with precision microphones and windscreens. The meters were calibrated before and after the measurements. Long-term (LT) reference noise measurements were made to quantify the daily trend in noise levels and to establish the existing day-night average noise level. Long-term noise measurement locations were selected to generally represent reference noise levels from a primary noise source or human activity areas along the project corridor. Care was taken to avoid those sites where extraneous noise sources such as barking dogs, pool pumps, or air conditioning units could contaminate the noise data. Short-term (ST) noise measurements were also made along the project corridor in concurrent time intervals with the data collected at the long-term reference measurement sites. This method facilitates a direct comparison between both the short-term and long-term noise measurements and allows for the identification of the day-night average noise level at land uses in the project vicinity where long-term noise measurements were not made. At all short-term locations, noise levels were measured five feet above the ground surface and at least 10 feet from structures or barriers. Weather conditions during the survey included gentle winds and mild temperatures. Long-term measurement data are shown in Appendix A.

Long-term noise measurement LT-1 was 65 feet west of the center of General Jim Moore Boulevard and approximately 380 feet south of Coe Avenue in Seaside, California. The measurement was located near residential property lines (backyards) along General Jim Moore Boulevard at a height of twelve feet above the ground. Hourly average noise levels typically ranged from 57 to 66 dBA $L_{eq}$ during the day, and from 47 to 56 dBA $L_{eq}$ at night. Calculated day-night average noise levels at this location ranged from 61 to 63 dBA $L_{dn}$ over six 24-hour periods.

Long-term noise measurement LT-2 was 200 feet north of the center of Del Monte Avenue along the Monterey Peninsula Recreational Trail in Monterey, California. The measurement was located amid a park just south of Municipal Beach at a height of twelve feet above the ground. Hourly average noise levels typically ranged from 56 to 66 dBA $L_{eq}$ during the day, and from 53 to 61 dBA $L_{eq}$ at night. Calculated day-night average noise levels at this location ranged from 63 to 66 dBA $L_{dn}$ over eight 24-hour periods.

Noise measurement LT-3 was 20 feet west of the center of Vaughan Avenue, north of Reindollar Avenue in Marina, California. The measurement was located in a neighborhood of single-family residential houses at a height of twelve feet above the ground. Hourly average noise levels typically ranged from 54 to 66 dBA $L_{eq}$ during the day, and from 43 to 56 dBA $L_{eq}$ at night. Calculated day-night average noise levels at this location ranged from 56 to 61 dBA $L_{dn}$ over seven 24-hour periods. The lower day-night average levels (56 dBA $L_{dn}$ and 58 dBA $L_{dn}$) were measured and calculated during Christmas day.

Noise measurement LT-4 was located at the dead-end of Las Cruces Way, at the border of an agricultural land use and a neighborhood of single-family residences in Salinas, California. The measurement was at a height of twelve feet above the ground. Hourly average noise levels typically ranged from 45 to 74 dBA $L_{eq}$ during the day, and from 38 to 50 dBA $L_{eq}$ at night. Calculated day-night average noise levels at this location ranged from 55 to 65 dBA $L_{dn}$ over six 24-hour periods. Again, the lowest day-night average level was measured during Christmas day.

Two attended short-term noise measurements (ST-1 & ST-2) completed the noise monitoring survey. These measurements were made after a.m. peak traffic hours. Noise measurement ST-1 was made to represent proposed project construction noise during drilling activity at an injection well site and was located approximately 50 feet from a running truck engine and 75 feet from the operating drill rig. The drill rig and truck engine were dominant noise sources during the measurement and resulted in average noise levels of 83 dBA $L_{eq}$ during drilling and 81 dBA $L_{eq}$ while backing out the drill. ST-1 was located more than 1,000 feet east of General Jim Moore Boulevard, along Eucalyptus Road, which was closed to through traffic due to construction. Noise measurement ST-2 was located along Juarez Street, 315 feet west of the center of General Jim Moore Boulevard. This location is representative of residences in the area at the nearest set-back from General Jim Moore Boulevard, which was the dominant noise during the measurement, resulting in average noise levels of 47 and 48 dBA $L_{eq}$. Table 12 summarizes the results of these short-term measurements.

**TABLE 12 - Summary of Short-Term Noise Measurements (dBA)**

| Noise Measurement Location | Date Time | $L_{eq}$ | $L_{max}$ | $L_{(10)}$ | $L_{(50)}$ | $L_{(90)}$ | $L_{dn}$* |
|---|---|---|---|---|---|---|---|
| ST-1: Water pipe drilling site in Seaside. 75 feet from drill rig, 50 feet from truck engine. | 12/19/2013 9:40-10:00 a.m. | 83 | 89 | 84 | 83 | 82 | 89 |
| | 10:00-10:10 a.m. | 81 | 84 | 83 | 82 | 67 | |
| ST-2: South of Seaside pump station along Juarez Street, 315 feet from the center of General Jim Moore Blvd. | 12/27/2013 11:00-11:10 a.m. | 48 | 60 | 49 | 46 | 44 | 49 |
| | 11:10-11:20 a.m. | 47 | 55 | 48 | 46 | 45 | 48 |

* $L_{dn}$ levels at ST-1 assume continuous 24-hour operations of the drilling operation. $L_{dn}$ levels at ST-2 were estimated based on noise levels measured at LT-1 during corresponding interval.

**Figure 1 Aerial Photo Showing Noise Monitoring Locations in Seaside, CA**

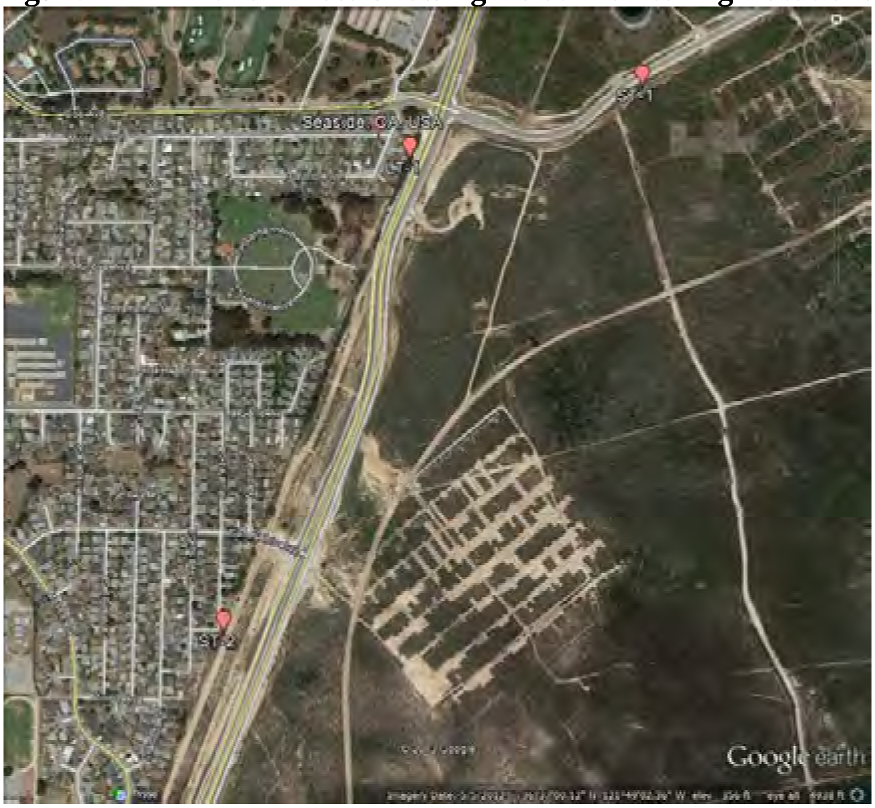
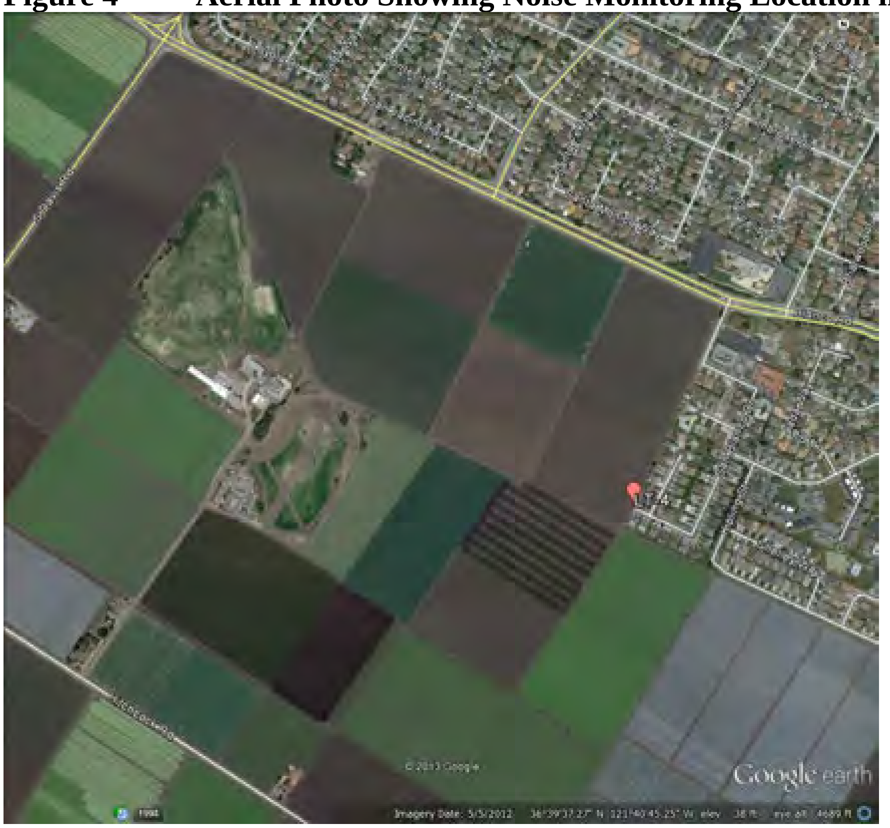



**Figure 2 Aerial Photo Showing Noise Monitoring Location in Monterey, CA**

**Figure 3 Aerial Photo Showing Noise Monitoring Location in Marina, CA**

**Figure 4 Aerial Photo Showing Noise Monitoring Location in Salinas, CA**



## NOISE IMPACTS AND MITIGATION MEASURES

This section contains the evaluation of potential environmental impacts associated with the proposed project related to noise. The section identifies the standards of significance used in evaluating the impacts, the methods used in conducting the analysis, and a detailed evaluation of impacts for the proposed project and any potential future expansion.

### Significance Criteria

Based on Appendix G of the CEQA Guidelines; applicable plans, policies, and/or guidelines described above; and agency and professional standards, the proposed project would cause a significant impact related to noise and vibration if the results would:

- Expose people to or generate noise levels in excess of standards established in the local General Plan or noise ordinance, or applicable standards of other agencies;
- Expose people to or generate excessive groundborne vibration or groundborne noise levels;
- Cause a substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project;
- Cause a substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project;
- For a project located within an airport land use plan area, or, where such a plan has not been adopted, in an area within two miles of a public airport or public use airport, expose people residing or working in the area to excessive noise levels; or
- For a project located in the vicinity of a private airstrip, expose people residing or working in the project area to excessive noise levels.

The project's short term construction impacts and long term operational impacts on the ambient noise environment would be considered substantial if it would expose sensitive receptors or other identified land uses to noise levels in excess of regulatory standards or codes. In addition to concerns regarding the absolute noise level that might occur when a new source is introduced into an area, it is also important to consider the existing ambient noise environment. If the ambient noise environment is quiet and the new noise source greatly increases the noise exposure, even though a criterion level might not be exceeded, an impact may occur.

For both construction and operational noise, a "substantial" noise increase can be defined as an increase in noise levels to that which causes interference with activities normally associated with established nearby land uses during the day and/or night. One indicator that noise could interfere with daytime activities normally associated with residential land uses (for example) would be speech interference; whereas, an indicator that noise could interfere with nighttime activities normally associated with residential uses would be sleep interference. This analysis, therefore, uses the following criteria to define whether a temporary or periodic increase in ambient noise levels in the Project vicinity above levels existing without the project would be substantial:

> *Speech Interference*. Speech interference is an indicator of an impact on daytime and evening activities typically associated with residential land uses, but which is also applicable to other similar land uses that are sensitive to excessive noise levels. Therefore, a speech interference criterion, in the context of impact duration and time of day, is used to identify substantial increases in ambient noise levels.
>
> Noise generated by construction equipment could result in speech interference in adjacent buildings if the noise level in the interior of the building were to exceed 45 to 60 dBA[1]. A typical building can reduce noise levels by 25 dBA with the windows closed (U.S. Environmental Protection Agency (EPA) 1974). This noise reduction could be maintained only on a temporary basis in some cases, since it assumes windows must remain closed at all times. Assuming a 25 dBA reduction with the windows closed, an exterior noise level of 70 dBA ($L_{eq}$) adjacent to a building would maintain an acceptable interior noise environment of 45 dBA. It should be noted that such noise levels would be sporadic rather than continuous in nature, because different types of construction equipment would be used throughout the construction process. Therefore, an exterior noise level in excess of 70 dBA $L_{eq}$ during the daytime is used as the threshold for substantial construction noise.
>
> *Sleep Interference*. An interior nighttime level of 35 dBA is considered acceptable (U.S. EPA 1974). Assuming a 25 dBA reduction from a residential structure with the windows closed, an exterior noise level of 60 dBA adjacent to the building would maintain an acceptable interior noise environment of 35 dBA. An exterior threshold of 60 dBA $L_{eq}$ is a reasonable threshold for short term impacts resulting from construction activities. With windows open, a typical house achieves an approximately 15-dBA reduction and, therefore, an exterior noise level of 50 dBA ($L_{eq}$) would be required to maintain an acceptable interior noise environment of 35 dBA. An exterior threshold of 60 dBA $L_{eq}$ is a reasonable threshold for short term impacts resulting from long term operation of the Project.

The duration of exposure at any given noise-sensitive receptor is one consideration in determining an impact's significance. For example, this analysis generally assumes that temporary construction noise that occurs during the day for a relatively short period of time would not be significant. In addition, this analysis assumes that most people of average sensitivity that live in suburban or rural agricultural environments are accustomed to a certain amount of construction activity or heavy equipment noise from time to time. Therefore, for the purposes of this analysis, temporary exposure to construction noise levels that exceed the daytime speech interference threshold would not be considered to result in a substantial temporary increase in ambient noise levels if the duration is two weeks or less.

[1] For indoor noise environments, the highest noise level that permits relaxed conversation with 100 percent intelligibility throughout the room is 45 dBA. Speech interference is considered to become intolerable when normal conversation is precluded at three feet, which occurs when background noise levels exceed 60 dBA.

A numerical threshold to identify the point at which a vibration impact occurs has not been identified by local jurisdictions in the applicable standards or municipal codes. In the absence of local regulatory significance thresholds for vibration from construction equipment, it is appropriate to use the California Department of Transportation (Caltrans) identified PPV thresholds for risk of architectural damage to older residential dwellings, which is 0.30 in/sec. It is also appropriate to use the Caltrans identified PPV thresholds for perceptibility for long term operational vibration, which is 0.10 in/sec (Caltrans, 2013).

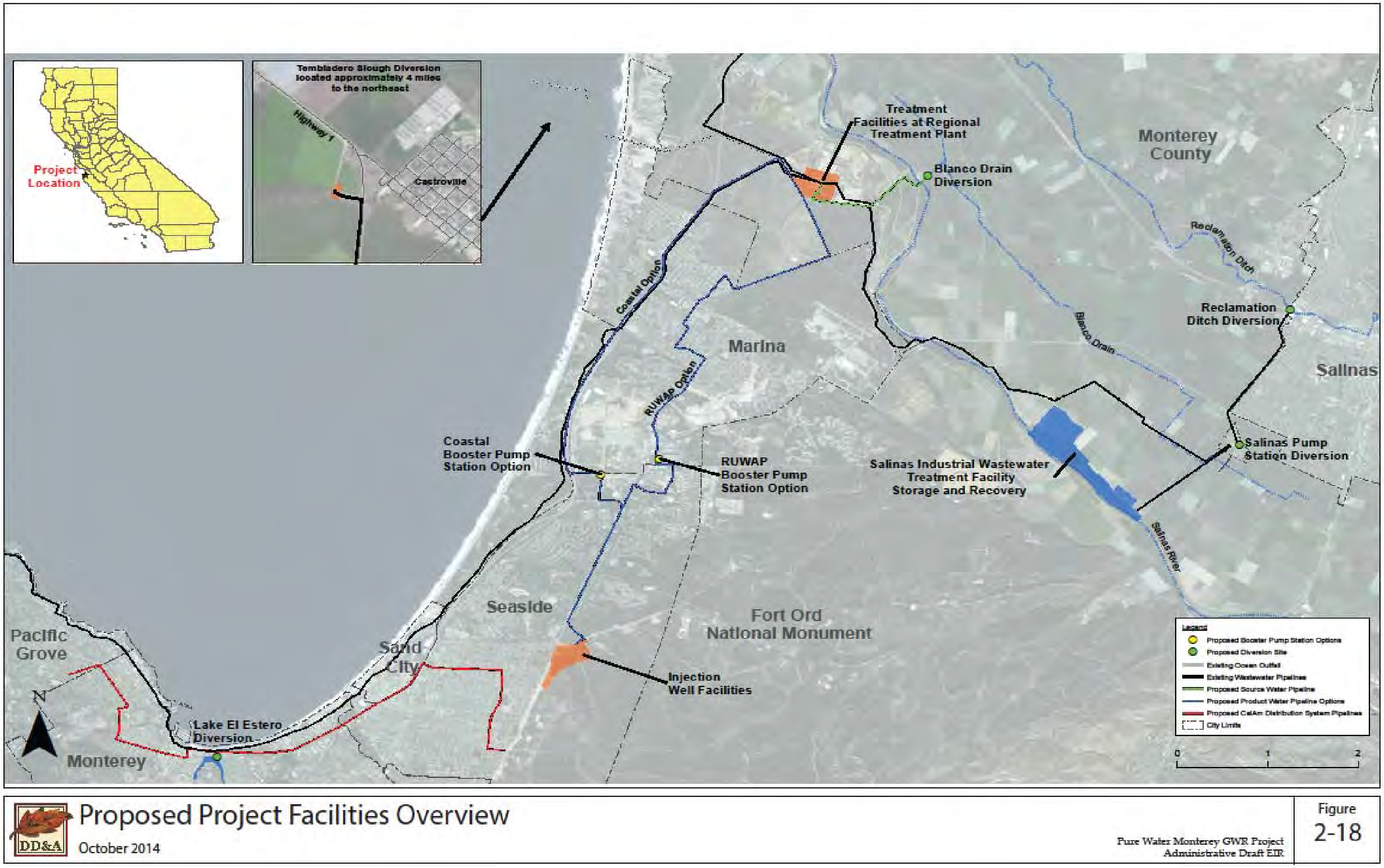
Regarding the last two significance criteria, because the GWR Project would not involve the development of noise-sensitive land uses that would be exposed to excessive aircraft noise, there would be no impacts associated with these criteria. Therefore, impacts associated with aviation noise are not addressed further in this Environmental Impact Report.

The noise and vibration impact assessment evaluates short-term impacts associated with construction of the GWR Project. It also assesses long-term operational impacts (i.e., those resulting from operation of the AWT, booster pump, injection well/back-flush facilities, the diversion sites, and the Salinas Treatment Facilities). The impact discussion analyzes substantial increases in ambient noise levels in the vicinity of the facility sites. In addition, this assessment uses local noise standards and applicable daytime exceptions as the basis for significance thresholds related to "established" noise standards. The assessment of potential noise impacts was conducted using information on existing ambient noise levels and the anticipated noise that would be produced during construction and operation of the Project. The assessment of vibration impacts was conducted using information on anticipated vibration during construction and operation of the Project.

For the purposes of this analysis, only construction noise is considered under the criterion that addresses temporary or periodic increase in ambient noise. Periodic noise increases are defined herein as intermittent or short-term and only construction activities are consistent with this definition.

For clarity and efficiency, the following discussion of impacts and mitigation measures is organized by the action that causes the impact, these being construction noise, construction vibration, and operational noise and vibration. Each impact discussion addresses applicable checklist questions and presents measures to mitigate significant impacts that are identified. Figure 2-10 of the Project Description is included for reference purposes.

## Figure: Facilities Overview



**Impact 1: Construction activity would violate standards established in the local general plans or noise ordinances, and/or would adversely affect nearby sensitive receptors.**

Construction activities would occur intermittently at several locations throughout northern Monterey County within a period of approximately 18-20 months. Such activities would result in the generation of noise associated with site preparation and building of each component of the project. The noise levels generated during construction of the project would vary during the construction period, depending upon the construction phase and the types of construction equipment used.

High noise levels would be created by the operation of heavy-duty trucks, backhoes, bulldozers, excavators, front-end loaders, compactors, cranes, pavers, and other heavy-duty construction equipment. Operating cycles for these types of construction equipment would involve fluctuations in power cycles that result in variations in noise levels, where as other equipment such as directional drill rigs typically operate at a continuous level.

Construction noise levels were calculated using the Federal Highway Administration's Roadway Construction Noise Model (RCNM). The maximum and hourly average noise levels for each phase of construction at the several project construction components are presented in Table 13. In some instances, maximum instantaneous noise levels are calculated to be slightly lower than hourly average noise levels. This occurs because the model calculates the maximum instantaneous noise level resulting from the single loudest piece of construction equipment operating during each construction phase. Hourly average noise levels add together multiple pieces of construction equipment, which results in hourly average noise levels that can be slightly higher than maximum instantaneous noise levels during construction phases involving several pieces of equipment. Construction equipment noise levels were modeled at a distance of 50 feet from the center of the construction site, typical of the distance that the vast majority of receptors would be located from project construction activities conducted along the project corridor. From these source data, calculations were made to estimate construction noise levels at receptors within 50 feet of the construction site or at more distant receptors assuming that the noise attenuation rate was 6 dBA for each doubling of distance from the source where the distance is over roadways and 7.5 dBA for each doubling of distance from the source where the distance is over fields.

Truck trips generated by project construction would be dispersed throughout the day and over the local road network, and commute trips by construction workers would primarily occur before and after project truck trips occur. Daily transportation of materials and construction workers would not be a substantial source of traffic noise levels along local roadways serving the project area.

**TABLE 13 Construction Equipment Noise Levels Modeled at 50 feet**

| Project Component | Duration | Construction Activities | $L_{max}$ | $L_{eq}$ |
|---|---|---|---|---|
| Treatment Facilities at the Regional Treatment Plant | 21 Months | Site preparation | 82 | 79 |
| | | Grading/Excavation | 85 | 87 |
| | | Building Exterior | 84 | 86 |
| | | Paving | 85 | 87 |
| Salinas Pump Station Site | 5 Months | Site Preparation | 84 | 80 |
| | | Grading/Excavation | 84 | 83 |
| | | Trenching, Grading, Install Valves/Piping | 90 | 86 |
| Salinas Industrial Wastewater Treatment Facility—Storage and Recovery | 13 Months | Construction of Facilities and Slip-lining | 91 | 89 |
| Reclamation Ditch Diversion Site | 5 Months | Construction of Facilities and Pipelines (Trenching) | 90 | 86 |
| Tembladero Slough Diversion Site | 5 Months | Construction of Facilities and Pipelines (Trenching), including vibratory driving | 101 | 94 |
| Blanco Drain Diversion Site | 9 Months | Construction of Facilities and Pipelines (Trenching) | 90 | 87 |
| Lake El Estero Diversion Site | 3 Months | Demolition | 90 | 83 |
| | | Site Preparation | 78 | 74 |
| | | Grading/Excavation | 84 | 81 |
| | | Trenching | 90 | 86 |
| | | Paving | 83 | 78 |
| Product Water Conveyance—Pipeline | 15 Months | Pipeline Installation (250 feet/day for roadways, 400 feet/day open areas) | 85 | 87 |
| Product Water Conveyance—Booster Pump Station Sites | 12 Months | Structural work requiring heavy equipment will be completed in 2 to 3 months. | 85 | 87 |
| Injection Well Facilities (including back-flush basin) | 20 Months | Site Preparation | 82 | 81 |
| | | Grading/Excavating | 85 | 85 |
| | | Deep Injection Wells | 85 | 87 |
| | | Vadose Zone Wells | 85 | 85 |
| | | Monitoring Well | 85 | 86 |
| | | Backflush Pipes and Basin | 85 | 85 |

Regional Treatment Plant: New facilities are proposed for construction at the RTP site in a northern portion of Monterey County, north of the city limits of Marina. Construction activities would include cutting, laying, and welding pipelines and pipe connections; pouring concrete footings for foundations, tanks, and other support equipment; constructing walls and roofs; assembling and installing advanced treatment process components; installing piping, pumps, storage tanks, and electrical equipment; testing and commissioning facilities; and finish work such as paving, landscaping, and fencing the perimeter of the site. A residence to the northwest is in Monterey County and residences to the southwest are in the City of Marina. Maximum noise levels generated by construction activities at the RTP would reach 85 dBA $L_{max}$ and 87 dBA $L_{eq}$ at a distance of 50 feet. As shown in Table 14, the source noise level would be attenuated due to distance resulting in noise levels up to 39 dBA at a distance of 1 mile and up to 38 dBA at 5,400 feet, which are the distances to the closest sensitive receptors. Construction noise levels would not exceed the daytime speech interference or nighttime sleep disturbance thresholds at the nearest residences.

**TABLE 14 Maximum Construction Noise Levels – Regional Treatment Plant**

| Construction Activity Source | Receptors | Distance to Receptor | $L_{max}$ | $L_{eq}$ |
|---|---|---|---|---|
| Construction of New Facilities (Grading/Excavating) | Monte Road Residence | 5,260 feet/1 mile (northwest) | 35 | 39 |
| | Cosky Drive Residences | 5,400 feet (southwest) | 34 | 38 |

Note: The noise attenuation rate is assumed to be approximately 6 dBA for each doubling of distance from the source where the distance is over and/or along roadways and developed areas and would be approximately 7.5 dBA for each doubling of distance from the source where the distance is over fields.

In addition, modifications to the existing Salinas Valley Reclamation Plant are proposed in order to enable increased use of tertiary treated wastewater for crop irrigation during winter months. The proposed modifications include new sluice gates, a new pipeline between the existing inlet and outlet structures within the storage pond, chlorination basin upgrades, and a new storage pond platform. All of the modifications would occur within the existing Salinas Valley Reclamation Plant footprint. (See **Section 2.8.2** for further details.) Construction activities would include cutting, laying, and welding pipelines and pipe connections; pouring concrete footings for foundations, and other support equipment; installing piping, sluice gates and electrical equipment; testing and commissioning facilities; and finish work such as repairing the existing storage pond lining. Construction activities related to the Salinas Valley Reclamation Plant Modifications are expected to occur over nine months during normal daytime hours, 7:00 AM to 6:00 PM.

The project site is located within the unincorporated area of Monterey County. Some of the proposed construction equipment that would be required to build the facilities was modeled to result in noise levels at or above 85 dBA at 50 feet, but no residences are within 2,500 feet so construction noise would be in conformance with the Monterey County Code Section 10.60.030. Construction noise impacts would be less than significant.

Section 10.60.040 of the County Code applies to nighttime noise, in which it is prohibited to make, assist in making, allow, continue, create, or cause to be made any loud and unreasonable sound any day of the week from 10:00 PM to 7:00 AM that exceeds 65 dBA $L_{max}$ or 45 dBA $L_{eq}$ as measured at or outside the property line. Construction noise levels would reach 39 dBA at the nearest receptor during nighttime construction, which is below the 65 dBA $L_{max}$ or 45 dBA $L_{eq}$ noise levels (see Table 4.13-14), and would not result in loud and unreasonable noise, consistent with the intent of the ordinance adopting the regulations. As indicated above for the Reclamation Ditch Diversion, Mitigation Measure NV-1b will ensure consistency with General Plan Policy S-7.10 regarding construction equipment, and the policy also allows construction limits to be waived for public convenience. The proposed facilities include improvements to the existing treatment facilities in order to provide additional agricultural irrigation water via the Castroville Seawater Intrusion Project, and commercial agricultural operations are exempt from the provisions of Section 10.60.040 of the County Code.

<u>Salinas Pump Station:</u> New facilities at the Salinas Pump Station are proposed for construction at a southwest portion of The City of Salinas and would include diversion structures and short pipelines to re-direct urban runoff, storm water, and agricultural wash water to the RTP for advanced water treatment. Construction activities at this site would include minor grading, demolition, and installation of a wet well/diversion structure and short pipeline segments. Typical construction hours would be from 7:00 a.m. to 8:00 p.m., Monday through Saturday, although temporary construction connections will be monitored at night because the wastewater will continue to be diverted. The site is surrounded by unincorporated agricultural lands in Monterey County. Three distant residences to the north, west, and south are in Monterey County and distant residences to the east are in the City of Salinas. Maximum noise levels generated by construction activities at the Salinas Pump Station are calculated to reach 90 dBA $L_{max}$ and 86 dBA $L_{eq}$ at a distance of 50 feet. The source noise level would be attenuated due to distance, resulting in noise levels ranging from 49 dBA $L_{max}$ and 45 dBA $L_{eq}$ at a distance of 2,200 feet to up to 54 dBA $L_{max}$ and 50 dBA $L_{eq}$ at 1,400 feet, which is the distance to the closest sensitive receptor (i.e., residence), as indicated in Table 15. Construction noise levels would not exceed the daytime speech interference or nighttime sleep disturbance thresholds at the nearest residences.

**TABLE 15 Maximum Construction Noise Levels – Salinas Pump Station**

| Construction Activity Source | Receptors | Distance to Receptor | $L_{max}$ | $L_{eq}$ |
|---|---|---|---|---|
| Construction of Diversion Structures and Pipelines. (Trenching/Piping) | Farmhouse Residences | 1,400 feet (north) | 54 | 50 |
| | | 1,500 feet (west ) | 53 | 49 |
| | | 1,700 – 2,000 feet (south) | 50 – 52 | 46 – 48 |
| | Salinas Residences | 2,200 feet (east) | 49 | 45 |

Note: The noise attenuation rate is assumed to be approximately 7.5 dBA for each doubling of distance from the source where the distance is over fields.

The City of Salinas Zoning Ordinance (see Table 7) indicates a maximum allowable nighttime noise level 55 dBA in a residential zone. The nighttime sleep disturbance significance threshold for construction noise is 60 dBA $L_{eq}$. Noise levels as a result of proposed construction activity for the Salinas Pump Station would not exceed standards set forth by the City of Salinas or the sleep disturbance threshold. No nighttime noise-generating construction is planned at this site. Therefore, short-term construction noise impacts at this Project site would be less than significant.

Lake El Estero Diversion: New facilities at El Estero would include either a column pump or a gravity system and motorized valve, and short connecting pipelines. The improvements would be in the existing structure or underground. Pavement demolition, trenching and installation of new pumps/pump motors, electrical facilities, and flow meters would all occur below grade using only equipment delivery trucks, loaders, and backhoes. Construction activities at these sites would occur only within typical working hours and would take less than one month.

The Lake El Estero facility and the nearest sensitive receptors southeast of the facility are in the City of Monterey. The site lies within the El Estero recreation area. Maximum noise levels generated by construction activities at El Estero are calculated to reach 90 dBA $L_{max}$ and 86 dBA $L_{eq}$ during the loudest construction phase at a distance of 50 feet. The source noise level would be attenuated due to distance, resulting in noise levels up to 70 dBA at a distance of 500 feet and 73 dBA at 350 feet, which is the distance to the closest sensitive receptor, as indicated in Table 16.

**TABLE 16 Maximum Construction Noise Levels – Lake El Estero Diversion**

| Construction Activity Source | Receptors | Distance to Receptor | $L_{max}$ | $L_{eq}$ |
|---|---|---|---|---|
| Construction of Facilities and Pipelines. (Trenching) | Monterey Bay Lodge | 350 feet (east-southeast) | 73 | 69 |
| | Residence (near First St. and Camino Aguajito) | 500 feet (southeast) | 70 | 66 |

Construction noise levels identified in Table 16 (above) would be below the significance threshold for speech interference at the nearby sensitive receptors. The City of Monterey has not established quantitative construction noise limits. Short-term construction noise impacts at these residences would be less than significant because noise levels are below daytime thresholds. Construction of new facilities at Lake El Estero Diversion site would occur Monday through Saturday, 7 a.m. to 8 p.m., and would take up to three months to complete. Construction activities after 7 p.m. would conflict with City regulations, although a permit may be issued by the Zoning Administrator for construction activities outside hours specified in the City's Municipal Code. .

<u>Product Water Conveyance Pipeline Alignment Options:</u> The Proposed Project would include construction of a pipeline to convey the advanced treated product water from the proposed AWT Facility to the Seaside Groundwater Basin for injection, along one of two potential pipeline alignments. One option would generally follow the RUWAP recycled water pipeline alignment through the City of Marina, CSUMB, and the City of Seaside. The other option, referred to as the Coastal Alignment, would follow in parallel with a portion of the proposed new CalAm Monterey Peninsula Water Supply Project desalination product water pipeline along the eastern side of the Transportation Agency of Monterey County (Transportation Agency) unused railroad tracks. The southern portion of the Coastal Alignment would also be located in the former Fort Ord within the rights of way of Second Avenue, Lightfighter Drive, and General Jim Moore Boulevard in the City of Seaside.

For the purpose of modeling construction noise, the location of the construction noise source (acoustic center) is assumed to be the center of the Area of Potential Effect as displayed in the Draft Area of Potential Effect Maps (DD&A, 2014).

***RUWAP Alignment***

The RUWAP alignment and adjacent sensitive receptors are described the Setting section of this report. Following the pipeline alignment from north to south, the first sensitive receptors are residences along Quebrada Del Mar Road and Crescent Avenue in the City of Marina. The alignment continues along Carmel Avenue, Vaughn Avenue, Reindollar Avenue, California

Avenue to Patton Parkway. These receptors would be located approximately 25 to 50 feet from the construction activities.

The RUWAP alignment enters the former Fort Ord within CSUMB and continues south of Patton Parkway along California Avenue to 5th Avenue, and continues south along 5th Avenue to the Booster Pump Station located adjacent to the City of Marina Corp Yard. No sensitive receptors border the alignment between Patton Parkway and the Booster Pump Station. CSUMB's Strawberry Apartments housing is located within 500 feet of the RUWAP alignment where it approaches the Booster Pump Station.

From the Booster Pump Station, the RUWAP alignment continues south along 5th Avenue and then, entering the City of Seaside, heads east along Inter-Garrison Road passing the CSUMB student dining halls and student center. The alignment heads south at 5th Avenue passing classroom buildings and the campus library. After passing the library, the alignment heads south and then west through open space connecting to General Jim Moore Boulevard south of the Veterans Administration Monterey Clinic. The alignment continues southward along General Jim Moore Boulevard and passes CSUMB outdoor sports/recreation areas, crossing Lightfighter Drive, where the Coastal Alignment would join the RUWAP alignment.

**TABLE 17 Maximum Construction Noise Levels – RUWAP Alignment**

| Alignment Segment (Jurisdiction) | Receptors | Distance to Receptor (feet) | $L_{max}$ (dBA) | $L_{eq}$ (dBA) |
|---|---|---|---|---|
| Quebrada Del Mar Road to Patton Parkway (Marina) | Residences | 25 | 91 | 93 |
| | | 50 | 85 | 87 |
| Patton Parkway to Booster Pump Station (Marina) | CSUMB Housing | 500 | 65 | 57 |
| 5th Avenue to Lightfighter Drive (Seaside) | CSUMB Dining, Student Center, Classrooms | 125 | 77 | 79 |
| | CSUMB Library | 65 | 83 | 85 |
| | Veterans Administration Monterey Clinic | 240 | 71 | 73 |
| Lightfighter Drive to Injection Wells/Back-flush Facility Site (Seaside) | 6th Division Road Residences | 250 | 71 | 73 |
| | 4th Army Road Residences | 210 | 73 | 75 |
| | Post Chapel<br><br>Porter Youth Center | 85 | 80 | 82 |
| | Stillwell Elementary School | 225 | 73 | 75 |
| | Residences between Normandy Road and Coe Avenue (west) | 110 | 78 | 80 |
| | Residences between Normandy Road and Coe Avenue (west) | 90 | 80 | 82 |
| | Seaside Middle School | 280 | 70 | 72 |

Note: The noise attenuation rate is assumed to be approximately 6 dBA for each doubling of distance for pipeline construction.

Both the Coastal and RUWAP Alignment options continue southward on General Jim Moore Boulevard passing residences, the Post Chapel, Stillwell Elementary School, and the Porter Youth Center at Normandy Road. South of Normandy Road, the Alignment passes residences, golf courses, and Seaside Middle School on its way to the Injection Well Facilities site.

Noise levels resulting from the construction of the Coastal Alignment exceeding 70 dBA $L_{eq}$ for more than two weeks would represent a significant nuisance to nearby residences or other sensitive receptors. Noise exceeding 60 dBA for 25 percent of an hour at any receiving property in the City of Marina would violate City of Marina Code.

The installation of the pipeline would occur at a rate of 250 to 400 feet per day. Pipeline trenching activities would proceed along the project alignment at a rate of 1,250 to 2,000 feet per five working days; approaching and departing any one receptor location over a fairly short duration. Assuming a source noise level of up to 87 dBA $L_{eq}$ at a distance of 50 feet, and an attenuation rate of 6 dBA per doubling of distance between the noise source and receptor, pipeline construction activities occurring within 350 feet (in either direction) of a sensitive receptor would yield noise levels greater than 70 dBA $L_{eq}$. As such, the construction noise resulting from proposed pipeline trenching activities at any one location along the alignment would be limited to four days or less. Construction noise would last for no longer than four days at any one location, which would not be considered a significant impact.

Daytime work shift times would violate both Marina and Seaside regulations that prohibit construction after 7:00 p.m. on weekdays and before 9 a.m. on Saturdays. However, section 9.24.050 of the Marina Municipal Code and section 9.12.040D of the Seaside Municipal Code exempt activities on or in publicly owned property and facilities, or by public employees or their franchisees, while in the authorized discharge of their responsibilities, provided that such activities have been authorized by the owner of such property or facilities or its agent or by the employing authority. Construction noise levels may exceed the levels specified in the City of Marina code (exceeding 60 dBA for 25 percent of an hour). The impact would be reduced to a less-than-significant level through implementation of Mitigation Measures 1b, 1c, 1d, 1e, and 1h.

***Coastal Alignment***

The Coastal Alignment enters the City of Marina along the west side of Del Monte Boulevard. Between Marina Green Drive and Legion Way, the alignment would be located about 150 feet west of residences along Del Monte Boulevard. South of Legion Way to Beach Road, residences are located both west (as close as 115 feet) and east (150 feet) of the alignment. South of Beach Road, residential land uses are located about 200 feet east of the alignment and the Marina Library is located about 220 feet to the west. The Superior Court of California, Marina Division, located north of Reservation Road, is approximately 150 east of the alignment.

South of Reservation Road, residences are located as near as approximately 80 feet of the Coastal Alignment to Palm Avenue. South of Palm Avenue, the pipeline would be approximately 100 feet east of play fields associated with the Marina Del Mar Elementary School and would be approximately 350 feet east of the nearest building associated with this elementary school.

Residences along Marina Drive are located as near as approximately 135 feet west of the Coastal Alignment.

The Coastal Alignment would continue south, under the Highway 1 overpass, past MRWPCA's Fort Ord Pump Station along the east side of the Transportation Agency's railroad corridor south to Divarty Street. From this point, the Coastal Alignment would cease to parallel the proposed CalAm Monterey Peninsula Water Supply Project pipeline alignment. There are no sensitive receptors along this segment. The GWR Coastal Alignment would cross under Highway 1Highway 1 at the Divarty Street underpass. The pipeline would follow Divarty Street to Second Avenue, where the Coastal option for the Booster Pump Station would be located. Land uses along Second Avenue include unoccupied (abandoned and dilapidated) buildings and open land with some trees and natural vegetation. Immediately east of the Booster Pump Station sites (on the other side of Second Avenue) are acres of parking lot areas with no vegetation. From the proposed Booster Pump Station site, the pipeline would turn south and follow on the west side of Second Avenue to Lightfighter Drive. At the intersection of Second Avenue and Lightfighter Drive the pipeline would be constructed under Lightfighter Drive by either directional drilling or bore and jack techniques to avoid disruption to this main thoroughfare. From this intersection the alignment would turn eastward and would be constructed on the south side of the Lightfighter Drive roadway, but off the pavement, up to the intersection with General Jim Moore Boulevard. The pipeline would follow the southbound ramp from Lightfighter Drive onto General Jim Moore Boulevard where it would merge to the same alignment as the RUWAP alignment. There are no sensitive receptors in the vicinity of the Coastal alignment south of the Booster Pump Station site until it joins the RUWAP alignment.

Both the RUWAP and Coastal Alignment options continue southward on General Jim Moore Boulevard passing residences, the Post Chapel, Stillwell Elementary School, and the Porter Youth Center at Normandy Road. South of Normandy Road, the Alignment passes residences, golf courses, and Seaside Middle School on its way to the Injection Well Facilities site.

**TABLE 18 Maximum Construction Noise Levels – Coastal Alignment**

| Alignment Segment (Jurisdiction) | Receptors | Distance to Receptor (feet) | $L_{max}$ (dBA) | $L_{eq}$ (dBA) |
|---|---|---|---|---|
| Marina Green to Legion Way (Marina) | Residences | 150 | 75 | 77 |
| Legion Way to Beach Road (Marina) | Residences | 115 | 78 | 80 |
| | Residences | 150 | 75 | 77 |
| Beach Road to Reservation Road (Marina) | Residences | 200 | 73 | 75 |

| **Alignment Segment (Jurisdiction)** | **Receptors** | **Distance to Receptor (feet)** | **$L_{max}$ (dBA)** | **$L_{eq}$ (dBA)** |
|---|---|---|---|---|
| | Marina Library | 220 | 72 | 74 |
| | Superior Court | 150 | 75 | 77 |
| Reservation Road to Highway 1 (Marina) | Residences | 80 | 81 | 83 |
| | Marina Del Mar Elementary School Playfields | 100 | 79 | 81 |
| | Marina Del Mar Elementary School | 350 | 68 | 70 |
| | Marina Drive Residences | 135 | 76 | 78 |
| Highway 1 to Lightfighter Drive (Marina to Seaside) | No Sensitive Receptors | -- | -- | -- |
| Lightfighter Drive to Injection Well Facilities Site (Seaside) | 6th Division Road Residences | 250 | 71 | 73 |
| | 4th Army Road Residences | 210 | 73 | 75 |
| | Post Chapel<br><br>Porter Youth Center | 85 | 80 | 82 |
| | Stillwell Elementary School | 225 | 73 | 75 |
| | Residences between Normandy Road and Coe Avenue (west) | 110 | 78 | 80 |
| | Residences between Normandy Road and Coe Avenue (west) | 90 | 80 | 82 |

| **Alignment Segment (Jurisdiction)** | **Receptors** | **Distance to Receptor (feet)** | **$L_{max}$ (dBA)** | **$L_{eq}$ (dBA)** |
|---|---|---|---|---|
| | Seaside Middle School | 280 | 70 | 72 |

Note: The noise attenuation rate is assumed to be approximately 6 dBA for each doubling of distance for pipeline construction.

Noise levels resulting from the construction of the Coastal Alignment exceeding 70 dBA $L_{eq}$ for more than two weeks would represent a significant nuisance to nearby residences or other sensitive receptors. The installation of the pipeline would occur at a rate of 250 to 400 feet per day. Pipeline trenching activities would proceed along the project alignment at a rate of 1,250 to 2,000 feet per five working days; approaching and departing any one receptor location over a fairly short duration. Assuming a source noise level of up to 87 dBA $L_{eq}$ at a distance of 50 feet, and an attenuation rate of 6 dBA per doubling of distance between the noise source and receptor, pipeline construction activities occurring within 350 feet (in either direction) of a sensitive receptor would yield noise levels greater than 70 dBA $L_{eq}$. As such, the construction noise nuisance resulting from proposed pipeline trenching activities at any one location along the alignment would be limited to four days or less and thus would not result in a significant noise impact.

Daytime work shift times would violate both Marina and Seaside regulations that prohibit construction after 7:00 p.m. on weekdays and before 9 a.m. on Saturdays. However, section 9.24.050 of the Marina Municipal Code and section 9.12.040D of the Seaside Municipal Code exempt activities on or in publicly owned property and facilities, or by public employees or their franchisees, while in the authorized discharge of their responsibilities, provided that such activities have been authorized by the owner of such property or facilities or its agent or by the employing authority. Construction noise levels may exceed the levels specified in the City of Marina code (exceeding 60 dBA for 25 percent of an hour). The impact would be reduced to a less-than-significant level through implementation of Mitigation Measures 1b, 1c, 1d, 1e, and 1h.

<u>New Booster Pump Station Sites:</u> The proposed new Booster Pump Station (located at one of two locations based on the selected alignment) would receive flow from the Product Water Conveyance Pipeline and pump the product water into one of the two proposed alternative alignments that merge to a single alignment along General Jim Moore Boulevard. Construction crews would prepare the pump station sites by removing vegetation and grading the sites to create a level work area. Construction activities would include excavations for wet wells, installing shoring and forms, pouring concrete footing for foundations; assembling and installing piping, pumps, and electrical equipment; constructing concrete enclosures and roofs; and finish work such as paving, landscaping, and fencing the perimeter of the pump station sites. One Booster Pump Station option would be located along the RUWAP alignment in the City of Marina. The nearest sensitive receptors are residents of the CSUMB campus housing located west of the pump station site and a classroom building southeast of the site. Maximum noise levels generated by structural work at RUWAP Booster Pump Station Option are calculated to reach 85 dBA $L_{max}$ and 87 dBA $L_{eq}$ during the loudest construction phase at a distance of 50 feet.

The source noise level would be attenuated due to distance, resulting in noise levels of up to 66 dBA $L_{max}$ and 68 dBA $L_{eq}$ at a distance of 450 feet and up to 63 dBA $L_{max}$ and 65 dBA $L_{eq}$ at 650 feet, as indicated in Table 19. This attenuation calculation is conservative because it does not take into account any additional attenuation that may occur due to topography, vegetation, nor buildings or fences between source and receptor. The RUWAP Booster Pump Station is located at a lower topographic area than nearby sensitive receptors and is surrounded by trees.

**TABLE 19 Maximum Construction Noise Levels – Booster Pump Station RUWAP Option**

| Construction Activity Source | Receptors | Distance to Receptor | $L_{max}$ | $L_{eq}$ |
|---|---|---|---|---|
| Booster Pump Structural Work. (Heavy Equipment) | Classroom Building | 450 feet (southeast) | 66 | 68 |
| | Campus Housing (Strawberry Apartments) | 650 feet (west) | 63 | 65 |

Construction noise levels identified in Table 19 above would be below the speech interference threshold of 70 dBA $L_{eq}$. Noise exceeding 60 dBA for 25 percent of an hour at any receiving property in the City of Marina would violate City of Marina Code. Although, construction noise levels may exceed the levels specified in the City of Marina code (exceeding 60 dBA for 25 percent of an hour), it is anticipated that the construction noise would not be considered a significant impact due to the predicted noise levels and short-term duration of project construction activities. The construction noise impact would be reduced to a less than significant level through implementation of Mitigation Measures 1b, 1c, 1d, 1e, and 1h.

The Coastal Booster Pump Station option would be located on CSUMB property along the Coastal alignment within the City of Seaside. There are no residential sensitive receptors in the vicinity of the site. A recreation area is located east of the Booster Pump Station site and a child development center is located about 875 feet northeast of the site and at a lower elevation. The recreation area is on CSUMB property within the City of Seaside while the project and child development center are within the City of Marina. Construction noise source generation would be the same as the RUWAP Booster Pump Station Option. The source noise level would be attenuated due to distance, resulting in noise levels of up to 61 dBA $L_{max}$ and 63 dBA $L_{eq}$ at a distance of 750 feet and up to 60 dBA $L_{max}$ 62 dBA $L_{eq}$ at 875 feet, as indicated in Table 20. As with the RUWAP Booster Pump Station option, these attenuation estimates are conservatively low given the topographic change and structures between source and receptor.

**TABLE 20 Maximum Construction Noise Levels – Booster Pump Station Coastal Option**

| Construction Activity Source | Receptors | Distance to Receptor | $L_{max}$ | $L_{eq}$ |
|---|---|---|---|---|
| Booster Pump Structural Work. (Heavy Equipment) | Recreation Center | 750 feet (east) | 61 | 63 |
| | Child Development Center | 875 feet (northeast) | 60 | 62 |

Construction noise levels identified in Table 20 above would be below the speech interference threshold of 70 dBA $L_{eq}$. Daytime work shift times would violate both Marina and Seaside regulations that prohibit construction after 7:00 p.m. on weekdays and before 9 a.m. on Saturdays. However, section 9.24.050 of the Marina Municipal Code and section 9.12.040D of the Seaside Municipal Code exempt activities on or in publicly owned property and facilities, or by public employees or their franchisees, while in the authorized discharge of their responsibilities, provided that such activities have been authorized by the owner of such property or facilities or its agent or by the employing authority. Construction noise levels may exceed the levels specified in the City of Marina code (exceeding 60 dBA for 25 percent of an hour). The construction noise impact would be reduced to a less than significant level through implementation of Mitigation Measures 1b, 1c, 1d, 1e, and 1h.

Injection Well Facilities Site: The proposed new Injection Well Facilities would be located east of General Jim Moore Boulevard, south of Eucalyptus Road in the City of Seaside, including a total of eight recharge wells (four deep injection wells, four vadose zone wells), monitoring wells, and back-flush facilities. The nearest sensitive receptors are residences located west of General Jim Moore Boulevard and the proposed well sites, back-flush facility, and operations buildings. The deep injection well would be drilled with rotary drilling methods. To construct the back-flush pipeline, the contractor would excavate pipe trenches, spread spoilage on site, import and install bedding material, and lay pipe, backfill and compact trench. A main electrical power supply/transformer and motor control building would be built for PG&E power supply. The following activities will be required to construct the pump motor control and electrical conveyance facilities:

- Excavation, haul spoilage, import and install bedding material, building foundation, trench, place concrete, backfill and compact trench, and finish concrete floor of electrical building;
- Install exterior electrical control cabinets on the paved area at the four clusters of vadose and deep injection wells; and
- For electrical building, construct block walls, install building windows, doors and louvers, then roof and appurtenances, then interior finishes, lighting and HVAC, and electrical equipment and wiring.

The project is within the boundary of former Fort Ord and receptors are within the city limits of Seaside. Maximum noise levels generated the during the loudest construction phase at monitoring well sites are calculated to be 85 dBA $L_{max}$ and 87 dBA $L_{eq}$ at a distance of 50 feet.

This source noise level would be attenuated due to distance, resulting in noise levels of up to 66 dBA $L_{eq}$ at a distance of 500 feet, which is the distance to the closest sensitive receptors (i.e., residences). Maximum construction noise levels generated at deep injection and vadose well sites would be the same as at the monitoring wells. This source noise level would be attenuated due to distance, resulting in noise levels of up to 64 dBA $L_{eq}$ at a distance of 700 feet, which is the distance to the closest sensitive receptor (i.e., residence). Maximum noise levels generated by construction at the back-flush basin site could reach 85 dBA $L_{eq}$ at a distance of 50 feet. This source noise level would be attenuated due to distance, resulting in noise levels of 57 dBA $L_{eq}$ at a distance of 1,200 feet, which is the distance to the closest sensitive receptor (i.e., residence).

Well drilling activity was assumed to occur for 24 hours a day at a noise level of 83 dBA $L_{eq}$ at a distance of 50 feet. These levels were measured during drilling on-site at measurement location ST-1, as shown in Table 12 above, and were higher than levels calculated using RCNM, so the measured levels were used for a credible worst case assessment. The noise level from drilling would be attenuated due to distance resulting in noise levels up to 63 dBA $L_{eq}$ at a distance of 500 feet at the residence nearest to a monitoring well and up to 60 dBA $L_{eq}$ at a distance of 700 feet at the residence nearest to a deep injection or vadose zone well. Table 21 shows worst-case noise levels at nearest noise sensitive receptors to Injection Well Facilities site (including back-flush facility).

**TABLE 21 Maximum Construction Noise Levels – Injection Well Facilities**

| Construction Activity Source | Receptors | Distance to Receptor | $L_{max}$ | $L_{eq}$ |
|---|---|---|---|---|
| Monitoring Well (Paving) | Residence near Gen. Jim Moore Blvd south of San Pablo Ave. | 500 feet (west) | 65 | 66 |
| Deep Injection and Vadose Wells (Paving) | Residence near Gen. Jim Moore Blvd north of San Pablo Ave. | 700 feet (west) | 63 | 64 |
| Back-flush Basin (Grading/Excavating) | Residence along Sandpiper Ct. | 1,200 feet (west) | 57 | 57 |
| Monitoring Well Drilling | Residence near Gen. Jim Moore Blvd south of San Pablo Ave. | 500 feet (west) | 69 | 63 |
| Deep Injection and Vadose Well Drilling | Residence near Gen. Jim Moore Blvd north of San Pablo Ave. | 700 feet (west) | 66 | 60 |

The City of Seaside has not adopted quantitative construction noise limits. Daytime construction activities would not exceed the daytime threshold of 70 dBA $L_{eq}$. Drilling activities during nighttime hours would result in noise levels of up to 63 dBA $L_{eq}$ at receiving properties, exceeding the sleep disturbance threshold of 60 dBA $L_{eq}$ by up to 3 dBA. Daytime work shift times would violate Seaside regulations that prohibit construction after 7:00 p.m. and before 9 a.m. on Saturdays. Therefore, impacts would be significant. Implementation of Mitigation Measures 1a, 1b, 1c, 1d, 1e, and 1f would reduce impacts to a less than significant level.

Reclamation Ditch Diversion Site: New facilities at the Reclamation Ditch Diversion are proposed for construction and would include a wet well/diversion structure, connecting pipelines, flow meter and valves, electrical cabinet, and concrete lining. Construction phases include site preparation, grading, trenching, building of facilities, and paving. Typical construction work hours would be 7:00 a.m. to 6:00 p.m., Monday through Saturday. The site is surrounded by agricultural lands to the west in Monterey County and industrial land uses are to the east in Salinas. One distant residence, located approximately 1,000 feet to the west, is in unincorporated Monterey County. Maximum noise levels generated by construction activities at the Reclamation Ditch Diversion site are calculated to reach 90 dBA $L_{max}$ and 86 dBA $L_{eq}$ at a distance of 50 feet. The source noise level would be attenuated due to distance, resulting in noise levels up to 64 dBA $L_{max}$ and 60 dBA $L_{eq}$ at 1,000-feet, which is the distance to the closest sensitive receptor (i.e., residence). Table 21 shows worst-case noise levels at nearest noise sensitive receptors to the Reclamation Ditch Diversion Site.

Some of the proposed construction equipment that would be required to build the facilities would potentially result in noise levels at or above 85 dBA at 50 feet within 2,500 feet of County residences, which would be an apparent violation of County Code Section 10.60.030. However, given the noise attenuation that would result due to the relatively long distance from the construction site to the residence locations about 1,000 feet away, in addition to existing ambient noise levels from traffic on W. Market Street, short-term construction noise impacts at these residences would be less than significant, although construction noise would violate County Code section 10.60.030, a potentially significant impact that would be less than significant with the implementation of the Mitigation Measures 1c and 1g. Mitigation Measure NV-1b requires that construction equipment have properly operating mufflers and stationary noise equipment be located as far as possible from sensitive receptors, consistent with County General Plan Policy S-7.10. General Plan Policy S-7.10 also indicates that construction shall occur only during times allowed by County ordinance or code unless such limits are waived for public convenience. Compliance with County regulations, unless otherwise waived by the County, would be required that would reduce the impact to a less-than-significant level.

**TABLE 21 Maximum Construction Noise Levels – Reclamation Ditch Diversion**

| Construction Activity Source | Receptors | Distance to Receptor | $L_{max}$ | $L_{eq}$ |
|---|---|---|---|---|
| Construction of Facilities and Pipelines (Trenching) | Monterey County residences | 1,000 feet (west) | 64 | 60 |

Tembladero Slough Diversion: New facilities at the Tembladero Slough Diversion Site are proposed for construction and would include a wet well/diversion structure, connecting pipelines, flow meter and valves, electrical cabinet, and concrete lining. Construction phases include site preparation, grading, trenching, building of facilities, and paving. Typical construction work hours would be 7:00 a.m. to 6:00 p.m., Monday through Saturday. The site is surrounded by agricultural lands in Monterey County with one residential land use to the north and a subdivision beyond Hwy 1 to the east. Maximum noise levels generated by construction activities (particularly vibratory driving) at the Tembladero Slough Diversion site are calculated to reach 101 dBA $L_{max}$ and 94 dBA $L_{eq}$ at a distance of 50 feet. The source noise level would be attenuated due to distance, resulting in noise levels up to 77 dBA $L_{max}$ and 70 dBA $L_{eq}$ at 750-feet, which is the distance to the closest sensitive receptor (i.e., residence). Table 22 shows worst-case noise levels at nearest noise sensitive receptors to Tembladero Slough Diversion construction activities.

Short-term construction noise levels at the nearest residences would be below the significance threshold for speech interference during the day for nearby sensitive receptors. Therefore, temporary noise increases due to construction would not be substantial, and noise impacts at this Proposed Project site would be less than significant. Construction noise could conflict with Monterey County Code Section 10.60.30 because some of the proposed construction equipment that would be required to build the facilities was modeled to result in noise levels above 85 dBA at 50 feet and construction would occur within 2,500 of residences within the unincorporated area of the county. Therefore, construction activities at this site could generate noise levels in excess of local standards, which is considered a significant impact. The impact would be less than significant with the implementation of the Mitigation Measures 1c and 1g. Noise levels would not exceed the speech interference or sleep disturbance thresholds at the residences and would be in accordance with Policy S-7.9 because the construction activities would be limited to daytime hours of Monday through Saturday. Mitigation Measure NV-1b requires that construction equipment have properly operating mufflers and stationary noise equipment be located as far as possible from sensitive receptors, consistent with County General Plan Policy S-7.10. General Plan Policy S-7.10 also indicates that construction shall occur only during times allowed by County ordinance or code unless such limits are waived for public convenience. Compliance with County regulations, unless otherwise waived by the County, would be required that would reduce the impact to a less-than-significant level.

**TABLE 22 Maximum Construction Noise Levels – Tembladero Slough Diversion**

| Construction Activity Source | Receptors | Distance to Receptor | $L_{max}$ | $L_{eq}$ |
|---|---|---|---|---|
| Construction of Facilities and Pipelines (Trenching) | Monterey County residences | 750 feet (north) | 77 | 70 |
| | | 850 feet (east, across Hwy 1) | 76 | 69 |

Blanco Drain Diversion Site: New facilities at the Blanco Drain Diversion are proposed for construction and would include a diversion structure, flow meter and valves, an on-site surge tank, electrical cabinet, concrete lining, and pipeline. Construction phases include grading, trenching, building of facilities, and paving. Typical construction work hours would be7:00 a.m. to 6:00 p.m., Monday through Saturday. The site is surrounded by agricultural lands in Monterey County with an industrial land use (the landfill and Regional Treatment Plant) to the west. Two distant residences, one to the northeast and another to the southeast, are in unincorporated Monterey County. Maximum noise levels generated by construction activities at the Blanco Drain Diversion site are calculated to reach 90 dBA $L_{max}$ and 87 dBA $L_{eq}$ at a distance of 50 feet. The source noise level would be attenuated due to distance, resulting in noise levels up to 56 dBA $L_{max}$ and 53 dBA $L_{eq}$ at 2,400-feet, which is the distance to the closest sensitive receptor (i.e., residence). Table 23 shows worst-case noise levels at nearest noise sensitive receptors northeast of Blanco Drain Diversion construction activities.

Short-term construction noise levels at the nearest residences would be below the significance threshold for speech interference during the day for nearby sensitive receptors. Therefore, temporary noise increases due to construction would not be substantial, and noise impacts at this Proposed Project site would be less than significant. Construction noise could conflict with Monterey County Code Section 10.60.30 because some of the proposed construction equipment that would be required to build the facilities was modeled to result in noise levels above 85 dBA at 50 feet and construction would occur within 2,500 of residences within the unincorporated area of the county. Therefore, construction activities at this site could generate noise levels in excess of local standards, which is considered a significant impact. The impact would be less than significant with the incorporation of the Mitigation Measures 1c and 1g. Noise levels would be consistent with Policy S-7.9 because the construction activities would be limited to daytime hours of Monday through Saturday. Mitigation Measure NV-1b requires that construction equipment have properly operating mufflers and stationary noise equipment be located as far as possible from sensitive receptors, consistent with County General Plan Policy S-7.10. General Plan Policy S-7.10 also indicates that construction shall occur only during times allowed by County ordinance or code unless such limits are waived for public convenience. Compliance with County regulations, unless otherwise waived by the County, would be required that would reduce the impact to a less-than-significant level.

**TABLE 23 Maximum Construction Noise Levels – Blanco Drain Diversion**

| Construction Activity Source | Receptors | Distance to Receptor | $L_{max}$ | $L_{eq}$ |
|---|---|---|---|---|
| Construction of Facilities and Pipelines (Trenching) | Monterey County residences | 2,400 feet (northeast) | 56 | 53 |
| | | 3,000 feet (southeast) | 54 | 51 |

Salinas Industrial Wastewater Treatment Facility Storage and Recovery: Construction of the Salinas Treatment Facility Storage and Recovery component is proposed for two project sites: on-site at the Salinas Treatment Facility and off-site along the existing 33-inch industrial wastewater pipeline that is proposed to be slip-lined. The facilities on-site at the Salinas Treatment Facility would include a recovery pump station, pond #3 pump station, and on-site pipelines. The off-site facilities would include slip-lining the existing 33-inch pipeline with a new smaller diameter pipe. Construction phases for both project components include site preparation, grading, trenching, building of facilities, and paving, all of which would occur within a six-month construction period. Typical construction work hours would be 7:00 a.m. to 8:00 p.m., Monday through Saturday. The site is surrounded by agricultural lands in Monterey County. One distant residence to the southeast is in unincorporated Monterey County. Maximum noise levels generated by construction activities at Salinas Treatment Facility site are calculated to reach 91 dBA $L_{max}$ and 89 dBA $L_{eq}$ at a distance of 50 feet. The source noise level would be attenuated due to distance, resulting in noise levels up to 57 dBA $L_{max}$ and 55 dBA $L_{eq}$ at 2,500-feet, which is the distance to the closest sensitive receptor (i.e., residence). Table 24 shows worst-case noise levels at nearest noise sensitive receptors to Salinas Treatment Facility construction activities.

Some of the proposed construction equipment that would be required to build the facilities was modeled to result in noise levels at or above 85 dBA at 50 feet, which could possibly be a violation of County Code 10.60.030. However, the code does not apply to machines operated in excess of 2,500 feet from an occupied dwelling. The nearest residence is about 2,500 feet away from the site. Given the noise attenuation that would result due to the relatively long distance from the construction site to the nearest residence about 2,500 feet away, in addition to existing ambient noise levels from traffic on Davis Road, short-term construction noise impacts at these residences would be less than significant because it is below the 60 dBA $L_{eq}$ level for daytime speech interference.

**TABLE 24 Maximum Construction Noise Levels – Salinas Treatment Facility Storage and Recovery**

| Construction Activity Source | Receptors | Distance to Receptor | $L_{max}$ | $L_{eq}$ |
|---|---|---|---|---|
| Construction of facilities at the Salinas Treatment Facility and slip-lining existing pipeline | Monterey County residences | 2,500 feet (southeast) | 57 | 55 |

**Mitigation 1:**

a) Contractor specifications shall include a requirement that drill rigs located within 700 feet of noise-sensitive receptors shall be equipped with noise reducing engine housings or other noise reducing technology and the line of sight between the drill rig and nearby sensitive receptors shall be blocked by portable acoustic barriers and/or shields to reduce noise levels such that drill rig noise levels are no more 75 dBA at 50 feet. This would reduce the nighttime noise level to less than 60 dBA $L_{eq}$ at the nearest residence.

b) The construction contractor shall limit all non-well drilling, noise-generating construction activities to between the hours of 7:00 a.m. and 7:00 p.m. on weekdays and between 9:00 a.m. and 7:00 p.m. Saturdays, or as agreed upon by the local jurisdiction.

c) The contractor shall assure that construction equipment with internal combustion engines has sound control devices at least as effective as those provided by the original equipment manufacturer. No equipment shall be permitted to have an un-muffled exhaust.

d) The contractor shall locate all stationary noise-generating equipment (e.g., generators, air compressors) as far from nearby noise-sensitive receptors as possible, and shall muffle and enclose them in temporary sheds, incorporate noise barriers, or implement other noise control measures to the extent feasible. The noise controls shall be sufficient to reduce noise levels during nighttime pipeline installation, drilling and development of injection wells, and pump station construction activities below the threshold of 60 dBA $L_{eq}$ at the nearest residential receptor.

e) Residences and other sensitive receptors within 500 feet of a daytime construction area and within 900 feet of a nighttime construction area shall be notified of the construction schedule in writing, at least two weeks prior to the commencement of construction activities. The notice shall also be posted along the proposed pipeline alignments, near the proposed facility sites, and at nearby recreational facilities. The project contractor shall designate a noise disturbance coordinator who would be responsible for responding to complaints regarding construction noise. The coordinator shall determine the cause of the complaint and ensure that reasonable measures are implemented to correct the problem. A contact number for the noise disturbance coordinator shall be conspicuously placed on construction site fences and included in the construction schedule notification sent to nearby residences. The notice to be distributed to residences and sensitive receptors shall first be submitted to local Building Officials for review and approval, to the MRWPCA and city and county staff as may be required by local regulations.

f) For work within the City of Seaside, the construction contractor shall submit to the MRWPCA and the Seaside Building Official, a “Well Construction Noise Control Plan” for review and approval. The plan shall identify all equipment that will operate at night and all feasible noise control procedures that would be implemented during night-time construction activities. At a minimum, the plan shall specify the noise control treatments that have been incorporated to achieve the noise performance standards contained in Mitigation Measure 1a.

g) The construction contractor shall comply with Monterey County regulations to not generate noise levels above 85 dBA at 50 feet at sites within 2,500 feet of an occupied residence unless approval has been obtained from Monterey County.

h) The construction contractor shall comply with Marina Municipal Code regulations to conduct day-time construction that would produce a noise level of no more than 60 decibels for twenty-five percent of an hour at any receiving property line unless approval has been obtained from the City.

**Significance after Mitigation: Less than Significant.**

**Impact 2: Exposure to, or Generation of, Excessive Groundborne Vibration.** Construction related vibration would not be excessive at nearby land uses.

For structural damage, the Caltrans recommends a vibration limit of 0.5 in/sec PPV for buildings structurally sound and designed to modern engineering standards, 0.3 in/sec PPV for buildings that are found to be structurally sound but where structural damage is a major concern, and a conservative limit of 0.08 in/sec PPV for ancient buildings or buildings that are documented to be structurally weakened.

All buildings in the project vicinity are assumed to be structurally sound, but these buildings may or may not have been designed to modern engineering standards. Vibration impacts would be considered significant if levels from proposed construction activities would exceed 0.3 in/sec PPV at nearby buildings. Vibration levels exceeding 0.3 in/sec PPV could result in cosmetic damage. No ancient buildings or buildings that are documented to be structurally weakened are known to exist along the project corridor.

The construction methods for the proposed project include both open trench installation and trenchless construction methods. Open trench construction activities with the potential of generating perceptible vibration levels would include the removal of pavement and soil, and the compacting of backfill after the new pipeline is installed. Trenchless methods such as jack-and-bore, drill-and-burst, horizontal directional drilling, and/or microtunneling would be employed where it is not feasible or desirable to perform open-cut trenching. Table 22 summarizes typical vibration levels associated with varying pieces of construction equipment at a distance of 25 feet.

A review of the proposed equipment and the vibration level data provided in Table 22 indicates that, with the exception of impact or vibratory pile driving (not proposed as a construction technique), vibration levels generated by the proposed equipment would be below the 0.3 in/sec PPV criterion used to assess the potential for cosmetic or structural damage to buildings located beyond a distance of 25 feet. The nearest buildings would be a minimum distance of 25 feet from the work areas. Trenchless construction methods results in less vibration than open trench construction activities because the equipment used in these processes are not high-powered vibratory devices, and the depth of the underground tunnel increases the distance between the equipment and structures on the surface and reduces vibration. This is a *less than significant* impact.

**TABLE 25 Vibration Source Levels for Construction Equipment**

| Equipment | | PPV at 25 ft. (in/sec) |
|---|---|---|
| Pile Driver (Impact) | upper range | 1.158 |
| | typical | 0.644 |
| Pile Driver (Sonic) | upper range | 0.734 |
| | typical | 0.170 |
| Clam shovel drop | | 0.202 |
| Hydromill (slurry wall) | in soil | 0.008 |
| | in rock | 0.017 |
| Vibratory Roller | | 0.210 |
| Hoe Ram | | 0.089 |
| Large bulldozer | | 0.089 |
| Caisson drilling | | 0.089 |
| Loaded trucks | | 0.076 |
| Jackhammer | | 0.035 |
| Small bulldozer | | 0.003 |

Source: Transit Noise and Vibration Impact Assessment, United States Department of Transportation, Federal Transit Agency, Office of Planning and Environment, May 2006.

**Mitigation 2: None required.**

**Impact 3: Operation of the proposed GWR facilities would potentially increase existing noise levels, which could exceed noise level standards and/or result in nuisance impacts at sensitive receptors.**

Sources of noise associated with the operation of the GWR Project would include new pumps and other equipment at the RTP, the Salinas Pump Station, Lake El Estero Diversion Site, new Booster Pump Station, the new Injection Well Facilities, the Reclamation Ditch, Tembladero Slough, Blanco Drain Diversion sites, and the Salinas Industrial Wastewater Treatment Facility Storage and Recovery. Employee traffic and maintenance activities would not be considerable sources of noise as discussed qualitatively below.

*OPERATIONAL TRAFFIC*

Table 2-10 of the Project Description provides a summary of operational traffic for each of the various project components as a result of employee commute trips, maintenance, and delivery of materials to the various pump stations. The project would generate up to 10 employee trips and 2 truck trips per day at the Regional Treatment Plant and fewer trips at all other facilities. Noise generated by employee and truck traffic would not be considerable. Thus, associated impacts would be less than significant.

*MAINTENANCE ACTIVITIES*

Noise that would be associated with plant, pipeline, and other facility maintenance would be short-term and infrequent (less than one trip per day to each component site) resulting from activities that would not result in measureable increases of ambient noise levels in the surrounding area. Impacts related to project maintenance would be less than significant.

*SOURCE WATER DIVERSION AND STORAGE SITES*

*Salinas Pump Station*

New facilities at the Salinas Pump Station Diversion site include diversion structures and short pipelines to re-direct urban runoff, storm water, and agricultural wash water to the RTP for advanced water treatment. No new noise-generating equipment is proposed.

*Salinas Industrial Wastewater Treatment Facility Storage and Recovery Site*

The proposed project includes improvements that would enable the agricultural wash water to be conveyed from the ponds at the Salinas Industrial Wastewater Treatment Facility to the Regional Treatment Plant for recycling. Components of the project include a new pump station, pipeline, on-site piping, SCADA, and a return with valve and meter vaults. No new operations/maintenance staff trips or work would be needed at the site. The only source of noise associated with this component of the project would be a new submersible pump installed in a wet well in pond 3 and a new return pump station near the aeration ponds. As noted above, the sound of the submersible pump would be attenuated and barely audible just outside of the wet well. Operational noise levels would not make a measurable contribution to ambient noise levels at the nearest receptors approximately 2,500 feet southeast of the site.

*Reclamation Ditch Diversion Site*

New facilities at the Reclamation Ditch Diversion site east of Davis Road include improvements to divert water to the Regional Treatment Plant. Components of the project include a wet well/diversion structure, connecting pipelines, flow meter and valve, electrical pump/cabinet, and concrete lining of channel banks. The only source of noise associated with this component of the project would be a new submersible pump installed in the wet well. The submersible pump and associated piping would be installed below grade and submersed in water. The sound of the submersible pump would be attenuated at the water/air interface because the acoustical characteristics of water and air are different given that the density of water is so much greater than the density of air. The noise from the new pump would be barely audible just outside of the wet well in the absence of traffic along Davis Road and inaudible at residences located approximately 1,000 feet away from the Davis Street site along West Market Circle (west), West Rossi Street (northwest), and Nacional Court (south). One truck trip up to three times per week is expected to go to the site creating no change in ambient noise levels.

*Tembladero Slough Diversion*

Improvements to divert water to the Regional Treatment Plant at the Tembladero Slough site include a wet well/diversion structure, connecting pipelines, flow meter and valves, electrical cabinet, and concrete lining of channel banks. Similar to the Reclamation Ditch Diversion site east of Davis Road, the sound of the proposed submersible pump in the wet well would be barely audible just outside of the wet well in the absence of local traffic along Highway 1. No new operations/maintenance staff is expected. Operational noise levels from new noise-generating equipment or vehicle trips would not make a measurable contribution to ambient noise levels resulting from Highway 1 traffic at the nearest receptors along Watsonville Road (750 feet north of the project site) or Merritt Circle (850 feet east of the project site).

*Blanco Drain Diversion Site*

The Blanco Drain Diversion site includes improvements that would allow for the diversion of water to the Regional Treatment Plant for recycling. Components of the project include a wet well/diversion structure, flow meter, valves, and on-site surge tank, connecting pipelines, electrical cabinet, concrete lining of channel banks, and pipelines. No new operations/maintenance staff is expected. The only source of noise associated with this component of the project would be a new submersible pump installed in the wet well. As noted above, the sound of the submersible pump would be attenuated and barely audible just outside of the wet well. Operational noise levels would not make a measurable contribution to ambient noise levels at the nearest receptors approximately 2,400 feet east-northeast of the site along Nashua Road.

*Lake El Estero Diversion Site*

New facilities at El Estero would include either a column pump or a gravity system and motorized valve, and short connecting pipelines. The improvements would be in the existing structure or underground. The small diversion pump would be located within the pump vault that houses two larger pumps. The addition of the new pump would not measurably affect the noise emanating from the pump station.

*TREATMENT FACILITIES AT THE RTP*

Treatment Facilities at the Regional Treatment Plant would include pre-treatment, the AWT Facility, product water pump station; concentrate disposal facilities and SVRP modifications. As previously indicated, modifications to the existing Salinas Valley Reclamation Plant are proposed in order to enable increased use of tertiary treated wastewater for crop irrigation during winter months. The proposed modifications include new sluice gates, a new pipeline between the existing inlet and outlet structures within the storage pond, chlorination basin upgrades, and a new storage pond platform. All of the modifications would occur within the existing Salinas Valley Reclamation Plant footprint and would not include new sound-generating equipment that would affect the community noise environment.

The proposed treatment facilities and brine mixing facility would include several structures. New pipes and pumps will be underground. In the analysis of operational noise, because mechanical equipment noise is constant, the $L_{eq}$ noise level is used to assess operational noises against the thresholds.

The proposed new AWT Facility would have a design capacity of approximately 4.0 mgd of product water. Noise resulting from new facilities would be generated from proposed stationary sources associated with facility operations, including primarily electric water pumps. The pumps have an estimated combined noise level of 108 dBA $L_{eq}$ at a distance of 3 feet. Typical operating conditions would result in pump reference noise levels of approximately 85 dBA $L_{eq}$ at 50 feet assuming the pumps were at grade and not inside an enclosure. There are no other known sources of noise that would measurably increase the noise levels generated by the pumps. A residence to the northwest is in Monterey County and residences to the southwest are in the City of Marina. Maximum noise levels generated by operations at the RTP would be 35 dBA $L_{eq}$ at a distance of approximately 1 mile.

**TABLE 26 Operational Noise Levels – Treatment Facilities at the Regional Treatment Plant**

| Operational Source | Receptors | Distance to Receptor | $L_{eq}$ |
|---|---|---|---|
| New pumps and other process equipment | Monte Road Residence | 5,260 feet/1 mile (northwest) | 35 |
| | Cosky Drive Residences | 5,400 feet (southwest) | 35 |

Note: The noise attenuation rate is assumed to be approximately 7.5 dBA for each doubling of distance from the source where the distance is over fields.

Noise levels as a result of the operation of the proposed Treatment Facilities at the RTP would not exceed the City of Marina or Monterey County noise standards. Noise levels would be substantially below ambient noise levels in the surrounding area, and plant operations would not result in an increase in ambient noise levels that would exceed local standards.

Section 10.60.040 of the County Code applies to nighttime noise, in which it is prohibited to make, assist in making, allow, continue, create, or cause to be made any loud and unreasonable sound any day of the week from 10:00 PM to 7:00 AM that exceeds 65 dBA $L_{max}$ or 45 dBA $L_{eq}$ as measured at or outside property line. As indicated above, noise levels would reach 37 dBA at the nearest sensitive receptor, which is below the 65 dBA $L_{max}$ or 45 dBA $L_{eq}$ noise levels, and would not result in loud and unreasonable noise, consistent with the intent of the ordinance adopting the regulations. Furthermore, the proposed facilities include improvements to the existing treatment facilities in order to provide additional agricultural irrigation water via the Castroville Seawater Intrusion Project, which is indirect support of commercial agricultural operations, which are exempt from the provisions of Section 10.60.040 of the County Code.

*PRODUCT WATER CONVEYANCE*

*Booster Pump Stations*

The proposed new Booster Pump Station would receive flow from the Product Water Conveyance Pipeline and pump the product water into one of the two proposed alternative alignments that merge to a single alignment along General Jim Moore Boulevard. One Booster Pump Station option would be located along the RUWAP alignment in the City of Marina. The nearest sensitive receptors are residents of the CSUMB campus housing located west of the pump station site and a classroom building southeast of the site.

Noise resulting from the Booster Pump Station would primarily result from the operation of electric water pumps. Two nominal 250 hp pumps would be installed, but only one pump would operate at any given time. The estimated operational noise level would be 93 dBA $L_{eq}$ at a distance of 3 feet. Typical operating conditions would result in pump reference noise levels of approximately 70 dBA $L_{eq}$ at 50 feet assuming the pumps were at grade and not inside an enclosure. The additional attenuation provided by locating the pumps below ground and within an enclosure is conservatively estimated to be 20 dBA resulting in pump reference noise levels of approximately 50 dBA $L_{eq}$ at 50 feet. The nearest sensitive receptors are residents of the CSUMB campus housing located west of the pump station site and a classroom building southeast of the site. Maximum noise levels generated by operations at Booster Pump Station RUWAP Option are calculated to result in noise levels of up to 31 dBA $L_{eq}$ at a distance of 450 feet and up to 28 dBA $L_{eq}$ at 650 feet, as indicated in Table 24.

**TABLE 27 Operational Noise Levels – Booster Pump Station RUWAP Option**

| Operational Source | Receptors | Distance to Receptor | $L_{eq}$ |
|---|---|---|---|
| Booster Pump Station RUWAP Option | Classroom Building | 450 feet (southeast) | 31 |
| | Campus Housing (Strawberry Apartments) | 650 feet (west) | 28 |

Noise levels as a result of the operation of Booster Pump Station (RUWAP options) would not exceed the City of Marina noise standards for daytime noise at the nearest classroom buildings or the daytime or nighttime noise standards at the campus housing. Operational noise levels would not make a measurable contribution to ambient noise levels at the nearest receptors.

The Coastal Booster Pump Station option would be located on City of Seaside or CSUMB property at the corner of Divarty Street and 2$^{nd}$ Avenue. There are no residential receptors in the vicinity of the site. A recreation center (gymnasium/workout facility is located east of the Booster Pump Station site and a child development center is located about 875 feet northeast of the site. The recreation center is on CSUMB property within the City of Seaside while the child development center is within the City of Marina. Operational noise generation would be the same as the RUWAP Option. Maximum noise levels generated by operations at Booster Pump Station Coastal Option are calculated to result in noise levels of up to 41 dBA $L_{eq}$ at a distance of 750 feet and up to 40 dBA $L_{eq}$ at 875 feet, as indicated in Table 25.

**TABLE 28 Operational Noise Levels – Booster Pump Station Coastal Option**

| Operational Source | Receptors | Distance to Receptor | $L_{eq}$ |
|---|---|---|---|
| Booster Pump Station Coastal Option | Recreation Center | 750 feet (east) | 41 |
| | Child Development Center | 875 feet (northeast) | 40 |

Noise levels as a result of the operation of Booster Pump Station Coastal Option would not exceed the City of Marina noise standards for daytime or nighttime noise. Operational noise levels would not make a measurable contribution to ambient noise levels at the nearest receptors. No City of Seaside standards currently apply to the Coastal Booster Pump Station due to lack of existing land uses in the vicinity that would be exposed to noise. Future planned land uses in the vicinity may include commercial uses, including restaurants, stores, and movie theaters, that would not be adversely affected by operation of the proposed Coastal Booster Pump Station.

*INJECTION WELL FACILITIES*

The proposed new Injection Well Facilities would be located east of General Jim Moore Boulevard, south of Eucalyptus Road in the City of Seaside, including a total of eight wells (four deep injection wells, four vadose zone wells), monitoring wells, and back-flush facilities, at an area formerly referred to as the Inland Recharge Area. Each injection well would be equipped with a well pump to back-flush the well. The estimated motor size for each pump is approximately 400 hp. The back-flush pumps are the only considerable source of noise from these facilities. The back-flushing rate would be approximately 2,000 gallons per minute (gpm) and would require a well pump and motor. Based on the experience of the Water Management District in the operation of its nearby Aquifer Storage and Recovery wells, back-flushing of each injection well would occur about weekly and would require discharge of the back-flush water to a percolation pond, or back-flush basin, with a capacity of about 300,000 gallons. At this back-flush rate, the pump would operate for about 150 minutes during the daytime.

The 400 hp back-flush pump has an estimated noise level 85 dBA $L_{eq}$ at 50 feet assuming the pumps are at grade and not inside an enclosure. The nearest residences to Deep Injection Well 4 (DIW4) are located 700 feet to the west in Seaside. The maximum noise level, generated by back-flush operations at DIW4, is calculated to be 56 dBA $L_{eq}$ and 46 dBA CNEL, as indicated in Table 25.

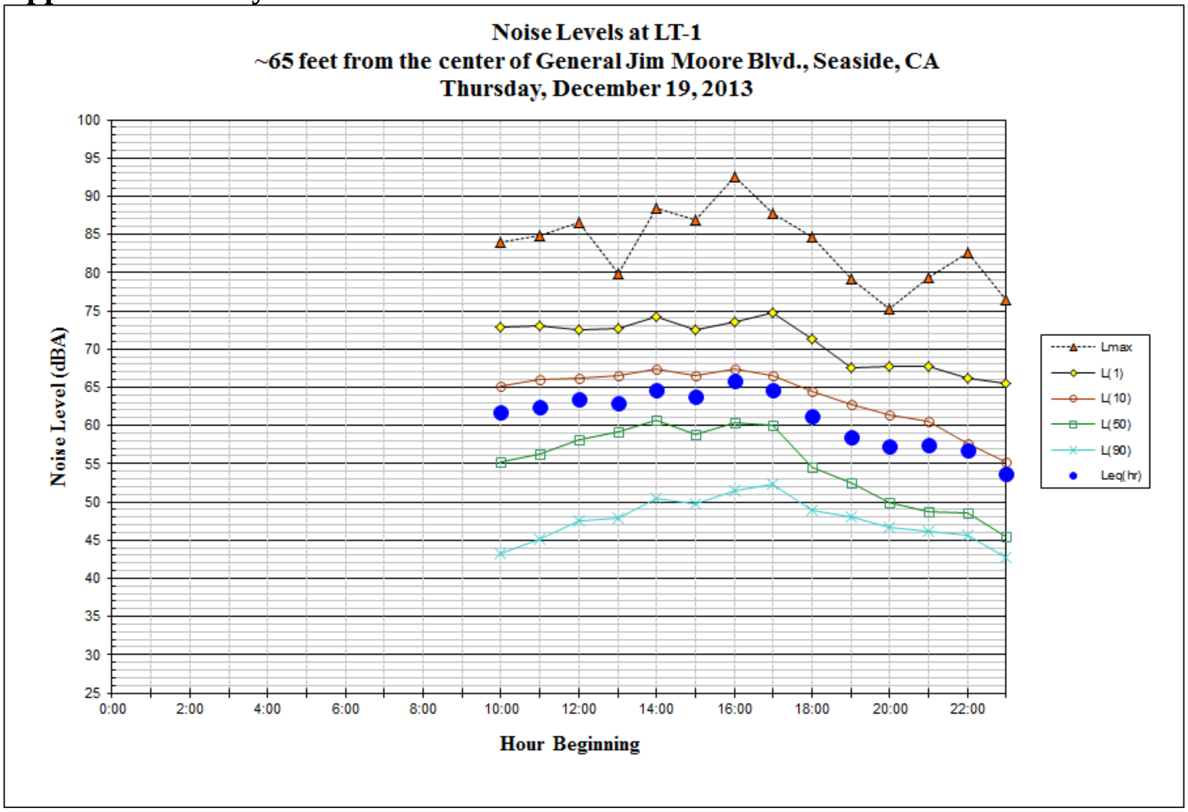
**TABLE 29 Operational Noise Levels – Injection Well Facilities**

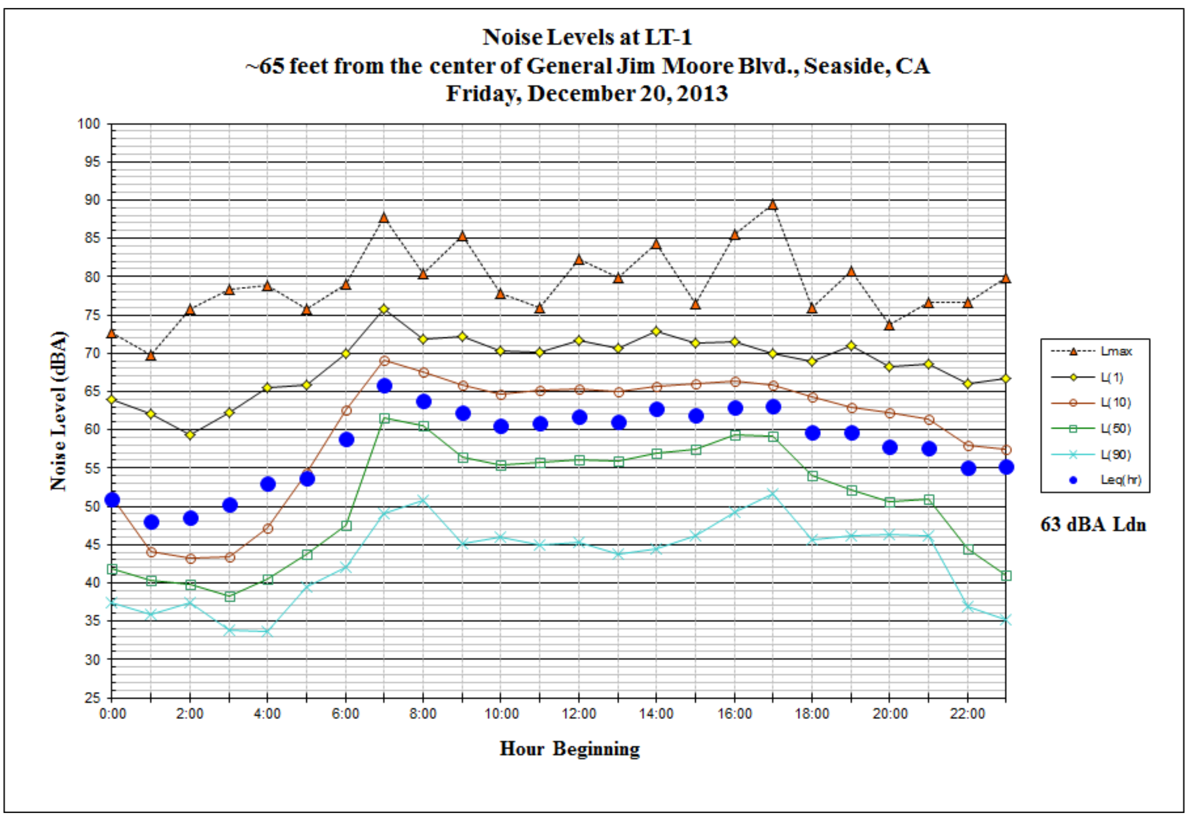
| Operational Source | Receptors | Distance to Receptor | $L_{eq}$ | CNEL |
|---|---|---|---|---|
| Back-flush pump at the southernmost injection well cluster | Residence near Gen. Jim Moore Blvd north of San Pablo Ave. | 700 feet (west) | 56 | 46 |

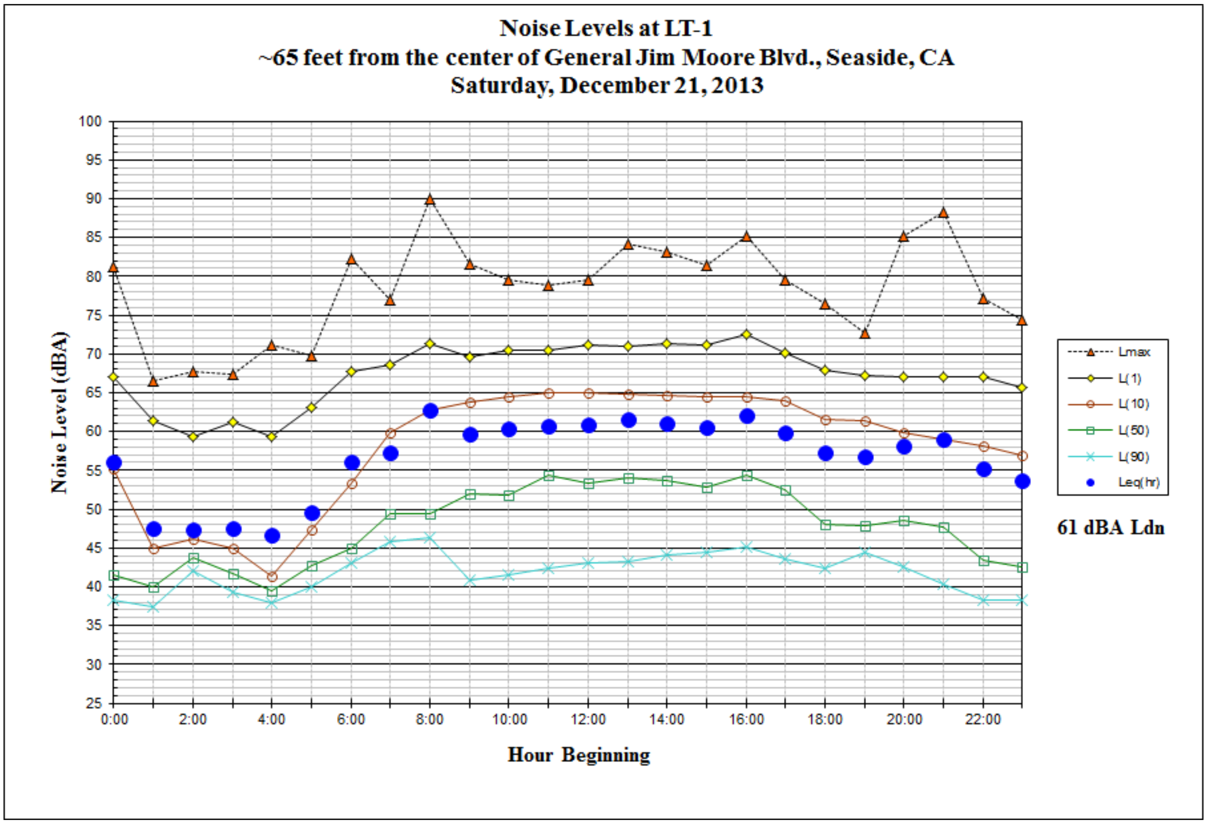
Noise levels as a result of the operation of the back-flush pump at DIW4, as well as the remaining wells located further from receptors, would not exceed the City of Seaside noise standard of 65 dBA CNEL.

**Mitigation 3: None required.**

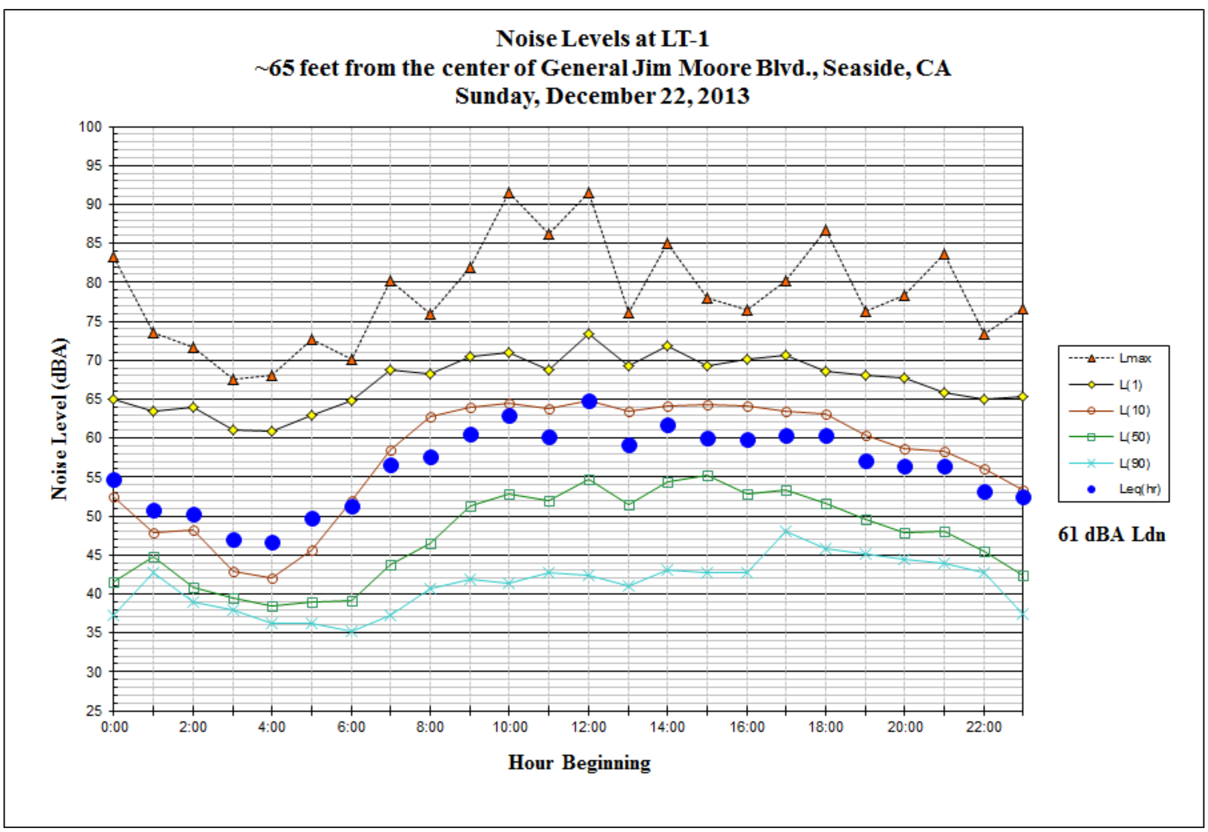
## Appendix A:  Daily Trend in Noise Levels



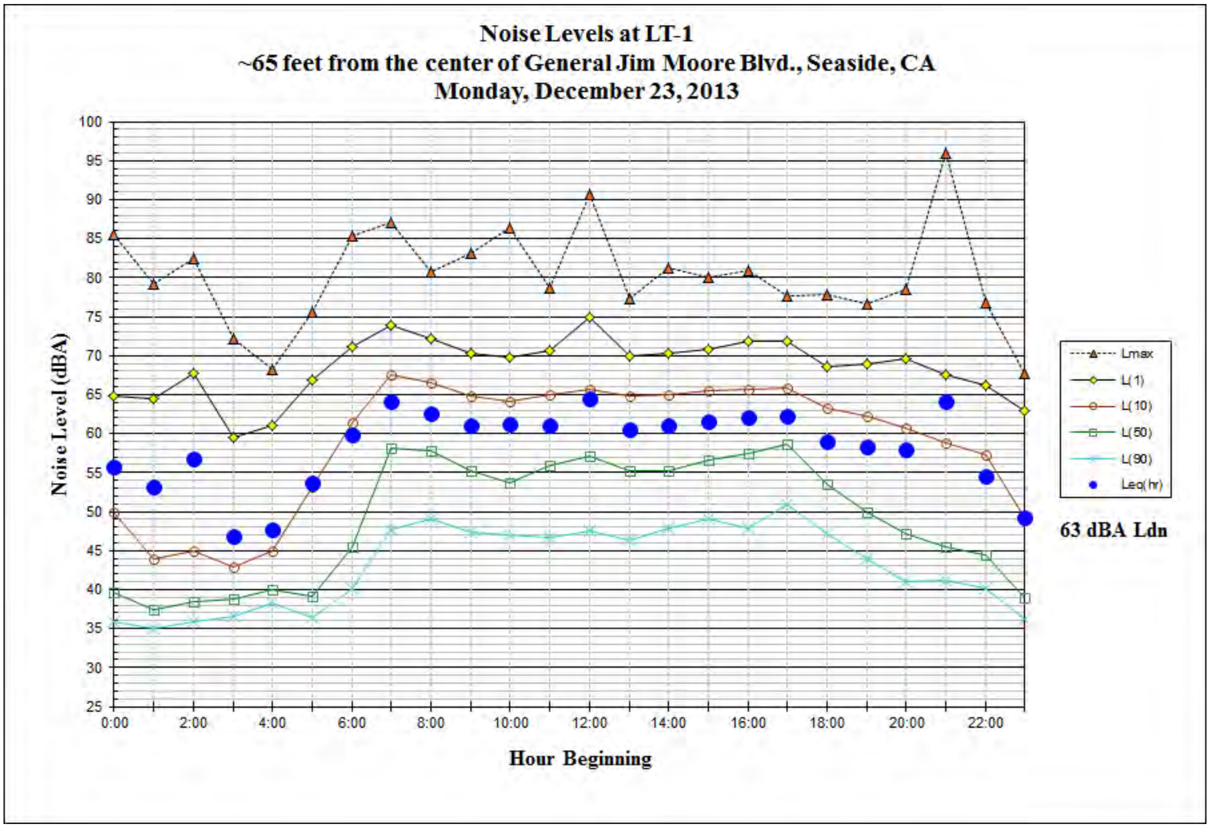





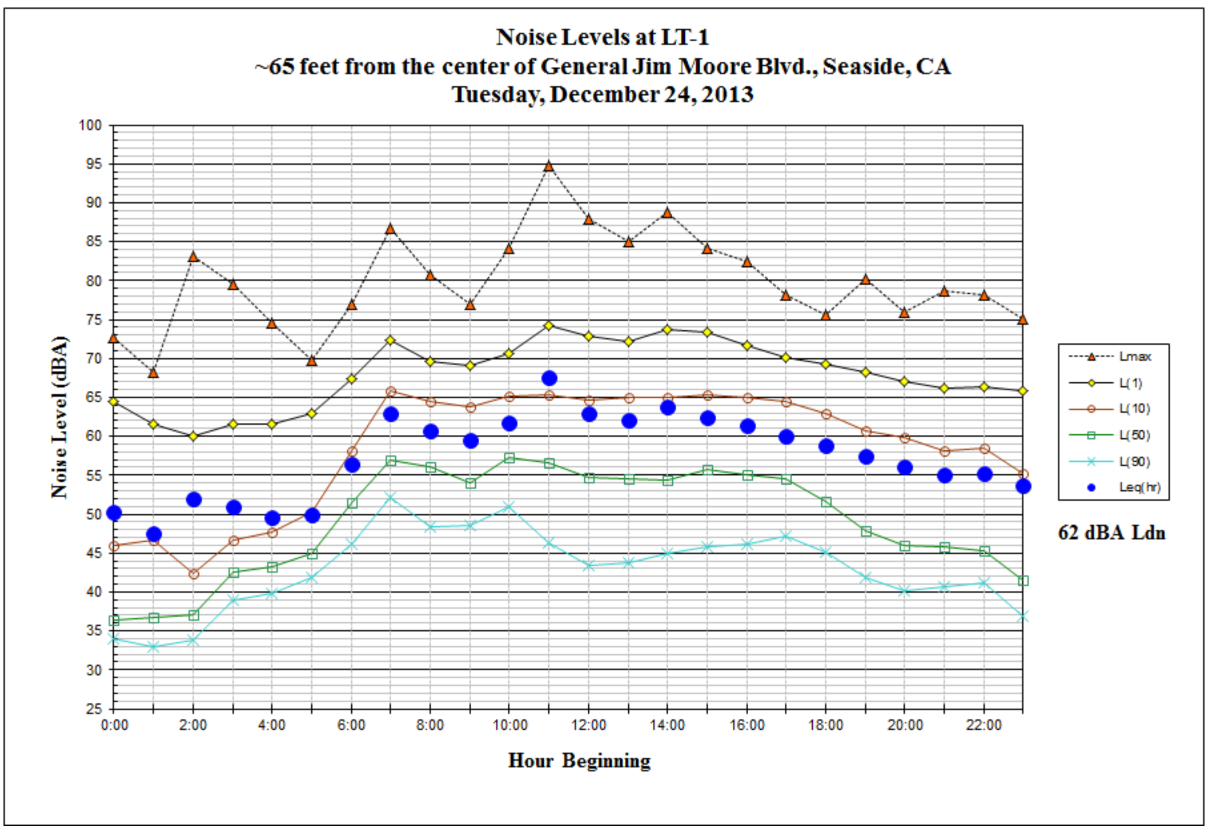
Noise Levels at LT-1
~65 feet from the center of General Jim Moore Blvd., Seaside, CA
Saturday, December 21, 2013
Noise Level (dBA)
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Leq(hr)
61 dBA Ldn

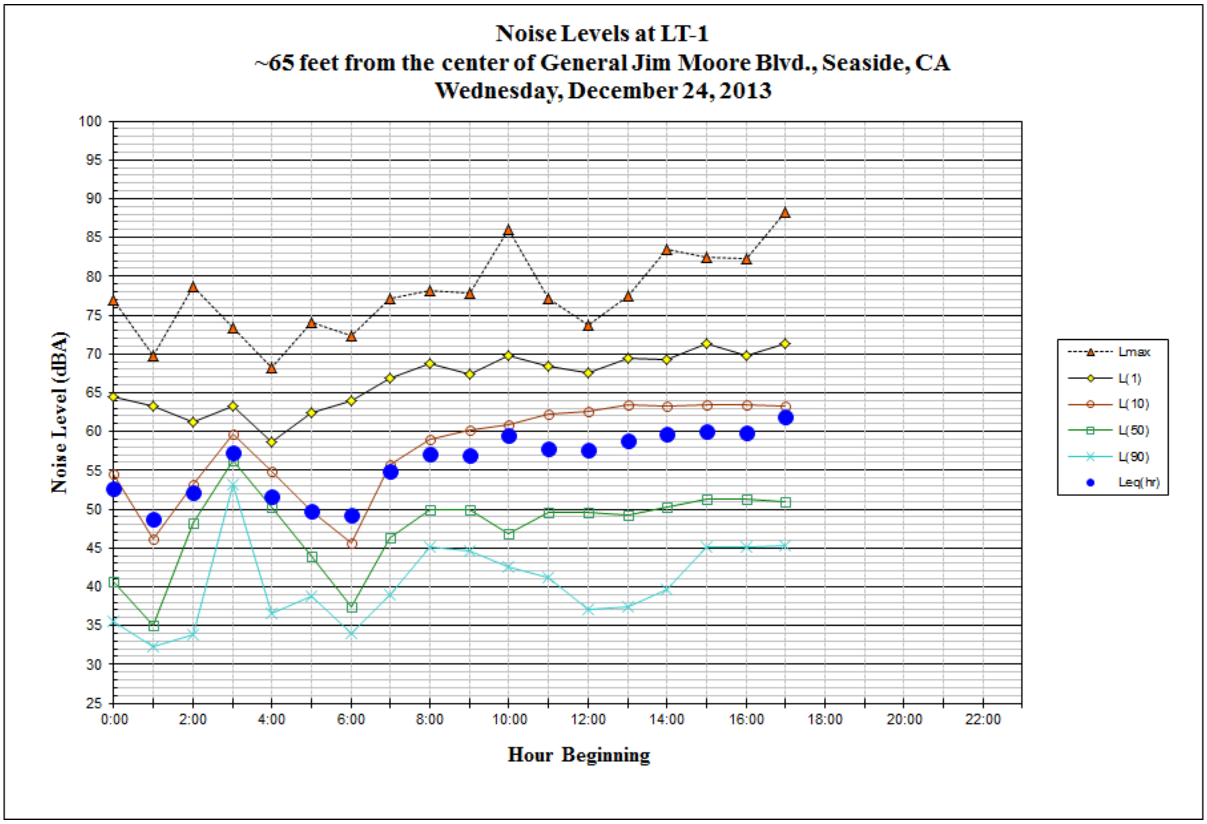
Noise Levels at LT-1
~65 feet from the center of General Jim Moore Blvd., Seaside, CA
Sunday, December 22, 2013
Noise Level (dBA)
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Leq(hr)
61 dBA Ldn

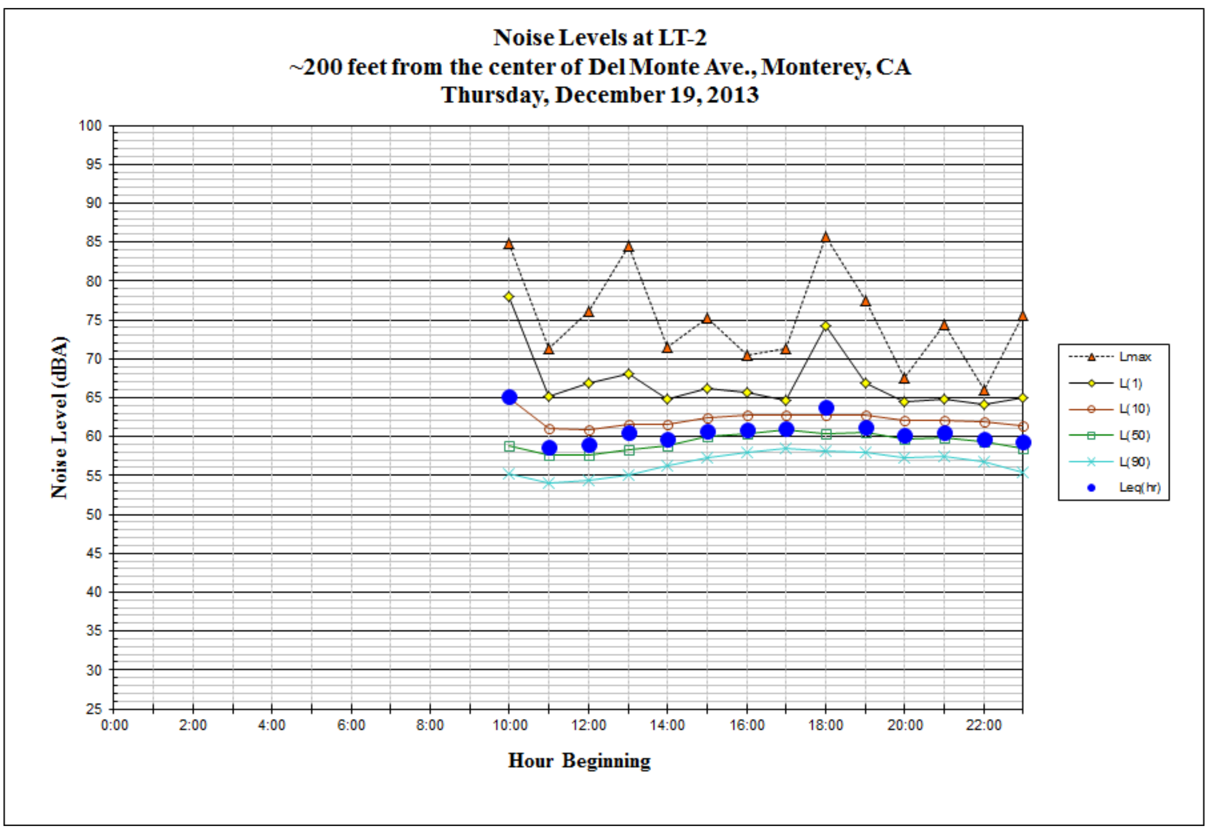


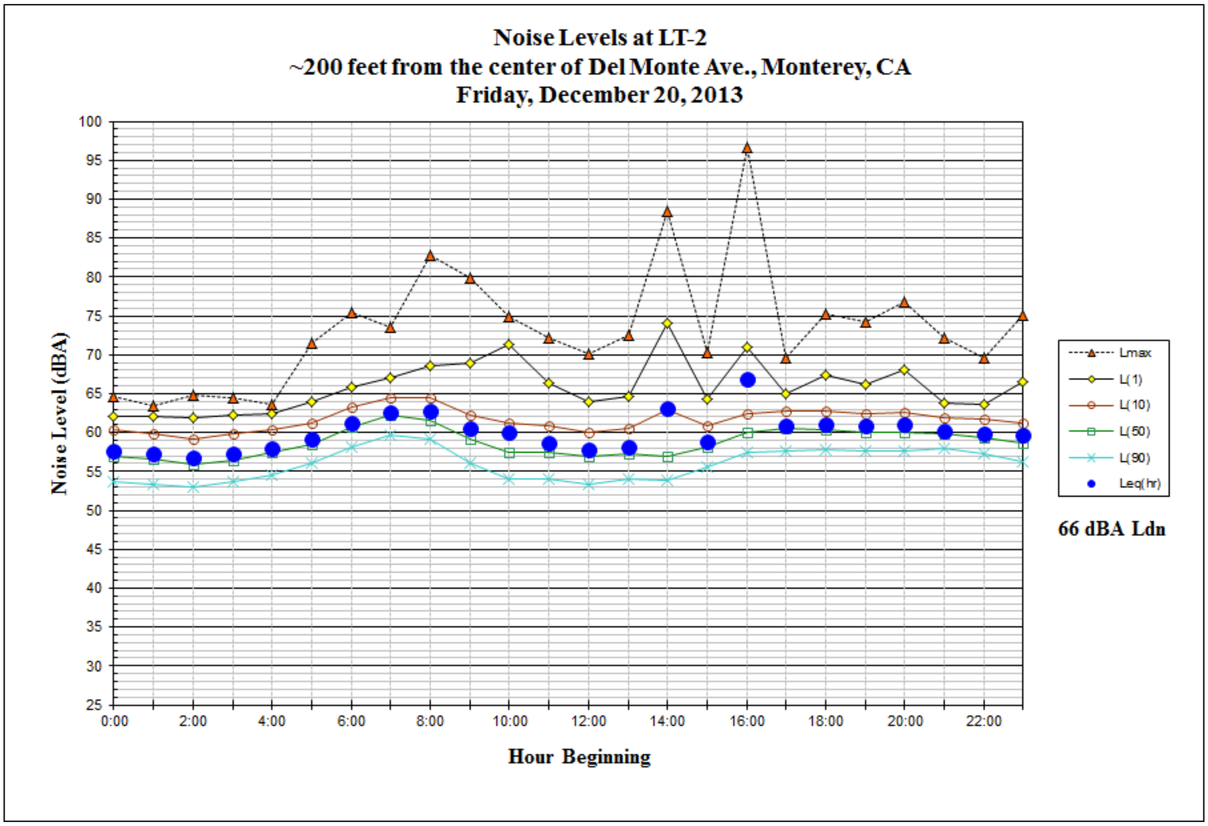
Noise Levels at LT-1
~65 feet from the center of General Jim Moore Blvd., Seaside, CA
Monday, December 23, 2013
Noise Level (dBA)
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Leq(hr)
63 dBA Ldn

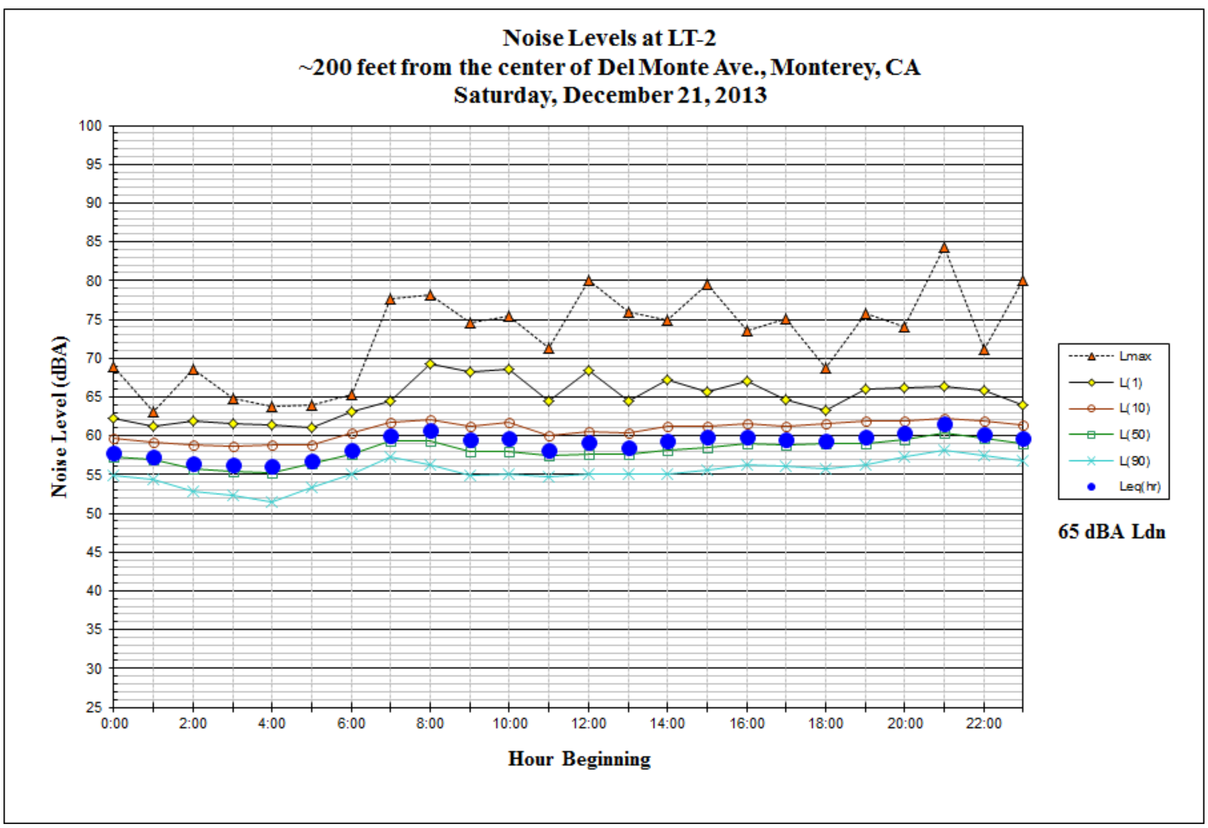
Noise Levels at LT-1
~65 feet from the center of General Jim Moore Blvd., Seaside, CA
Tuesday, December 24, 2013
Noise Level (dBA)
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Leq(hr)
62 dBA Ldn


Noise Levels at LT-1
~65 feet from the center of General Jim Moore Blvd., Seaside, CA
Wednesday, December 24, 2013
Noise Level (dBA)
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Leq(hr)

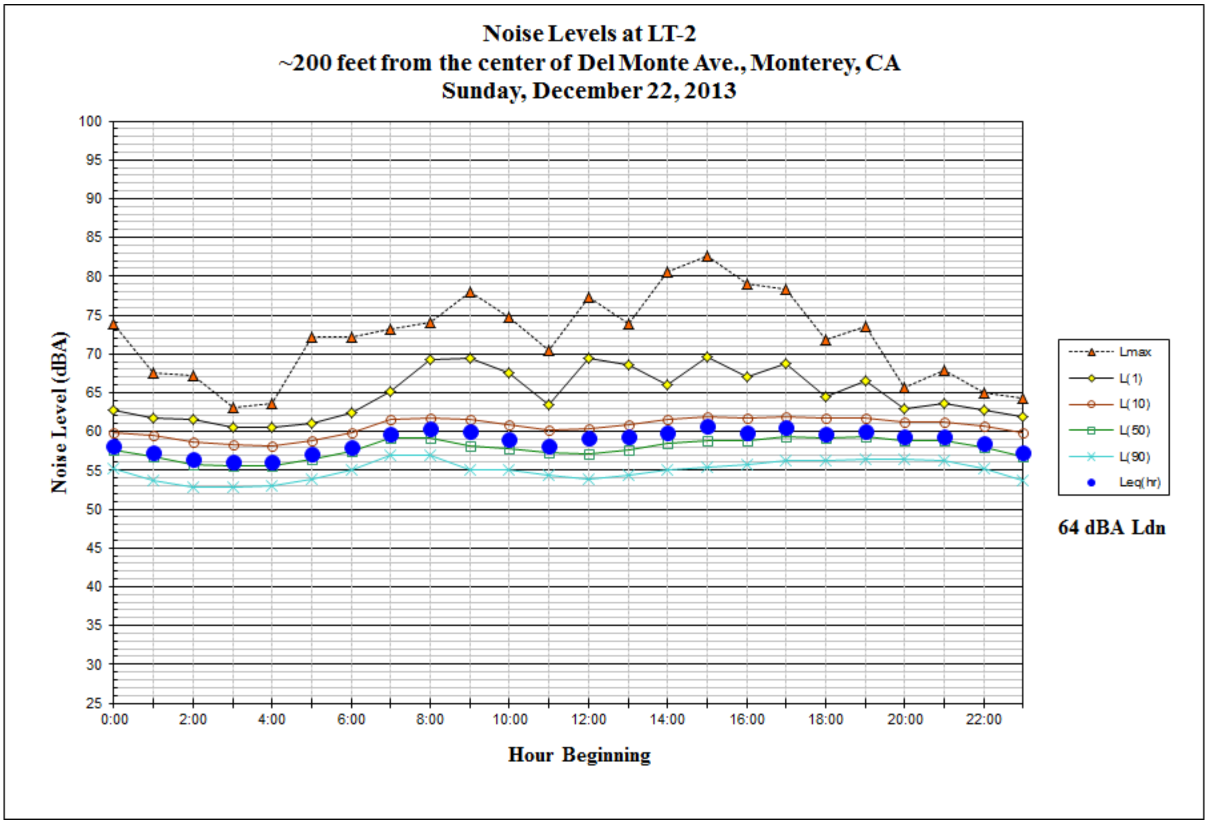

Noise Levels at LT-2
~200 feet from the center of Del Monte Ave., Monterey, CA
Thursday, December 19, 2013
Noise Level (dBA)
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Leq(hr)



Noise Levels at LT-2
~200 feet from the center of Del Monte Ave., Monterey, CA
Friday, December 20, 2013
Noise Level (dBA)
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Leq(hr)
66 dBA Ldn

Noise Levels at LT-2
~200 feet from the center of Del Monte Ave., Monterey, CA
Saturday, December 21, 2013
Noise Level (dBA)
Hour Beginning
Lmax
L(1)
L(10)
L(50)
L(90)
Leq(hr)
65 dBA Ldn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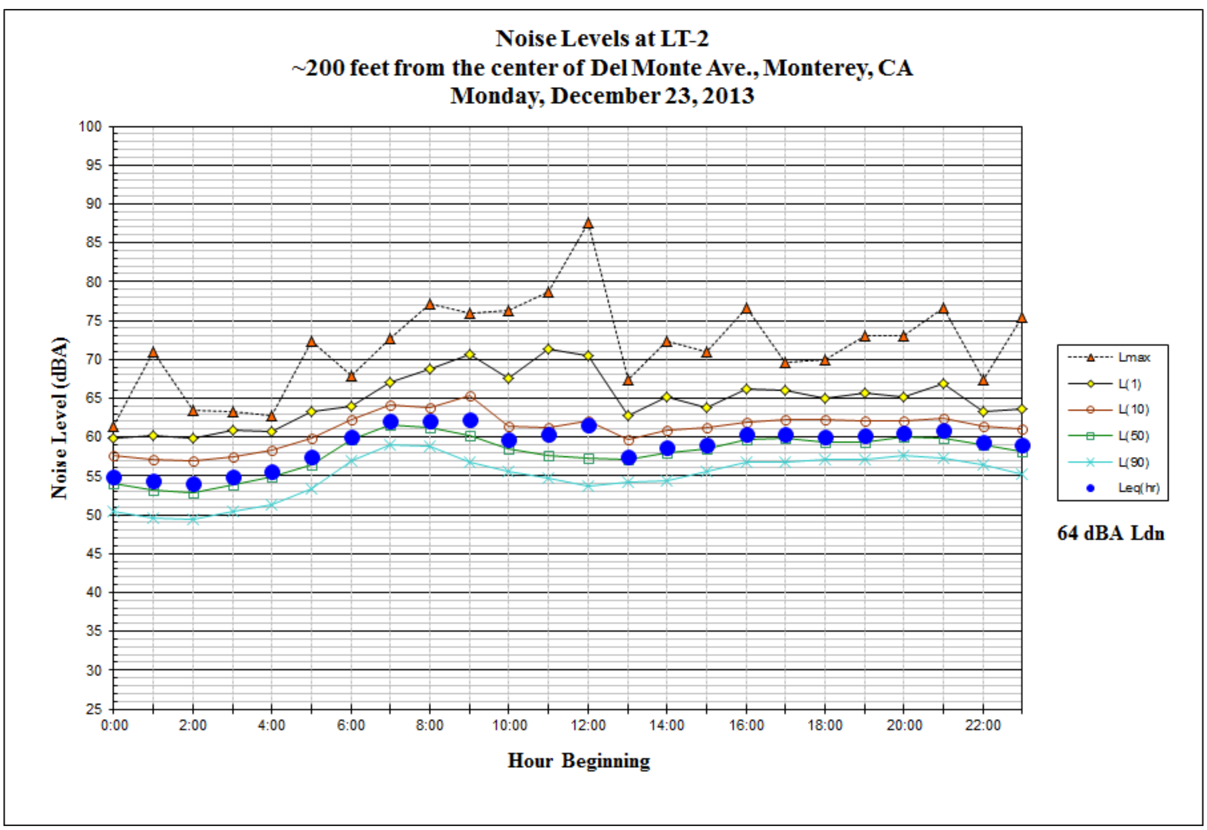
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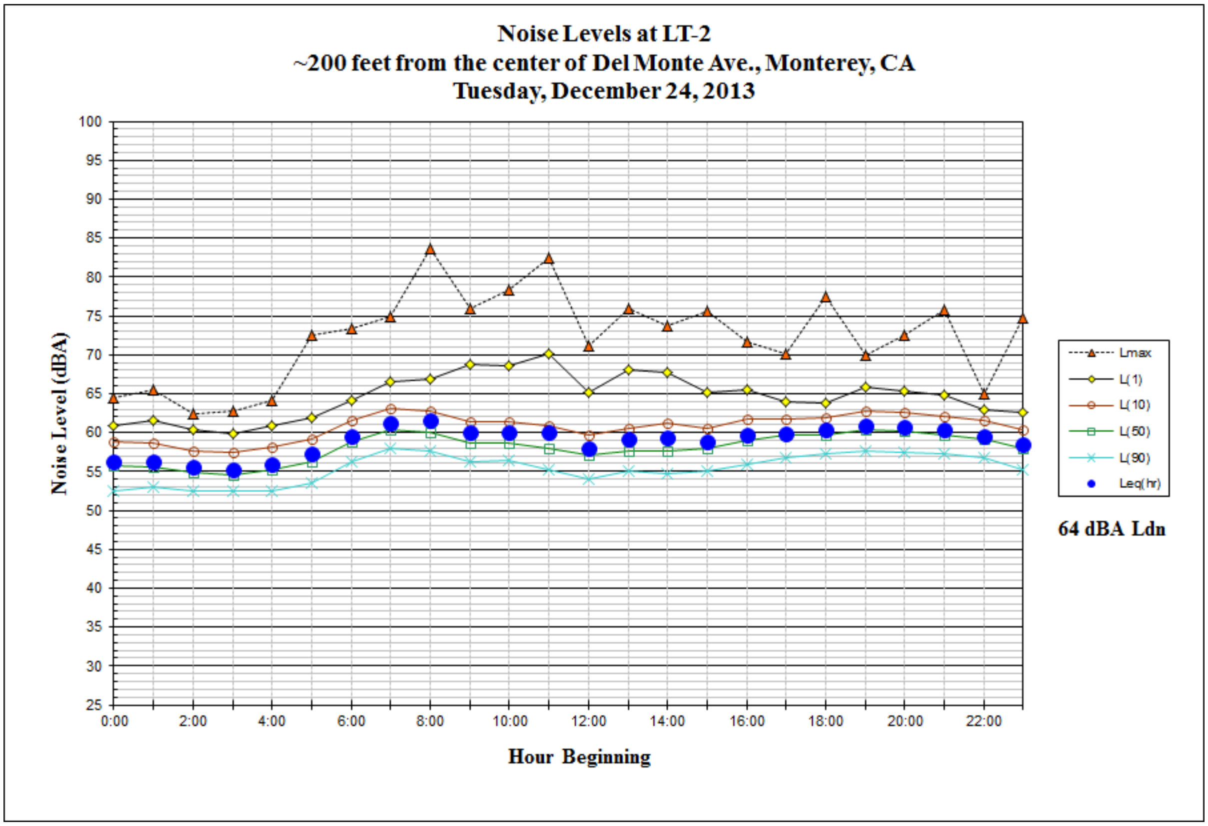
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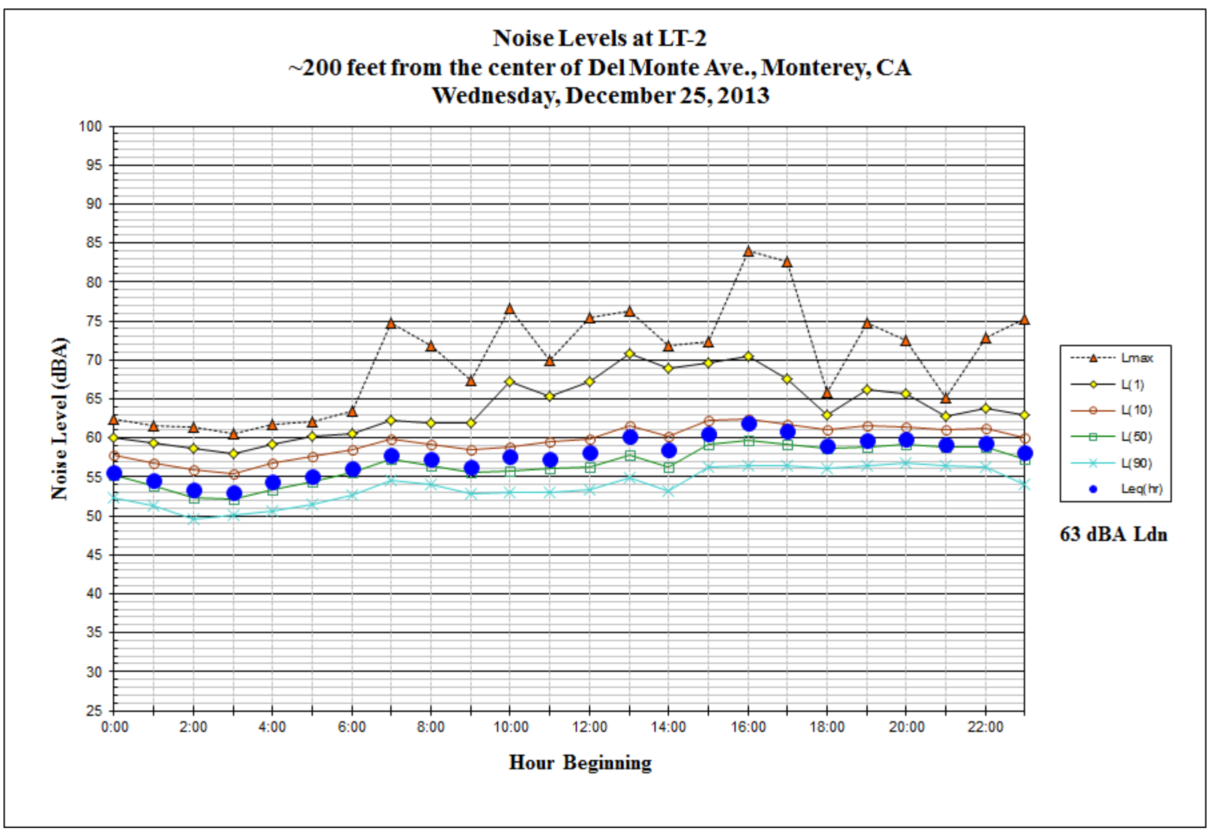
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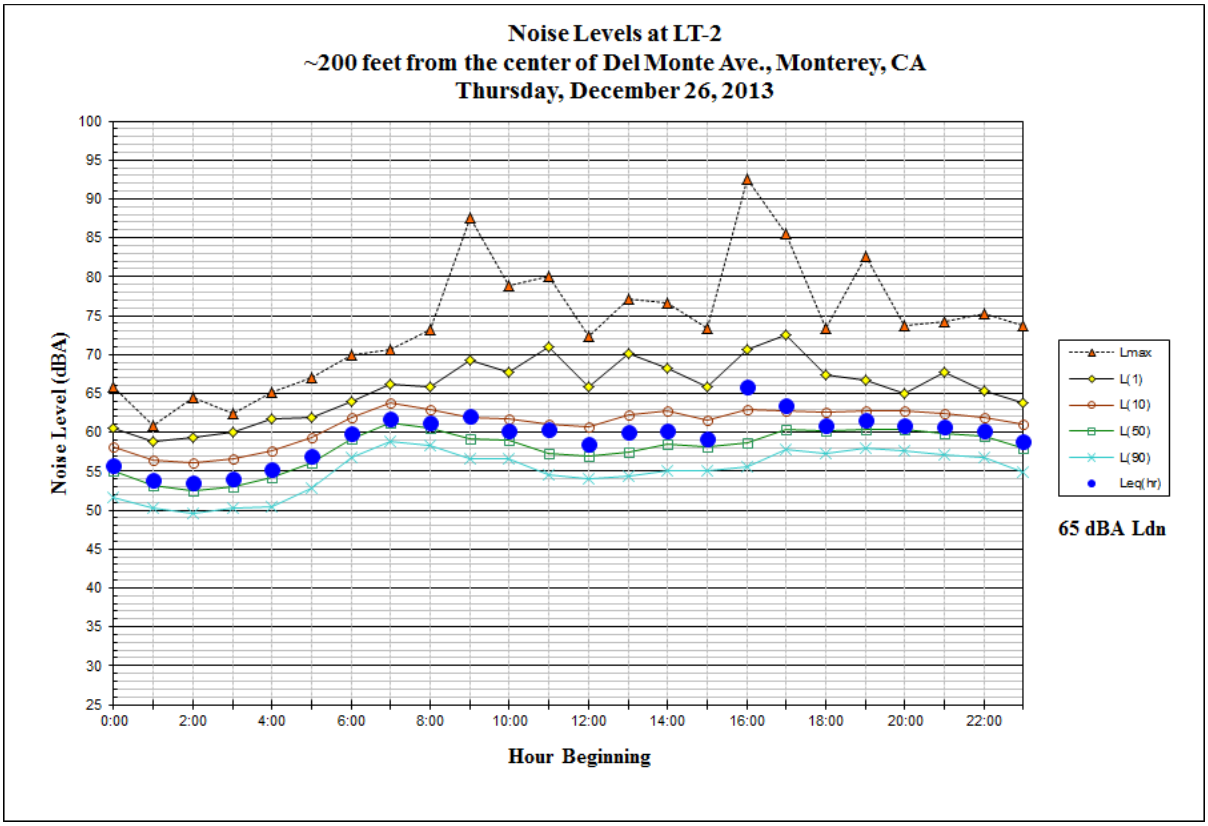
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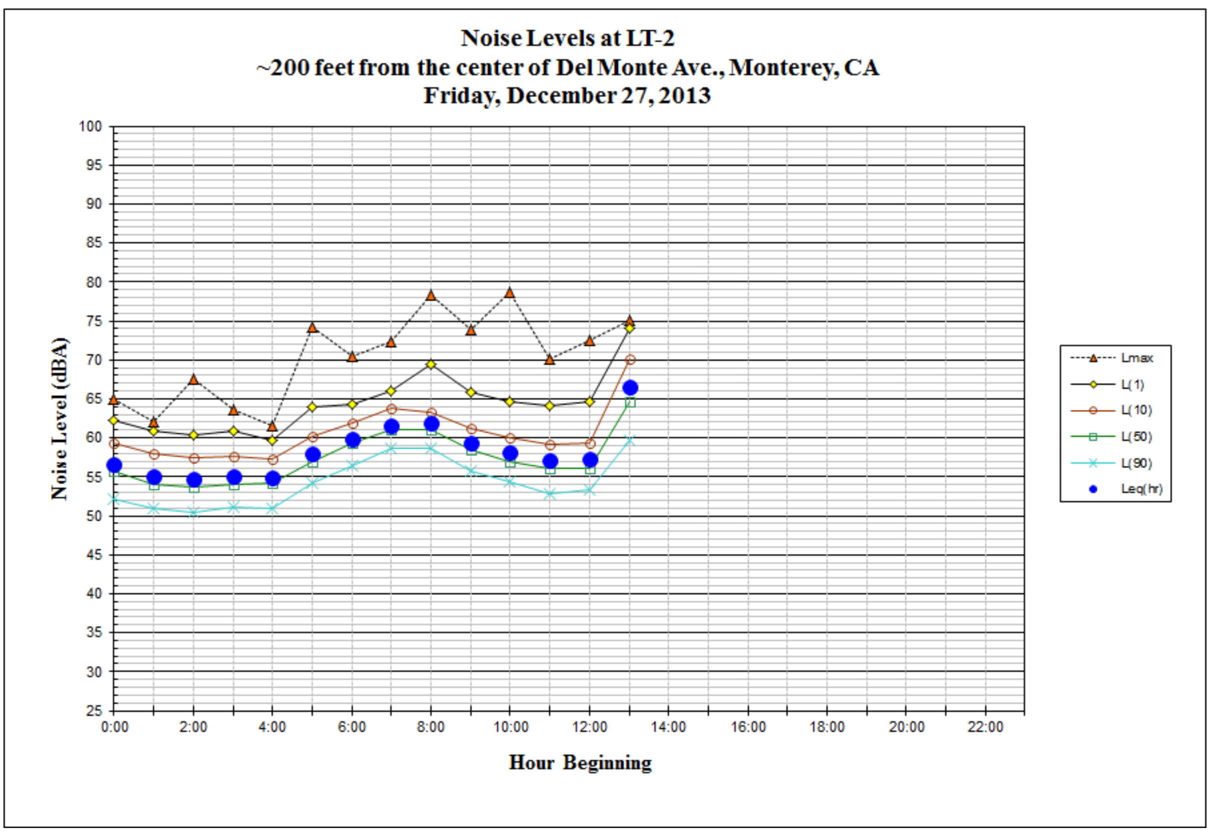
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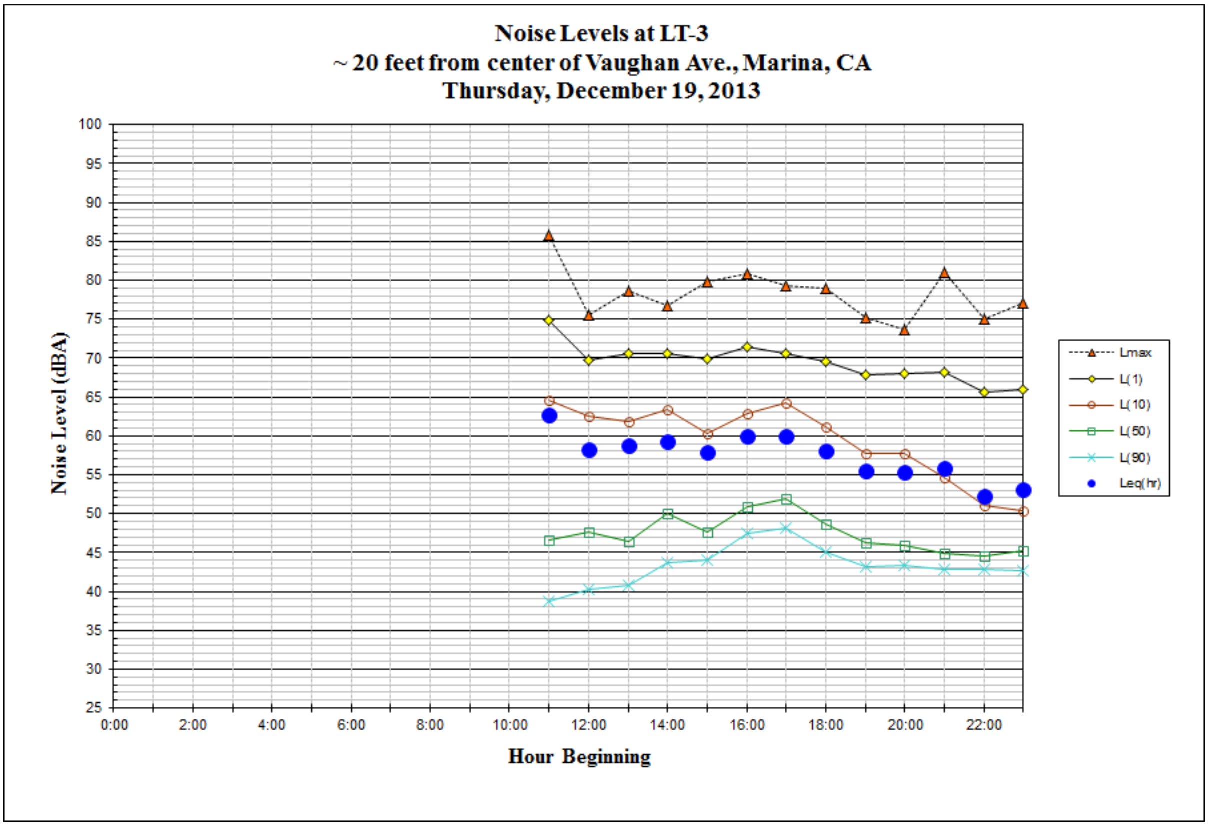
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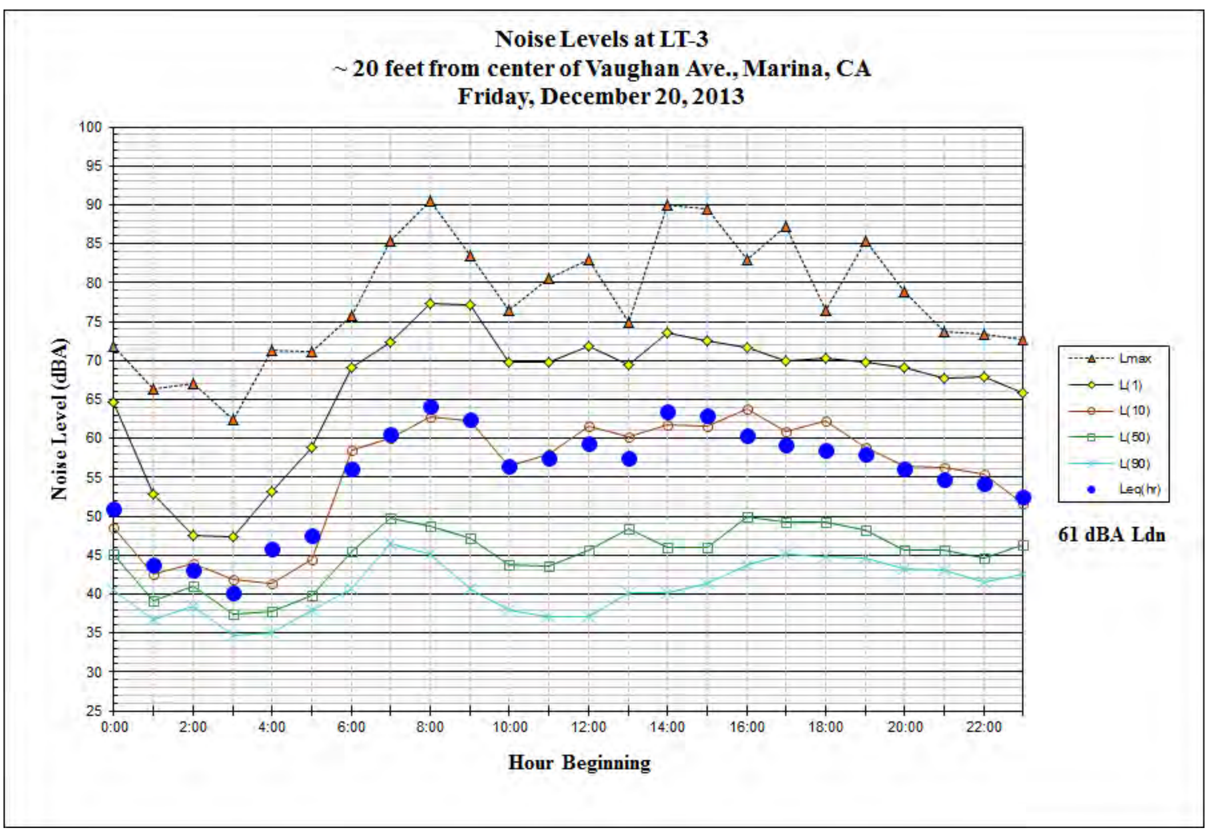
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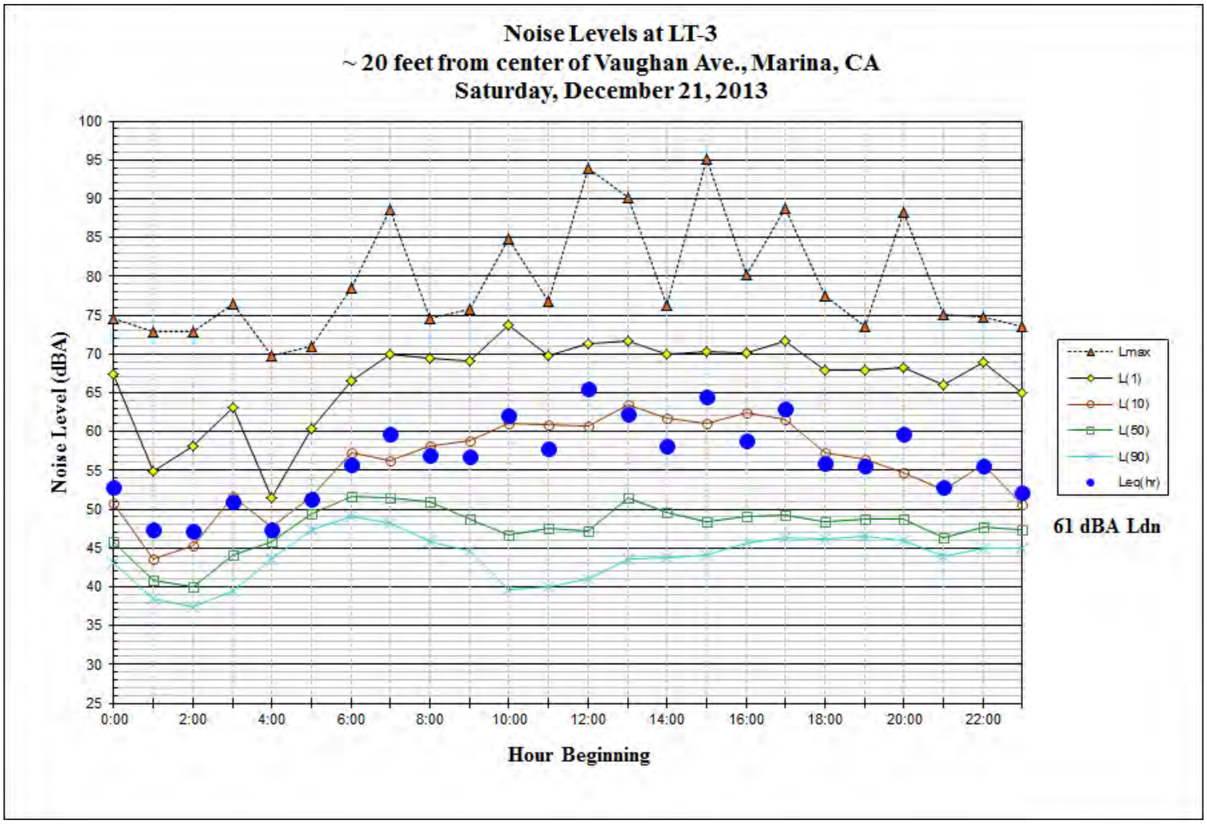
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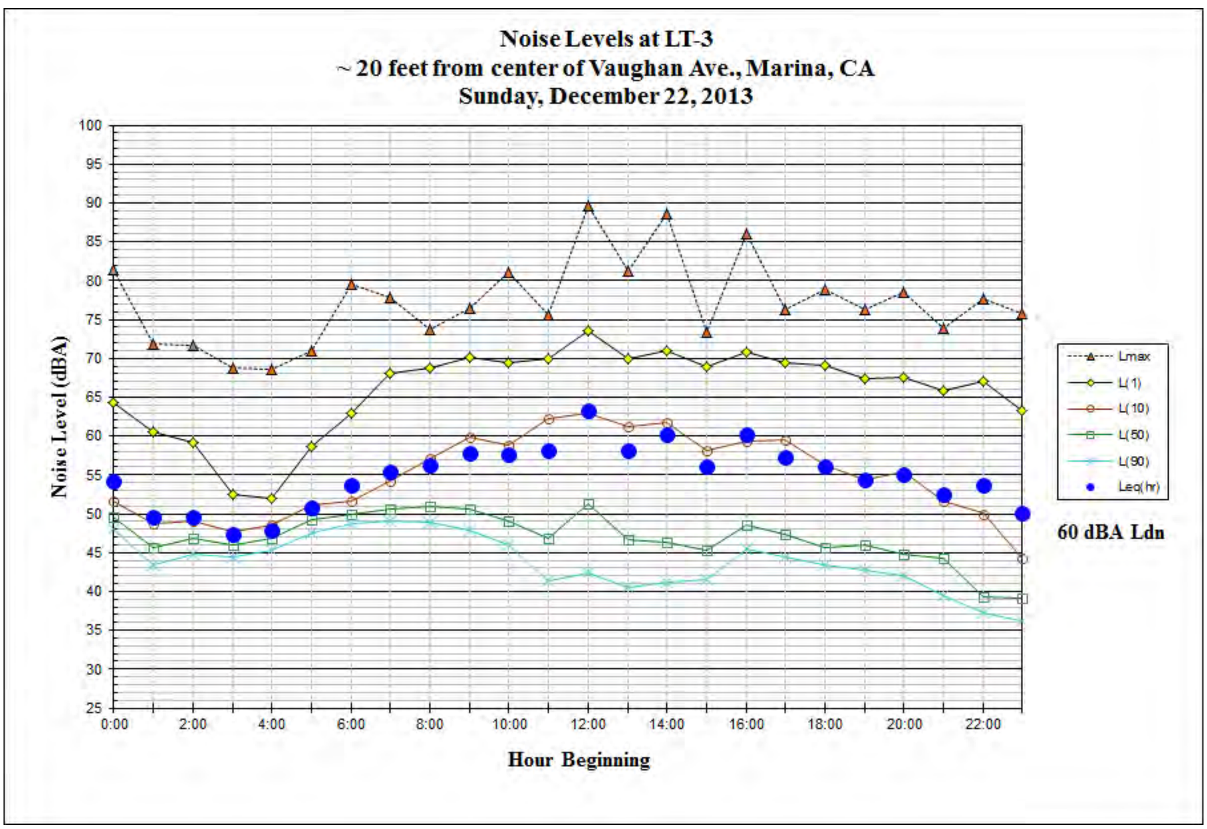
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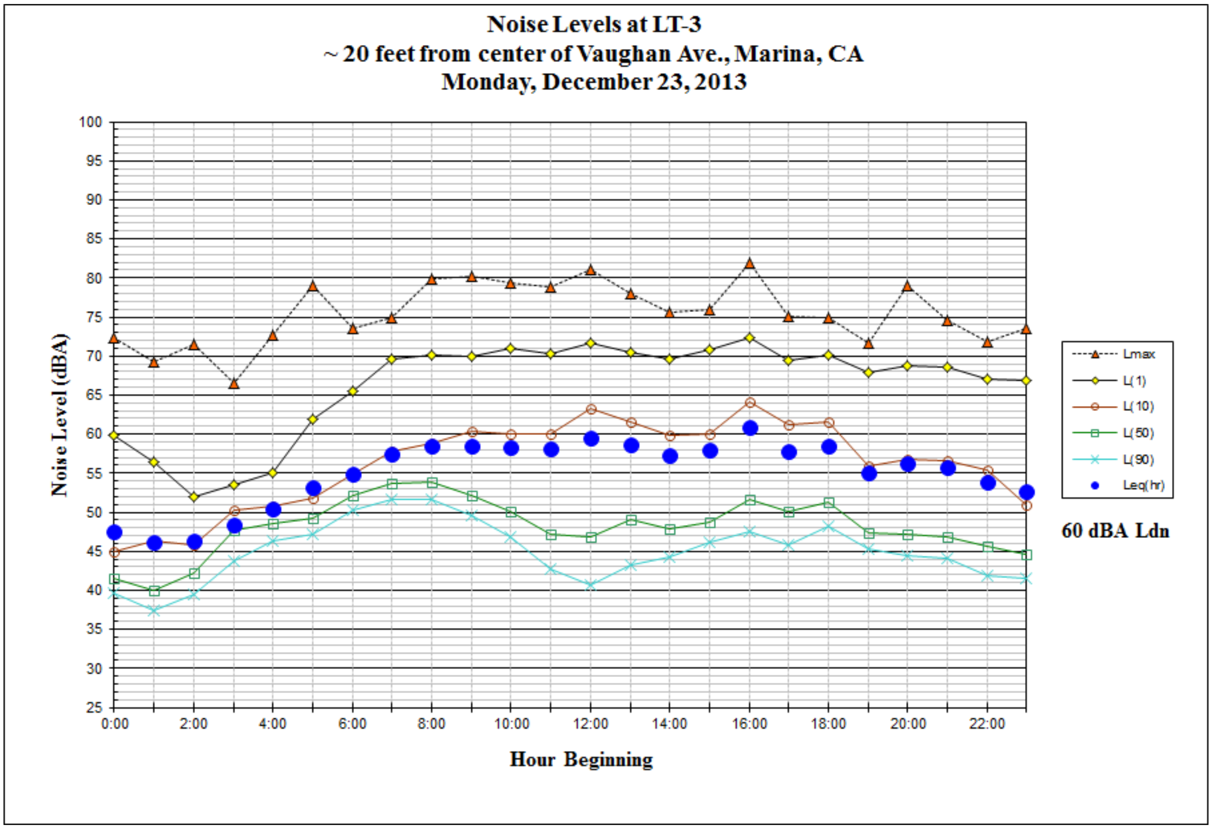
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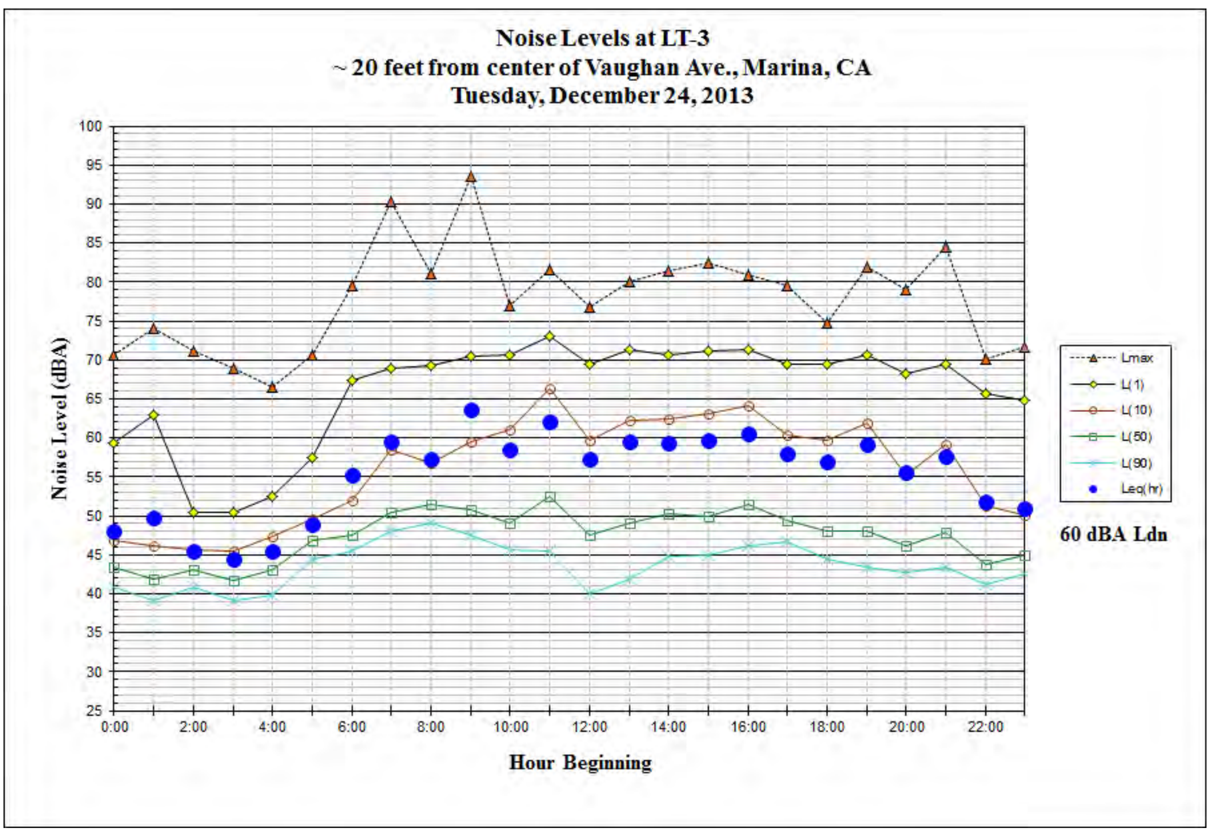
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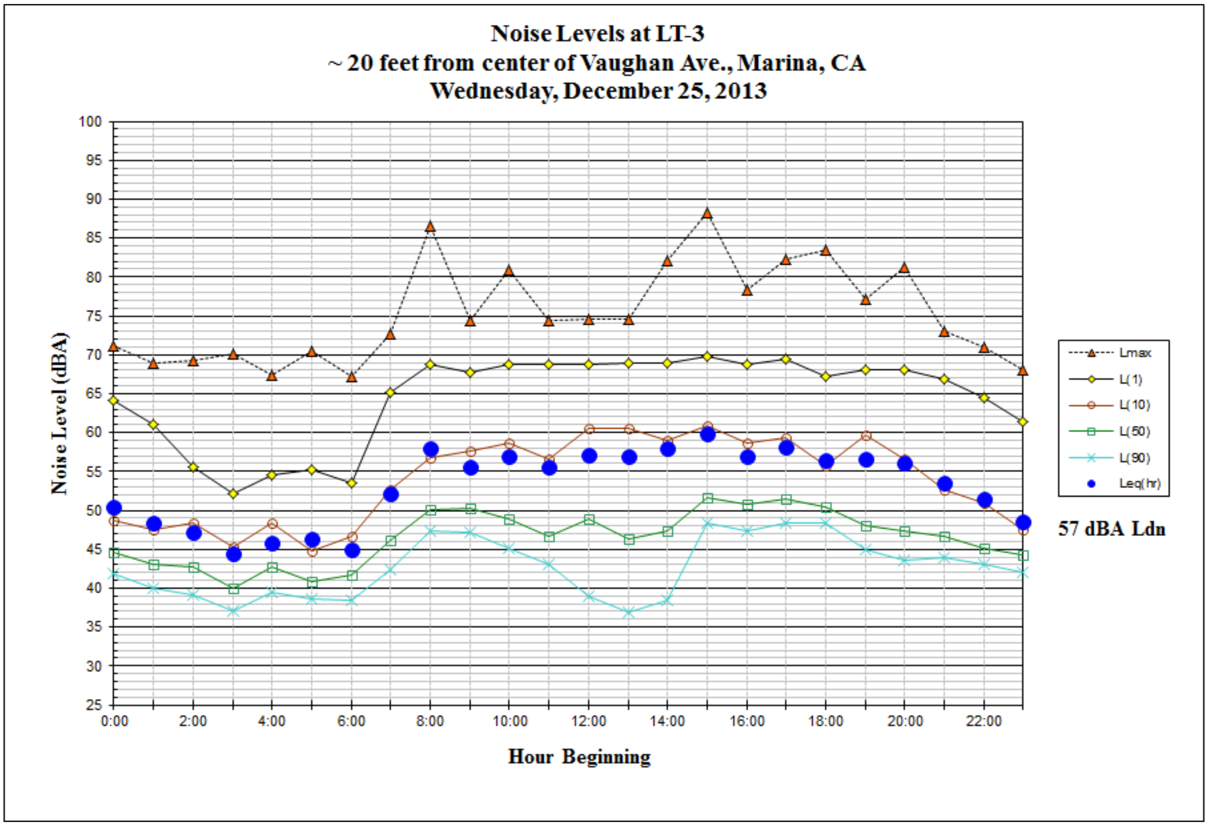
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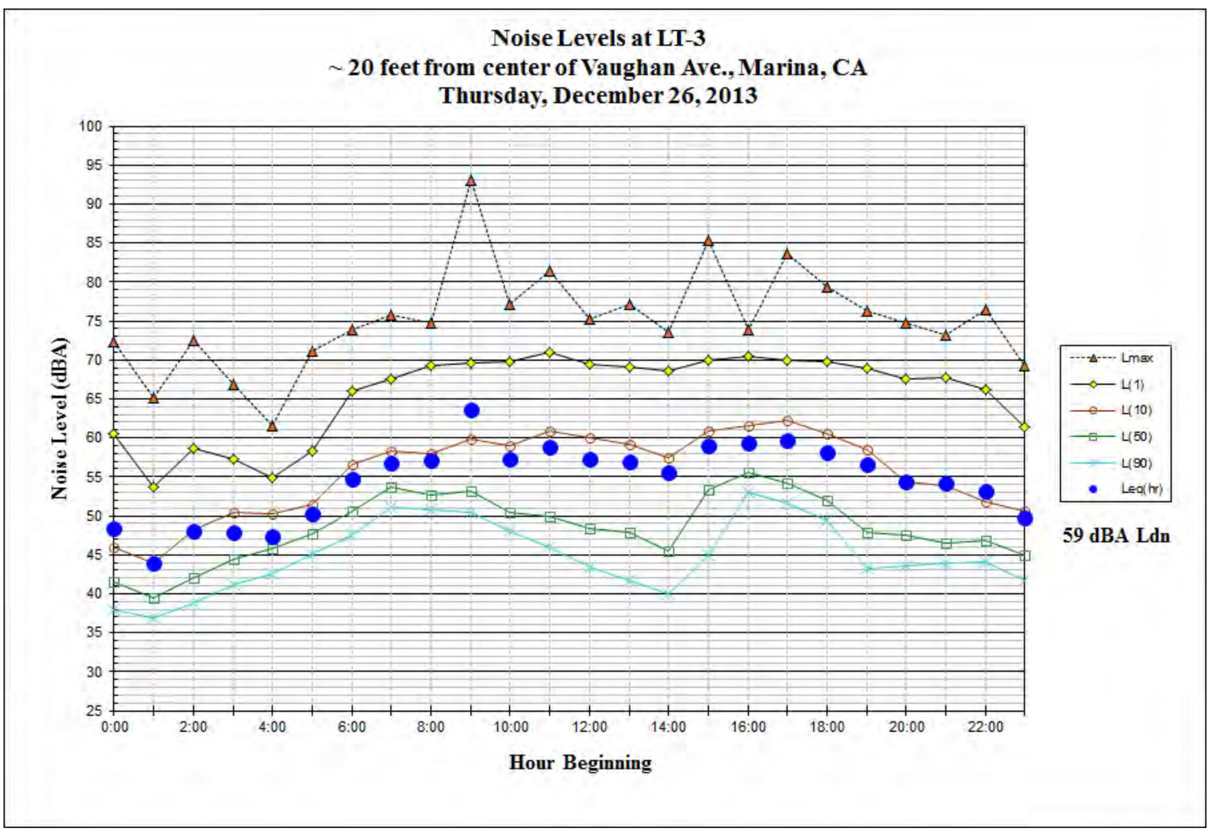
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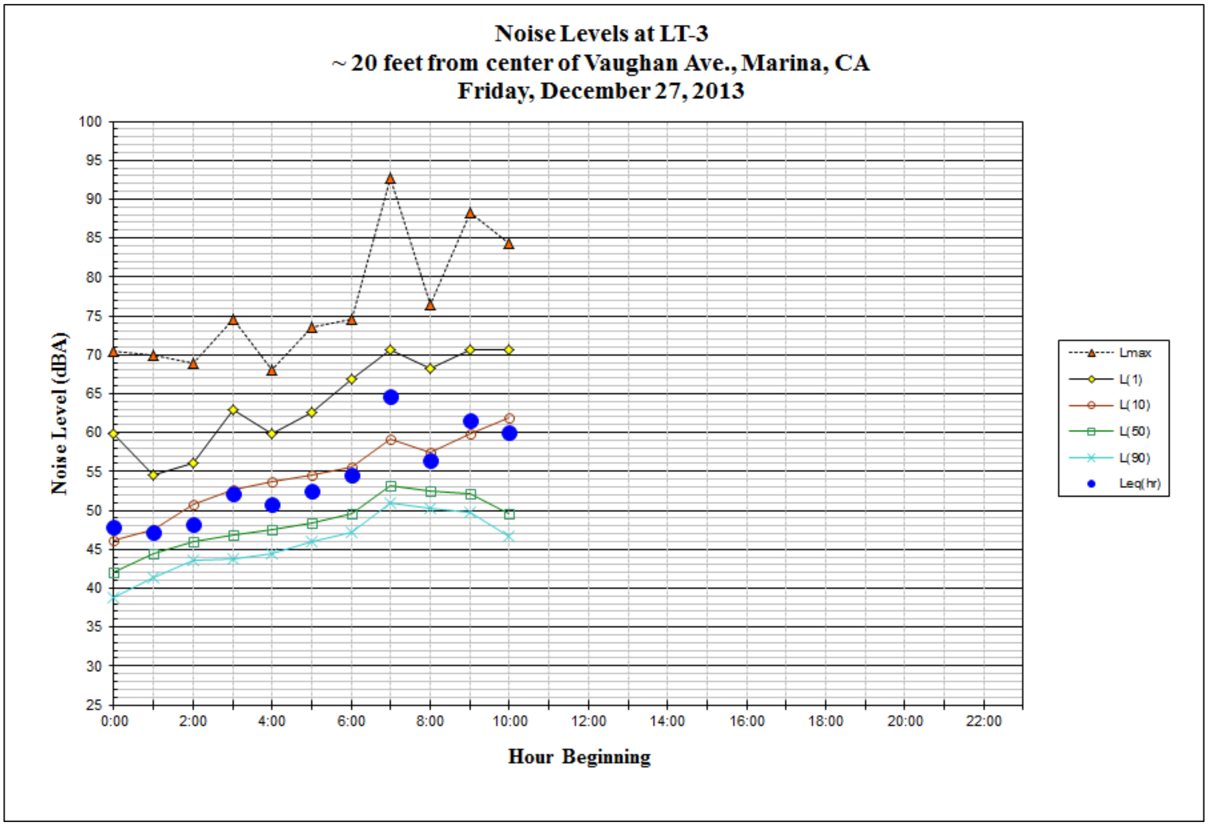
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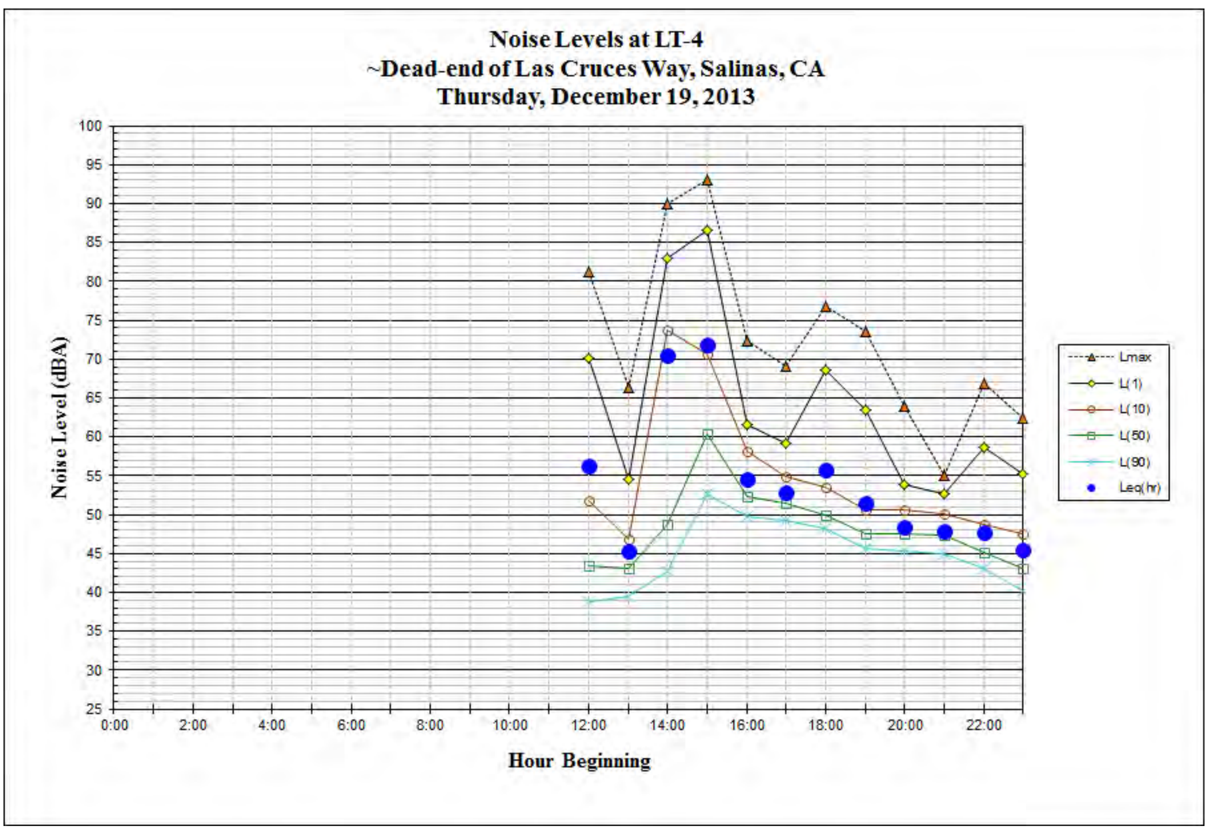
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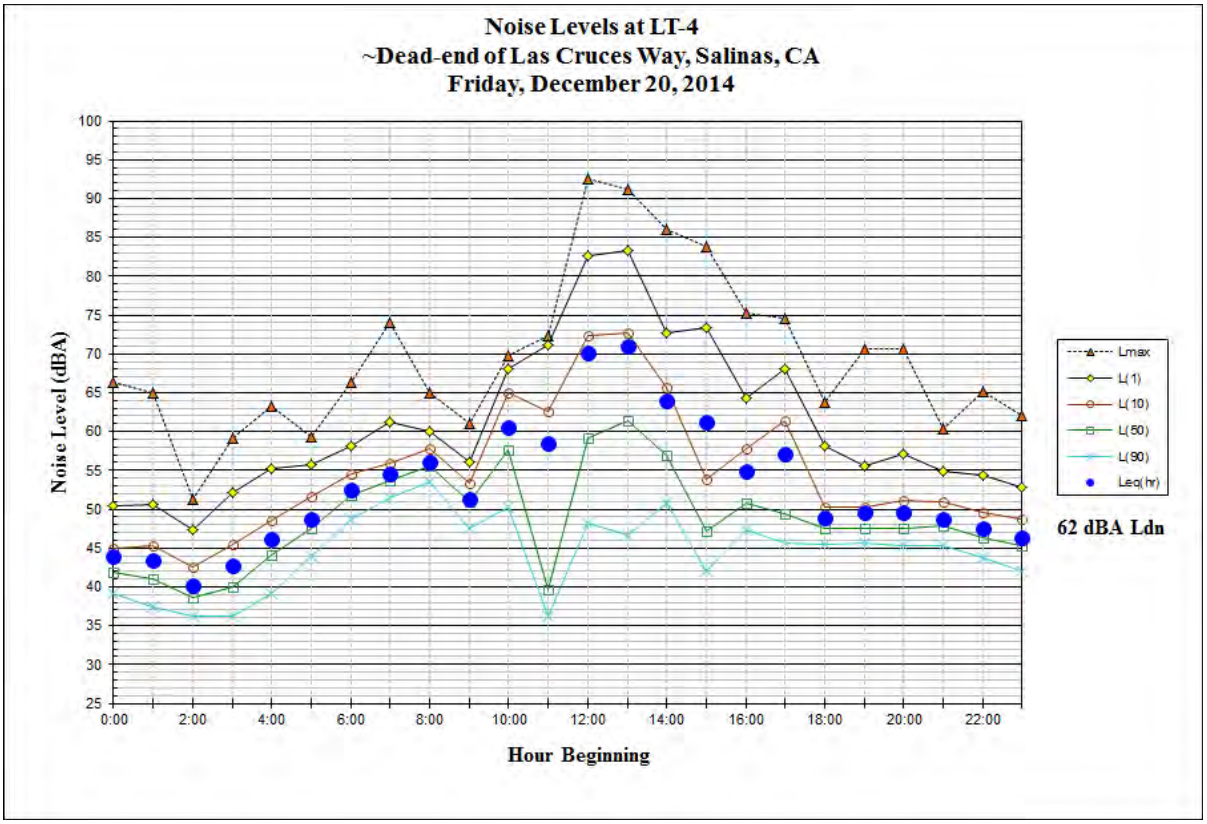
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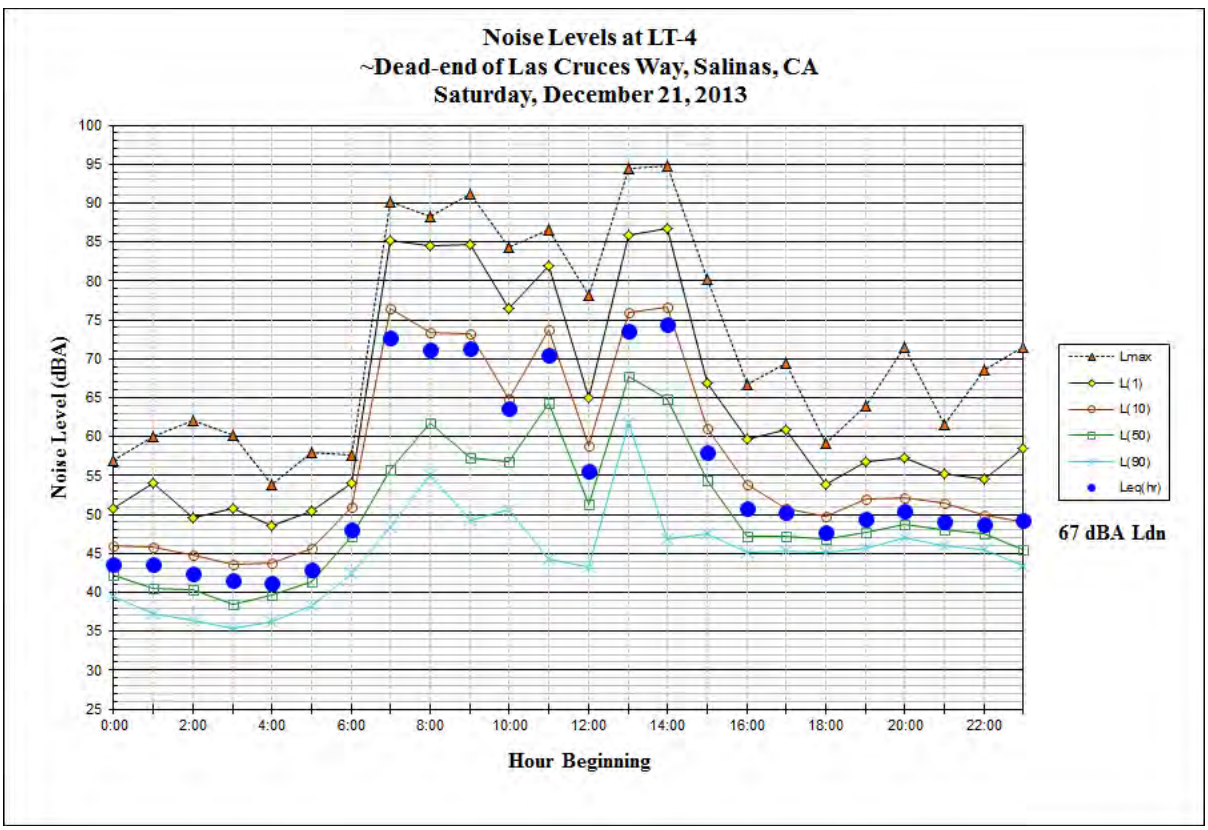
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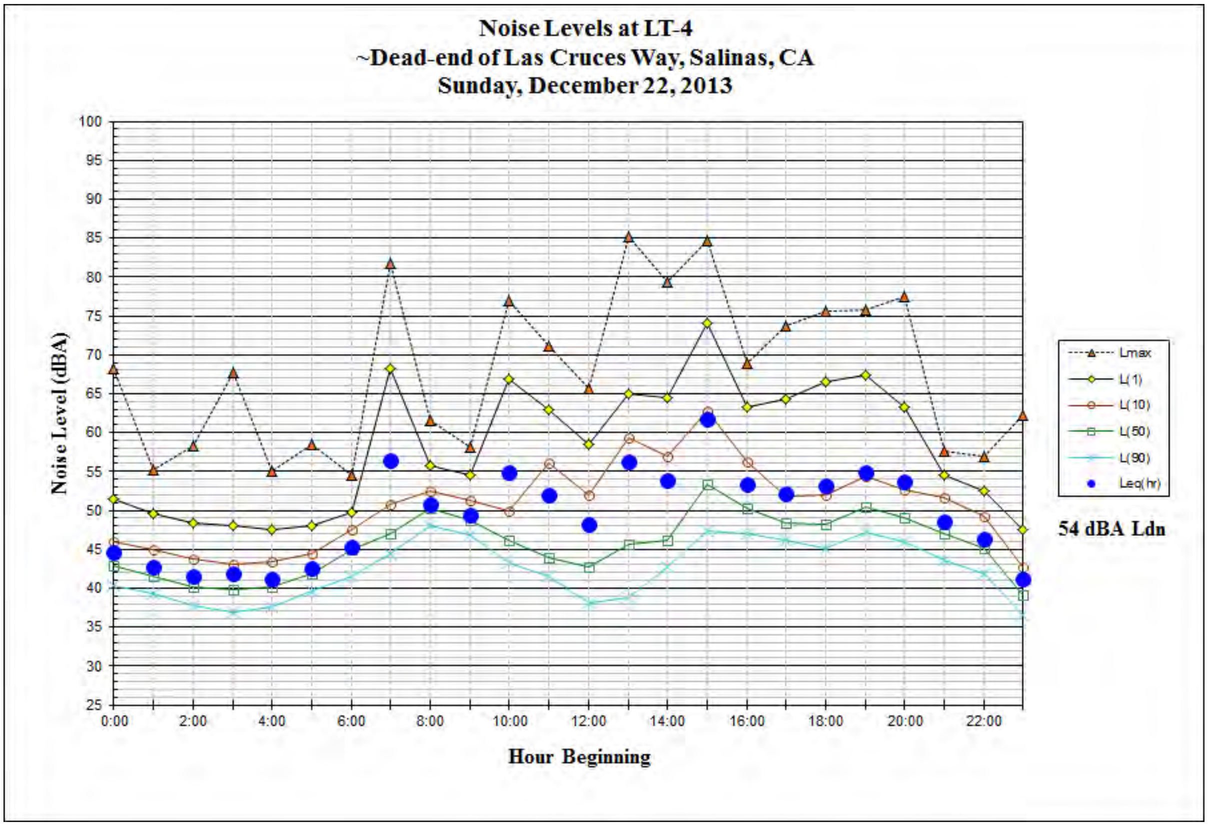
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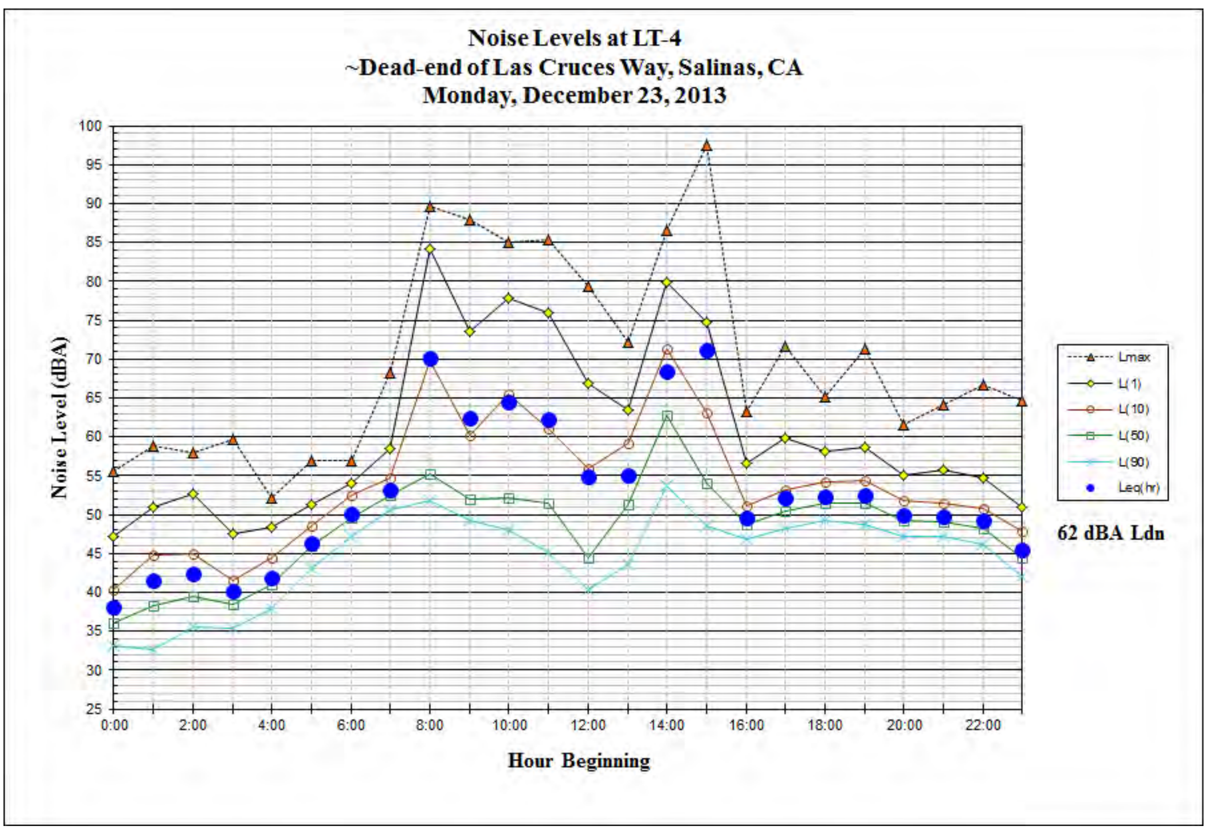
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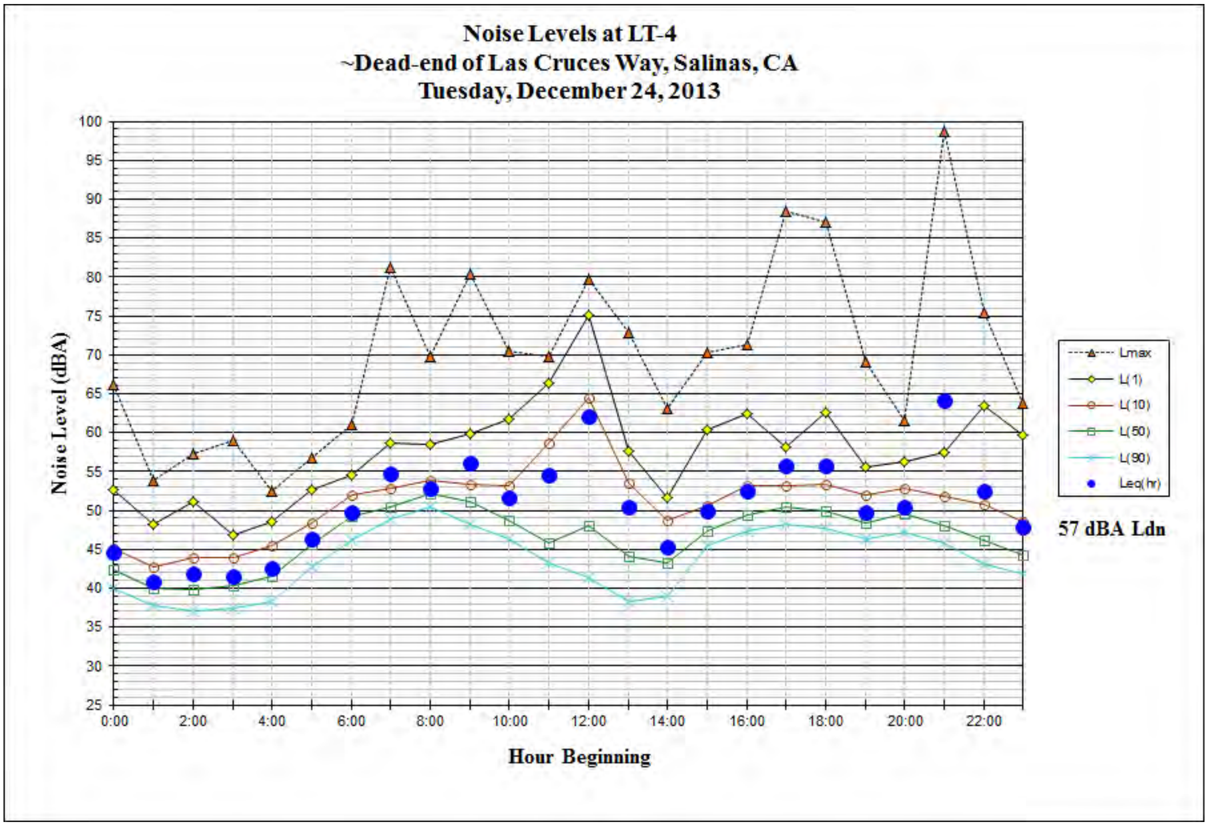

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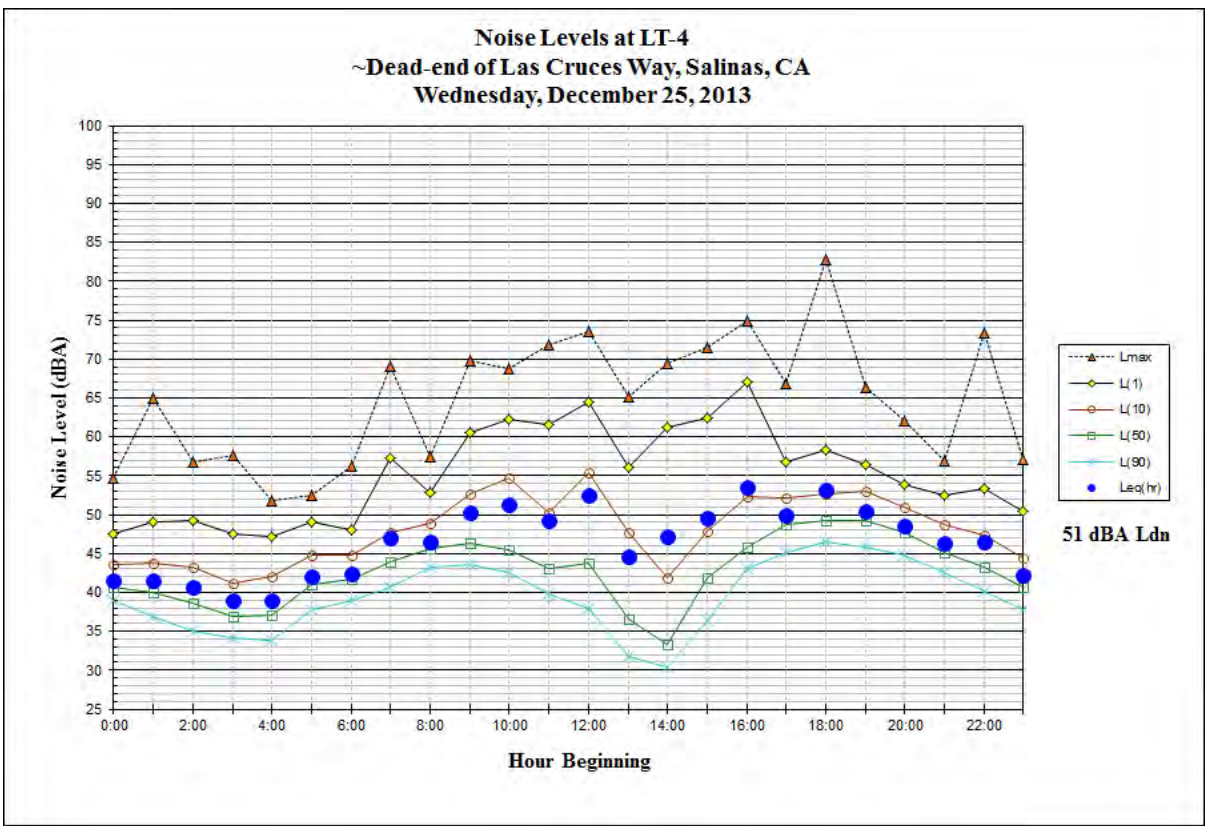

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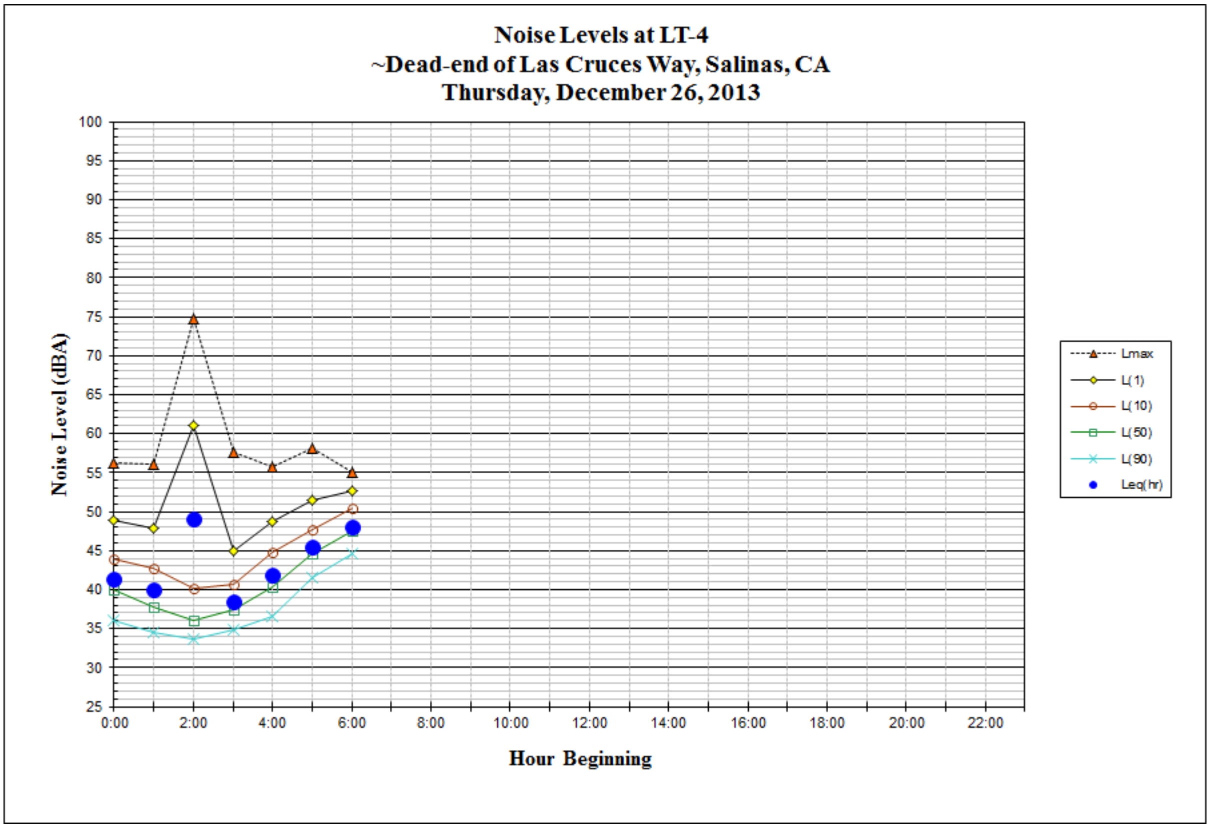

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**Appendix B: References**

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# Appendix X

# Regional Treatment Plant Wastewater Flow Projection Report

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June 16, 2014

Mr. Keith Israel
General Manager
Monterey Regional Water Pollution Control Agency
5 Harris Court
Monterey CA 9

Subject: RTP Wastewater Flow Projection Report

Mr. Israel:
This report presents the results of Brezack & Associates Planning, LLC (B&AP) development of forty-year wastewater flow projections to the Regional Treatment Plant (RTP). The purpose of this investigation has been to rationalize, quantify and extrapolate the observations by MRWPCA that influent to the RTP has been decreasing for the last several years.

Key to our analysis was the assistance of several MRWPCA staff including Mr. Robert Holden and Mrs. Jennifer Gonzales to whom we are grateful for their reviews of draft documents and provision of vital data.

Factors contributing to reduced wastewater flows have previously been assumed to include: the economic downturn to the regional economy; the high cost of urban water throughout the Monterey Peninsula; and, increased use of interior water conservation best management practices.

Rather than speculate on the future impact of potential causes, it was agreed that the project would base its forecasts of wastewater flows on the following two key data: population and per capita wastewater generation in the service area. A spreadsheet model was developed using historical population and flow data to produce a range of potential projections through the year 2055.

RTP flow is projected to decrease to a range of 19.2 to 17.1 mgd. After 2030, flows may increase to a range of highs between 24.3 and 22.7 mgd. The model included in this report facilitate MRWPCA's testing of data input values and the development of additional flow scenarios.

Sincerely,

James M. Brezack
President & Project Director

# MONTEREY REGIONAL WATER POLLUTION CONTROL AGENCY

40-Year Wastewater Flow Projections Report 2014 - 2054

June 2014

## Prepared by Brezack & Associates Planning, LLC

*Monterey Regional Water Pollution Control Agency 40-Year Wastewater Flow Projections Report*
Brezack & Associates Planning
40-Year Flow Projections Report.docx
JN: 14-002

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# LIST OF ABBREVIATIONS

AWWARF .................American Water Works Association Research Foundation (Water Research Foundation)

B&AP.........................Brezack & Associates Planning

CDP............................Census Designated Place

EMC...........................EMC Planning Group Incorporated

GPCD.........................Gallons per Capita per Day

mgd ............................Million Gallons per Day

MRWPCA..................Monterey Regional Water Pollution Control Agency

RTP ............................Regional Treatment Plant

# EXECUTIVE SUMMARY

The Monterey Regional Water Pollution Control Agency (MRWPCA) engaged Brezack & Associates Planning (B&AP) to produce a forty-year projection of wastewater flows to the MRWPCA Regional Treatment Plant (RTP). This report details the development and results of those projections.

MRWPCA staff has observed the trend of decreasing wastewater flows influent to the RTP. If this condition continues, available capacity at the RTP can become a valuable benefit to the service area in the following ways:

- New wastewater treatment capacity that can be allocated to new and planned development projects.
- Wastewater treatment capacity that can be reallocated to member entities with the greatest need.
- Treatment of dry weather flows from storm drains and the reduction or elimination of nuisance discharges.
- Treatment of wet weather flows from storm drains and a decrease in discharges to the ocean and to Areas of Special Biological Significance (ASBS).
- Increases in wastewater and storm water that can be recycled to serve as source waters for agricultural and landscape irrigation and groundwater replenishment.

Accurate predictions of long-term capacity availability at the RTP is a critical first step in planning for these and other benefits.

The estimation of long-range projections in wastewater flows is an imprecise science subject to numerous variables. The longer the planning horizon is, the more difficult it becomes to make reliable projections. Typically, wastewater projections in California are made within the ten-year horizon of a City's General Plan and or the twenty-year horizon of an Urban Water Management Plan. This investigation attempts to estimate projected wastewater flows forty years into the future, past the anticipated build-out of the service area.

Demographics, employment, water use and conservation trends, as well as local and regional economic factors all play a role in determining the volume of wastewater generated by any community. The MRWPCA service area is not a homogenous community that can be easily characterized. The economic and demographic characteristics of each of the twelve communities that comprise the MRWPCA regional wastewater service area results in additional challenges in predicting the total influent flows to the RTP.

Therefore, one important element of this investigation was the development of a simple process to regularly review and update its conclusions. This was done by the preparation of a spreadsheet model presented in Appendix G of this report.

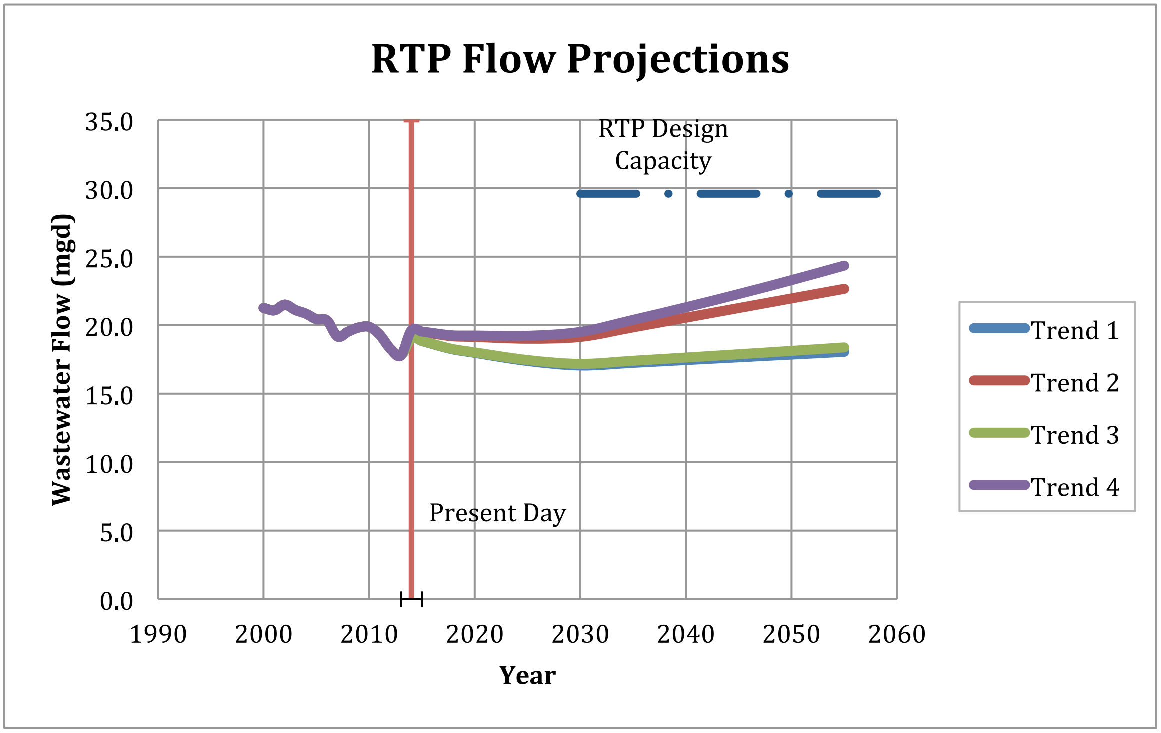
Historical population and wastewater flow data was used to create a spreadsheet model to calculate a range of potential wastewater flow projections. Using recorded pump station data, average wastewater flow generated per person in units of gallons per capita per day (GPCD) was calculated for the years 2000 through 2012. Trends in population and GPCD were projected forward to the year 2055. Wastewater flow projections for each community in MRWPCA's service area were calculated from these trends.

The conclusion of this investigation is that wastewater flows to the RTP are projected to decrease to a minimum value in the year 2030. This decease is predicted as the result of increased water conservation, raising water rates and regional economic factors. Wastewater flows to the RTP may then range between 17.1 and 19.2 mgd. This investigation projected four trends of population growth based on data (Table ES-1). The high RTP wastewater flow trends that may occur in 2055 due to projected population growth are 22.7 and 24.3 mgd. The forty-year projected wastewater flows to the RTP are shown in Figure ES - 1. By 2055, the high trend values of average wastewater flows to the RTP are projected to range from 82% to 77% of design capacity, leaving 23% to 18% capacity availability at the RTP for treatment of additional wastewater, dry weather, or storm water flows.

**Table ES - 1: Description of Population Trends Used to Produce Range of Wastewater Flow Projections**

| Legend Entry | Description |
|---|---|
| Trend 1 | A linear curve is fitted to data from year 2000 to 2012 |
| Trend 2 | A linear curve is fitted to data from year 2006 to 2012 |
| Trend 3 | An exponential curve is fitted to data from year 2000 to 2012 |
| Trend 4 | An exponential curve is fitted to data from year 2006 to 2012 |

**Figure ES - 1: RTP Wastewater Flow Projections**




The following recommendations are made to further refine the wastewater projections for the RTP and the service area communities:

1. Routinely make updates to the flow projections by recording and projecting pump station flows and the populations by community. This should be done on a three to five year cycle.
2. Recalibrate the models as new data becomes available.
3. Use a Geographic Information System (GIS) to refine service area populations and sewershed boundaries to determine precisely any differences in the boundaries of MRWPCA service areas, areas contributing flow to each pump station, and the city and census designated place (CDP) boundaries defined by the U.S. Census Bureau.
4. Conduct wastewater flow monitoring and acquire potable water service connection information at the Seaside and Moss Landing pump stations to validate wastewater flow data.
5. Conduct wastewater flow monitoring for various land use types to acquire flow data per sewer connection by land use type.
6. Consult a demographer with knowledge of regional trends to produce additional population and GPCD projections.

7. Perform a study of the Fort Ord Pump Station, to refine its contributing sewershed. This will allow for the projection of population growth, GPCD decline, and wastewater flow specific to the Ord Pump Station.

# 1 PURPOSE

The Monterey Regional Water Pollution Control Agency (MRWPCA) retained Brezack & Associates Planning (B&AP) to prepare a 40-year projection of wastewater flow from its service area to the Regional Treatment Plant (RTP) in Marina, California. The RTP has a permitted treatment capacity of 29.6 mgd. Influent flow to the RTP has been decreasing over the past several years and is believed to be the result of regional economic conditions and water conservation factors. This report presents the development and results of the 40-year wastewater flow projections to the RTP.

A spreadsheet model was created to calculate future wastewater flows based on service area populations and per capita wastewater generation rates.

MRWPCA manages a regional wastewater system that provides centralized wastewater treatment for cities and communities throughout portions of Monterey County as shown in Figure 1. A network of wastewater pump stations and pressure pipelines convey wastewater to the RTP for treatment and recycling. Figure 2 is a schematic diagram of the relationship between the major service area pumping facilities. Many of the pump stations are located at former wastewater treatment plants and were repurposed when the regional system was developed.

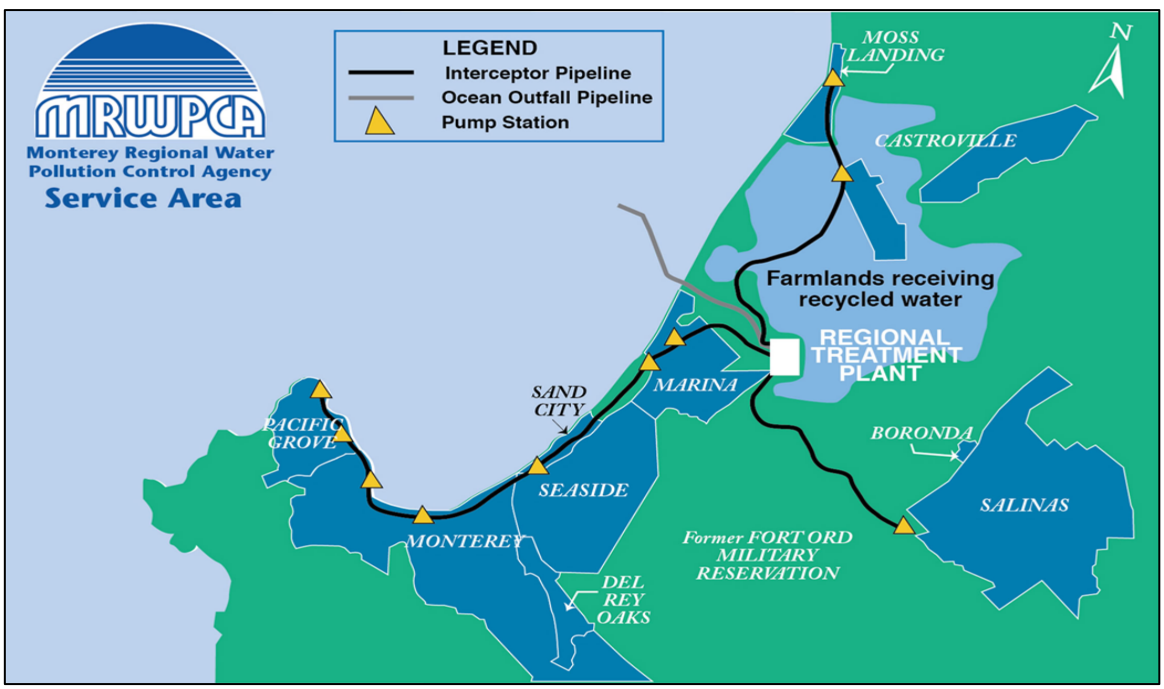



**Figure 1: MRWPCA Service Area**

| Facility Name | Flow Rates (MGD) ADWF | PWWF |
|---|---|---|
| Monterey Interceptor (MI) Flows | 6.7 | 19.8 |
| Salinas Interceptor (SI) Flows | 11.8 | 15.0 |
| Castroville Interceptor (CI) Flows | 0.7 | 2.0 |
| Total RTP Influent Flows to Headworks | 19.2 | 36.8 |
| RTP Permitted Design Flows | 29.6 | 75.6 |

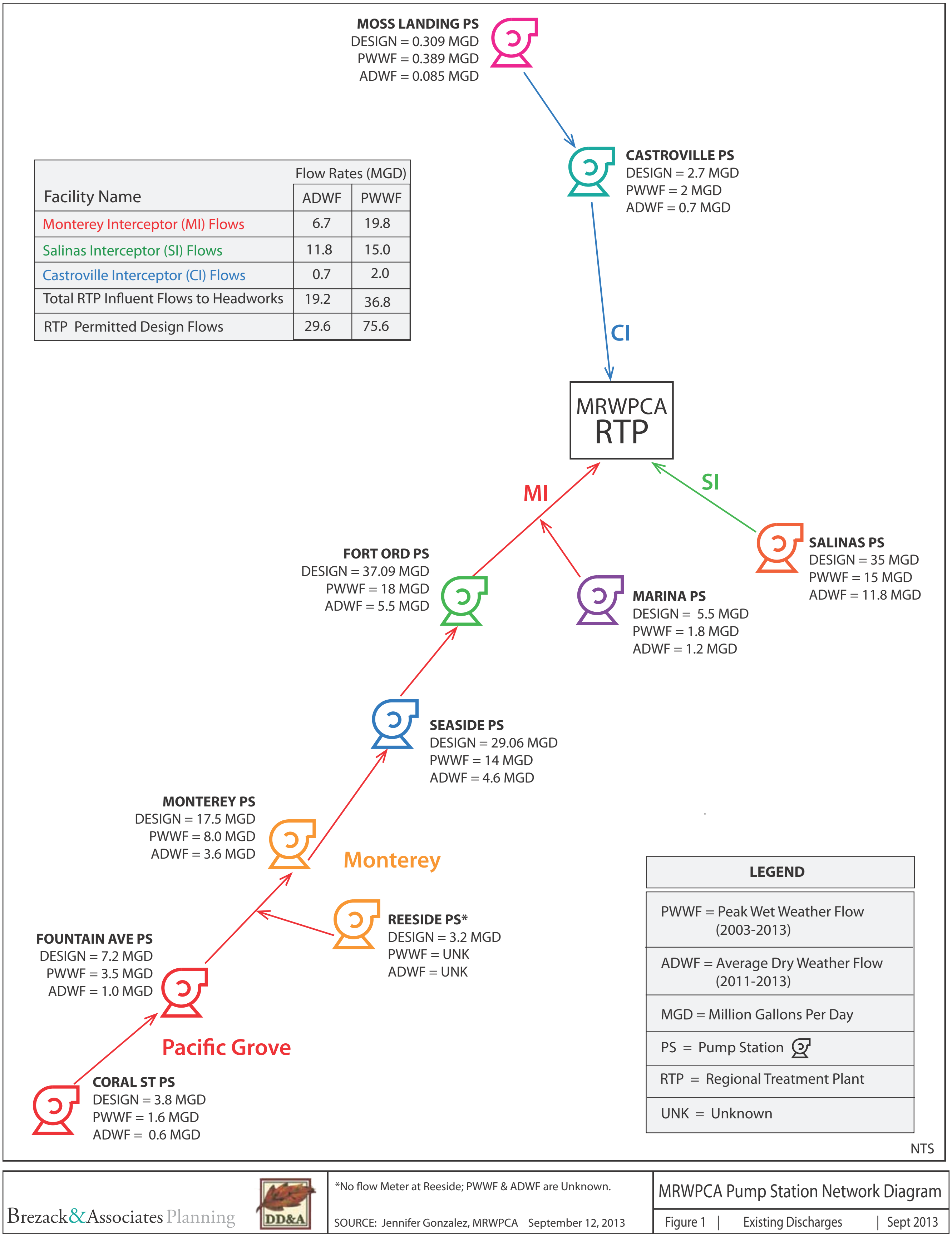



**Figure 2: MRWPCA Pump Station Network Diagram**

# 2 METHODOLOGY

The following wastewater projection methods were considered:

1. Analyzing trends in potable water prices.
2. Correlating economic trends and predictions of water use with assistance from a demographer.
3. Analyzing economic and tourism indicators such as hotel occupancy and ticket sales to the Monterey Bay Aquarium.
4. Using curve-fitting techniques to model future wastewater flow projections based on historical flows.

MRWPCA provided an extensive record of daily wastewater flows from 1999 to 2013 at each of its regional pump stations. This data was used to determine the daily flow of wastewater generated by the communities associated with each pump station, and to aid in choosing a projection method.

The U.S. Census Bureau classifies most of the service areas members as cities. Boronda, Castroville, and Moss Landing are classified as census designated places (CDP). This report uses the word *community* to refer to either designation.

Some communities in the MRWPCA service area lack a designated pump station: Boronda wastewater flows to the Salinas Pump Station, and wastewater from the Cities of Sand City and Del Rey Oaks both flow to the Seaside Pump Station. The Cities of Pacific Grove and Monterey each have two MRWPCA owned pump stations. Only the pump station that collects and pumps the city's total wastewater flow was used in this analysis.

The daily flow record was analyzed as monthly and annual averages to visualize data at different levels of detail. Approximately 47,000 individual data points were used in this investigation, and the few outliers that were identified were reconciled. A memorandum was developed to present the initial analysis and the methods being considered for making flow projections. A workshop meeting was held with MRWPCA staff to review the project and select the method used to complete this analysis. The curve-fitting method was chosen due to the availability of pertinent data.

A spreadsheet model was developed to analyze and project future wastewater flow to the RTP. Trends in historical community populations and wastewater flows produced a range of potential wastewater flow projections. Population data were acquired for each community from the U.S. Census Bureau website. Most cities have a continuous annual record of total population from 2000 to 2012. Data availability for Boronda, Castroville, and Moss Landing was limited to the years 2000 and 2010. Therefore, linear interpolation was used to estimate the populations of Boronda, Castroville, and Moss Landing for the years 2001 through 2009. For simplicity, it was assumed that each community's entire census population contributes to the regional wastewater system. That is, no individual septic or satellite reuse systems were known or evaluated as a part of this work.

The former Fort Ord Military Reservation is not a place recognized by the U.S. Census Bureau for population purposes. Therefore,, data for the populations typically associated with the Ord Community (and therefore the Ford Ord Pump Station) are represented in census counts of the communities with designated jurisdiction, i.e. Seaside, Marina, Del Rey Oaks, and Monterey County.

The population and historical wastewater flow data were used to calculate average flow generated per person in units of gallons per capita per day (GPCD) for the years 2000 through 2012. Trends in population and GPCD in each community were projected forward to the year 2055, and wastewater flow projections were calculated from these trends. Because Seaside, Marina, and Del Rey Oak's population projections account for the population changes attributable to Ord, likewise their flow projections also account for changes in Ord's flow.

A minimum value for GPCD was developed for the purposes of establishing goals for making wastewater flow projections. This minimum GPCD is based in part on the results of an American Water Works Association Research Foundation (AWWARF) residential end use water study (1999). That study found that interior water use on a per capita basis appears to have a theoretical minimum of 69 GPCD. In consideration of the aggressive water conservation measures already in use in many parts of the MRWPCA service area, and the regional value of water, this report adopted a lower minimum value of 59 GPCD. Projections for wastewater flow to the RTP were calculated as summations of community wastewater projections.

# 3 RESULTS

## 3.1 Analysis of Historical Wastewater Flow Data

Average annual wastewater flows to the RTP for years 1999 through 2013 are shown in Figure 3. Wastewater flows to the RTP have been steadily decreasing since 2002. The latest year of record shows the average annual wastewater flow of 17.8 mgd. Relative contributions of each pump station to the RTP changed between 1999 and 2013. Figure 4 and Figure 5 are pie charts representing these relative changes. Noticeably, the Salinas Pump Station contributed the majority of flow, and it increased its relative contribution by 9% for the years of record. The next largest contributor was the Monterey Pump Station, but its relative contribution decreased by 7% for the years on record. Charts presenting individual pump station wastewater flows from 1999 to 2013 are provided in Appendix A.

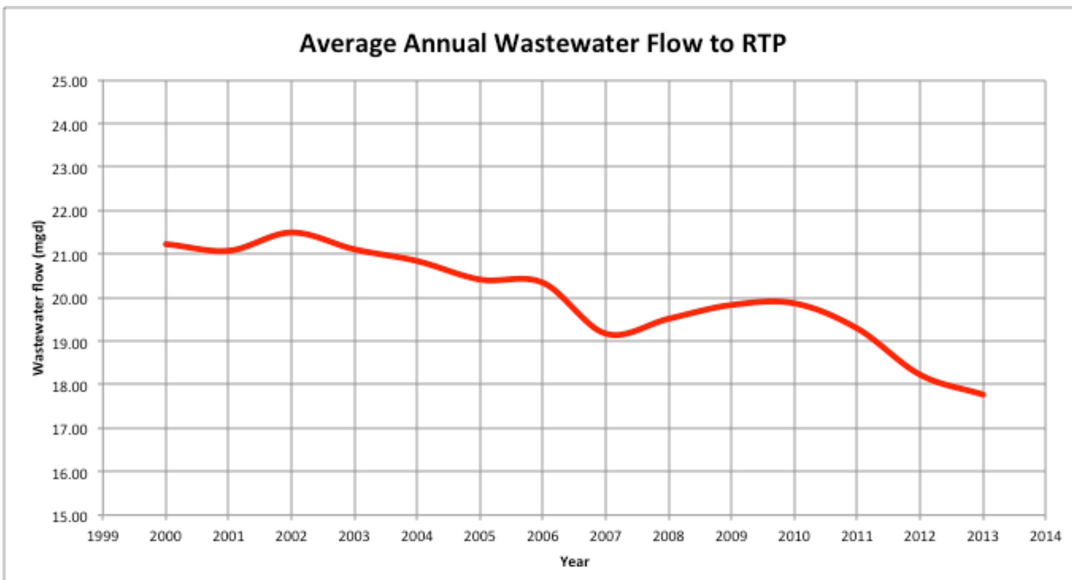



**Figure 3: Average Annual Wastewater Flow to RTP**

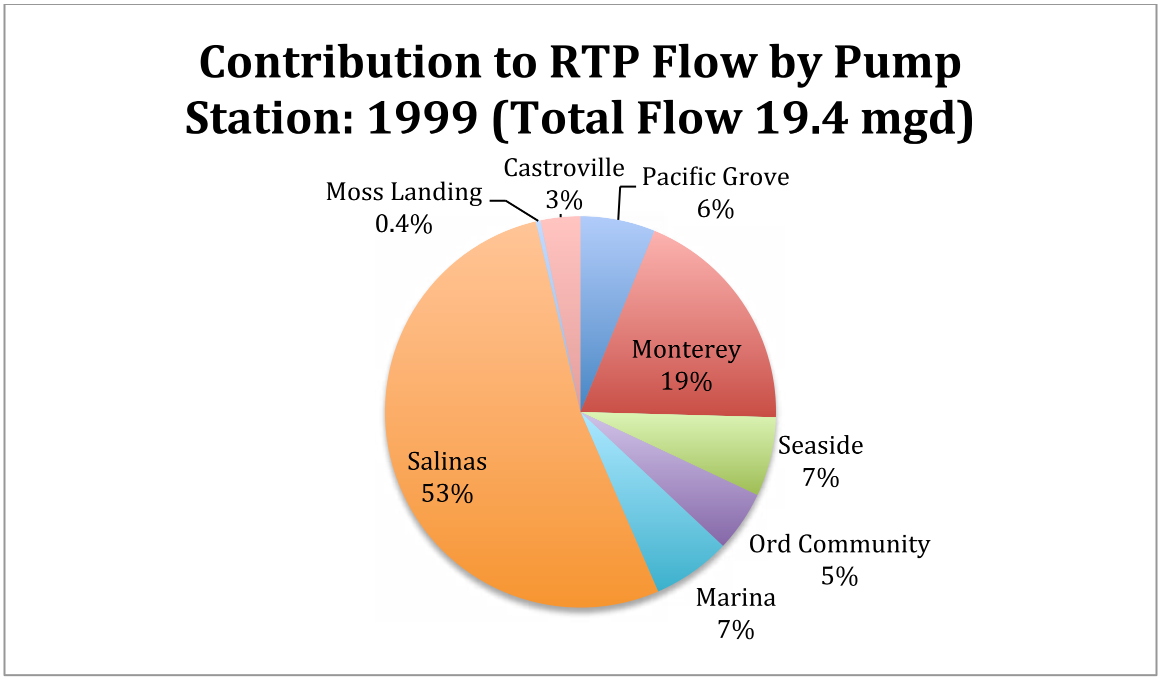



Figure 4: Contribution to RTP Flow by Pump Station: 1999 (Total Flow 19.4 mgd)

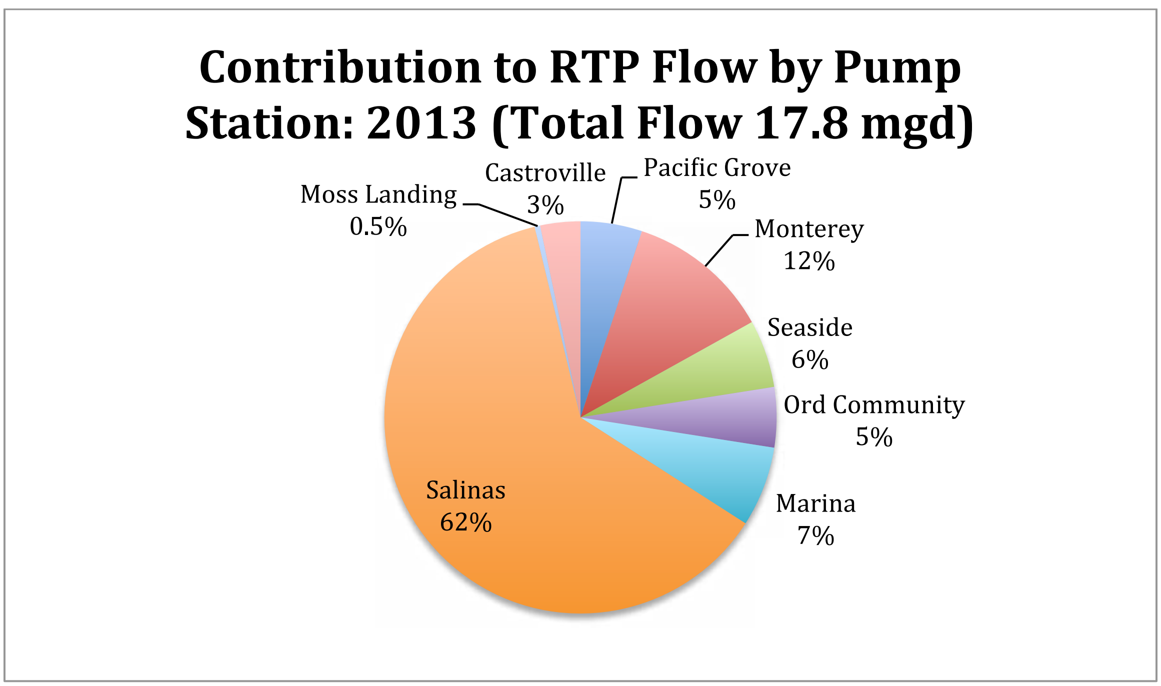



Figure 5: Contribution to RTP Flow by Pump Station: 2013 (Total Flow 17.8 mgd)

### 3.1.1 Statistical Validity of Flow Data

A linear regression analysis performed on flow data at the RTP shows a poor fit and large degree of uncertainty for making flow projections (Figure 6). Population data and GPCD were analyzed to determine whether better flow projections could be calculated.

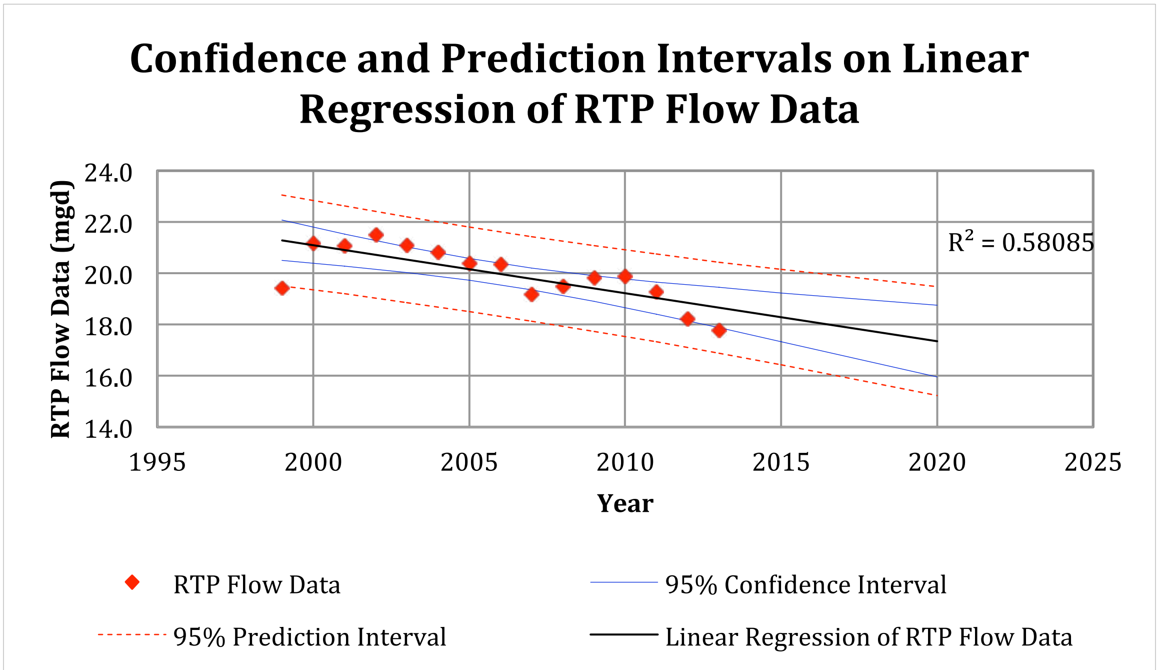



**Figure 6: Confidence and Prediction Intervals on Linear Regression of RTP Flow Data**

## 3.2 Analysis of Census Population Data

Census population data for the total RTP service area for years 2000 through 2012 are plotted in Figure 7. A 2.3% decrease in population from 254,882 to 249,014 is shown between 2001 and 2005. Population increased after 2005. The 2012 estimated MRWPCA service area population is 263,433.

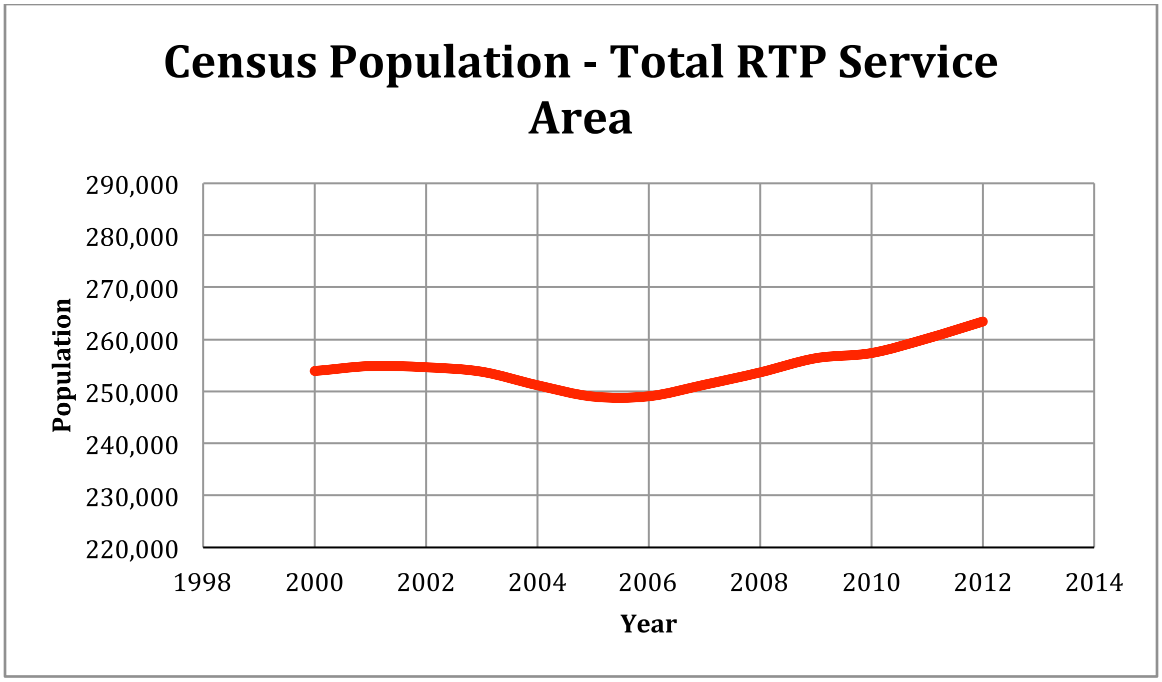



**Figure 7: Census Population – Total RTP Service Area**

### 3.2.1 Statistical Validation of Population Data

Linear and exponential regressions behave similarly given short time frames and steady growth, so for efficiency in analysis, only linear regressions were used to determine confidence intervals.

The decline in population seen between 2000 and 2005 poses a challenge for applying regression analysis to the data. Typical demographic models of population projections fit linear or exponential curves to historical population data[1]. When unusually large and long periods of population decline are used as inputs to the regression, the resulting trend line may not closely align with the most recent group of data points, and confidence and prediction intervals show a large degree of uncertainty. Such was the case of the regression analysis performed on population data from 2000-2012; the resulting regression line shows a poor fit, a larger degree of uncertainty and a much slower trend in growth than what is suggested by the six most recent years on the record. Using only data

[1] Alan Walter Steiss. Population Estimates and Projections. *Local Government Finance: Capital Facilities Planning and Debt Administration*. http://www-personal.umich.edu/~steiss/page55.html

O'Neill, Brian C. et al. A Guide to Global Population Projections. *Demographic Research,* Vol 4, Article 8, Pages 203-288, Published 13 June 2001 www. http://www.demographic-research.org/volumes/vol4/8/4-8.pdf

from 2006 to 2012 produces a trend line with a much better fit and a very small confidence interval.

Both of the above results are useful for making population projections. By their nature, population projections contain a high degree of uncertainty, and it is not appropriate to use confidence intervals to measure uncertainty in long-range projections. Typical demographic methods attempt to capture this uncertainty by producing "high" and "low" projections, that represent extreme scenarios, and an estimate of future value is expected to occur between these curves[2]. In this case, the slow growth trends produced by using the full range of data available from 2000 to 2012 will serve as the "low" projection for each community, and the faster growth trends produced using only the years 2006 through 2012 will serve to create the "high" projection.

Figures 8 and 9 present the statistical confidence intervals of the population trends.

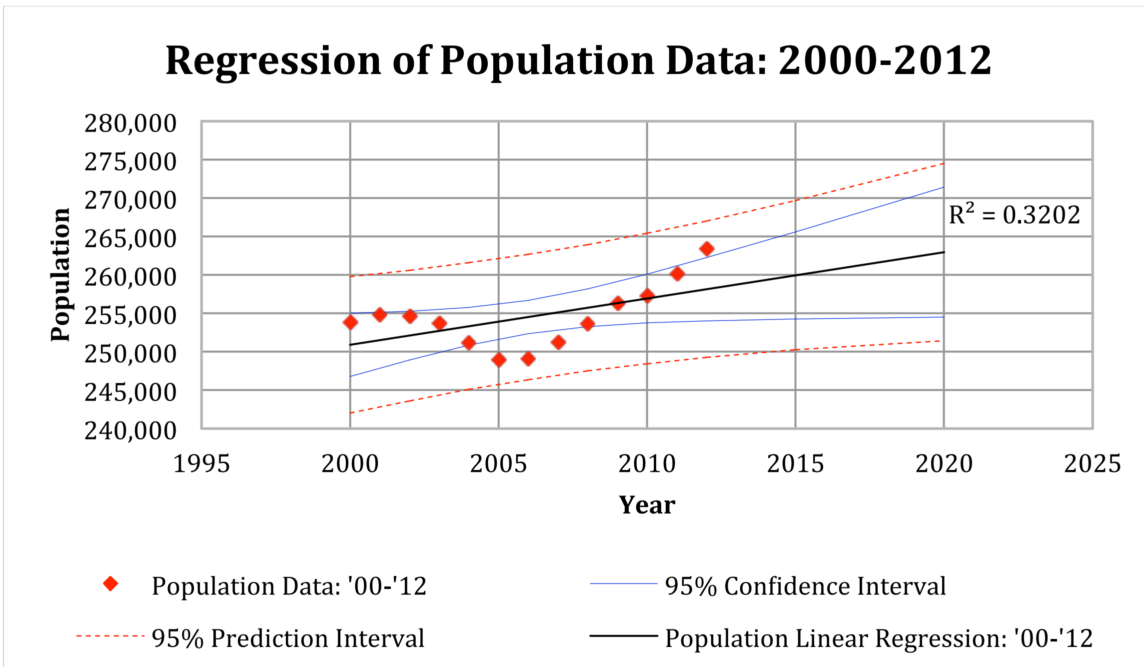



**Figure 8: Confidence and Prediction Intervals on Linear Regression of Population Data: 2000-2012**

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[2] Alan Walter Steiss. Population Estimates and Projections. *Local Government Finance: Capital Facilities Planning and Debt Administration*. http://www-personal.umich.edu/~steiss/page55.html

O'Neill, Brian C. et al. A Guide to Global Population Projections. *Demographic Research,* Vol 4, Article 8, Pages 203-288, Published 13 June 2001 www. http://www.demographic-research.org/volumes/vol4/8/4-8.pdf

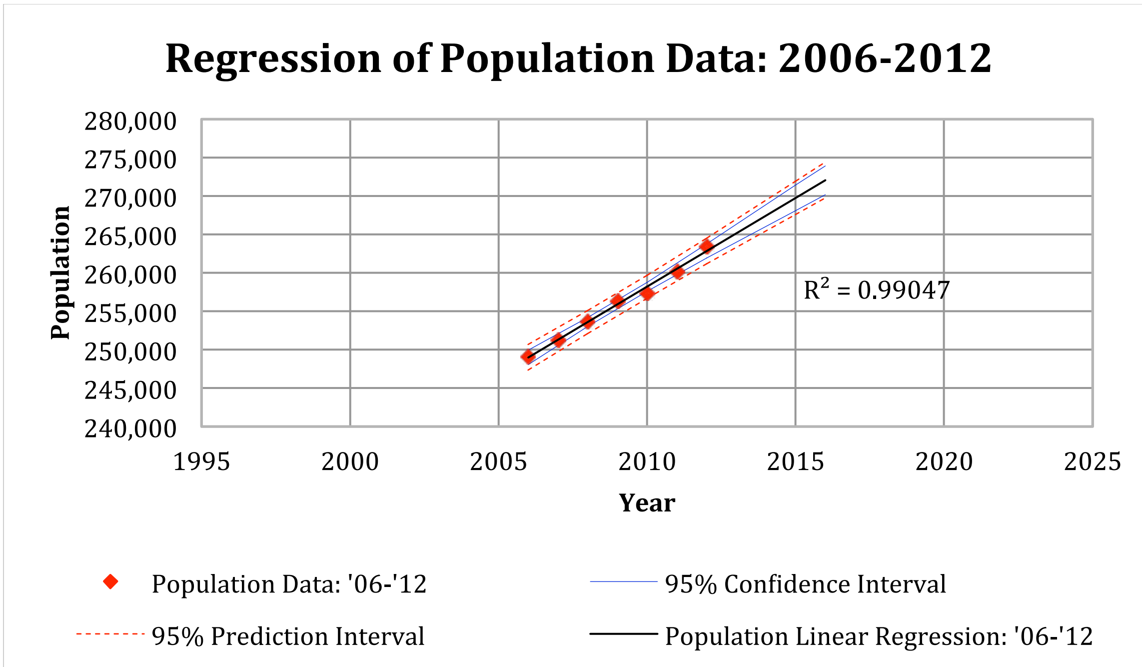


**Figure 9: Confidence and Prediction Intervals on Linear Regression of Population Data: 2006-2012**

## 3.3 Calculation of Historical GPCD

Average wastewater GPCD for the total RTP service area for years 2000 through 2012 were calculated using the historical wastewater flow and population data, as presented in Figure 10. Wastewater generation has trended downward from a 2002 maximum of 84.4 GPCD to a year 2012 minimum of 69.2 GPCD.

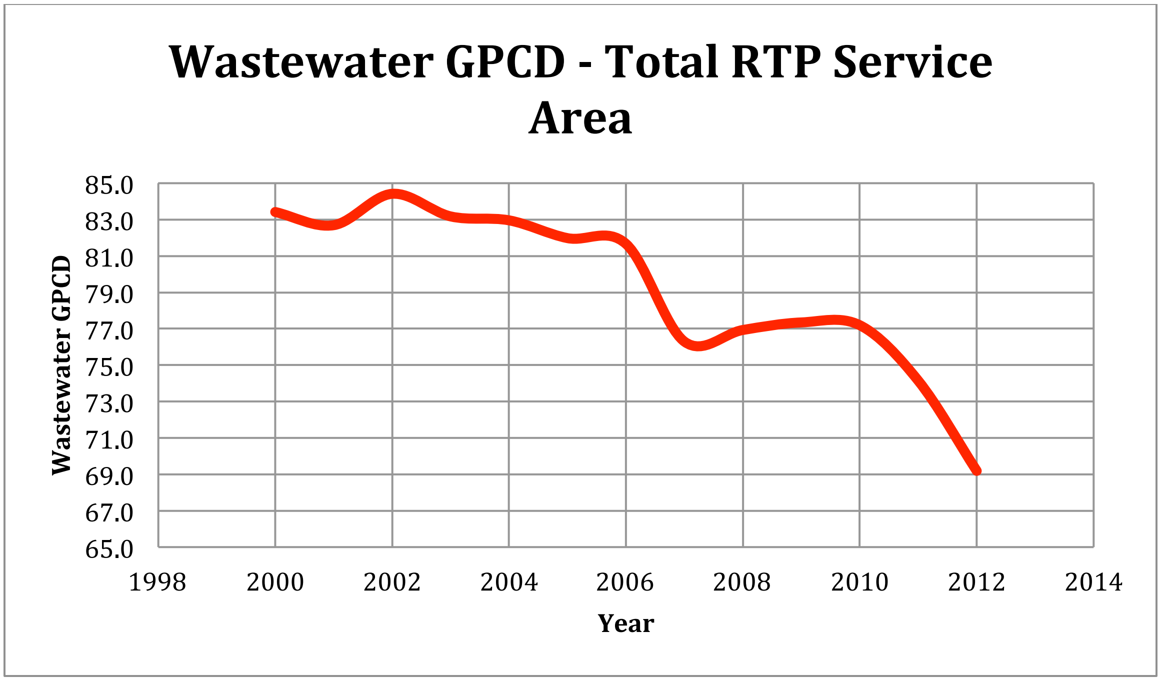


Figure 10: Wastewater GPCD – Total RTP Service Area

#### 3.3.1 Statistical Validation of GPCD

Historical GPCD was calculated from population and flow data, so its variation, goodness of fit in a linear regression, and confidence interval are dependent upon these measured quantities. However, the regression analysis does show that GPCD is linearly correlated with time, useful as an input variable for RTP flow projections (Figure 11).

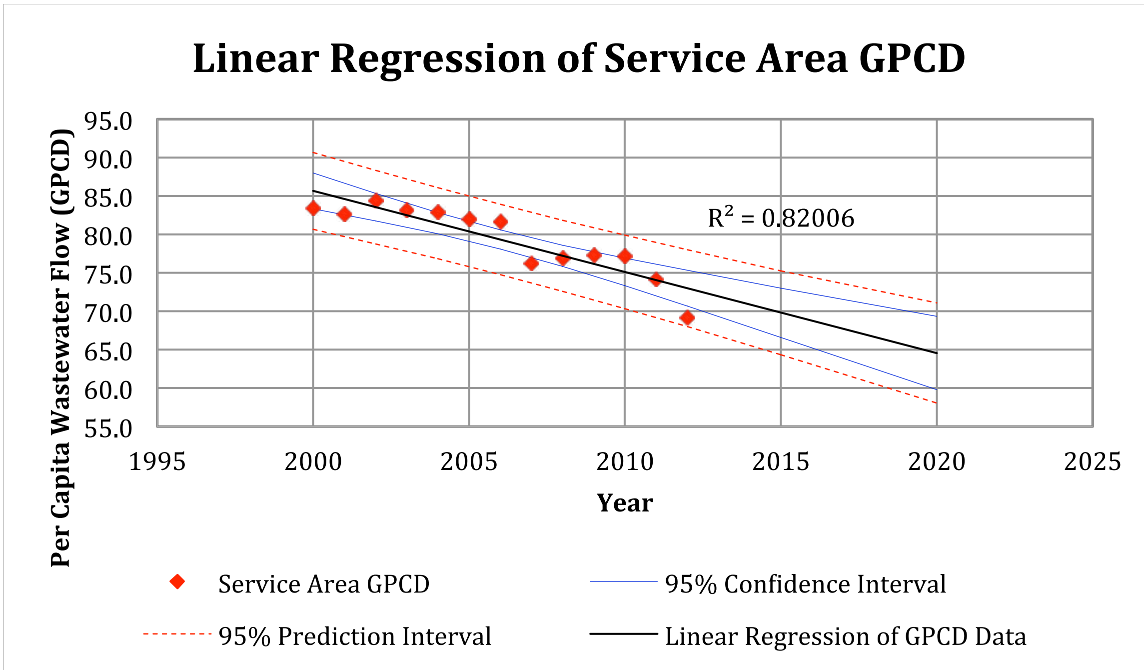


**Figure 11: Confidence and Prediction Intervals on Linear Regression of Historical Service Area GPCD**

## 3.4 RTP Wastewater Flow Projections

MRWPCA service area populations were projected to the year 2055 using the four trends described in Table 1. Linear trends were applied for their simplicity, and exponential trends were applied for their predictions of more rapid growth under ideal conditions. Using the full set of data from 2000 to 2012 provides the most data points for input, while using only 2006 to 2012 data helps attenuate the effects of population decreases between 2000 and 2005. Table 1 shows the percent increase in 2055 population compared to the most current estimates in 2012. Resulting population projections to the RTP are shown in Figure 12.

GPCD projections are made using a phased method. Starting from the present day, GPCD is projected using Trend 1, because regression analysis of historical GPCD showed that a linear trend is appropriate. GPCD cannot realistically fall below zero, so a minimum value is chosen. When the downward linear trend in GPCD meets the minimum value, it is assumed that all future values of GPCD remain constant at this minimum. A report by AWWARF sets an expected value of 69.0 GPCD. Because of strict conservation in the MRWPCA service area, this report chooses 59.0 GPCD as the minimum value.

**Table 1: Description of Population Trend Analysis Methods Used to Produce Range of Wastewater Flow Projections**

| Legend Entry | Description | % Pop. Increase |
|---|---|---|
| Trend 1 | A linear curve is fitted to data from year 2000 to 2012 | 8% |
| Trend 2 | A linear curve is fitted to data from year 2006 to 2012 | 30% |
| Trend 3 | An exponential curve is fitted to data from year 2000 to 2012 | 10% |
| Trend 4 | An exponential curve is fitted to data from year 2006 to 2012 | 48% |

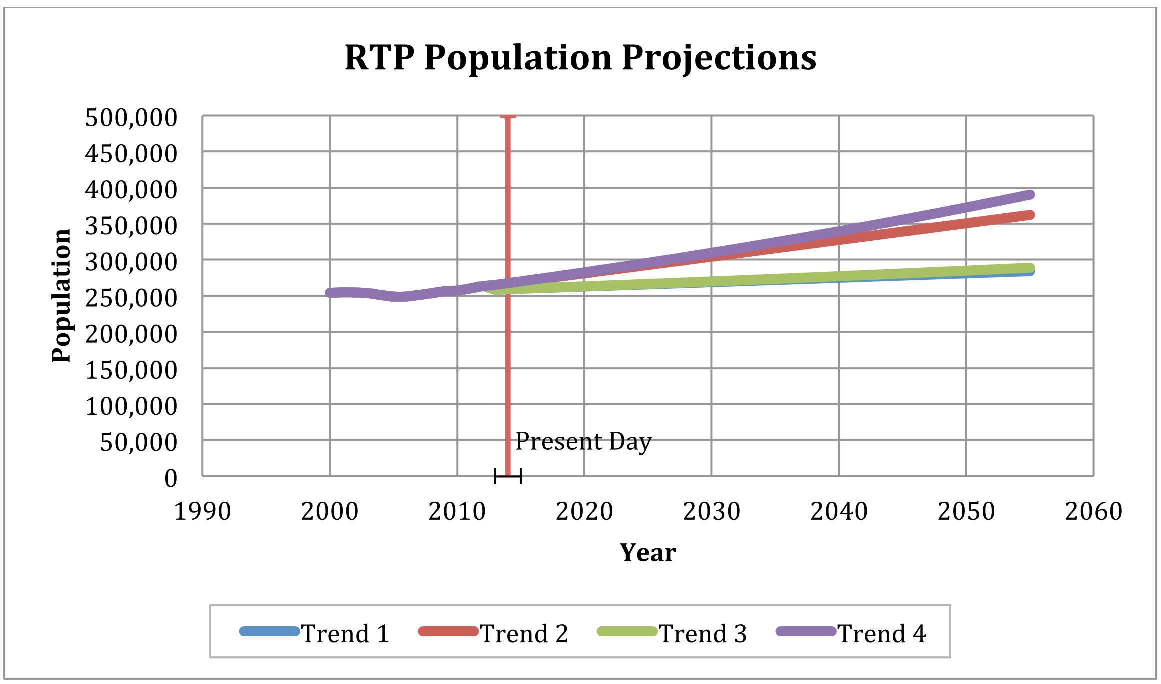


**Figure 12: RTP Service Area Population Projections**

Projections of per capita flow for the total service area is presented in Figure 13. A linear curve was applied to per capita flow data from year 2000 to 2012 and projected forward in time. GPCD values were constrained to the minimum value of 59.0 GPCD.

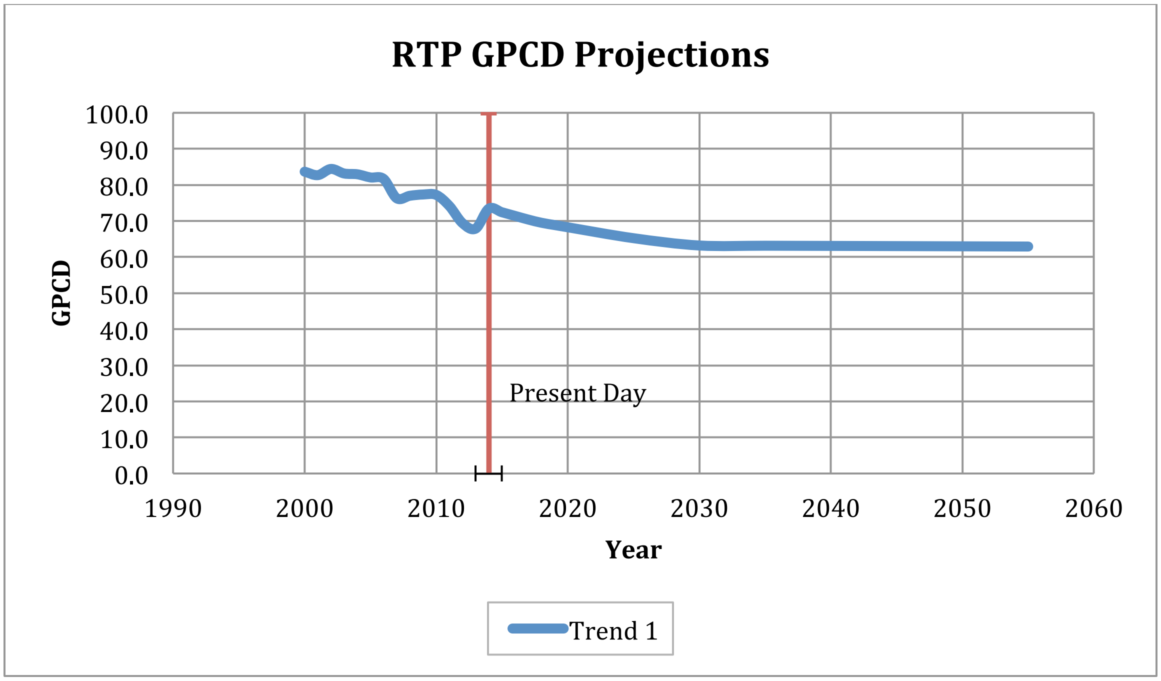


**Figure 13: Average Service Area GPCD Projection**

The set of population and GPCD projections was used to calculate four wastewater flow projections at the RTP, and the results are shown in Figure 14. Lines showing the RTP design capacity and an estimate of build-out wastewater flow (EMC Planning Group, 2013) are shown for reference. Flow to the RTP is projected to decrease until approximately the year 2030, as per capita wastewater flow decreases toward 59.0 GPCD. A resulting estimate of RTP flow for year 2030 is a range between 17.1 and 19.5 mgd. Once GPCD reaches its minimum value, the influence of projected population growth causes projected flow to increase.

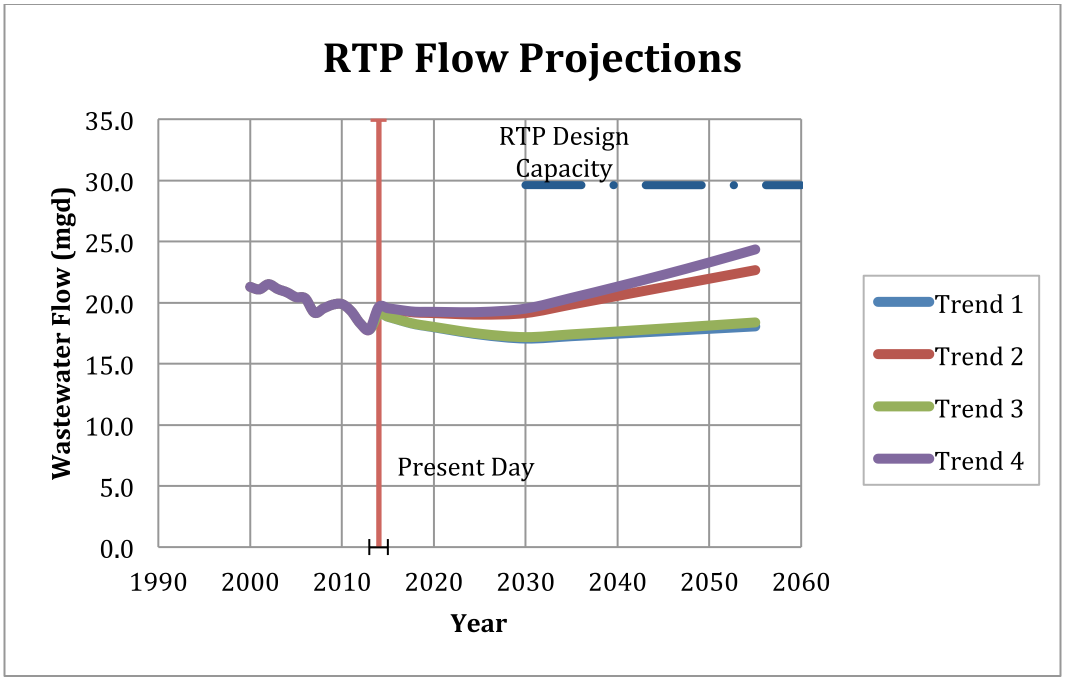


**Figure 14: RTP Wastewater Flow Projections**

Table 2 tabulates the "low" and "high" projections of wastewater flow in 2055 for each community and at the RTP. These represent extreme conditions, and it is expected that the true value will lie between these values.

**Table 2: 2055 Projections of "Low" and "High" Flow Scenarios**

| Pump Station | Low Flow (mgd) | High Flow (mgd) |
|---|---|---|
| **Pacific Grove** | 0.8 | 1.2 |
| **Monterey** | 1.4 | 2.3 |
| **Seaside** | 2.3 | 3.1 |
| **Ord*** | 0.9* | 0.9* |
| **Marina** | 1.1 | 1.6 |
| **Salinas** | 10.9 | 14.6 |
| **Moss Landing** | 0.00 | 0.04 |
| **Castroville** | 0.7 | 0.7 |
| **Total RTP** | 18.1 | 24.3 |

* Projected differences in flow at Ord from the 2013 baseline of 0.9 mgd are included in the flow projections of its surrounding communities, as discussed in the methodology section. The baseline 0.9 mgd is shown here to allow the summation of community flows to equal RTP flow.

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# 4 CONCLUSION

Wastewater flows to the RTP from the MRWPCA service area have been decreasing for the past several years. It is projected that flows will continue to decrease until approximately the year 2030, when per capita flows are projected to reach a minimum and flows at the RTP may range between 17.1 and 19.2 mgd. Based on the “high” and “low” projections of population growth and the establishment of a basement GPCD of 59.0, flows are projected to increase after 2030 and may range between 22.7 and 24.3 mgd by the year 2055, i.e. 77% to 82% of RTP design capacity. Other choices in projection methodology and assumptions may produce varying results.

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# 5 RECOMMENDATIONS

The following recommendations are made to improve the accuracy of the wastewater flow projections to the RTP and from each of the MRWPCA service area communities:

1. Update the wastewater flow projection model as new population and flow data becomes available.
2. Use a land use GIS to determine precisely differences in the sewersheds throughout the MRWPCA service area, and delineate the sewershed contributing wastewater flow to each pump station. Review and revise the sewersheds to resolve population data defined by the U.S. Census Bureau.
3. Conduct wastewater flow monitoring and acquire potable water consumption data at Seaside and Moss Landing to validate current wastewater flow data and correct historical flow data.
4. Conduct wastewater flow monitoring for non-residential land uses to verify large connections that may be affecting the wastewater GPCD values. This would include each of the military connections and the large commercial connections.
5. Incorporate the recommendations of a demographer that is familiar with the regional economic constraints and opportunities to validate service area population projections and methodologies.
6. Perform a study of the Fort Ord Pump Station, to determine the portions of Ord's surrounding communities that have sewers linked to the pump station. This will allow for the projection of population growth, GPCD decline, and wastewater flow in the Ord region, which currently goes unrecognized by the Census Bureau.

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# 6 REFERENCES

Alan Walter Steiss. Population Estimates and Projections. *Local Government Finance: Capital Facilities Planning and Debt Administration*. http://www-personal.umich.edu/~steiss/page55.html

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EMC Planning Group. Mayer et al. *Member agencies projected needs inventory*. Monterey, CA, 2013.

Monterey Regional Water Pollution Control Agency (MRWPCA). *About facilities treatment*. Monterey, CA, 2013. <http://www.mrwpca.org/about_facilities_treatment.php> (Accessed April 11, 2014).

O'Neill, Brian C. et al. A Guide to Global Population Projections. *Demographic Research,* Vol 4, Article 8, Pages 203-288, Published 13 June 2001 www. http://www.demographic-research.org/volumes/vol4/8/4-8.pdf

# APPENDIX A - WASTEWATER FLOW DATA

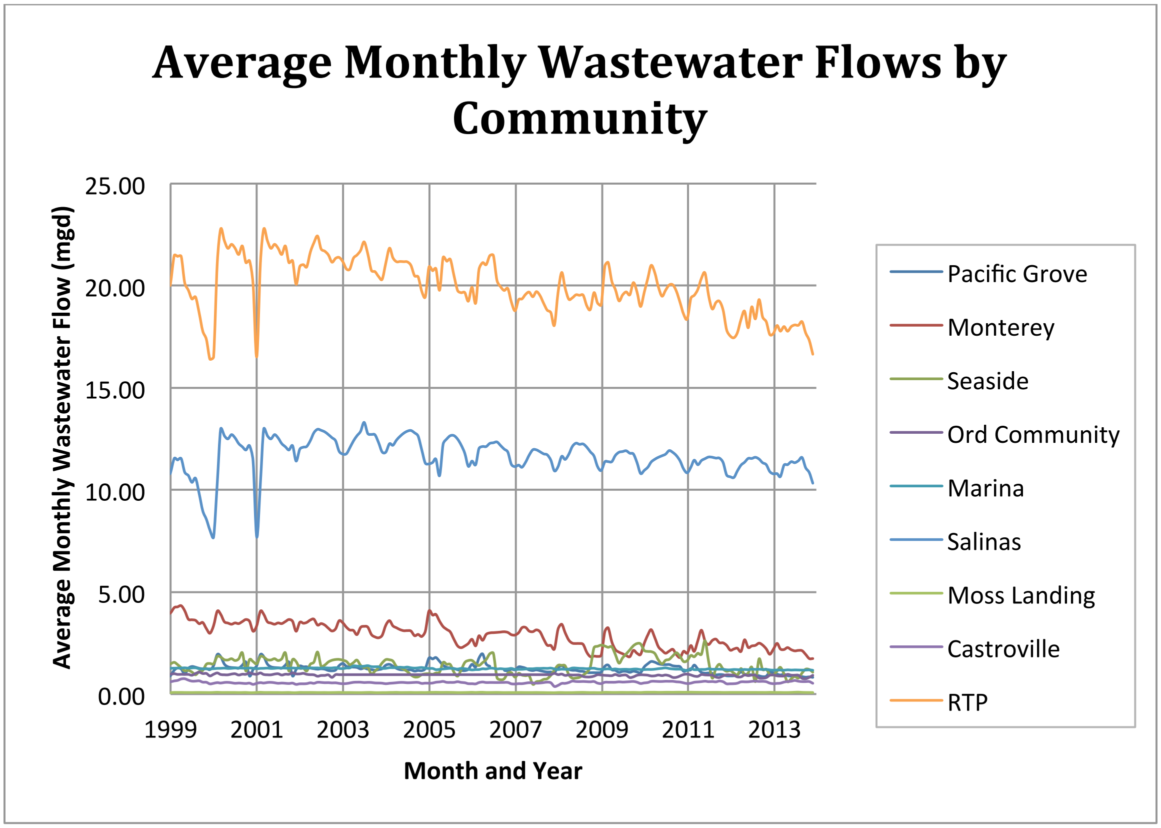



Figure 15: Average Monthly Wastewater Flows by Community

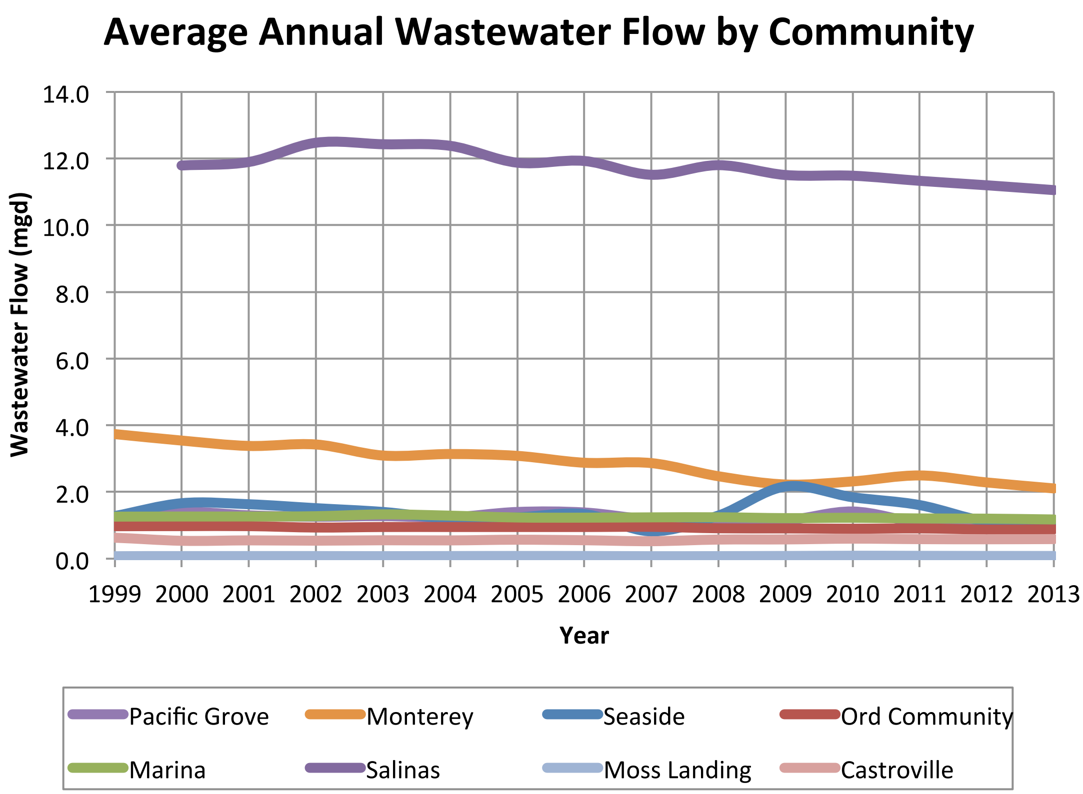



**Figure 16: Average Annual Wastewater Flow by Community**

# APPENDIX B - POPULATION DATA

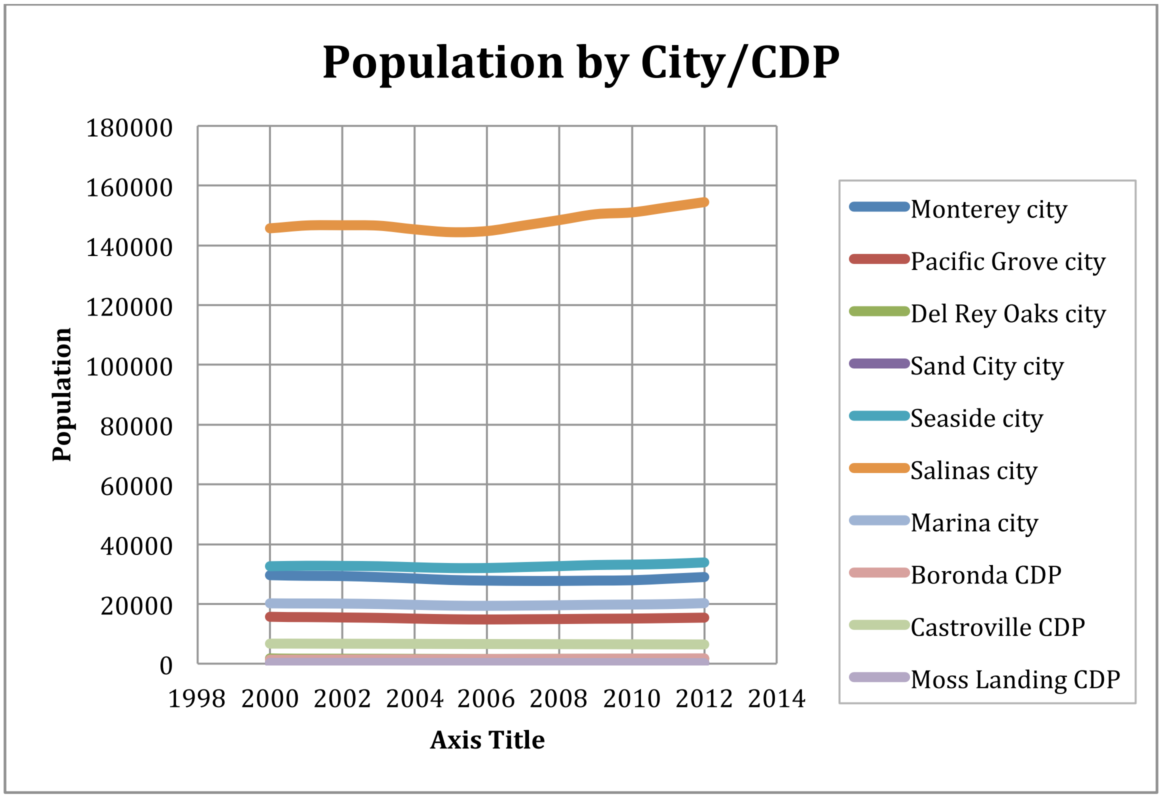



**Figure 17: Census Population by City/CDP**

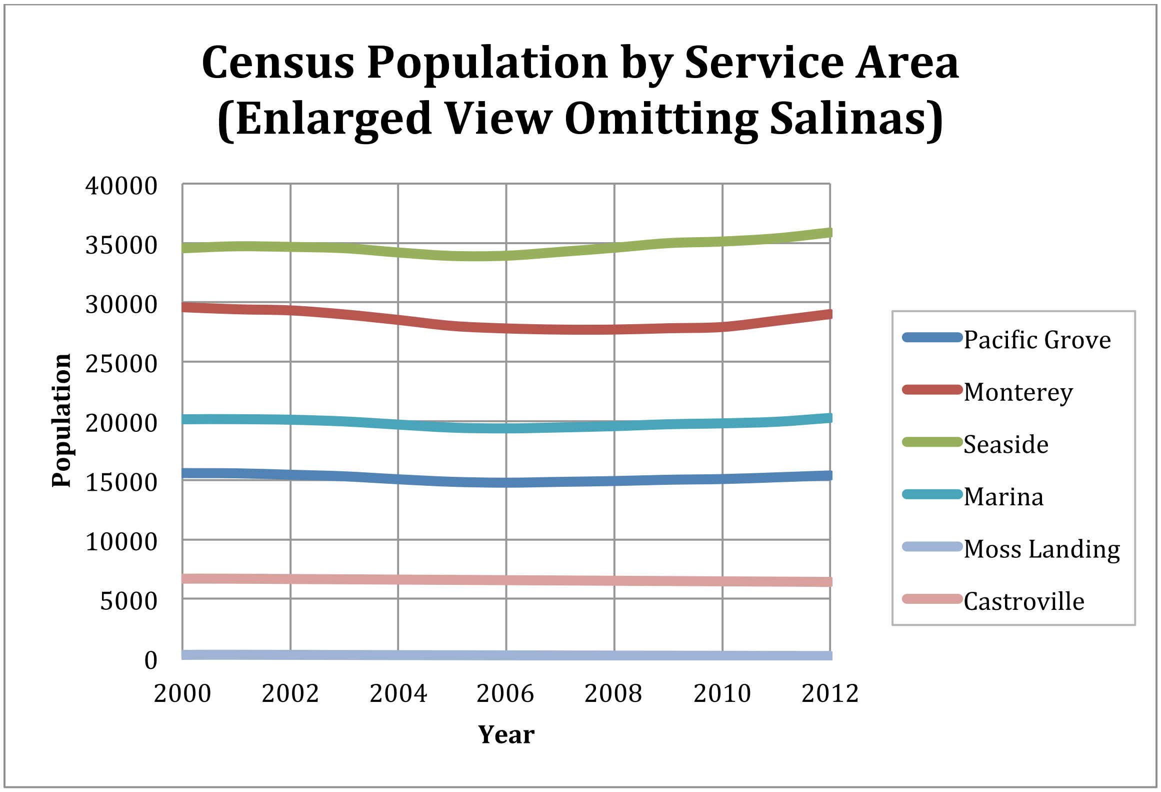



**Figure 18: Census Population by Service Area (Zoomed)**

# APPENDIX C - WASTEWATER GPCD ESTIMATES

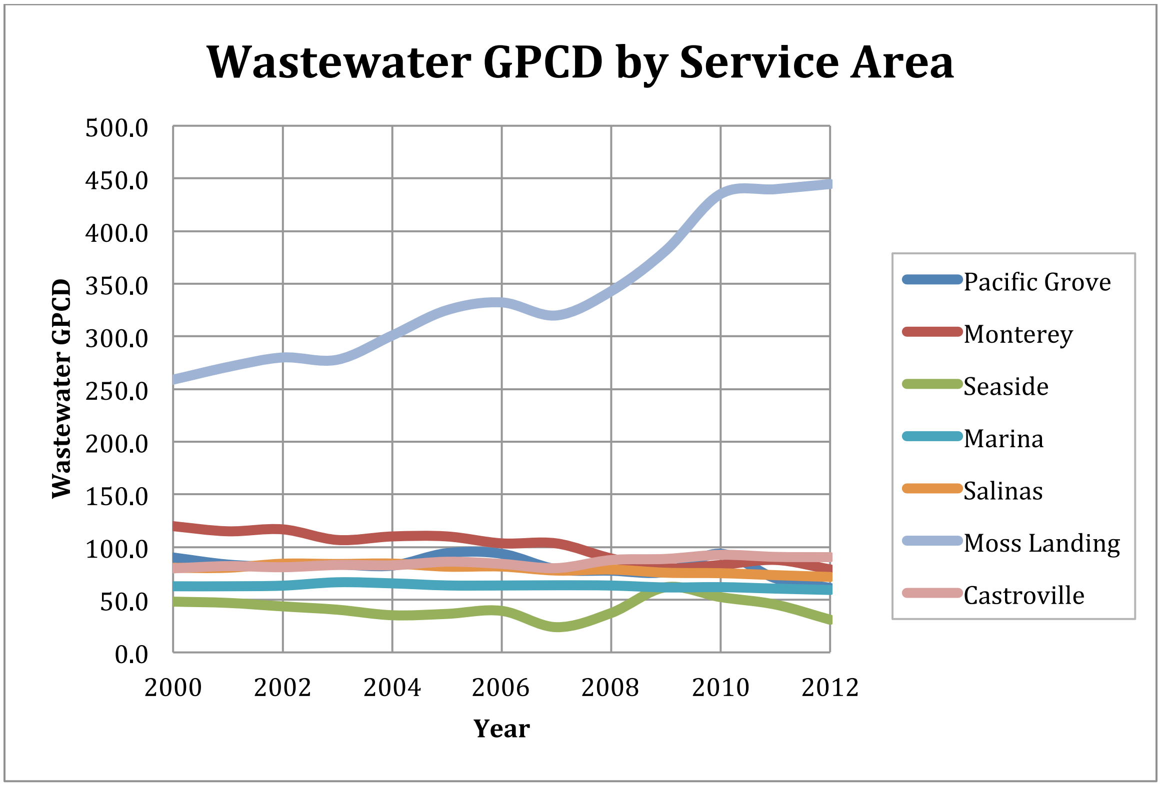
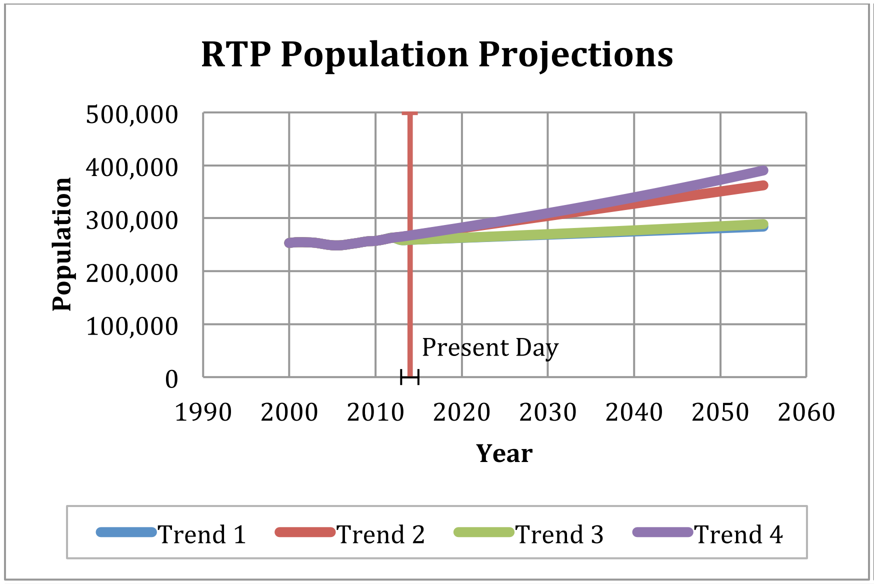
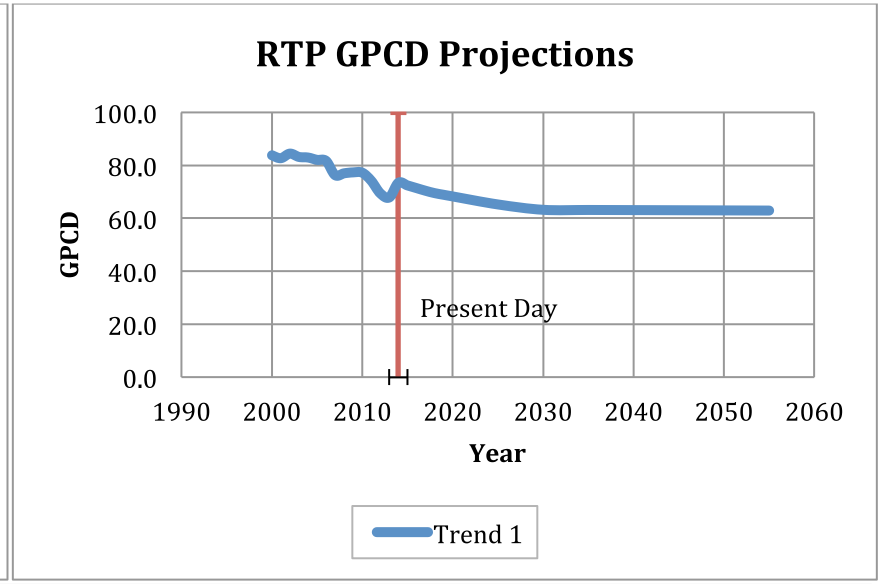



**Figure 19: Wastewater GPCD by Service Area**

# APPENDIX D – RTP PROJECTIONS



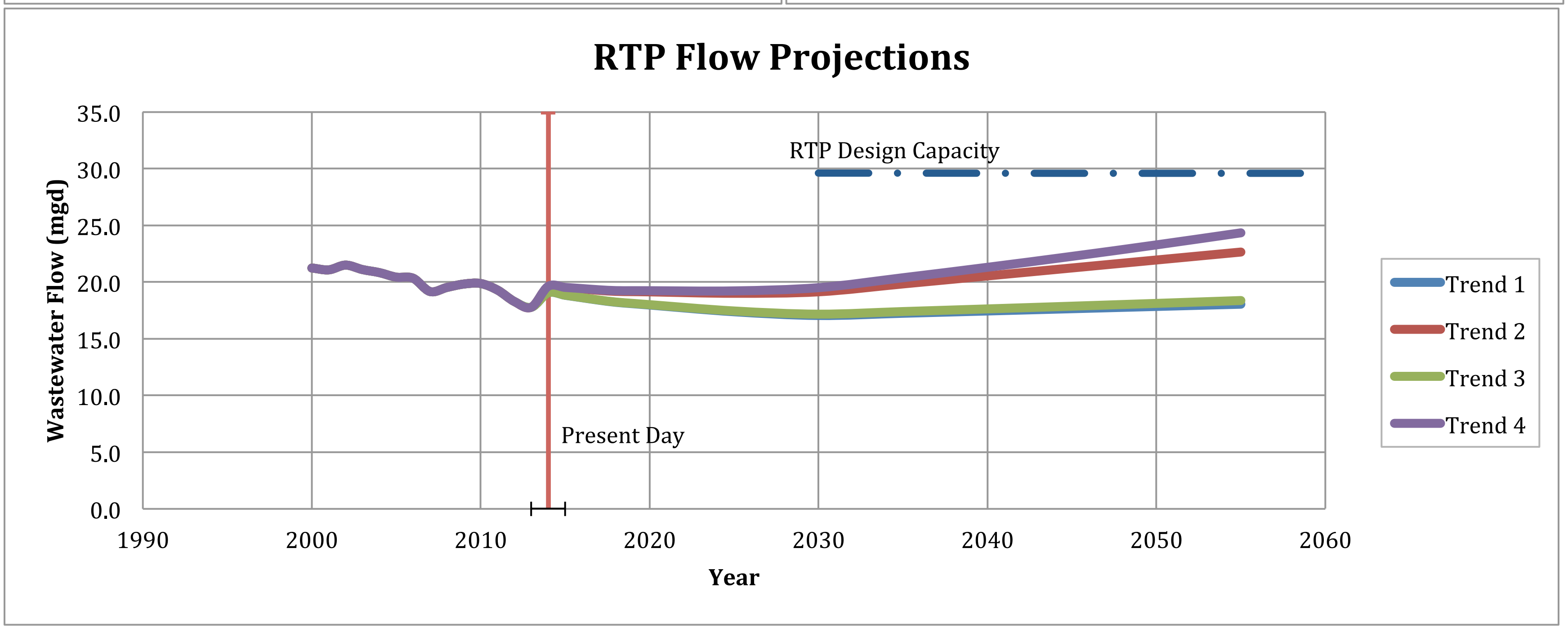




**Figure 20: RTP Projections**

**Table 3: RTP Model Results**

| | |
|---|---|
| **Community** | RTP Total |
| **Min GPCD** | 59.0 |

| | | **Population** | | | | **GPCD** | **Wastewater Flow** | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Year** | **Trend 1** | **Trend 2** | **Trend 3** | **Trend 4** | **Trend 1** | **Trend 1** | **Trend 2** | **Trend 3** | **Trend 4** |
| Historical | 1999 | | | | | | 19.4 | 19.4 | 19.4 | 19.4 |
| | 2000 | 253,870 | 253,870 | 253,870 | 253,870 | 83.8 | 21.3 | 21.3 | 21.3 | 21.3 |
| | 2001 | 254,882 | 254,882 | 254,882 | 254,882 | 82.7 | 21.1 | 21.1 | 21.1 | 21.1 |
| | 2002 | 254,644 | 254,644 | 254,644 | 254,644 | 84.4 | 21.5 | 21.5 | 21.5 | 21.5 |
| | 2003 | 253,791 | 253,791 | 253,791 | 253,791 | 83.2 | 21.1 | 21.1 | 21.1 | 21.1 |
| | 2004 | 251,200 | 251,200 | 251,200 | 251,200 | 83.0 | 20.8 | 20.8 | 20.8 | 20.8 |
| | 2005 | 249,014 | 249,014 | 249,014 | 249,014 | 82.1 | 20.4 | 20.4 | 20.4 | 20.4 |
| | 2006 | 249,066 | 249,066 | 249,066 | 249,066 | 81.7 | 20.3 | 20.3 | 20.3 | 20.3 |
| | 2007 | 251,280 | 251,280 | 251,280 | 251,280 | 76.3 | 19.2 | 19.2 | 19.2 | 19.2 |
| | 2008 | 253,653 | 253,653 | 253,653 | 253,653 | 77.0 | 19.5 | 19.5 | 19.5 | 19.5 |
| | 2009 | 256,383 | 256,383 | 256,383 | 256,383 | 77.3 | 19.8 | 19.8 | 19.8 | 19.8 |
| | 2010 | 257,375 | 257,375 | 257,375 | 257,375 | 77.2 | 19.9 | 19.9 | 19.9 | 19.9 |
| | 2011 | 260,164 | 260,164 | 260,164 | 260,164 | 74.2 | 19.3 | 19.3 | 19.3 | 19.3 |
| | 2012 | 263,433 | 263,433 | 263,433 | 263,433 | 69.4 | 18.3 | 18.3 | 18.3 | 18.3 |
| Projections | 2013 | 258,737 | 265,135 | 258,747 | 265,273 | 67.9 | 17.8 | 17.8 | 17.8 | 17.8 |
| | 2014 | 259,340 | 267,442 | 259,376 | 267,686 | 73.4 | 19.1 | 19.6 | 19.1 | 19.6 |
| | 2015 | 259,942 | 269,749 | 260,010 | 270,123 | 72.4 | 18.8 | 19.5 | 18.8 | 19.5 |
| | 2016 | 260,545 | 272,056 | 260,648 | 272,584 | 71.4 | 18.6 | 19.4 | 18.6 | 19.4 |
| | 2017 | 261,147 | 274,362 | 261,290 | 275,070 | 70.4 | 18.4 | 19.3 | 18.4 | 19.3 |
| | 2018 | 261,750 | 276,669 | 261,937 | 277,581 | 69.5 | 18.2 | 19.2 | 18.2 | 19.3 |
| | 2019 | 262,353 | 278,976 | 262,588 | 280,118 | 68.8 | 18.1 | 19.2 | 18.1 | 19.2 |
| | 2020 | 262,955 | 281,283 | 263,243 | 282,679 | 68.2 | 18.0 | 19.1 | 18.0 | 19.2 |
| | 2025 | 265,968 | 292,817 | 266,587 | 295,876 | 65.2 | 17.4 | 19.0 | 17.5 | 19.2 |
| | 2030 | 268,980 | 304,352 | 270,042 | 309,745 | 63.2 | 17.1 | 19.1 | 17.2 | 19.5 |
| | 2035 | 272,029 | 315,922 | 273,609 | 324,317 | 63.1 | 17.3 | 19.8 | 17.4 | 20.4 |
| | 2040 | 275,090 | 327,504 | 277,289 | 339,628 | 63.1 | 17.5 | 20.5 | 17.6 | 21.3 |
| | 2045 | 278,150 | 339,086 | 281,084 | 355,715 | 63.0 | 17.7 | 21.3 | 17.9 | 22.3 |
| | 2050 | 281,211 | 350,669 | 284,996 | 372,616 | 63.0 | 17.9 | 22.0 | 18.1 | 23.3 |
| | 2055 | 284,272 | 362,251 | 289,026 | 390,372 | 62.9 | 18.1 | 22.7 | 18.4 | 24.3 |

# APPENDIX E – PACIFIC GROVE PROJECTIONS

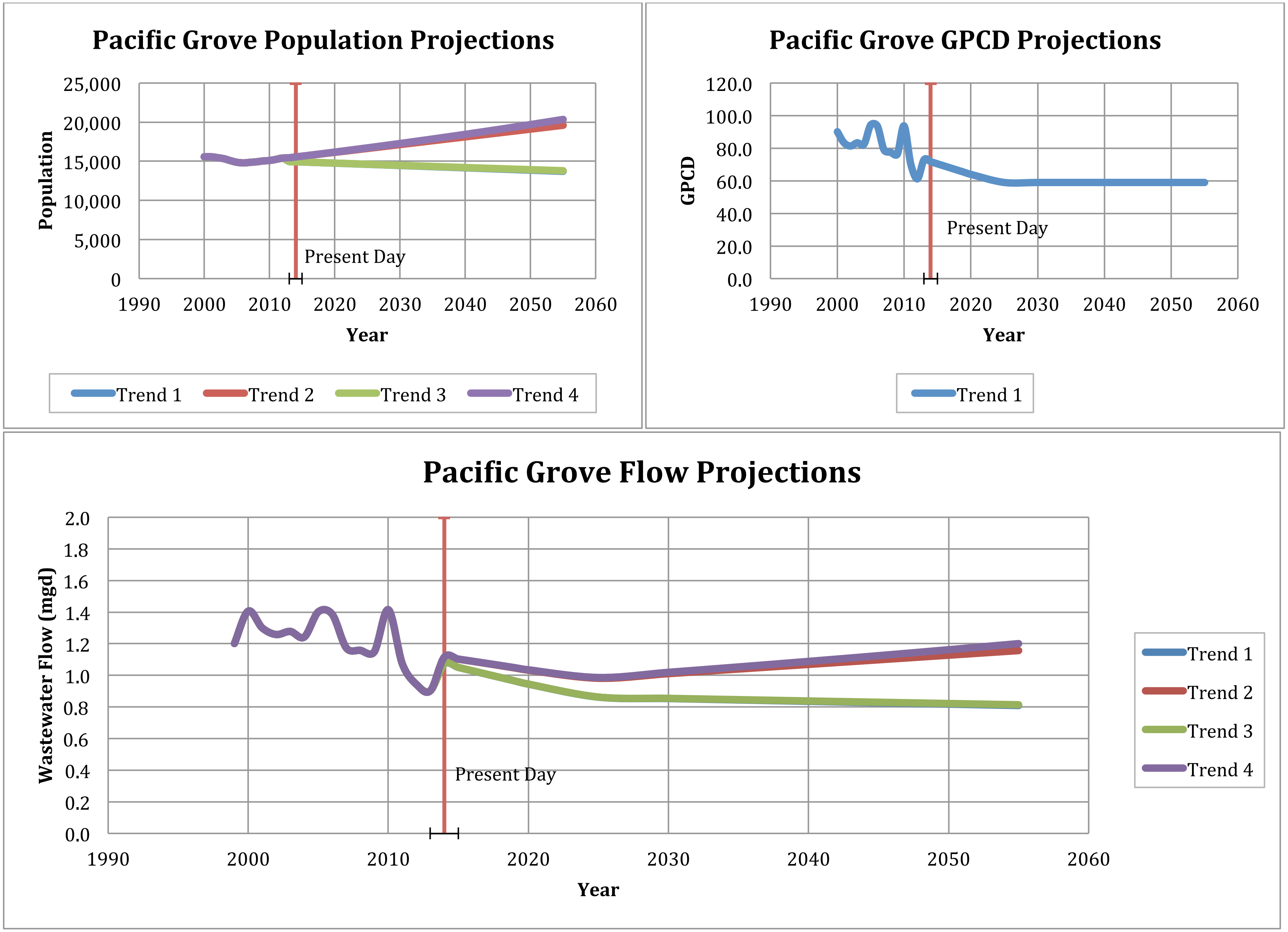


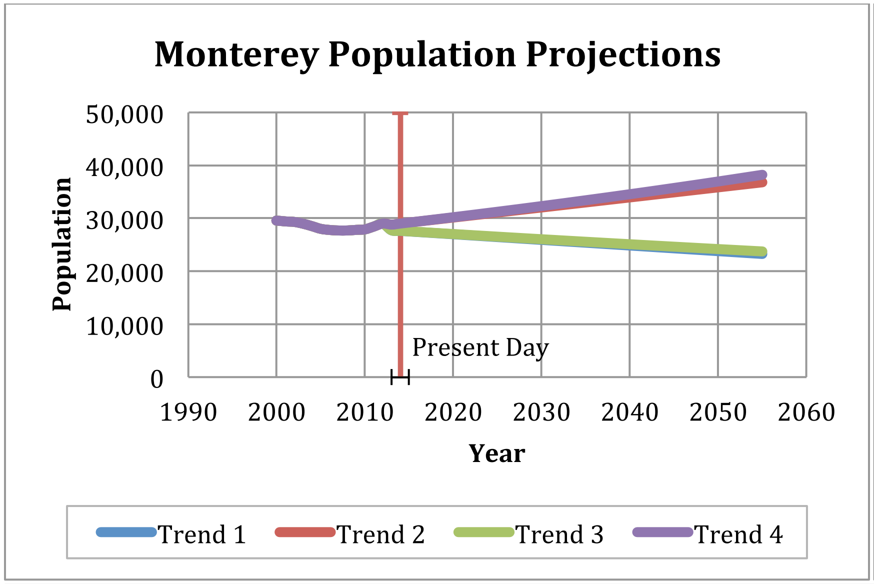

**Figure 21: Pacific Grove Projections**

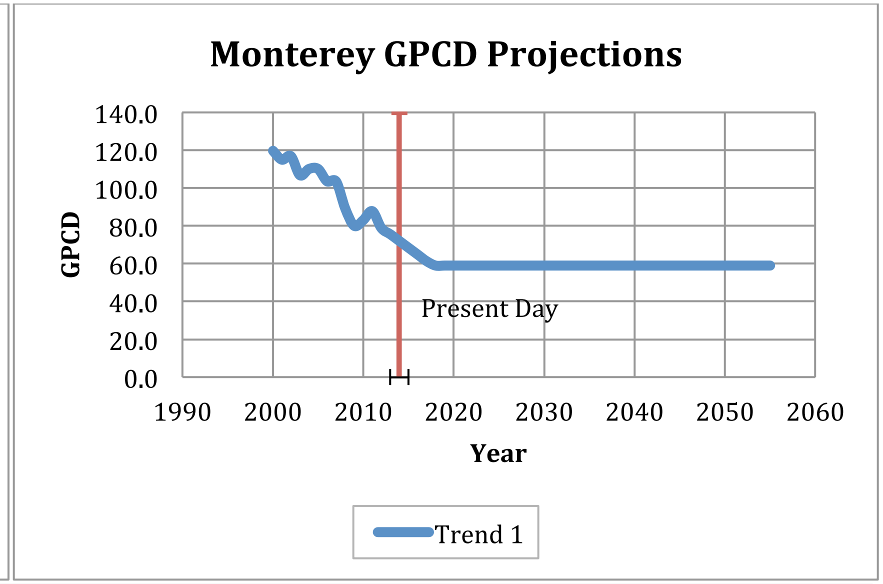
**Table 4: Pacific Grove Model Results**

| | |
|---|---|
| **Community** | Pacific Grove |
| **Min GPCD** | 59.0 |

| | | **Population** | | | | **GPCD** | **Wastewater Flow** | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Year** | **Trend 1** | **Trend 2** | **Trend 3** | **Trend 4** | **Trend 1** | **Trend 1** | **Trend 2** | **Trend 3** | **Trend 4** |
| Historical | 1999 | | | | | | 1.2 | 1.2 | 1.2 | 1.2 |
| Historical | 2000 | 15,595 | 15,595 | 15,595 | 15,595 | 90.2 | 1.4 | 1.4 | 1.4 | 1.4 |
| Historical | 2001 | 15,584 | 15,584 | 15,584 | 15,584 | 83.4 | 1.3 | 1.3 | 1.3 | 1.3 |
| Historical | 2002 | 15,464 | 15,464 | 15,464 | 15,464 | 81.4 | 1.3 | 1.3 | 1.3 | 1.3 |
| Historical | 2003 | 15,330 | 15,330 | 15,330 | 15,330 | 83.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| Historical | 2004 | 15,080 | 15,080 | 15,080 | 15,080 | 82.4 | 1.2 | 1.2 | 1.2 | 1.2 |
| Historical | 2005 | 14,869 | 14,869 | 14,869 | 14,869 | 94.3 | 1.4 | 1.4 | 1.4 | 1.4 |
| Historical | 2006 | 14,795 | 14,795 | 14,795 | 14,795 | 93.7 | 1.4 | 1.4 | 1.4 | 1.4 |
| Historical | 2007 | 14,864 | 14,864 | 14,864 | 14,864 | 79.0 | 1.2 | 1.2 | 1.2 | 1.2 |
| Historical | 2008 | 14,933 | 14,933 | 14,933 | 14,933 | 77.6 | 1.2 | 1.2 | 1.2 | 1.2 |
| Historical | 2009 | 15,041 | 15,041 | 15,041 | 15,041 | 76.4 | 1.1 | 1.1 | 1.1 | 1.1 |
| Historical | 2010 | 15,101 | 15,101 | 15,101 | 15,101 | 93.7 | 1.4 | 1.4 | 1.4 | 1.4 |
| Historical | 2011 | 15,246 | 15,246 | 15,246 | 15,246 | 70.4 | 1.1 | 1.1 | 1.1 | 1.1 |
| Historical | 2012 | 15,407 | 15,407 | 15,407 | 15,407 | 61.2 | 0.9 | 0.9 | 0.9 | 0.9 |
| Projections | 2013 | 14,969 | 15,451 | 14,970 | 15,454 | 73.0 | 0.9 | 0.9 | 0.9 | 0.9 |
| Projections | 2014 | 14,939 | 15,550 | 14,941 | 15,556 | 71.7 | 1.1 | 1.1 | 1.1 | 1.1 |
| Projections | 2015 | 14,909 | 15,648 | 14,912 | 15,658 | 70.4 | 1.1 | 1.1 | 1.1 | 1.1 |
| Projections | 2016 | 14,879 | 15,747 | 14,883 | 15,761 | 69.1 | 1.0 | 1.1 | 1.0 | 1.1 |
| Projections | 2017 | 14,849 | 15,846 | 14,854 | 15,864 | 67.8 | 1.0 | 1.1 | 1.0 | 1.1 |
| Projections | 2018 | 14,819 | 15,945 | 14,825 | 15,969 | 66.6 | 1.0 | 1.1 | 1.0 | 1.1 |
| Projections | 2019 | 14,789 | 16,044 | 14,796 | 16,074 | 65.3 | 1.0 | 1.0 | 1.0 | 1.0 |
| Projections | 2020 | 14,759 | 16,143 | 14,767 | 16,179 | 64.0 | 0.9 | 1.0 | 0.9 | 1.0 |
| Projections | 2025 | 14,610 | 16,637 | 14,624 | 16,719 | 59.0 | 0.9 | 1.0 | 0.9 | 1.0 |
| Projections | 2030 | 14,461 | 17,131 | 14,482 | 17,276 | 59.0 | 0.9 | 1.0 | 0.9 | 1.0 |
| Projections | 2035 | 14,311 | 17,626 | 14,342 | 17,851 | 59.0 | 0.8 | 1.0 | 0.8 | 1.1 |
| Projections | 2040 | 14,162 | 18,120 | 14,203 | 18,446 | 59.0 | 0.8 | 1.1 | 0.8 | 1.1 |
| Projections | 2045 | 14,013 | 18,614 | 14,065 | 19,060 | 59.0 | 0.8 | 1.1 | 0.8 | 1.1 |
| Projections | 2050 | 13,863 | 19,108 | 13,929 | 19,695 | 59.0 | 0.8 | 1.1 | 0.8 | 1.2 |
| Projections | 2055 | 13,714 | 19,603 | 13,794 | 20,352 | 59.0 | 0.8 | 1.2 | 0.8 | 1.2 |

# APPENDIX F – MONTEREY PROJECTIONS



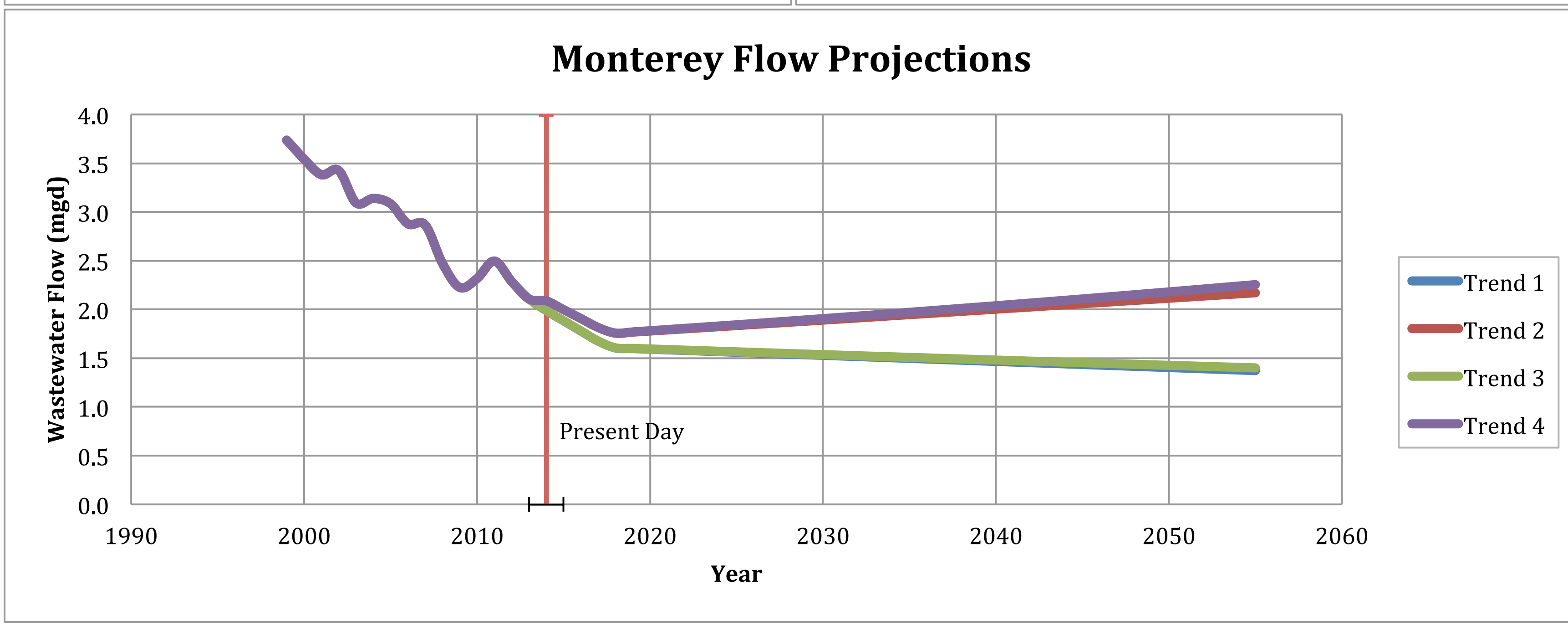




**Figure 22: Monterey Projections**

**Table 5: Monterey Model Results**

| | |
|---|---|
| **Community** | Monterey |
| **Min GPCD** | 59.0 |

| | | Population | | | | GPCD | Wastewater Flow | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Year** | **Trend 1** | **Trend 2** | **Trend 3** | **Trend 4** | **Trend 1** | **Trend 1** | **Trend 2** | **Trend 3** | **Trend 4** |
| Historical | 1999 | | | | | | 3.7 | 3.7 | 3.7 | 3.7 |
| | 2000 | 29,582 | 29,582 | 29,582 | 29,582 | 119.7 | 3.5 | 3.5 | 3.5 | 3.5 |
| | 2001 | 29,410 | 29,410 | 29,410 | 29,410 | 115.0 | 3.4 | 3.4 | 3.4 | 3.4 |
| | 2002 | 29,315 | 29,315 | 29,315 | 29,315 | 116.8 | 3.4 | 3.4 | 3.4 | 3.4 |
| | 2003 | 28,975 | 28,975 | 28,975 | 28,975 | 106.8 | 3.1 | 3.1 | 3.1 | 3.1 |
| | 2004 | 28,512 | 28,512 | 28,512 | 28,512 | 110.1 | 3.1 | 3.1 | 3.1 | 3.1 |
| | 2005 | 28,005 | 28,005 | 28,005 | 28,005 | 110.1 | 3.1 | 3.1 | 3.1 | 3.1 |
| | 2006 | 27,794 | 27,794 | 27,794 | 27,794 | 103.5 | 2.9 | 2.9 | 2.9 | 2.9 |
| | 2007 | 27,698 | 27,698 | 27,698 | 27,698 | 103.5 | 2.9 | 2.9 | 2.9 | 2.9 |
| | 2008 | 27,701 | 27,701 | 27,701 | 27,701 | 89.3 | 2.5 | 2.5 | 2.5 | 2.5 |
| | 2009 | 27,810 | 27,810 | 27,810 | 27,810 | 80.0 | 2.2 | 2.2 | 2.2 | 2.2 |
| | 2010 | 27,914 | 27,914 | 27,914 | 27,914 | 83.0 | 2.3 | 2.3 | 2.3 | 2.3 |
| | 2011 | 28,440 | 28,440 | 28,440 | 28,440 | 87.8 | 2.5 | 2.5 | 2.5 | 2.5 |
| | 2012 | 29,003 | 29,003 | 29,003 | 29,003 | 78.8 | 2.3 | 2.3 | 2.3 | 2.3 |
| Projections | 2013 | 27,729 | 28,812 | 27,737 | 28,812 | 75.5 | 2.1 | 2.1 | 2.1 | 2.1 |
| | 2014 | 27,623 | 29,002 | 27,635 | 29,007 | 72.0 | 2.0 | 2.1 | 2.0 | 2.1 |
| | 2015 | 27,517 | 29,192 | 27,533 | 29,202 | 68.4 | 1.9 | 2.0 | 1.9 | 2.0 |
| | 2016 | 27,410 | 29,382 | 27,431 | 29,399 | 64.9 | 1.8 | 1.9 | 1.8 | 1.9 |
| | 2017 | 27,304 | 29,573 | 27,329 | 29,598 | 61.3 | 1.7 | 1.8 | 1.7 | 1.8 |
| | 2018 | 27,198 | 29,763 | 27,228 | 29,798 | 59.0 | 1.6 | 1.8 | 1.6 | 1.8 |
| | 2019 | 27,091 | 29,953 | 27,128 | 29,999 | 59.0 | 1.6 | 1.8 | 1.6 | 1.8 |
| | 2020 | 26,985 | 30,143 | 27,027 | 30,201 | 59.0 | 1.6 | 1.8 | 1.6 | 1.8 |
| | 2025 | 26,454 | 31,094 | 26,532 | 31,234 | 59.0 | 1.6 | 1.8 | 1.6 | 1.8 |
| | 2030 | 25,922 | 32,044 | 26,045 | 32,301 | 59.0 | 1.5 | 1.9 | 1.5 | 1.9 |
| | 2035 | 25,390 | 32,995 | 25,567 | 33,406 | 59.0 | 1.5 | 1.9 | 1.5 | 2.0 |
| | 2040 | 24,859 | 33,946 | 25,098 | 34,548 | 59.0 | 1.5 | 2.0 | 1.5 | 2.0 |
| | 2045 | 24,327 | 34,897 | 24,637 | 35,729 | 59.0 | 1.4 | 2.1 | 1.5 | 2.1 |
| | 2050 | 23,795 | 35,847 | 24,185 | 36,951 | 59.0 | 1.4 | 2.1 | 1.4 | 2.2 |
| | 2055 | 23,264 | 36,798 | 23,742 | 38,214 | 59.0 | 1.4 | 2.2 | 1.4 | 2.3 |

# APPENDIX G – SEASIDE PROJECTIONS

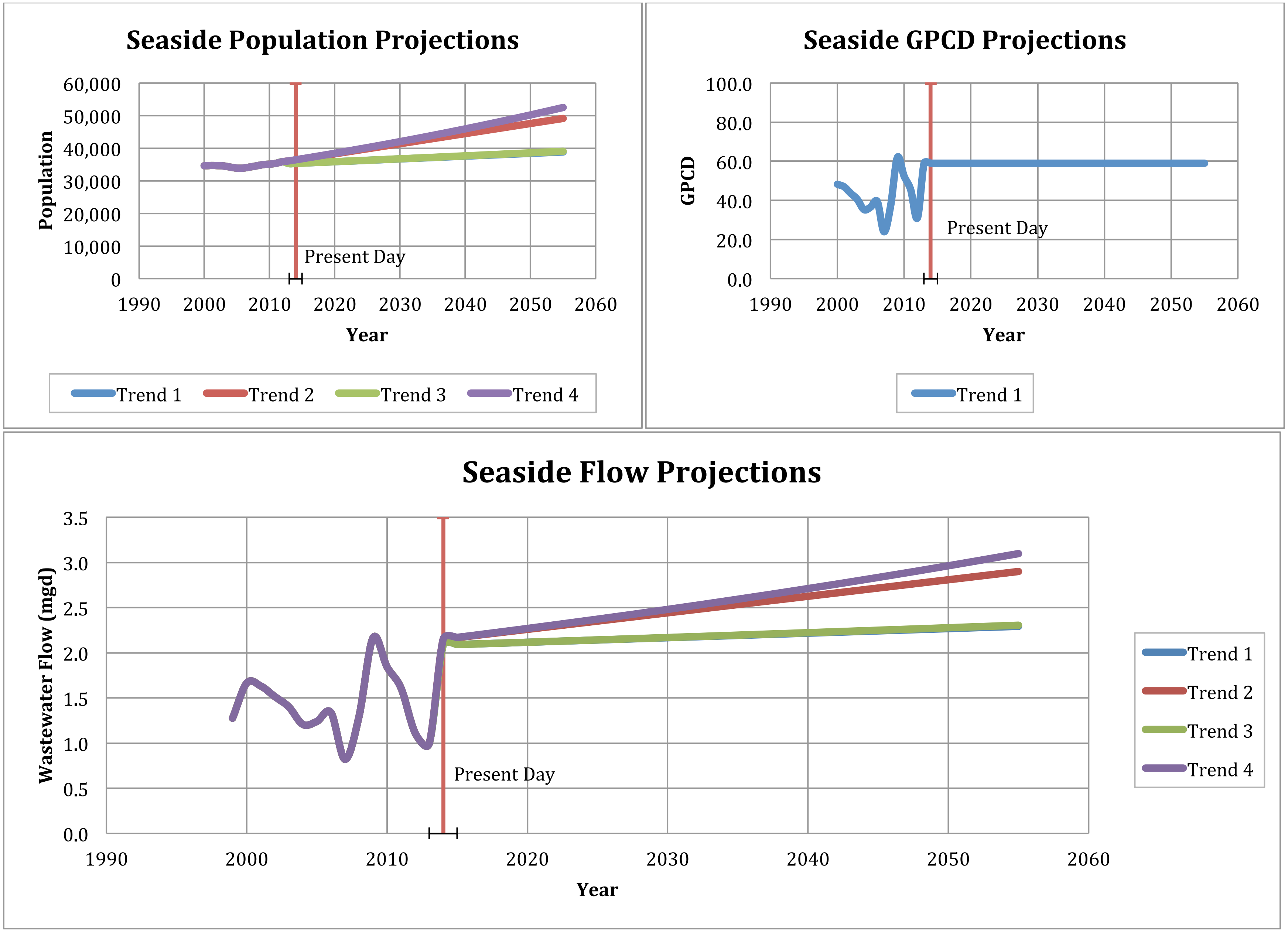


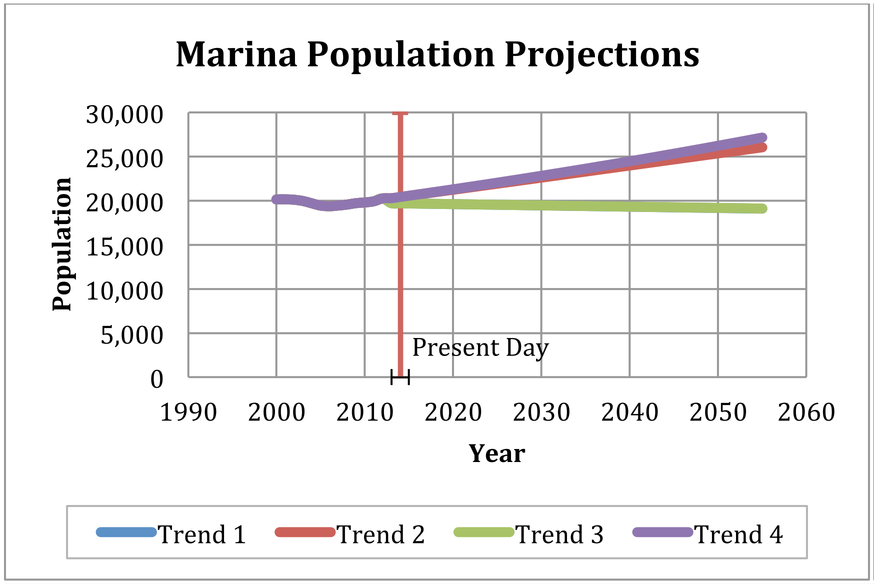

**Figure 23: Seaside Projections**

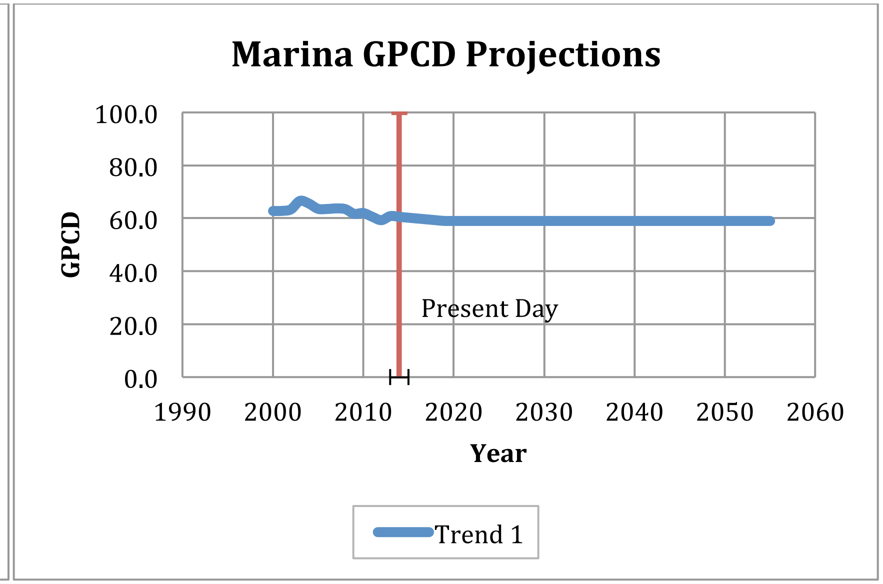
**Table 6: Seaside Model Results**

| | |
|---|---|
| **Community** | Seaside, Sand City, and Del Rey Oaks |
| **Min GPCD** | 59.0 |

| | | Population | | | | GPCD | Wastewater Flow | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Year** | **Trend 1** | **Trend 2** | **Trend 3** | **Trend 4** | **Trend 1** | **Trend 1** | **Trend 2** | **Trend 3** | **Trend 4** |
| **Historical** | 1999 | | | | | | 1.3 | 1.3 | 1.3 | 1.3 |
| | 2000 | 34,558 | 34,558 | 34,558 | 34,558 | 48.2 | 1.7 | 1.7 | 1.7 | 1.7 |
| | 2001 | 34,716 | 34,716 | 34,716 | 34,716 | 47.0 | 1.6 | 1.6 | 1.6 | 1.6 |
| | 2002 | 34,665 | 34,665 | 34,665 | 34,665 | 43.7 | 1.5 | 1.5 | 1.5 | 1.5 |
| | 2003 | 34,555 | 34,555 | 34,555 | 34,555 | 40.5 | 1.4 | 1.4 | 1.4 | 1.4 |
| | 2004 | 34,196 | 34,196 | 34,196 | 34,196 | 35.3 | 1.2 | 1.2 | 1.2 | 1.2 |
| | 2005 | 33,903 | 33,903 | 33,903 | 33,903 | 36.6 | 1.2 | 1.2 | 1.2 | 1.2 |
| | 2006 | 33,923 | 33,923 | 33,923 | 33,923 | 39.4 | 1.3 | 1.3 | 1.3 | 1.3 |
| | 2007 | 34,247 | 34,247 | 34,247 | 34,247 | 24.0 | 0.8 | 0.8 | 0.8 | 0.8 |
| | 2008 | 34,593 | 34,593 | 34,593 | 34,593 | 37.4 | 1.3 | 1.3 | 1.3 | 1.3 |
| | 2009 | 34,983 | 34,983 | 34,983 | 34,983 | 61.9 | 2.2 | 2.2 | 2.2 | 2.2 |
| | 2010 | 35,122 | 35,122 | 35,122 | 35,122 | 52.5 | 1.8 | 1.8 | 1.8 | 1.8 |
| | 2011 | 35,387 | 35,387 | 35,387 | 35,387 | 45.4 | 1.6 | 1.6 | 1.6 | 1.6 |
| | 2012 | 35,882 | 35,882 | 35,882 | 35,882 | 31.0 | 1.1 | 1.1 | 1.1 | 1.1 |
| **Projections** | 2013 | 35,270 | 36,118 | 35,264 | 36,134 | 59.0 | 1.0 | 1.0 | 1.0 | 1.0 |
| | 2014 | 35,355 | 36,428 | 35,350 | 36,457 | 59.0 | 2.1 | 2.1 | 2.1 | 2.2 |
| | 2015 | 35,440 | 36,738 | 35,436 | 36,783 | 59.0 | 2.1 | 2.2 | 2.1 | 2.2 |
| | 2016 | 35,526 | 37,048 | 35,523 | 37,112 | 59.0 | 2.1 | 2.2 | 2.1 | 2.2 |
| | 2017 | 35,611 | 37,358 | 35,610 | 37,443 | 59.0 | 2.1 | 2.2 | 2.1 | 2.2 |
| | 2018 | 35,697 | 37,669 | 35,697 | 37,778 | 59.0 | 2.1 | 2.2 | 2.1 | 2.2 |
| | 2019 | 35,782 | 37,979 | 35,784 | 38,116 | 59.0 | 2.1 | 2.2 | 2.1 | 2.2 |
| | 2020 | 35,868 | 38,289 | 35,871 | 38,456 | 59.0 | 2.1 | 2.3 | 2.1 | 2.3 |
| | 2025 | 36,295 | 39,840 | 36,311 | 40,205 | 59.0 | 2.1 | 2.4 | 2.1 | 2.4 |
| | 2030 | 36,722 | 41,391 | 36,757 | 42,034 | 59.0 | 2.2 | 2.4 | 2.2 | 2.5 |
| | 2035 | 37,149 | 42,942 | 37,208 | 43,946 | 59.0 | 2.2 | 2.5 | 2.2 | 2.6 |
| | 2040 | 37,576 | 44,493 | 37,664 | 45,945 | 59.0 | 2.2 | 2.6 | 2.2 | 2.7 |
| | 2045 | 38,003 | 46,044 | 38,126 | 48,035 | 59.0 | 2.2 | 2.7 | 2.2 | 2.8 |
| | 2050 | 38,431 | 47,596 | 38,594 | 50,220 | 59.0 | 2.3 | 2.8 | 2.3 | 3.0 |
| | 2055 | 38,858 | 49,147 | 39,067 | 52,504 | 59.0 | 2.3 | 2.9 | 2.3 | 3.1 |

# APPENDIX H – MARINA PROJECTIONS



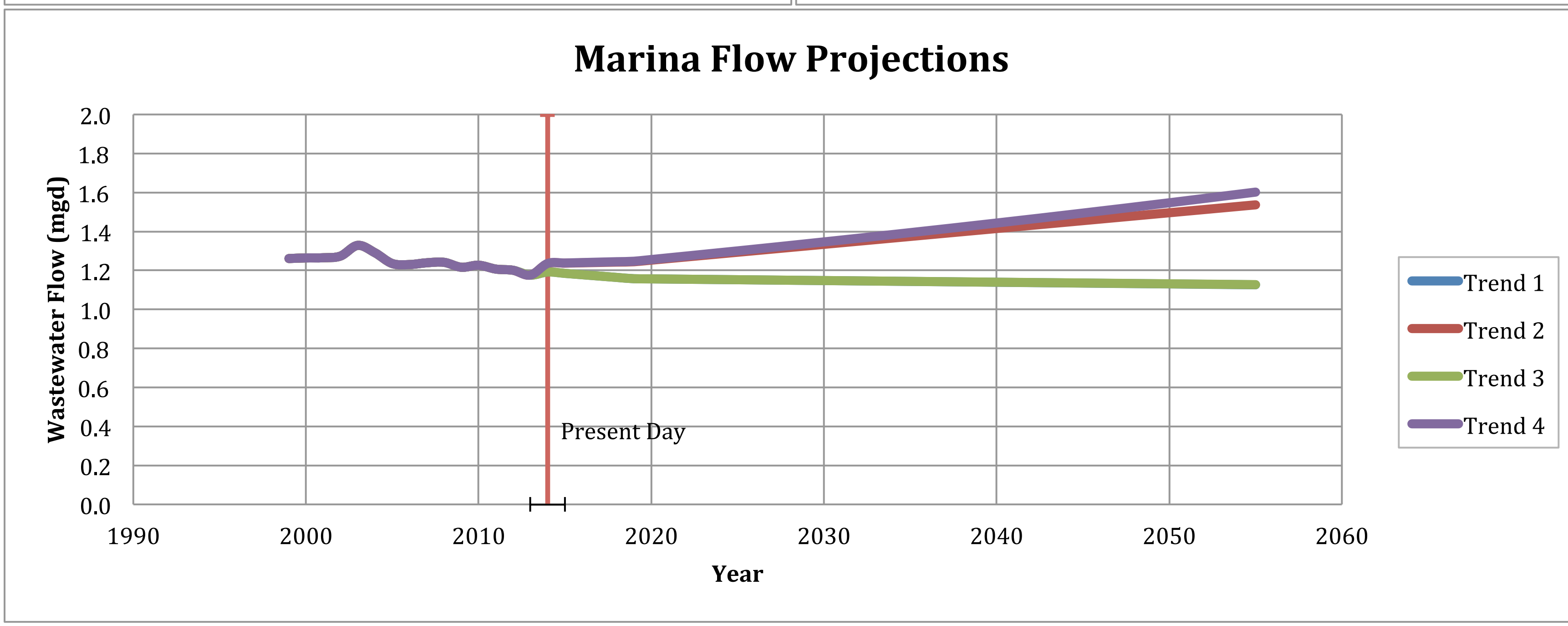




**Figure 24: Marina Projections**

**Table 7: Marina Model Results**

| | |
|---|---|
| **Community** | Marina |
| **Min GPCD** | 59.0 |

| | | Population | | | | GPCD | Wastewater Flow | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Year** | **Trend 1** | **Trend 2** | **Trend 3** | **Trend 4** | **Trend 1** | **Trend 1** | **Trend 2** | **Trend 3** | **Trend 4** |
| Historical | 1999 | | | | | | 1.3 | 1.3 | 1.3 | 1.3 |
| | 2000 | 20,151 | 20,151 | 20,151 | 20,151 | 62.7 | 1.3 | 1.3 | 1.3 | 1.3 |
| | 2001 | 20,147 | 20,147 | 20,147 | 20,147 | 62.8 | 1.3 | 1.3 | 1.3 | 1.3 |
| | 2002 | 20,100 | 20,100 | 20,100 | 20,100 | 63.4 | 1.3 | 1.3 | 1.3 | 1.3 |
| | 2003 | 19,956 | 19,956 | 19,956 | 19,956 | 66.6 | 1.3 | 1.3 | 1.3 | 1.3 |
| | 2004 | 19,690 | 19,690 | 19,690 | 19,690 | 65.5 | 1.3 | 1.3 | 1.3 | 1.3 |
| | 2005 | 19,435 | 19,435 | 19,435 | 19,435 | 63.6 | 1.2 | 1.2 | 1.2 | 1.2 |
| | 2006 | 19,369 | 19,369 | 19,369 | 19,369 | 63.5 | 1.2 | 1.2 | 1.2 | 1.2 |
| | 2007 | 19,449 | 19,449 | 19,449 | 19,449 | 63.7 | 1.2 | 1.2 | 1.2 | 1.2 |
| | 2008 | 19,559 | 19,559 | 19,559 | 19,559 | 63.5 | 1.2 | 1.2 | 1.2 | 1.2 |
| | 2009 | 19,718 | 19,718 | 19,718 | 19,718 | 61.7 | 1.2 | 1.2 | 1.2 | 1.2 |
| | 2010 | 19,795 | 19,795 | 19,795 | 19,795 | 62.0 | 1.2 | 1.2 | 1.2 | 1.2 |
| | 2011 | 19,928 | 19,928 | 19,928 | 19,928 | 60.6 | 1.2 | 1.2 | 1.2 | 1.2 |
| | 2012 | 20,253 | 20,253 | 20,253 | 20,253 | 59.3 | 1.2 | 1.2 | 1.2 | 1.2 |
| Projections | 2013 | 19,709 | 20,274 | 19,707 | 20,278 | 60.8 | 1.2 | 1.2 | 1.2 | 1.2 |
| | 2014 | 19,694 | 20,411 | 19,693 | 20,420 | 60.5 | 1.2 | 1.2 | 1.2 | 1.2 |
| | 2015 | 19,680 | 20,549 | 19,678 | 20,562 | 60.2 | 1.2 | 1.2 | 1.2 | 1.2 |
| | 2016 | 19,665 | 20,686 | 19,664 | 20,705 | 59.9 | 1.2 | 1.2 | 1.2 | 1.2 |
| | 2017 | 19,650 | 20,823 | 19,649 | 20,850 | 59.6 | 1.2 | 1.2 | 1.2 | 1.2 |
| | 2018 | 19,636 | 20,961 | 19,635 | 20,995 | 59.3 | 1.2 | 1.2 | 1.2 | 1.2 |
| | 2019 | 19,621 | 21,098 | 19,621 | 21,141 | 59.0 | 1.2 | 1.2 | 1.2 | 1.2 |
| | 2020 | 19,607 | 21,235 | 19,606 | 21,289 | 59.0 | 1.2 | 1.3 | 1.2 | 1.3 |
| | 2025 | 19,533 | 21,922 | 19,534 | 22,041 | 59.0 | 1.2 | 1.3 | 1.2 | 1.3 |
| | 2030 | 19,460 | 22,609 | 19,462 | 22,821 | 59.0 | 1.1 | 1.3 | 1.1 | 1.3 |
| | 2035 | 19,387 | 23,296 | 19,390 | 23,627 | 59.0 | 1.1 | 1.4 | 1.1 | 1.4 |
| | 2040 | 19,314 | 23,983 | 19,319 | 24,463 | 59.0 | 1.1 | 1.4 | 1.1 | 1.4 |
| | 2045 | 19,240 | 24,669 | 19,248 | 25,327 | 59.0 | 1.1 | 1.5 | 1.1 | 1.5 |
| | 2050 | 19,167 | 25,356 | 19,177 | 26,223 | 59.0 | 1.1 | 1.5 | 1.1 | 1.5 |
| | 2055 | 19,094 | 26,043 | 19,107 | 27,150 | 59.0 | 1.1 | 1.5 | 1.1 | 1.6 |

# APPENDIX I – SALINAS PROJECTIONS

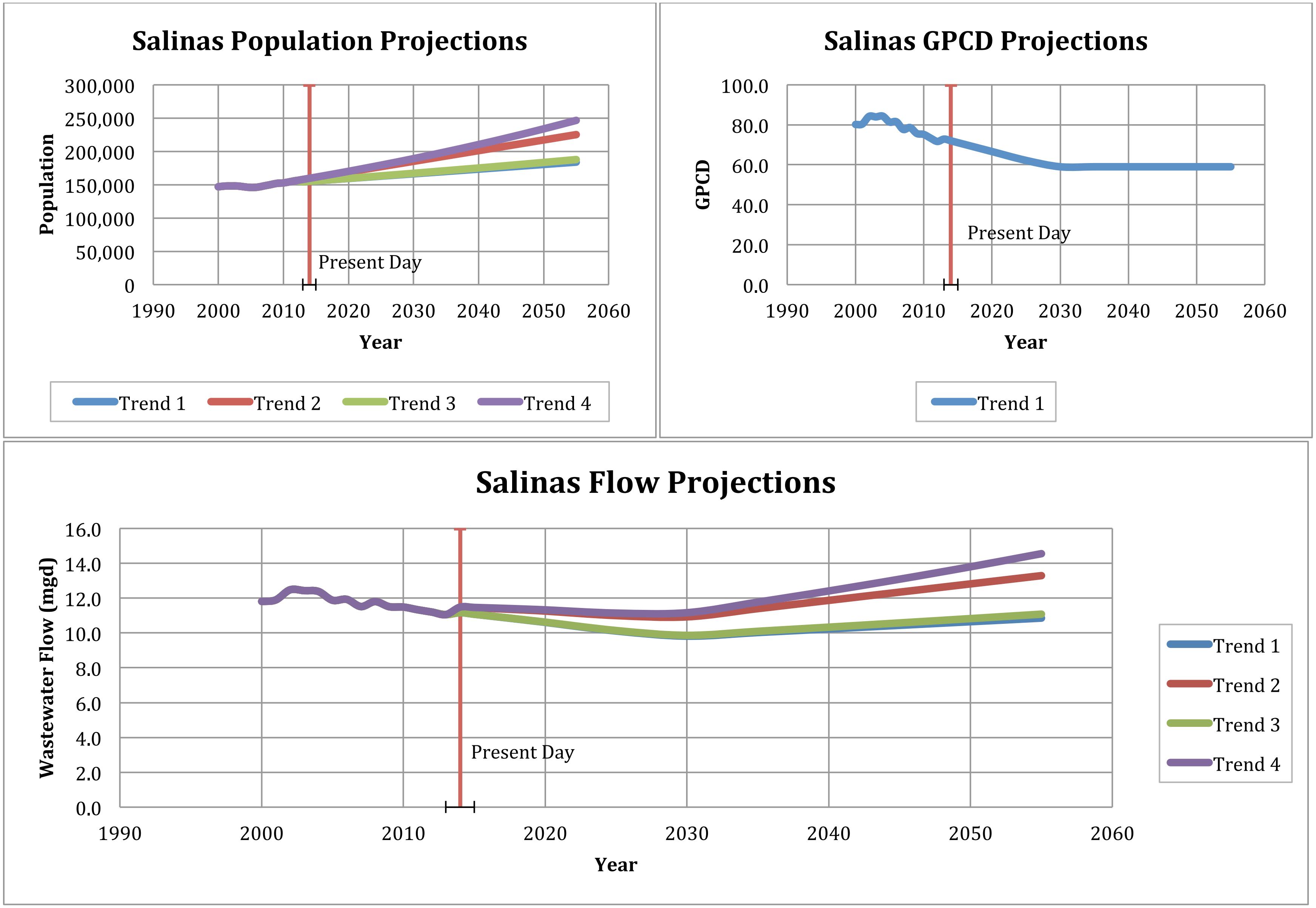



**Figure 25: Salinas Projections**

**Table 8: Salinas Model Results**

| | |
|---|---|
| **Community** | Salinas and Boronda |
| **Min GPCD** | 59.0 |

| | | Population | | | | GPCD | Wastewater Flow | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Year** | **Trend 1** | **Trend 2** | **Trend 3** | **Trend 4** | **Trend 1** | **Trend 1** | **Trend 2** | **Trend 3** | **Trend 4** |
| Historical | 1999 | | | | | | 10.3 | 10.3 | 10.3 | 10.3 |
| | 2000 | 146,960 | 146,960 | 146,960 | 146,960 | 80.3 | 11.8 | 11.8 | 11.8 | 11.8 |
| | 2001 | 148,035 | 148,035 | 148,035 | 148,035 | 80.4 | 11.9 | 11.9 | 11.9 | 11.9 |
| | 2002 | 148,144 | 148,144 | 148,144 | 148,144 | 84.2 | 12.5 | 12.5 | 12.5 | 12.5 |
| | 2003 | 148,053 | 148,053 | 148,053 | 148,053 | 84.0 | 12.4 | 12.4 | 12.4 | 12.4 |
| | 2004 | 146,834 | 146,834 | 146,834 | 146,834 | 84.3 | 12.4 | 12.4 | 12.4 | 12.4 |
| | 2005 | 145,948 | 145,948 | 145,948 | 145,948 | 81.4 | 11.9 | 11.9 | 11.9 | 11.9 |
| | 2006 | 146,364 | 146,364 | 146,364 | 146,364 | 81.5 | 11.9 | 11.9 | 11.9 | 11.9 |
| | 2007 | 148,236 | 148,236 | 148,236 | 148,236 | 77.7 | 11.5 | 11.5 | 11.5 | 11.5 |
| | 2008 | 150,114 | 150,114 | 150,114 | 150,114 | 78.6 | 11.8 | 11.8 | 11.8 | 11.8 |
| | 2009 | 152,113 | 152,113 | 152,113 | 152,113 | 75.7 | 11.5 | 11.5 | 11.5 | 11.5 |
| | 2010 | 152,758 | 152,758 | 152,758 | 152,758 | 75.2 | 11.5 | 11.5 | 11.5 | 11.5 |
| | 2011 | 154,512 | 154,512 | 154,512 | 154,512 | 73.4 | 11.3 | 11.3 | 11.3 | 11.3 |
| | 2012 | 156,271 | 156,271 | 156,271 | 156,271 | 71.7 | 11.2 | 11.2 | 11.2 | 11.2 |
| Projections | 2013 | 154,477 | 157,898 | 154,478 | 158,008 | 72.8 | 11.1 | 11.1 | 11.1 | 11.1 |
| | 2014 | 155,179 | 159,502 | 155,198 | 159,692 | 71.9 | 11.2 | 11.5 | 11.2 | 11.5 |
| | 2015 | 155,881 | 161,106 | 155,921 | 161,394 | 71.0 | 11.1 | 11.4 | 11.1 | 11.5 |
| | 2016 | 156,583 | 162,710 | 156,648 | 163,114 | 70.1 | 11.0 | 11.4 | 11.0 | 11.4 |
| | 2017 | 157,285 | 164,314 | 157,378 | 164,853 | 69.2 | 10.9 | 11.4 | 10.9 | 11.4 |
| | 2018 | 157,987 | 165,919 | 158,112 | 166,610 | 68.4 | 10.8 | 11.3 | 10.8 | 11.4 |
| | 2019 | 158,688 | 167,523 | 158,849 | 168,386 | 67.5 | 10.7 | 11.3 | 10.7 | 11.4 |
| | 2020 | 159,390 | 169,127 | 159,589 | 170,181 | 66.6 | 10.6 | 11.3 | 10.6 | 11.3 |
| | 2025 | 162,900 | 177,148 | 163,343 | 179,447 | 62.1 | 10.1 | 11.0 | 10.1 | 11.1 |
| | 2030 | 166,409 | 185,169 | 167,185 | 189,216 | 59.0 | 9.8 | 10.9 | 9.9 | 11.2 |
| | 2035 | 169,918 | 193,190 | 171,117 | 199,518 | 59.0 | 10.0 | 11.4 | 10.1 | 11.8 |
| | 2040 | 173,427 | 201,210 | 175,142 | 210,381 | 59.0 | 10.2 | 11.9 | 10.3 | 12.4 |
| | 2045 | 176,936 | 209,231 | 179,262 | 221,835 | 59.0 | 10.4 | 12.3 | 10.6 | 13.1 |
| | 2050 | 180,446 | 217,252 | 183,479 | 233,912 | 59.0 | 10.6 | 12.8 | 10.8 | 13.8 |
| | 2055 | 183,955 | 225,273 | 187,795 | 246,648 | 59.0 | 10.9 | 13.3 | 11.1 | 14.6 |

# APPENDIX J – MOSS LANDING PROJECTIONS

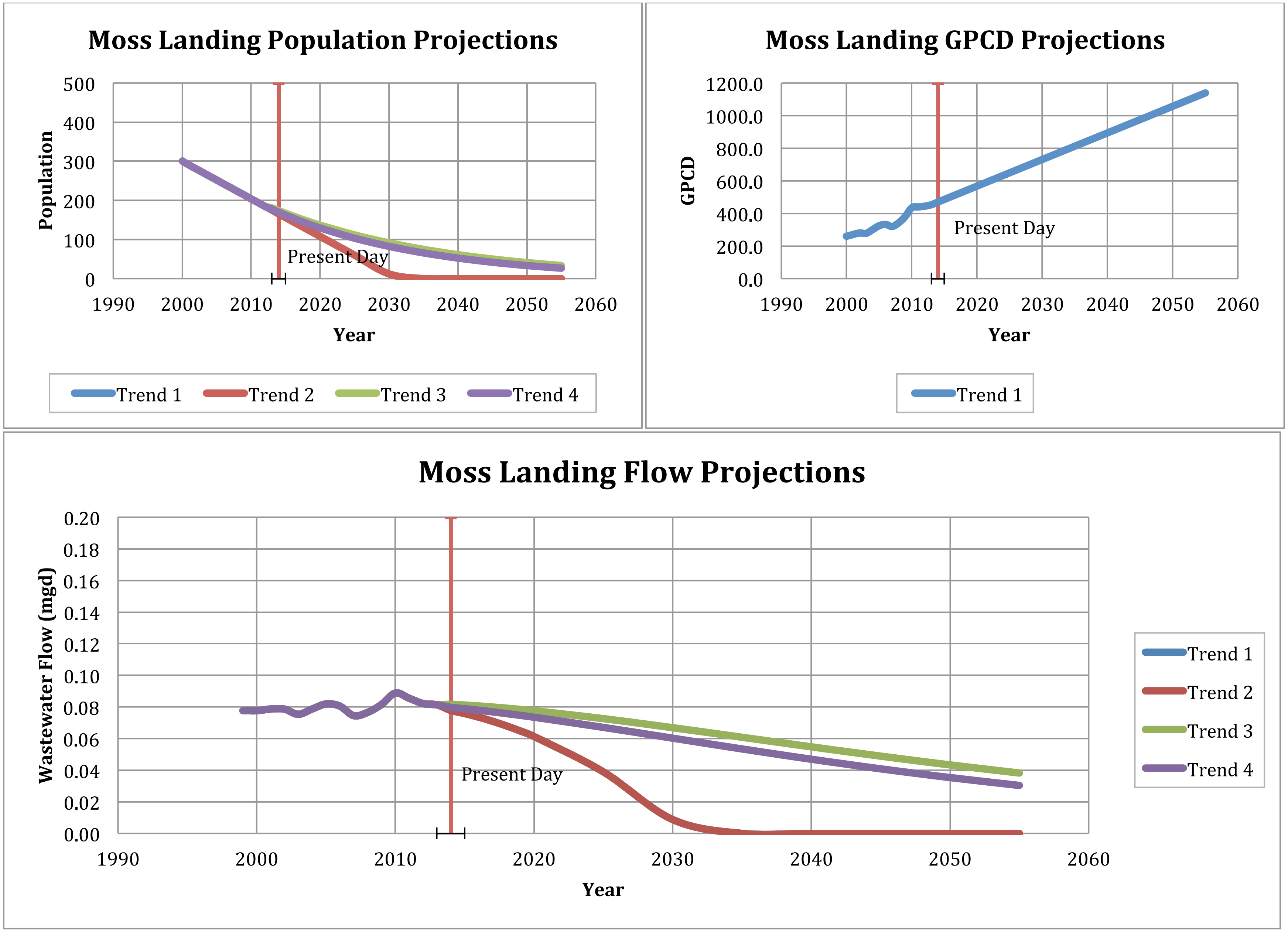



**Figure 26: Moss Landing Projections**

**Table 9: Moss Landing Model Results**

| | |
|---|---|
| **Community** | Moss Landing |
| **Min GPCD** | 59.0 |

| | | Population | | | | GPCD | Wastewater Flow | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Year** | **Trend 1** | **Trend 2** | **Trend 3** | **Trend 4** | **Trend 1** | **Trend 1** | **Trend 2** | **Trend 3** | **Trend 4** |
| **Historical** | 1999 | | | | | | 0.08 | 0.08 | 0.08 | 0.08 |
| | 2000 | 300 | 300 | 300 | 300 | 258.8 | 0.08 | 0.08 | 0.08 | 0.08 |
| | 2001 | 290 | 290 | 290 | 290 | 271.0 | 0.08 | 0.08 | 0.08 | 0.08 |
| | 2002 | 281 | 281 | 281 | 281 | 280.0 | 0.08 | 0.08 | 0.08 | 0.08 |
| | 2003 | 271 | 271 | 271 | 271 | 277.9 | 0.08 | 0.08 | 0.08 | 0.08 |
| | 2004 | 262 | 262 | 262 | 262 | 300.9 | 0.08 | 0.08 | 0.08 | 0.08 |
| | 2005 | 252 | 252 | 252 | 252 | 325.0 | 0.08 | 0.08 | 0.08 | 0.08 |
| | 2006 | 242 | 242 | 242 | 242 | 332.3 | 0.08 | 0.08 | 0.08 | 0.08 |
| | 2007 | 233 | 233 | 233 | 233 | 319.9 | 0.07 | 0.07 | 0.07 | 0.07 |
| | 2008 | 223 | 223 | 223 | 223 | 343.0 | 0.08 | 0.08 | 0.08 | 0.08 |
| | 2009 | 214 | 214 | 214 | 214 | 381.7 | 0.08 | 0.08 | 0.08 | 0.08 |
| | 2010 | 204 | 204 | 204 | 204 | 435.3 | 0.09 | 0.09 | 0.09 | 0.09 |
| | 2011 | 194 | 194 | 194 | 194 | 439.8 | 0.09 | 0.09 | 0.09 | 0.09 |
| | 2012 | 185 | 185 | 185 | 185 | 444.7 | 0.08 | 0.08 | 0.08 | 0.08 |
| **Projections** | 2013 | 175 | 175 | 181 | 178 | 453.5 | 0.08 | 0.08 | 0.08 | 0.08 |
| | 2014 | 166 | 166 | 174 | 170 | 469.8 | 0.08 | 0.08 | 0.08 | 0.08 |
| | 2015 | 156 | 156 | 167 | 162 | 486.2 | 0.08 | 0.08 | 0.08 | 0.08 |
| | 2016 | 146 | 146 | 160 | 155 | 502.5 | 0.07 | 0.07 | 0.08 | 0.08 |
| | 2017 | 137 | 137 | 154 | 148 | 518.8 | 0.07 | 0.07 | 0.08 | 0.08 |
| | 2018 | 127 | 127 | 148 | 142 | 535.1 | 0.07 | 0.07 | 0.08 | 0.08 |
| | 2019 | 118 | 118 | 142 | 135 | 551.5 | 0.06 | 0.06 | 0.08 | 0.07 |
| | 2020 | 108 | 108 | 137 | 129 | 567.8 | 0.06 | 0.06 | 0.08 | 0.07 |
| | 2025 | 60 | 60 | 112 | 103 | 649.4 | 0.04 | 0.04 | 0.07 | 0.07 |
| | 2030 | 12 | 12 | 91 | 82 | 731.1 | 0.01 | 0.01 | 0.07 | 0.06 |
| | 2035 | 0 | 0 | 75 | 66 | 812.7 | 0.00 | 0.00 | 0.06 | 0.05 |
| | 2040 | 0 | 0 | 61 | 52 | 894.3 | 0.00 | 0.00 | 0.05 | 0.05 |
| | 2045 | 0 | 0 | 50 | 42 | 975.9 | 0.00 | 0.00 | 0.05 | 0.04 |
| | 2050 | 0 | 0 | 41 | 33 | 1057.6 | 0.00 | 0.00 | 0.04 | 0.04 |
| | 2055 | 0 | 0 | 34 | 27 | 1139.2 | 0.00 | 0.00 | 0.04 | 0.03 |

# APPENDIX K – CASTROVILLE PROJECTIONS

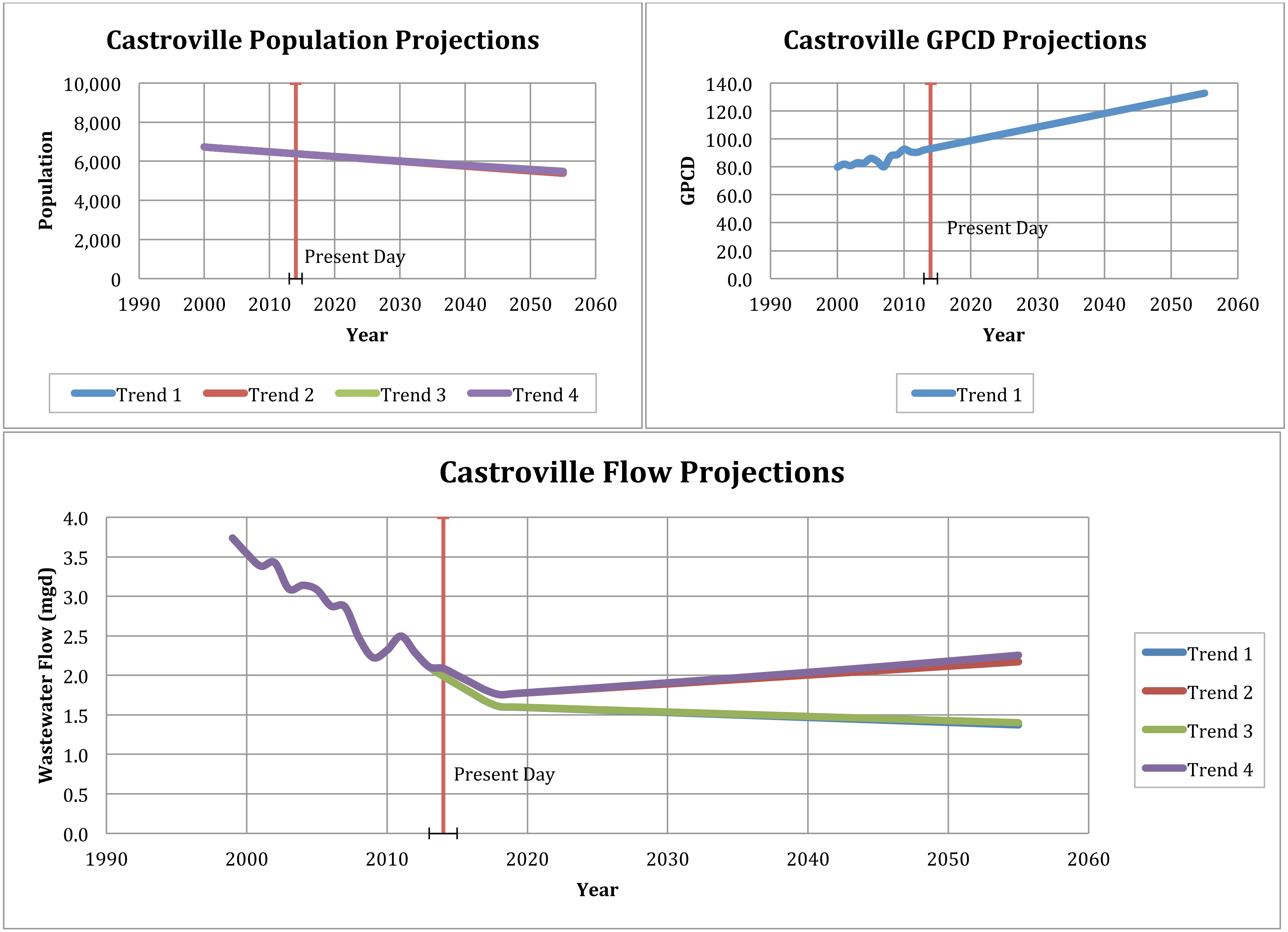



**Figure 27: Castroville Projections**

**Table 10: Castroville Model Results**

| | |
|---|---|
| **Community** | Castroville |
| **Min GPCD** | 59.0 |

| | | Population | | | | GPCD | Wastewater Flow | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Year** | **Trend 1** | **Trend 2** | **Trend 3** | **Trend 4** | **Trend 1** | **Trend 1** | **Trend 2** | **Trend 3** | **Trend 4** |
| **Historical** | 1999 | | | | | | 0.6 | 0.6 | 0.6 | 0.6 |
| | 2000 | 6,724 | 6,724 | 6,724 | 6,724 | 79.8 | 0.5 | 0.5 | 0.5 | 0.5 |
| | 2001 | 6,700 | 6,700 | 6,700 | 6,700 | 82.0 | 0.5 | 0.5 | 0.5 | 0.5 |
| | 2002 | 6,675 | 6,675 | 6,675 | 6,675 | 80.9 | 0.5 | 0.5 | 0.5 | 0.5 |
| | 2003 | 6,651 | 6,651 | 6,651 | 6,651 | 83.0 | 0.6 | 0.6 | 0.6 | 0.6 |
| | 2004 | 6,627 | 6,627 | 6,627 | 6,627 | 82.7 | 0.5 | 0.5 | 0.5 | 0.5 |
| | 2005 | 6,603 | 6,603 | 6,603 | 6,603 | 86.1 | 0.6 | 0.6 | 0.6 | 0.6 |
| | 2006 | 6,578 | 6,578 | 6,578 | 6,578 | 84.0 | 0.6 | 0.6 | 0.6 | 0.6 |
| | 2007 | 6,554 | 6,554 | 6,554 | 6,554 | 80.0 | 0.5 | 0.5 | 0.5 | 0.5 |
| | 2008 | 6,530 | 6,530 | 6,530 | 6,530 | 87.7 | 0.6 | 0.6 | 0.6 | 0.6 |
| | 2009 | 6,505 | 6,505 | 6,505 | 6,505 | 88.8 | 0.6 | 0.6 | 0.6 | 0.6 |
| | 2010 | 6,481 | 6,481 | 6,481 | 6,481 | 92.7 | 0.6 | 0.6 | 0.6 | 0.6 |
| | 2011 | 6,457 | 6,457 | 6,457 | 6,457 | 90.7 | 0.6 | 0.6 | 0.6 | 0.6 |
| | 2012 | 6,432 | 6,432 | 6,432 | 6,432 | 90.4 | 0.6 | 0.6 | 0.6 | 0.6 |
| **Projections** | 2013 | 6,408 | 6,408 | 6,410 | 6,409 | 92.1 | 0.6 | 0.6 | 0.6 | 0.6 |
| | 2014 | 6,384 | 6,384 | 6,386 | 6,385 | 93.0 | 0.6 | 0.6 | 0.6 | 0.6 |
| | 2015 | 6,360 | 6,360 | 6,362 | 6,361 | 94.0 | 0.6 | 0.6 | 0.6 | 0.6 |
| | 2016 | 6,335 | 6,335 | 6,339 | 6,337 | 95.0 | 0.6 | 0.6 | 0.6 | 0.6 |
| | 2017 | 6,311 | 6,311 | 6,316 | 6,314 | 95.9 | 0.6 | 0.6 | 0.6 | 0.6 |
| | 2018 | 6,287 | 6,287 | 6,292 | 6,290 | 96.9 | 0.6 | 0.6 | 0.6 | 0.6 |
| | 2019 | 6,262 | 6,262 | 6,269 | 6,267 | 97.9 | 0.6 | 0.6 | 0.6 | 0.6 |
| | 2020 | 6,238 | 6,238 | 6,246 | 6,243 | 98.8 | 0.6 | 0.6 | 0.6 | 0.6 |
| | 2025 | 6,117 | 6,117 | 6,132 | 6,128 | 103.7 | 0.6 | 0.6 | 0.6 | 0.6 |
| | 2030 | 5,995 | 5,995 | 6,019 | 6,014 | 108.5 | 0.7 | 0.7 | 0.7 | 0.7 |
| | 2035 | 5,874 | 5,874 | 5,909 | 5,903 | 113.4 | 0.7 | 0.7 | 0.7 | 0.7 |
| | 2040 | 5,752 | 5,752 | 5,801 | 5,794 | 118.2 | 0.7 | 0.7 | 0.7 | 0.7 |
| | 2045 | 5,631 | 5,631 | 5,695 | 5,687 | 123.1 | 0.7 | 0.7 | 0.7 | 0.7 |
| | 2050 | 5,509 | 5,509 | 5,591 | 5,581 | 127.9 | 0.7 | 0.7 | 0.7 | 0.7 |
| | 2055 | 5,388 | 5,388 | 5,488 | 5,478 | 132.7 | 0.7 | 0.7 | 0.7 | 0.7 |

# APPENDIX L – INSTRUCTIONS FOR ADJUSTING THE MODEL

# Adjusting the Projections Model

The MRWPCA wastewater flow projections spreadsheet model is contained within one Excel 2011 spreadsheet file. The file is separated into multiple worksheets that are viewed by clicking on the named tabs located at the bottom of the open file's window. The model was developed so that new population and flow data may be added and minimum GPCD constraints changed. Changes to the model can be made within the 9 community model worksheets. The community model worksheets are:

- Pacific Grove Model
- Monterey Model
- Seaside Model (includes Del Rey Oaks and Sand City)
- Marina Model
- Salinas Model (includes Boronda)
- Moss Landing Model
- Castroville Model
- RTP Model
- RTP Independent Model

The other worksheets are for reference and calculation purposes only and should not be modified.

The following sections describe the adjustable model features.

## Change Minimum Assumed GPCD

The model accounts for assumptions that per capita wastewater flow is always greater than or equal to a selected baseline value. The baseline value is adjustable by the user. The current model uses 59.0 GPCD as the default assumed minimum baseline value. To test a different minimum assumed GPCD for any community, type the desired number into the box labeled "Min GPCD" at the top of a community model tab. Projected GPCD values will only decrease to values greater than or equal to this minimum value.

| Community | Pacific Grove |
|---|---|
| Min GPCD | 59.0 |

| | | pulation | | | | GPCD | Wastewater Flow | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Year | | 2 | Trend 3 | Trend 4 | Trend 1 | Trend 1 | Trend 2 | Trend 3 | Trend 4 |
| Historical | 1999 | | | | | | 1.2 | 1.2 | 1.2 | 1.2 |
| | 2000 | 15,595 | 15,595 | 15,595 | 15,595 | 90.2 | 1.4 | 1.4 | 1.4 | 1.4 |
| | 2001 | 15,584 | 15,584 | 15,584 | 15,584 | 83.4 | 1.3 | 1.3 | 1.3 | 1.3 |
| | 2002 | 15,464 | 15,464 | 15,464 | 15,464 | 81.4 | 1.3 | 1.3 | 1.3 | 1.3 |
| | 2003 | 15,330 | 15,330 | 15,330 | 15,330 | 83.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| | 2004 | 15,080 | 15,080 | 15,080 | 15,080 | 82.4 | 1.2 | 1.2 | 1.2 | 1.2 |
| | 2005 | 14,869 | 14,869 | 14,869 | 14,869 | 94.3 | 1.4 | 1.4 | 1.4 | 1.4 |
| | 2006 | 14,795 | 14,795 | 14,795 | 14,795 | 93.7 | 1.4 | 1.4 | 1.4 | 1.4 |
| | 2007 | 14,864 | 14,864 | 14,864 | 14,864 | 79.0 | 1.2 | 1.2 | 1.2 | 1.2 |
| | 2008 | 14,933 | 14,933 | 14,933 | 14,933 | 77.6 | 1.2 | 1.2 | 1.2 | 1.2 |
| | 2009 | 15,041 | 15,041 | 15,041 | 15,041 | 76.4 | 1.1 | 1.1 | 1.1 | 1.1 |
| | 2010 | 15,101 | 15,101 | 15,101 | 15,101 | 93.7 | 1.4 | 1.4 | 1.4 | 1.4 |
| | 2011 | 15,246 | 15,246 | 15,246 | 15,246 | 70.4 | 1.1 | 1.1 | 1.1 | 1.1 |
| | 2012 | 15,407 | 15,407 | 15,407 | 15,407 | 61.2 | 0.9 | 0.9 | 0.9 | 0.9 |
| Projections | 2013 | 14,969 | 15,451 | 14,970 | 15,454 | 73.0 | 0.9 | 0.9 | 0.9 | 0.9 |
| | 2014 | 14,939 | 15,550 | 14,941 | 15,556 | 71.7 | 1.1 | 1.1 | 1.1 | 1.1 |
| | 2015 | 14,909 | 15,648 | 14,912 | 15,658 | 70.4 | 1.1 | 1.1 | 1.1 | 1.1 |
| | 2016 | 14,879 | 15,747 | 14,883 | 15,761 | 69.1 | 1.0 | 1.1 | 1.0 | 1.1 |
| | 2017 | 14,849 | 15,846 | 14,854 | 15,864 | 67.8 | | 1.1 | 1.0 | 1.1 |
| | 2018 | 14,819 | 15,945 | 14,825 | 15,969 | 66.6 | | 1.1 | 1.0 | 1.1 |
| | 2019 | 14,789 | 16,044 | 14,796 | 16,074 | 65.3 | | 1.0 | 1.0 | 1.0 |
| | 2020 | 14,759 | 16,143 | 14,767 | 16,179 | 64.0 | | 1.0 | 0.9 | 1.0 |
| | 2025 | 14,610 | 16,637 | 14,624 | 16,719 | 59.0 | 0.9 | 1.0 | 0.9 | 1.0 |
| | 2030 | 14,461 | 17,131 | 14,482 | 17,276 | 59.0 | 0.9 | 1.0 | 0.9 | 1.0 |
| | 2035 | 14,311 | 17,626 | 14,342 | 17,851 | 59.0 | 0.8 | 1.0 | 0.8 | 1.1 |
| | 2040 | 14,162 | 18,120 | 14,203 | 18,446 | 59.0 | 0.8 | 1.1 | 0.8 | 1.1 |
| | 2045 | 14,013 | 18,614 | 14,065 | 19,060 | 59.0 | 0.8 | 1.1 | 0.8 | 1.1 |
| | 2050 | 13,863 | 19,108 | 13,929 | 19,695 | 59.0 | 0.8 | 1.1 | 0.8 | 1.2 |
| | 2055 | 13,714 | 19,603 | 13,794 | 20,352 | 59.0 | 0.8 | 1.2 | 0.8 | 1.2 |

Input Value

Min GPCD Achieved

Figure 28: Change Minimum Assumed GPCD

## Input New Population and Flow Data

Green shaded cells in the community model tabs contain historical data, while unshaded cells contain projected values. To update the community models with the latest actual population data, type the new data into the first year of unshaded projections. Because four different population projections are made to account for a range of possible scenarios, there are four columns of population data that need to be updated. For example, if the U.S. Census publishes a 2013 population estimate of 15,600 for the city of Pacific Grove, type 15,600 into each of the four population columns corresponding to the year 2013.

Use the same method to input the latest actual wastewater flow data.

After a row is updated with actual data for both population and wastewater flow, update the GPCD cell in the same row by copying the green shaded GPCD cell from the row above, right clicking the unshaded cell to be updated, select Paste Special, then choose Formulas from the pop-up menu.

As a visual aid, shade the new cells containing actual data green: select the cells, right click, and choose Format Cells from the pop-up menu. From the window that appears, select the fill tab, and choose light green to shade the cells to signify that they contain data and not projections.

Update population projections by double clicking the population projection cell under the row that was just updated. The data used as inputs to this cell should appear as colored rectangles on the spreadsheet. Click and drag the bottom corners of the rectangles covering the input population data and input years so that the rectangle enlarges to also cover the new population data value entered and its corresponding year. Press Enter. Right click the cell, select copy, then highlight all rows of unshaded projections within that column, taking care not to highlight any rows of actual data. Right click, select Paste Special, then choose Formulas from the pop-up menu. The formulas used to calculate population projections should update. Repeat the steps from this paragraph for the remaining columns of population projections.

Once the population projections are updated by following these steps, the wastewater flow projections automatically update.

| | |
|---|---|
| **Community** | Pacific Grove |
| **Min GPCD** | 59.0 |

| | | Population | | | | GPCD | Wastewater Flow | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Year** | **Trend 1** | **Trend 2** | **Trend 3** | **Trend 4** | **Trend 1** | **Trend 1** | **Trend 2** | **Trend 3** | **Trend 4** |
| **Historical** | 1999 | | | | | | 1.2 | 1.2 | 1.2 | 1.2 |
| | 2000 | 15,595 | 15,595 | 15,595 | 15,595 | 90.2 | 1.4 | 1.4 | 1.4 | 1.4 |
| | 2001 | 15,584 | 15,584 | 15,584 | 15,584 | 83.4 | 1.3 | 1.3 | 1.3 | 1.3 |
| | 2002 | 15,464 | 15,464 | 15,464 | 15,464 | 81.4 | 1.3 | 1.3 | 1.3 | 1.3 |
| | 2003 | 15,330 | 15,330 | 15,330 | 15,330 | 83.3 | 1.3 | 1.3 | 1.3 | 1.3 |
| | 2004 | 15,080 | 15,080 | 15,080 | 15,080 | 82.4 | 1.2 | 1.2 | 1.2 | 1.2 |
| | 2005 | 14,869 | 14,869 | 14,869 | 14,869 | 94.3 | 1.4 | 1.4 | 1.4 | 1.4 |
| | 2006 | 14,795 | 14,795 | 14,795 | 14,795 | 93.7 | 1.4 | 1.4 | 1.4 | 1.4 |
| | 2007 | 14,864 | 14,864 | 14,864 | 14,864 | 79.0 | 1.2 | 1.2 | 1.2 | 1.2 |
| | 2008 | 14,933 | 14,933 | 14,933 | 14,933 | 77.6 | 1.2 | 1.2 | 1.2 | 1.2 |
| | 2009 | 15,041 | 15,041 | 15,041 | 15,041 | 76.4 | 1.1 | 1.1 | 1.1 | 1.1 |
| | 2010 | 15,101 | 15,101 | 15,101 | 15,101 | 93.7 | 1.4 | 1.4 | 1.4 | 1.4 |
| | 2011 | 15,246 | 15,246 | 15,246 | 15,246 | 70.4 | 1.1 | 1.1 | 1.1 | 1.1 |
| | 2012 | 15,407 | 15,407 | 15,407 | 15,407 | 61.2 | 0.9 | 0.9 | 0.9 | 0.9 |
| **Projections** | 2013 | 14,969 | 5,451 | 14,970 | 15,454 | 73.0 | 0.9 | 0.9 | 0.9 | 0.9 |
| | 2014 | =TREND($D$7:$D$19,$B$7:$B$19,B21) | | | | 71.7 | 1.1 | 1.1 | 1.1 | 1.1 |
| | 2015 | TREND(known_y's, [known_x's], [new_x's], [const]) | | | | 70.4 | 1.1 | 1.1 | 1.1 | 1.1 |
| | 2016 | 14,879 | 15,747 | 14,883 | 15,761 | 69.1 | 1.0 | 1.1 | 1.0 | 1.1 |
| | 2017 | 14,849 | 15,846 | 14,854 | 15,864 | 67.8 | 1.0 | 1.1 | 1.0 | 1.1 |
| | 2018 | 14,819 | 15,945 | 14,825 | 15,969 | 66.6 | 1.0 | 1.1 | 1.0 | 1.1 |
| | 2019 | 14,789 | 16,044 | 14,796 | 16,074 | 65.3 | 1.0 | 1.0 | 1.0 | 1.0 |
| | 2020 | 14,759 | 16,143 | 14,767 | 16,179 | 64.0 | 0.9 | 1.0 | 0.9 | 1.0 |
| | 2025 | 14,610 | 16,637 | 14,624 | 16,719 | 59.0 | 0.9 | 1.0 | 0.9 | 1.0 |
| | 2030 | 14,461 | 17,131 | 14,482 | 17,276 | 59.0 | 0.9 | 1.0 | 0.9 | 1.0 |
| | 2035 | 14,311 | 17,626 | 14,342 | 17,851 | 59.0 | 0.8 | 1.0 | 0.8 | 1.1 |
| | 2040 | 14,162 | 18,120 | 14,203 | 18,446 | 59.0 | 0.8 | 1.1 | 0.8 | 1.1 |
| | 2045 | 14,013 | 18,614 | 14,065 | 19,060 | 59.0 | 0.8 | 1.1 | 0.8 | 1.1 |
| | 2050 | 13,863 | 19,108 | 13,929 | 19,695 | 59.0 | 0.8 | 1.1 | 0.8 | 1.2 |
| | 2055 | 13,714 | 19,603 | 13,794 | 20,352 | 59.0 | 0.8 | 1.2 | 0.8 | 1.2 |

**Figure 29: Input New Population and Flow Data**

## Adjust "Present Day" on Graphs

The red vertical bars in the projection graphs are visual aids that can be individually adjusted to match the current year. To do this, right click anywhere on the graph and choose "Select Data." A pop-up menu will open. From the list of data series on the left, scroll down and click "Present Day." Change the "X–value" on the right by typing in an equal sign, a curly brace, the current year, and a closing curly brace.

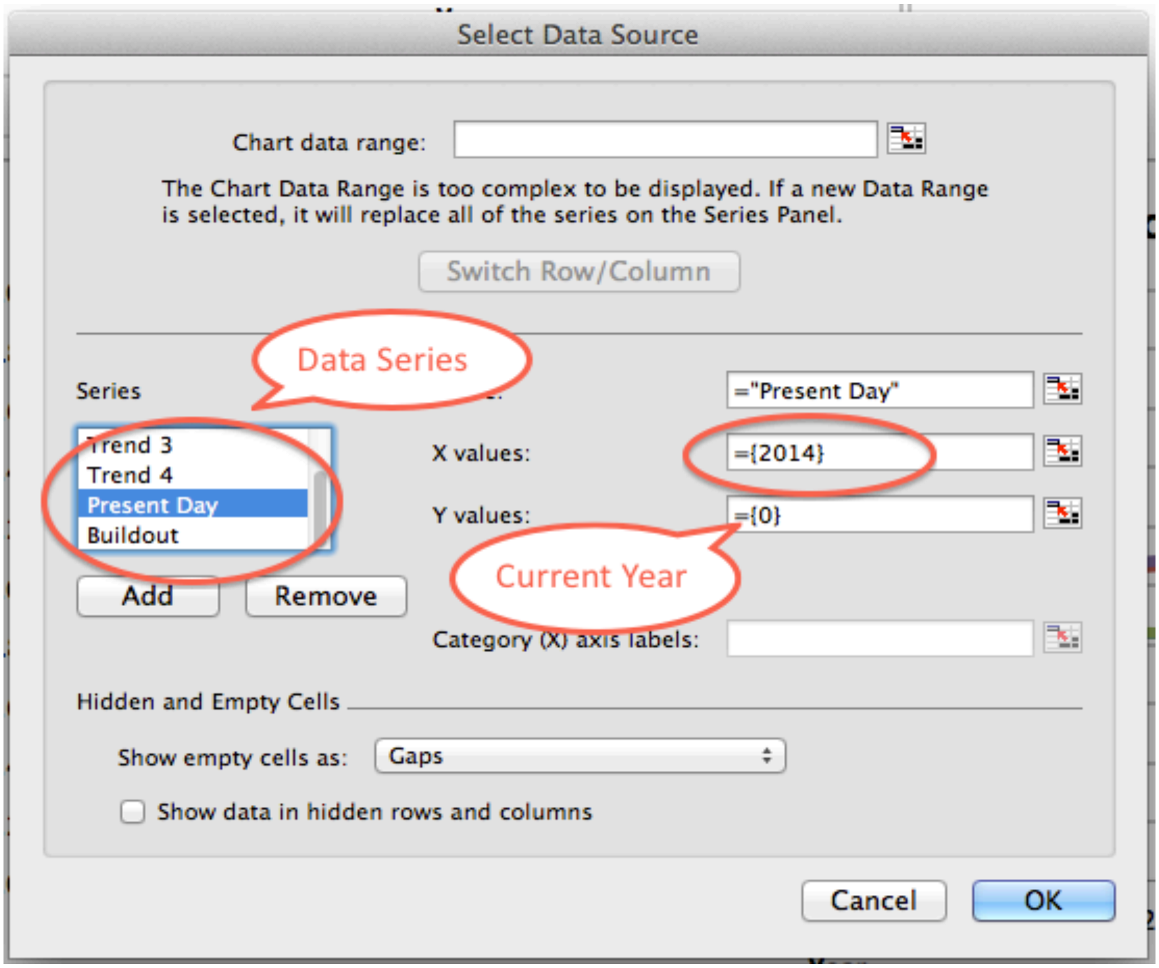



Figure 30: Input “Present Day” on Graphs

## Independent RTP Projections

Changes made to population and wastewater flow projections in individual community spreadsheets are calculated to accumulate in the RTP projection results, presented in the worksheet “RTP Model”. That is, RTP wastewater flow projections are made from cumulative results at the community level.

To test changes in population and wastewater flow projections or GPCD constraints at the RTP independently from the behavior of its communities, use the “RTP Independent Model” spreadsheet tab in the same manner as other community tabs.  This worksheet relies on flow data directly from the RTP and is not data calculated from the regional pump stations.

| Community | | RTP Independent | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Min GPCD | | 59.0 | | | | | | | | |
| | | Population | | | | | Wastewater Flow | | | |
| | Year | Trend 1 | Trend 2 | Trend 3 | Trend | | end 1 | Trend 2 | Trend 3 | Trend 4 |
| Historical | 1999 | [redacted] | | | | | 19.4 | 19.4 | 19.4 | 19.4 |
| | 2000 | 253,870 | 253,870 | 253,870 | 253,870 | 83.7 | 21.2 | 21.2 | 21.2 | 21.2 |
| | 2001 | 254,882 | 254,882 | 254,882 | 254,882 | 82.7 | 21.1 | 21.1 | 21.1 | 21.1 |
| | 2002 | 254,644 | 254,644 | 254,644 | 254,644 | 84.4 | 21.5 | 21.5 | 21.5 | 21.5 |
| | 2003 | 253,791 | 253,791 | 253,791 | 253,791 | 83.2 | 21.1 | 21.1 | 21.1 | 21.1 |
| | 2004 | 251,200 | 251,200 | 251,200 | 251,200 | 83.0 | 20.8 | 20.8 | 20.8 | 20.8 |
| | 2005 | 249,014 | 249,014 | 249,014 | 249,014 | 82.1 | 20.4 | 20.4 | 20.4 | 20.4 |
| | 2006 | 249,066 | 249,066 | 249,066 | 249,066 | 81.7 | 20.3 | 20.3 | 20.3 | 20.3 |
| | 2007 | 251,280 | 251,280 | 251,280 | 251,280 | 76.3 | 19.2 | 19.2 | 19.2 | 19.2 |
| | 2008 | 253,653 | 253,653 | 253,653 | 253,653 | 77.0 | 19.5 | 19.5 | 19.5 | 19.5 |
| | 2009 | 256,383 | 256,383 | 256,383 | 256,383 | 77.3 | 19.8 | 19.8 | 19.8 | 19.8 |
| | 2010 | 257,375 | 257,375 | 257,375 | 257,375 | 77.2 | 19.9 | 19.9 | 19.9 | 19.9 |
| | 2011 | 260,164 | 260,164 | 260,164 | 260,164 | 74.2 | 19.3 | 19.3 | 19.3 | 19.3 |
| | 2012 | 263,433 | 263,433 | 263,433 | 263,433 | 69.4 | 18.3 | 18.3 | 18.3 | 18.3 |
| Projections | 2013 | 258,737 | 265,135 | 258,693 | 265,256 | 72.0 | 17.8 | 17.8 | 17.8 | 17.8 |
| | 2014 | 259,340 | 267,442 | 259,300 | 267,657 | 70.9 | 18.4 | 19.0 | 18.4 | 19.0 |
| | 2015 | 259,942 | 269,749 | 259,907 | 270,080 | 69.9 | 18.2 | 18.9 | 18.2 | 18.9 |
| | 2016 | 260,545 | 272,056 | 260,517 | 272,524 | 68.8 | 17.9 | 18.7 | 17.9 | 18.8 |
| | 2017 | 261,147 | 274,362 | 261,127 | 274,991 | 67.8 | 17.7 | 18.6 | 17.7 | 18.6 |
| | 2018 | 261,750 | 276,669 | 261,739 | 277,480 | 66.7 | 17.5 | 18.5 | 17.5 | 18.5 |
| | 2019 | 262,353 | 278,976 | 262,353 | 279,992 | 65.7 | 17.2 | 18.3 | 17.2 | 18.4 |
| | 2020 | 262,955 | 281,283 | 262,968 | 282,526 | 64.6 | 17.0 | 18.2 | 17.0 | 18.3 |
| | 2025 | 265,968 | 292,817 | 266,064 | 295,546 | 59.3 | 15.8 | 17.4 | 15.8 | 17.5 |
| | 2030 | 268,980 | 304,352 | 269,196 | 309,166 | 59.0 | 15.9 | 18.0 | 15.9 | 18.2 |
| | 2035 | 271,993 | 315,886 | 272,366 | 323,414 | 59.0 | 16.0 | 18.6 | 16.1 | 19.1 |
| | 2040 | 275,006 | 327,420 | 275,573 | 338,318 | 59.0 | 16.2 | 19.3 | 16.3 | 20.0 |
| | 2045 | 278,018 | 338,954 | 278,817 | 353,910 | 59.0 | 16.4 | 20.0 | 16.5 | 20.9 |
| | 2050 | 281,031 | 350,489 | 282,100 | 370,219 | 59.0 | 16.6 | 20.7 | 16.6 | 21.8 |
| | 2055 | 284,044 | 362,023 | 285,422 | 387,281 | 59.0 | 16.8 | 21.4 | 16.8 | 22.8 |

Independent Model

**Figure 31: Independent RTP Projections**

# APPENDIX M – WASTEWATER FORECASTING MODEL

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# Appendix Y

# Overview of Combined MPWSP with 6.4-mgd Desalination Plant and GWR Project

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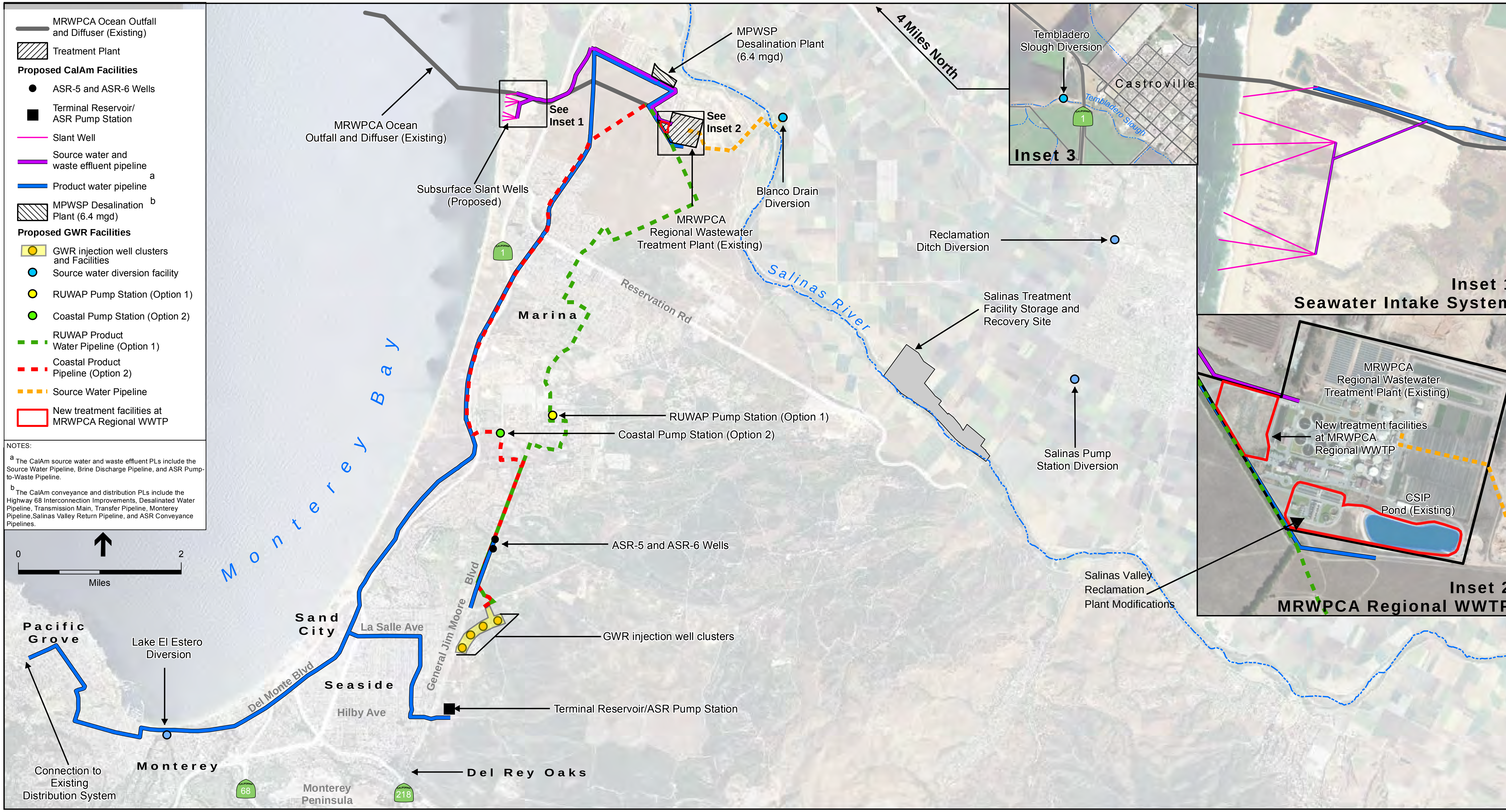


SOURCE: ESA, 2014

## TABLE Y-1

**MPWSP WITH 6.4 MGD DESALINATION PLANT (ALSO KNOWN AS CALAM FACILITIES OF THE MPWSP VARIANT)**

(Source: ESA, March 21, 2015)

| Facility | Description | Purpose |
|---|---|---|
| **Seawater Intake System** | | |
| Subsurface Slant Wells | • Seven slant wells (*vs. ten slant wells under the proposed project*) extending offshore beneath the Monterey Bay (the conversion of an existing test slant well into a permanent well plus six new wells), with up to five wells (*vs. eight wells under the proposed project*) operating at any given time and two wells maintained on standby<br>• The slant wells would be grouped into two well clusters (*vs. three well clusters under the proposed project*), one with four wells and the other with three wells<br>• Each slant well would be equipped with a 2,200-gallon-per-minute (gpm) submersible well pump<br>• Each well would be approximately 700 to 800 feet long and extend offshore to a depth of approximately 200 to 220 feet below mean sea level (msl)<br>• The wells would be screened in the Dune Sands Aquifer and the 180-Foot-Equivalent Aquifer of the Salinas Valley Groundwater Basin | These wells would draw approximately 15 mgd of seawater (*vs. 24 mgd under the proposed project*) from beneath the ocean floor for use as source water for the MPWSP Desalination Plant. |
| Source Water Pipeline | • 2.7-mile-long 42-inch-diameter pipeline | This pipeline would convey the combined source water from the slant well clusters to the MPWSP Desalination Plant. |
| **Desalination Facilities** | | |
| Pretreatment System | • Pressure filters or multimedia gravity filters would be housed within a 6,000-square-foot pretreatment building<br>• Two 300,000-gallon backwash supply and filtered water equalization tanks<br>• Two 0.25-acre, 6-foot-deep lined backwash settling basins with decanting system | The pretreatment system would treat source water to remove suspended and dissolved contaminants that could damage the RO system, and thus increase the efficiency and lifespan of the RO system. |
| Reverse Osmosis (RO) System | • Dual-pass RO system consisting of four active modules and one standby module, with each module producing 1.6 mgd of "permeate" (the purified water produced through the RO membrane)<br>• UV disinfection system (if required)<br>• The RO and post-treatment systems and chemical storage tanks would be housed within a 30,000-square-foot process and electrical building | The RO system would remove salts and other minerals from pretreated source water. If required by the California Department of Public Health, the UV Disinfection system would provide additional primary disinfection |
| Post-treatment System | • Chemical feedlines and injection stations (for carbon dioxide, lime, sodium hydroxide, phosphate-based corrosion inhibitor, and sodium hypochlorite) | The post-treatment system would adjust the hardness, pH, and alkalinity of the desalinated product water and disinfect the water in accordance with drinking water requirements. |
| Chemical Storage | • Chemical storage tanks with secondary containment<br>• Sumps and sump pumps | This facility would provide for chemical storage. The capacity of the chemical storage tanks would range from less than 5,000 gallons to 20,000 gallons, depending on the treatment chemical. |
| Administrative Building | • 4,000- to 6,000-square-foot building | This building would house restrooms, locker rooms, break rooms, conference rooms, electrical controls, laboratory facilities, equipment storage and maintenance, and electrical service equipment. |
| **Brine Storage and Disposal Facilities** | | |
| Brine Storage and Disposal | • 3-million-gallon brine storage basin<br>• 1-mile-long, 30-inch-diameter Brine Discharge Pipeline | Approximately 8.99 mgd of brine (*vs. 13.98 mgd of brine under the proposed project*) would be generated by the RO process. Brine concentrate produced during the RO process would be conveyed to the brine storage basin located at the MPWSP Desalination Plant. The Brine Discharge Pipeline would convey decanted effluent from the pretreatment filtration backwash cycle and RO concentrate produced by the RO system to an existing ocean outfall. |
| MRWPCA Ocean Outfall Pipeline and Diffuser (existing) | • 2.3-mile long, 60-inch-diameter pipe (onshore portion)<br>• 2.1-mile-long, 60-inch-diameter pipe<br>• 1,100-foot-long diffuser with 172 ports (120 ports are open and 52 are closed), each 2 inches in diameter and spaced 8 feet apart | Brine and pretreatment backwash effluent from the desalination plant would be conveyed to the existing ocean outfall pipeline. The outfall would terminate at a diffuser located offshore that would discharge the concentrate to Monterey Bay. |
| **Desalinated Water Conveyance and Storage Facilities** | | |
| Clearwells (Water Storage Tanks) and Clearwell Pump Station | • 6.4-mgd, 120-horsepower pump<br>• Two 85-foot-diameter, 750,000-gallon aboveground storage tanks (providing a total combined storage volume of 1.5 million gallons) | The clearwell pump station would pump water from the post-treatment process to the clearwells. The clearwells would serve as holding tanks from which water would be pumped to either the CalAm water system or the existing Castroville Seawater Intrusion Project (CSIP) pond. |
| Desalinated Water Pump Station | • 6.4-mgd, 800-horsepower pump to pump water through the Desalinated Water Pipeline to the CalAm water system<br>• 1.4-mgd, 20-horsepower pump to pump water through the Salinas Valley Return Pipeline to the CSIP pond | This facility would pump desalinated product water from the MPWSP Desalination Plant to the CalAm water system and existing CSIP pond. |
| Salinas Valley Return Pipeline | • 1.2-mile-long, 12-inch-diameter pipeline | This pipeline would convey desalinated product water from the MPWSP Desalination Plant to the CSIP pond for subsequent delivery to agricultural users in the Salinas Valley. |
| Desalinated Water Pipeline | • 3.25-mile-long, 36-inch-diameter pipeline | This pipeline would convey desalinated product water from the clearwells at the MPWSP Desalination Plant to the Transmission Main at Reservation Road. |
| Transmission Main | • 6-mile-long, 36-inch-diameter force main | This pipeline would convey desalinated product water between the Desalinated Water Pipeline at Reservation Road to the Monterey Pipeline and Transfer Pipeline at the intersection of Del Monte Boulevard/La Salle Avenue. |
| Transfer Pipeline | • 2.4-mile-long, 36-inch-diameter pipeline (could be operated in both directions) | This pipeline would convey desalinated product water or water that is extracted from the ASR injection/extraction wells (including GWR product water) to the Terminal Reservoir for storage; water extracted from ASR directly to the CalAm distribution system; and water stored in Terminal Reservoir to the CalAm distribution system. |
| Monterey Pipeline | • 5.4-mile-long, 36-inch-diameter pipeline (could be operated in both directions) | This pipeline would convey CalAm water supplies (including desalinated product water, ASR product water, and GWR product water) between Seaside and the Monterey Peninsula. |

## TABLE Y-1

**MPWSP WITH 6.4 MGD DESALINATION PLANT (ALSO KNOWN AS CALAM FACILITIES OF THE MPWSP VARIANT)**

(Source: ESA, March 21, 2015)

| Facility | Description | Purpose |
|---|---|---|
| Interconnection Improvements for State Route 68 Satellite Systems<br>a) Ryan Ranch–Bishop Interconnection<br>b) Main System–Hidden Hills Interconnection | a) 1.1-mile-long, 8-inch-diameter pipeline<br>b) 1,200-foot-long, 6-inch-diameter pipeline | These interconnection pipelines and associated improvements would allow MPWSP supplies to be conveyed to the Ryan Ranch, Bishop, and Hidden Hills water systems. |
| Terminal Reservoir | • Two 3-million-gallon storage tanks | These tanks would store desalinated product water and ASR product water. |
| Valley Greens Pump Station | • 3-mgd, 100-horsepower pump station | This 600-square-foot facility would provide the additional water pressure needed to pump water through the existing Segunda Pipeline into Segunda Reservoir. |
| **ASR System** | | |
| Six ASR Injection/Extraction Wells (four existing wells and two proposed):<br>a) ASR-1, ASR-2, ASR-3, and ASR-4 Wells (existing)<br>b) ASR-5 and ASR-6 Wells (proposed) | • Two proposed 1,000-foot-deep injection/extraction wells (ASR-5 and ASR-6 Wells) with a combined injection capacity of 2.2 mgd and extraction capacity of 4.3 mgd<br>• Four existing injection/extraction wells (Phase I and II wells) | The existing and proposed ASR injection/extraction wells would be used to inject Carmel River supplies and desalinated product water into the Seaside Groundwater Basin for storage. During periods of peak demand, the wells would be used to extract water that is stored in the Seaside Groundwater Basin (including Carmel River supplies, desalinated product water, and GWR product water) for subsequent delivery to customers. |
| ASR Pump Station | • 8.4-mgd, 300-horsepower pump station | This pump station would be used to pump water to and from the ASR injection/extraction wells through existing and proposed pipelines. |
| ASR Conveyance Pipelines | • Two parallel 0.9-mile-long, 30-inch-diameter pipelines | One of these pipelines would be used to convey water from existing conveyance facilities at the corner of Coe Avenue and General Jim Moore Boulevard to the new ASR-5 and ASR-6 Wells for injection; the other pipeline would be used to convey extracted ASR supplies to the same existing facilities. |
| ASR Pump-to-Waste System | • 0.9-mile-long, 16-inch-diameter pipeline<br>• 4,800-square-foot, 12-foot-deep settling basin | The ASR Pump-to-Waste System would flush sediment and other suspended solids out of the two proposed ASR injection/extraction wells and convey it to a new settling basin (the proposed ASR Settling Basin) at the same site, or to the existing settling basin for the ASR-1 and ASR-2 Wells located approximately 2 miles to the south. The ASR Pump-to-Waste Pipeline would connect to existing pump-to-waste pipelines located at the intersection of General Jim Moore Boulevard and Coe Avenue. |

# TABLE Y-2

**PROPOSED GWR PROJECT WITHOUT CALAM DISTRIBUTION SYSTEM: MONTEREY AND TRANSFER PIPELINES**

(ALSO KNOWN AS GWR FACILITIES OF THE MPWSP VARIANT)

| Facility | Description | Purpose |
|---|---|---|
| **New Source Water Diversion and Storage Facilities** | | |
| Diversion facilities for Unused Treated Wastewater from MRWPCA Regional Treatment Plant | New diversion structure on the existing secondary effluent pipeline to capture unused secondary-treated effluent. This facility is described as part of the Treatment Facilities at the Regional Treatment Plant | To capture unused secondary-treated effluent and divert it to the proposed AWT Facility. |
| Salinas Pump Station Diversion and Salinas Treatment Facility Storage and Recovery Improvements | Salinas Pump Station Diversion:<br>– Underground junction structure constructed over the existing 48-inch sanitary sewer line, to mix sanitary, agricultural wash waster and stormwater flows. This structure would also receive agricultural wash water and stormwater return flow from the Salinas Treatment Facility's Pond 3.<br>– Modifications to the existing agricultural wash water underground diversion structure and the addition of 42-inch diameter 150-foot long underground pipeline and metering structure.<br>– Underground stormwater diversion structure and underground pipeline between this structure and the existing 33-inch agricultural wash water line.<br>– Underground stormwater diversion structure and underground pipeline to divert to divert stormwater flow to the Salinas Pump Station through an existing 30-inch abandoned pipeline.<br>– Meters, valves, electrical and control systems, and fencing around the diversion structures<br>Salinas Treatment Facility Storage and Recovery Improvements:<br>– Return pump station including valve, mater vault, and two variable frequency drive pumps<br>– 18-inch return pipeline connecting the pump station to the Salinas Diversion site<br>– Pipeline connecting Pond 3 to the new return pump station<br>– Pump station near the lower end of Pond 3<br>– Pipeline to convey treated wastewater from the aeration basin to the pipeline that returns waster from Pond 3 or directly to the return pump station. | Water would be diverted to the existing Salinas Pump Station using a new diversion structure and new short pipelines connecting the existing agricultural wash water pipeline to the existing municipal wastewater system. The agricultural wash water would then mix with the municipal wastewater and be conveyed through the existing 36-inch diameter Salinas interceptor to the Regional Wastewater Treatment Plant.<br>City of Salinas urban runoff and stormwater would be diverted to the Regional Wastewater Treatment Plant rather than discharged to the Salinas River. |
| Reclamation Ditch Diversion at Davis Road | • Diversion structure consisting of a intake structure connecting to a wet well (manhole) via a gravity pipeline<br>• Two submersible pumps installed within the wet well, controlled by variable frequency drives<br>• Valve and meter vaults<br>• Weatherproof cabinet enclosing electrical controls and drives<br>• Two short force main approximate 50 foot long, discharging to an existing manhole on the City of Salinas 54-inch sewer main<br>• Modification to existing sanitary manhole and a short pipeline from the existing manhole to the pump station | To divert and convey source waters from the Reclamation Ditch to the Regional Treatment Plant |
| Tembladero Slough Diversion at Castroville | • Intake structure connecting to a new lift station wet well (manhole) via a gravity pipeline<br>• Modifications to the existing Castroville Pump Station<br>• Two submersible pumps installed within the wet well, controlled by variable frequency drives<br>• Weatherproof cabinet enclosing electrical controls and drives<br>• Short force main approximate 100 foot long discharging to the existing wet well at the MRWPCA Castroville Pump Station<br>• Underground valve vault, isolation valves and flow meter | To divert and convey source waters from the Tembladero Slough to the Regional Treatment Plant. |
| Blanco Drain Diversion Pump Station and Pipeline | • Intake structure connecting to a wet well (manhole) via a gravity pipeline<br>• Two submersible pumps installed within the wet well, controlled by variable frequency drives<br>• Weatherproof cabinet enclosing electrical controls and drives<br>• The pump station would discharge through a18-inch force main and a 30-inch gravity main, running from the pump station to the headworks for the Regional Wastewater Treatment Plant<br>• Underground valve vault, isolation valves and flow meter<br>• Surge tank | To divert and convey source water from the Blanco Drain watershed to the Regional Treatment Plant. |
| Lake El Estero Diversion | Lake El Estero Source Water Diversion System Option 1:<br>– Pumping system consisting of a new column pump installed in the wet well of the existing lake management pump station<br>– Upgrades to the existing electric panel<br>– 30-foot long, 12-inch diameter discharge pipeline<br>Lake El Estero Source Water Diversion System Option 2:<br>– Gravity system consisting headwall and screen intake pipe<br>– 40-foot long, 12-inch diameter discharge pipeline<br>– Isolation valve (controlled and motorized) | Lake El Estero Source Water Diversion System would connect existing facilities and convey the new source water flows to the Regional Treatment Plant. |
| **New Treatment Facilities and Modifications at the MRWPCA Regional Wastewater Treatment Plant** | | |
| Inlet Raw Water Diversion Structure and Pump Station | • Diversion structure installed on an existing secondary effluent pipeline at the Regional Treatment Plan<br>• Influent pump station (subgrade wetwell and pumps) | The diversion structure would divert and convey secondary effluent source water to the proposed Advanced Water Treatment Facility.<br>The influent pump station would accept and equalize the Regional Wastewater Treatment Plant secondary effluent flow. |
| Raw Water Pretreatment | Chloramination<br>– Sodium hypochlorite storage<br>– Chemical feed pumps<br>– Inline injection and mixing system<br>Ozonation<br>– Liquid oxygen storage and vaporizers or onsite oxygen generator<br>– Nitrogen boost system<br>– Ozone generator and power supply unit<br>– Cooling water system<br>– Side-stream injection system<br>– Ozone contactor<br>– Ozone destruct units<br>Biologically active filtration (if required)<br>– Gravity-feed filter basins with approximately 12 feet if granular media, and an underdrain/media support system<br>– Ancillary systems<br>Alkalinity addition system for pH control, backwash water basin, backwash pumps, air compressor and a supply system for an air scour system, air compressor and a supply system for process air, and a wash water basin to facilitate filter backwashing | Before membrane filtration, the secondary effluent would be pretreated using these pre-screening methods in up to three separate subsystems.<br>Chloramines would be used to reduce biofouling of the membrane systems.<br>Ozone treatment would provide a chemical/pathogen destruction barrier and reduce the membrane fouling.<br>Biologically active filtration (if required) would be used downstream of ozone treatment to reduce the concentration of residual organic matter present in the ozone effluent and to reduce the solids loading on the membrane filtration process. |

## TABLE Y-2

**PROPOSED GWR PROJECT WITHOUT CALAM DISTRIBUTION SYSTEM: MONTEREY AND TRANSFER PIPELINES**

(ALSO KNOWN AS GWR FACILITIES OF THE MPWSP VARIANT)

| Facility | Description | Purpose |
|---|---|---|
| Microfiltration/Ultrafiltration Membrane Treatment System | Membrane filtration system<br>– Hollow fiber membrane modules<br>– Valve manifolds to direct the flow of feed, filtrate, cleaning solutions, backwash supply, backwash waste, and compressed air to the corresponding module connecting piping.<br>– Feed pumps | The membrane filtration system would remove suspended and colloidal solids, including bacteria and protozoa through hollow fiber membrane modules. |
| Reverse Osmosis Membrane Treatment System | Individual process trains housing the process membranes in pressure vessels along with connecting piping and valve manifolds for feed, permeate, concentrate, cleaning and flush supplies. | The reverse osmosis process that employs semi-permeable membranes is proposed to remove dissolved salts, inorganic and organic constituents, and pathogens from the membrane filtration treated water. |
| Advanced Oxidation Process System | • Chemical feed to add hydrogen peroxide and reactors housing arrays of ultraviolet lamps along with ballasts to power the ultraviolet system. | The advanced oxidation system would provide a final polishing step for pathogen disinfection and would provide an additional chemical destruction barrier for the reverse osmosis permeate. |
| Post-Treatment System | • Post-treatment stabilization system | Post-treatment stabilization of the product water would prevent corrosion of pipe materials in the product water conveyance system. Stabilization would also be used to reduce the potential for product water to leach minerals and other chemicals from the soils within the Seaside Groundwater Basin upon injection. |
| Advanced Water Treatment Pump Station | • Pump station constructed on a new concrete pad<br>• Split-faced block building approximately 30 feet by 70 feet and up to 25 feet tall.<br>- Pump motors<br>- Discharge piping<br>- Electrical power equipment<br>- HVAC<br>- Instrumentation and control equipment<br>• Electrical supply transformer<br>• Pressurized surge tank<br>• Standby pumping units for pump stations | The Advanced Water Treatment Pump Station would pump the product water into the product water conveyance pipeline. |
| Brine Mixing Facility | • Two cast-in-place concrete vaults on the existing outfall<br>• A cast-in-place concrete mixing structure with a 60-inch static mixer in a fiberglass mixing pipe and air release valve<br>• Pipelines and valves<br>• Flow meters<br>• Sampling port<br>• Two sluice gates<br>• Air release valve<br>• Lab and control building | The Brine Mixing Facility would thoroughly mixed osmosis reject or concentrate water (or brine) to prevent stratification of MRWPCA's ocean outfall that may lead to complicated corrosion potential to the outfall pipe and to optimize the mixing with sea water in the bay. this is also the connection point between the Desalination Brine Discharge Pipelines and the PCA's outfall |
| Power Supply | • Utility service<br>• Transformers<br>• Switchgear | The Advanced Water Treatment Facility power would be supplied through a new PG&E utility connection. |
| Salinas Valley Reclamation Plant Modifications | • Sluice gates<br>• A new pipeline between the existing inlet and outlet structures with the storage pond<br>• Chlorination basin upgrades | Modifications would enable the plant to produce more continuous flows in the winter when demand by the CSIP users decreases to as low as 0.5 mgd. |
| **GWR Product Water Conveyance Facilities** | | |
| RUWAP Alignment (Option 1) or Coastal Alignment (Option 2) | • 24-inch-diameter pipeline<br>• In-line isolation valves on the pipeline approximately every 2,000 feet | Conveys the advanced treated product water from the proposed Advanced Water Treatment Facility to the Seaside Groundwater Basin for injection. The Product Water Conveyance system would be designed to convey a total of up to 3,700 afy of product water to the proposed new injection wells. |
| Booster Pump Station | • 2,100-sqaure foot, up to 25 foot tall booster pump station building<br>• Split-faced block building<br>– Pump motors<br>– Discharge piping<br>– Electrical power equipment<br>– HVAC<br>– Instrumentation and control equipment<br>• Electrical supply transformer<br>• Pressurized surge tank<br>• Standby pumping units for pump stations | The Booster Pump Station would provide adequate pressure to convey the Advanced Water Treatment product water to the proposed new GWR Injection Well Facilities for injection. |
| **GWR Injection Well Facilities** | | |
| Injection Well Clusters | • Four deep injection wells (DIW-1, DIW-2, DIW-3 and DIW-4) with a combined injection capacity of 4.6 mgd. And four vadose zone well (VZW-1, VZW-2, VZW-3, and VZW-4) with a combined injection capacity of 2.88 mgd. Each well cluster would include one of each type of well and the following:<br>– Back flushing pump and motors<br>– Above and below grade injection and back-flush wash pipelines<br>– Values and flow meters<br>– Small building (approximately 16 feet by 24 feet) for electrical and control equipment<br>• Wells would be constructed in close proximity to each other to share electrical, motor control, pumps, and site building pad infrastructure. | The proposed injection wells would be used to inject product water into the Seaside Groundwater Basin. |
| Backflush Facilities | • 2,000 gpm back-flush well pump, flow meter, electrical cabinet and 400 hp motor attached to the injection well<br>• Pipeline to convey the back-flushed water to the percolation basin<br>• 240,000 gallon, 50-foot-wide, 180-foot-long, and 3-foot-deep percolation basin | The back-flush facilities would flush or cleans out organic material or bacterial growth, which would otherwise result in the lost pumping capacity of the injection wells. Back-flushed water would be conveyed to the percolation basin for storage. |
| Monitoring Wells | • Six Paso Robles Aquifer monitoring wells<br>• Six Santa Margarita Aquifer monitoring wells | Monitoring wells would be used to monitor project performance and compliance with State Board Division of Drinking Water regulations. The monitoring wells would also be used to satisfy regulatory requirements for monitoring of subsurface travel time, tracer testing, and other requirements for a groundwater replenishment project. |
| Electrical Power Supply and Instrumentation for GWR Injection Wells | • Electrical equipment<br>• Electrical control building (for backflush pumps) housing SCADA, electrical controls, pump drive, and adjacent transformer<br>• 400 square foot electrical control building housing the motor control center<br>• External electrical control cabinets<br>• Wiring<br>• Connections of electrical power and instrumentation and control facilities | Injection wells would require a permanent power supply to the site. |

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# Appendix Z

# Alternative to CalAm Distribution System: Monterey and Transfer Pipelines

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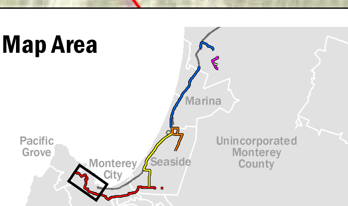
California American Water

*Transmission Mains and Aquifer Storage & Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

MARCH 3, 2014

Map Area




**Data Source**

**State Parks, State Lands, Federal Lands**
*California Protected Areas Database, 2013, GreenInfo Networks*
**County**
*Monterey County 2013*
**City Limits**
*Monterey County 2011*
**Coastal Zone**
*California Coastal Commission 2012*

**Pipeline Alignment**
- Monterey Pipe
- TAMC ROW
- Caltrans ROW
- Coastal Zone
- City Limits
- Federal Lands
- State Park, State Beach
- State, Other Lands
- Military

**SHEET 1**


**URS**

California American Water

*Transmission Mains and Aquifer Storage & Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

MARCH 3, 2014

**Map Area**

**Data Source**

**State Parks, State Lands, Federal Lands**
*California Protected Areas Database, 2013, GreenInfo Networks*

**County**
*Monterey County 2013*

**City Limits**
*Monterey County 2011*

**Coastal Zone**
*California Coastal Commission 2012*

**Pipeline Alignment**
- Monterey Pipe

- TAMC ROW
- Caltrans ROW
- Coastal Zone
- City Limits
- Federal Lands
- State Park, State Beach
- State, Other Lands

# SHEET 2

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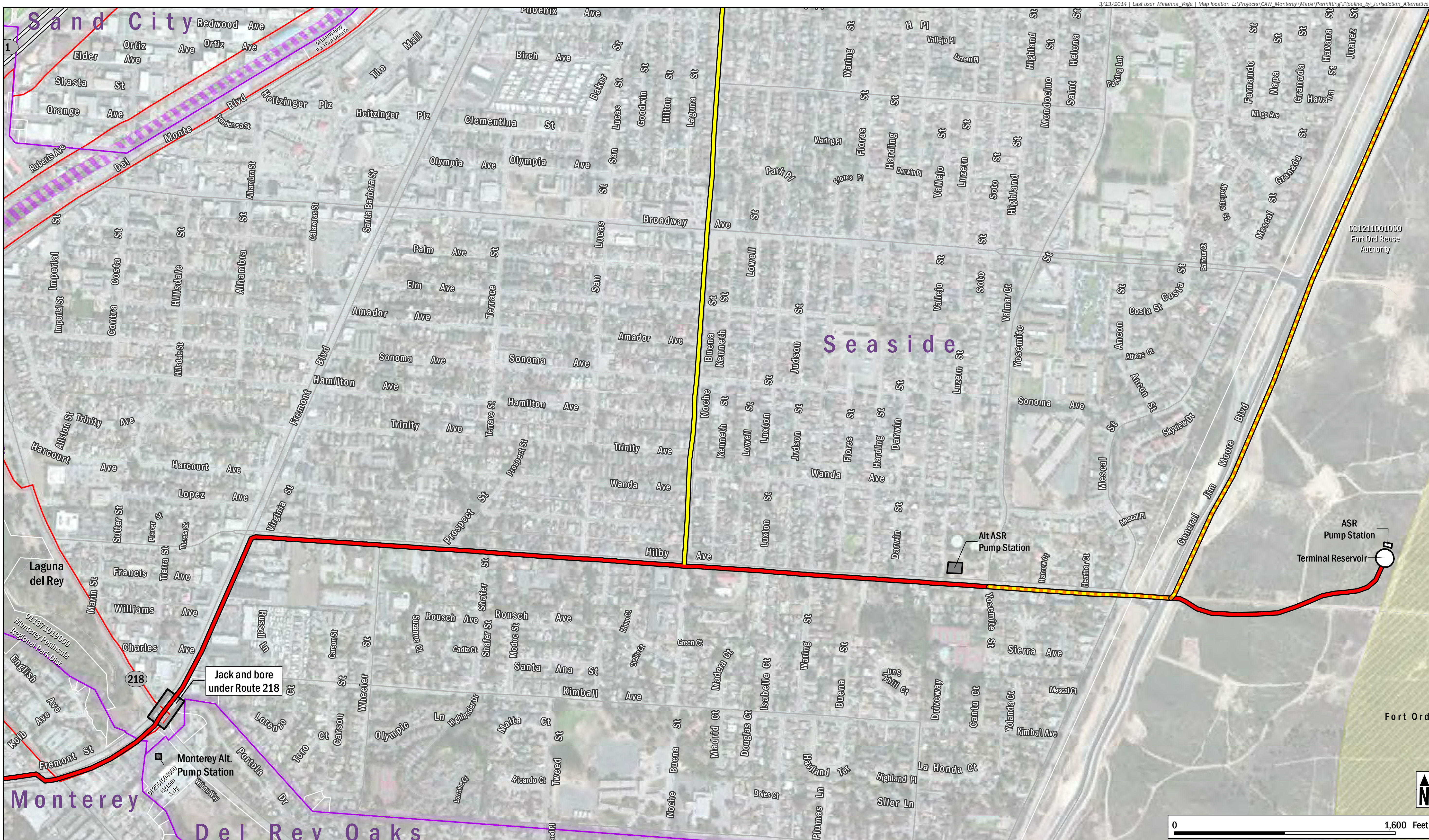


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MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP
MARCH 3, 2014

**Map Area**


**Data Source**
State Parks, State Lands, Federal Lands
*California Protected Areas Database, 2013, GreenInfo Networks*
County
*Monterey County 2013*
City Limits
*Monterey County 2011*
Coastal Zone
*California Coastal Commission 2012*

**Pipeline Alignment**
- Alignment 1
- Monterey Pipe
- Existing ASR Pipe
- TAMC ROW
- Caltrans ROW
- Terminal Reservoir
- ASR Wells
- Coastal Zone
- City Limits
- State Park, State Beach

**SHEET 3**

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The pipe would be a 400-foot bridge inside a steel truss attached to the Fairgrounds Drive/Mark Thomas Road bridge across Highway 68. Example/typical photos of similar type pipe bridges are shown above. Construction would require 5 to 6 days of traffic management and detours on the bridge and/or Highway 68 over a total construction period of six months.(Kelly White, personal communication, March 15, 2015)

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California American Water

*Transmission Mains and Aquifer Storage & Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

**Legend**

Monterey

**Bridge Alternative**

Alternative 1

Alternative 2

# FAIRGROUNDS ROAD PIPE BRIDGE ALTERNATIVES

0 200 400 Feet

1:1,400

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# Appendix AA new

# Salinity Impacts to Elkhorn Slough resulting from Surface Water Diversion for the Pure Water Monterey Groundwater Replenishment Project

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3 Quail Run Circle, Suite 101
Salinas, CA 93907-2348
(831) 833-4848
FAX (831) 833-2424
swmb@swsv.com

# TECHNICAL MEMORANDUM

**TO: Bob Holden, MRWPCA** **DATE: September 16, 2015**

**FROM: Andrew A. Sterbenz, PE; Andrew Racz, EIT** **JOB #: MRWP.01.14:004**

**SUBJECT: Salinity Impacts to Elkhorn Slough resulting from surface water diversions for the Pure Water Monterey Groundwater Replenishment Project**

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## INTRODUCTION:

This technical memo assesses the potential impact of the diversion of up to 16.6 cfs of freshwater inflows for the Pure Water Monterey Groundwater Replenishment Project (Project) on the salinity in Elkhorn Slough. Elkhorn Slough is a tidal estuary, receiving saltwater tidal inflow from Monterey Bay at the Moss Landing harbor inlet, as well as freshwater inflow from several surface streams, the largest of which is the Old Salinas River. These inputs mix within the estuary, and, along with precipitation, evaporation, and groundwater exchange, determine salinity levels in the slough. The following diversions are proposed from streams that feed the Old Salinas River: up to 6 cfs from the Reclamation Ditch near Salinas, up to 3 cfs from Tembladero Slough near Castroville, an average flow of 4.6 cfs from Blanco Drain, and 3 cfs of lost percolation pond inflow to the Salinas River. The minimum flow bypassing the proposed Project would be 2.0 cfs in the Salinas River and 1.0 cfs in the Reclamation Ditch/ Tembladero Slough, although higher flows are expected in most months.

## CURRENT SALINITY RANGE AND DISTRIBUTION IN ELKHORN SLOUGH

The Reclamation Ditch drains a watershed of approximately 157 square miles in and around Salinas. The Reclamation Ditch is a tributary of Tembladero Slough, which is itself a tributary of the Old Salinas River (OSR). The Old Salinas River, which also receives controlled flows of up to 120 cfs from the Salinas River Lagoon, discharges into Elkhorn Slough at the southern end of Moss Landing harbor.

As a result of complex branching geometry, tidal influence, and seasonally variable freshwater inputs, the salinity in Elkhorn Slough varies significantly with both time and location. Freshwater from the OSR discharges into Moss Landing harbor at low tide. It mixes with the outgoing tide in the main channel and is carried out into Monterey Bay. When the tide comes back in, any fresh/brackish water remaining in the main channel is pushed some distance up Elkhorn Slough by the rising tide, mixing to varying degrees as it travels. Depending on the season, water in the most inland reaches of the slough can be either fresher due to winter runoff, or saltier due to summer evaporation, than water in Monterey Bay, and also influences overall slough salinity when mixing occurs. The Land/Ocean Biogeochemical Observatory (LOBO) at MBARI has established a network of floating sensors that continuously record salinity at various locations in and around Elkhorn Slough (Figure 1).


**Figure 1:** Map of Elkhorn Slough. Significant features and LOBO sampling stations (pins) are identified.

**MIXING MODEL:**

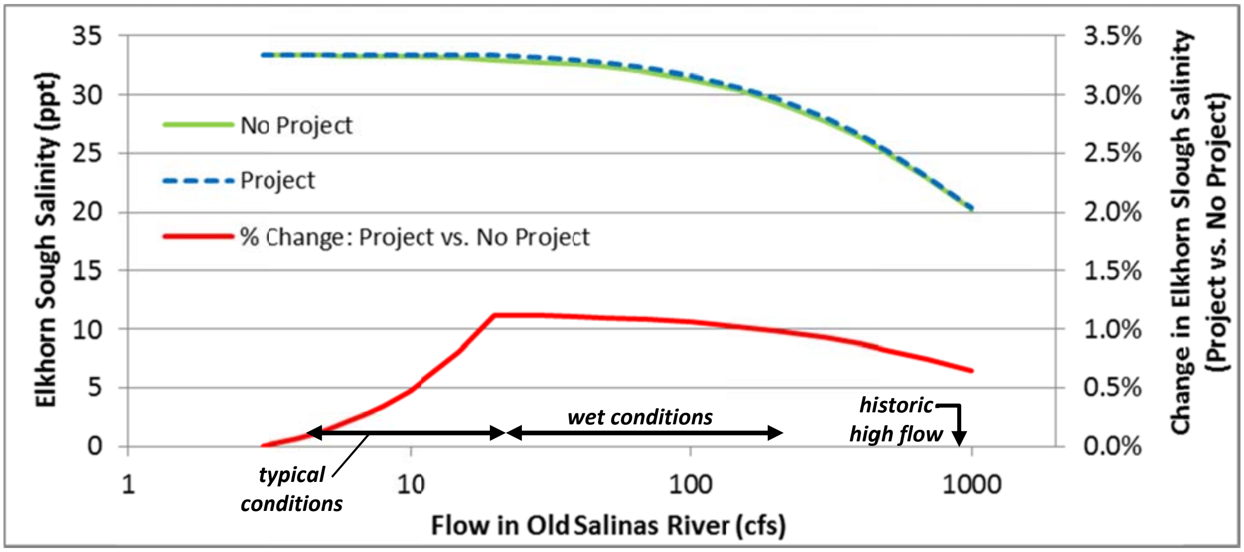
Elkhorn Slough has a surface area of approximately 1.25 square miles and an average tidal range of about 3.5 feet, resulting in an average daily tidal flux of approximately 1400 cfs. The actual tidal range in any given tide cycle is governed by the position of the moon, sun, ocean currents, pressure systems and winds, and can vary between extremes of approximately 0.5 feet and 7 feet. Elkhorn Slough typically experiences two high and two low tides per day, such that the minimum 0.5-foot tidal cycle will always be accompanied by a second daily tide with a range of at least 2 feet. The model therefore uses a 2-foot range to calculate the minimum tidal inflow: approximately 800 cfs. The maximum modeled tidal flux caused by a 7' tide is approximately 2800 cfs. The salinity of inflowing Monterey Bay water varies within a narrow range of 32-34 parts per thousand (ppt). The average value of 33.4 ppt is used in the model.

The Old Salinas River is not gaged at its outlet to Moss Landing harbor, but inflows to the OSR from the Salinas River Lagoon are regulated by a slide gate. Typical summer flows are <15 cfs, and the gate is operated such that high flows never exceed 120 cfs. Flows on the Reclamation Ditch/Tembladero Slough (RD/TS) watershed are recorded by USGS gage #11152650, located at San Jon Road just north of Salinas. A scaling factor of 1.44 (based on relative watershed area and runoff characteristics) is applied to readings from this gage to estimate total flow in TS at its confluence with the OSR. The peak instantaneous gaged flow measured for the RD is 684 cfs. This occurred on 12/12/14 and was on the order of a 100-year event. Typical mean daily flows on the RD are <50 cfs during the wet season and <10 cfs during the summer months. Flows in the RD/TS are fresh, and an average salinity value of 1.5 ppt is used in the model.

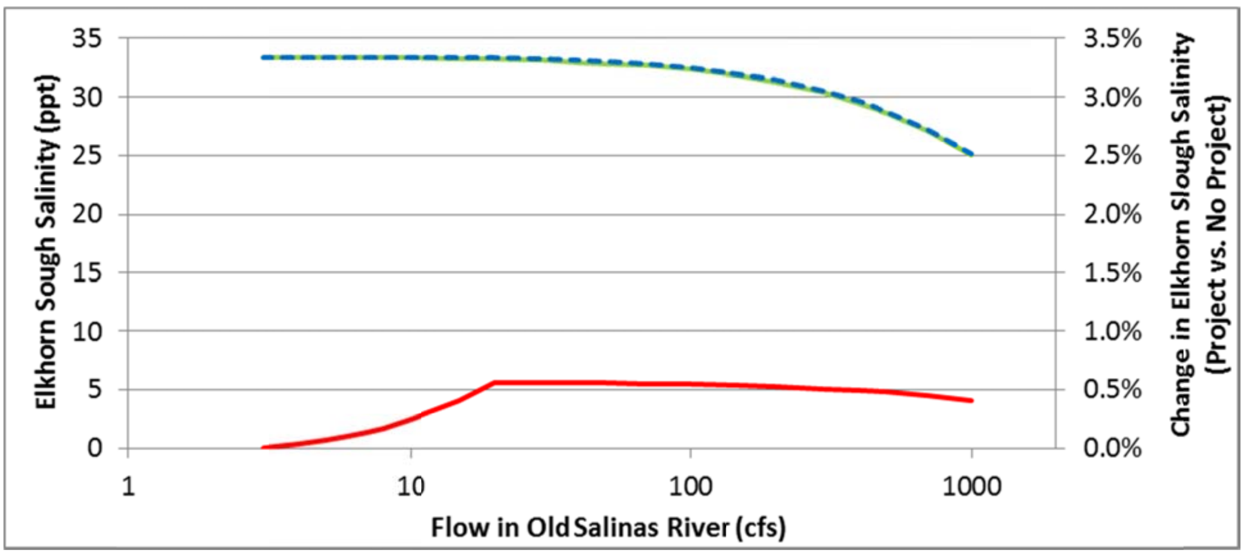
A mixing model was created using the equation: $\mathbf{Q_1C_1 + Q_2C_2 = (Q_1 + Q_2)C_3}$, where $Q_1$ and $Q_2$ are the flow rates of two different inflows, and $C_1$ and $C_2$ are their respective salinities. The model solves for $C_3$, the resulting salinity of the mixed water body. Table 1 lists mixing model inputs and results for a tidal range of 3.5 feet and flow rates on the OSR ranging between 3 and 1000 cfs. Mixing assumes only two end-members (Monterey Bay Inflow and Old Salinas River Inflow) and is presumed to be conservative and complete. For the “Project” scenario, the Project Diversion is subtracted from OSR Inflow values prior to calculating mixing. The impact of the Project on Elkhorn Slough salinity (relative to No Project conditions) is expressed as both an absolute quantity and a percentage change. Data from Table 1 are plotted in Figure 2A. Figures 2B and 2C show model results for tidal ranges 7.0’ and 2.0’ respectively.

| **Inflows** | | **Project** | **Salinity: Inflows** | | **Salinity: Elkhorn Slough** | | **Salinity Difference:** | |
|---|---|---|---|---|---|---|---|---|
| ***Tidal*** | ***OSR*** | **Diversion** | ***Bay*** | ***OSR*** | ***No Project*** | ***Project*** | **Project vs. No Project** | |
| (cfs) | (cfs) | (cfs) | (ppt) | (ppt) | (ppt) | (ppt) | (ppt) | (%) |
| 1412 | 3 | 0 | 33.4 | 1.5 | 33.33 | 33.33 | 0.00 | 0.00% |
| 1412 | 4 | 1 | 33.4 | 1.5 | 33.31 | 33.33 | 0.02 | 0.07% |
| 1412 | 5 | 2 | 33.4 | 1.5 | 33.29 | 33.33 | 0.04 | 0.14% |
| 1412 | 6 | 3 | 33.4 | 1.5 | 33.26 | 33.33 | 0.07 | 0.20% |
| 1412 | 7 | 4 | 33.4 | 1.5 | 33.24 | 33.33 | 0.09 | 0.27% |
| 1412 | 8 | 5 | 33.4 | 1.5 | 33.22 | 33.33 | 0.11 | 0.34% |
| 1412 | 10 | 7 | 33.4 | 1.5 | 33.18 | 33.33 | 0.16 | 0.47% |
| 1412 | 15 | 12 | 33.4 | 1.5 | 33.06 | 33.33 | 0.27 | 0.81% |
| 1412 | 20 | 16.6 | 33.4 | 1.5 | 32.95 | 33.32 | 0.37 | 1.12% |
| 1412 | 30 | 16.6 | 33.4 | 1.5 | 32.74 | 33.10 | 0.36 | 1.11% |
| 1412 | 40 | 16.6 | 33.4 | 1.5 | 32.52 | 32.88 | 0.36 | 1.10% |
| 1412 | 50 | 16.6 | 33.4 | 1.5 | 32.31 | 32.66 | 0.35 | 1.10% |
| 1412 | 70 | 16.6 | 33.4 | 1.5 | 31.89 | 32.24 | 0.34 | 1.08% |
| 1412 | 100 | 16.6 | 33.4 | 1.5 | 31.29 | 31.62 | 0.33 | 1.06% |
| 1412 | 150 | 16.6 | 33.4 | 1.5 | 30.34 | 30.65 | 0.31 | 1.02% |
| 1412 | 200 | 16.6 | 33.4 | 1.5 | 29.44 | 29.73 | 0.29 | 0.99% |
| 1412 | 300 | 16.6 | 33.4 | 1.5 | 27.81 | 28.07 | 0.26 | 0.93% |
| 1412 | 400 | 16.6 | 33.4 | 1.5 | 26.36 | 26.59 | 0.23 | 0.87% |
| 1412 | 500 | 16.6 | 33.4 | 1.5 | 25.06 | 25.26 | 0.21 | 0.82% |
| 1412 | 700 | 16.6 | 33.4 | 1.5 | 22.83 | 22.99 | 0.17 | 0.74% |
| 1412 | 1000 | 16.6 | 33.4 | 1.5 | 20.17 | 20.30 | 0.13 | 0.64% |

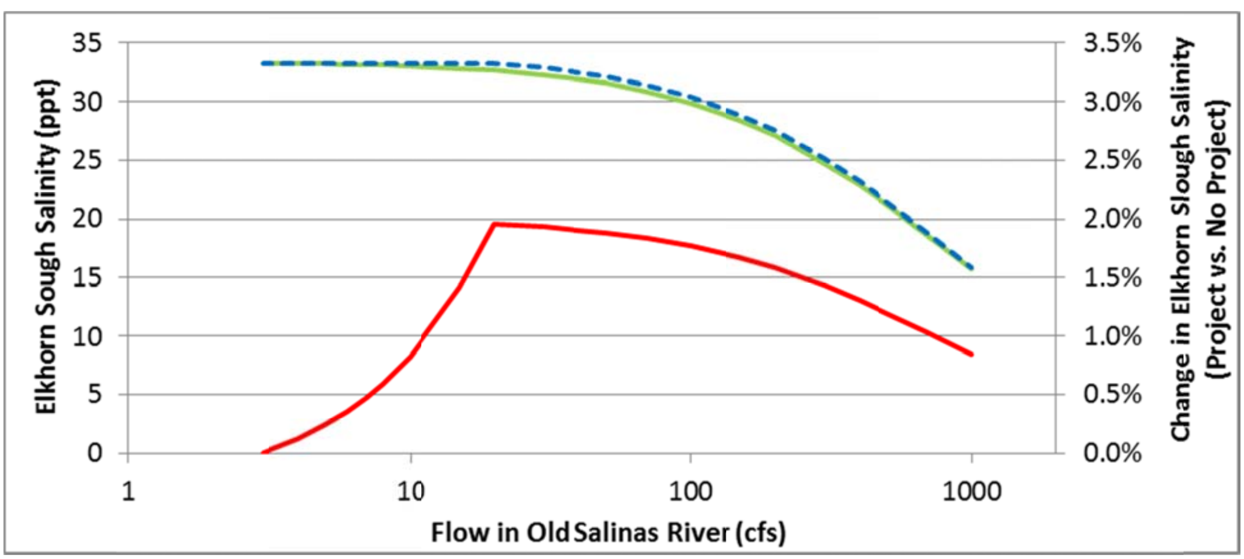
**Table 1:** Mixing model input and results for at tidal range of 3.5 feet.




(A)




(B)




(C)

**Figure 2:** Modeled salinity in Elkhorn Slough versus OSR inflow, for tidal ranges of (A) 1412 cfs [3.5' tide, average], (B) 2823 cfs [ 7.0' tide, maximum], and (C) 807 cfs [2.0' tide, minimum].

**DISCUSSION**:

During most of the year, the relative volume of inflow to Elkhorn Slough from the OSR is very small (<15 cfs) compared to inflows from Monterey Bay (approximate flow ranges indicated on Figure 2). At such a small mixing ratio, the water in Elkhorn Slough will not be appreciably freshened beyond background seawater values. Even though diversions may represent a large portion of the freshwater inflows under such conditions, the absolute quantity of freshwater entering Elkhorn Slough is so small that measurable differences between Project and No Project conditions are undetectable due to background variation.

Conversely, when flows from the OSR are high enough to appreciably drive down the salinity in Elkhorn Slough, the 16.6 cfs proposed to be diverted for the Groundwater Replenishment Project comprise such a small fraction of total freshwater inflows as to likewise have no detectable influence on the resulting salinity in Elkhorn Slough. Furthermore, during the time of year when flows tend to be high (winter wet season), demand for recycled water for irrigation is low, and surface water diversions would not be required.

Even at flow ranges where impact to Elkhorn Slough salinity is highest (approximately 10-50 cfs), the magnitude of the impact remains small: <0.4 ppt (1%) on the average tide, and in the most conservative case (2.0’ tidal range), still <0.7 ppt (2%). These salinity concentrations fall within the range of natural variability of Monterey Bay water, and are significantly smaller than the range of observed salinity concentrations in Elkhorn Slough. The Proposed Project would not detectably change the salinity of Elkhorn Slough on an average daily, weekly or monthly basis. The overall impact of the Project on Elkhorn Slough salinity is determined to be negligible.

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# Appendix BB new

# Future RUWAP Urban Recycled Water Irrigation Water Use and Implications for CSIP Yields

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**Schaaf & Wheeler**
**CONSULTING CIVIL ENGINEERS**

3 Quail Run Circle, Suite 101
Salinas, CA 93907-2348
831-883-4848
FAX 831-758-6328
asterbenz@swsv.com

# MEMORANDUM

| | | | |
|---|---|---|---|
| TO: | Bob Holden, MRWPCA | DATE: | September 16, 2015 |
| FROM: | Andrew Sterbenz, PE<br>Alison Imamura, AICP | JOB #: | MRWP.01.14 |
| SUBJECT: | Future RUWAP Recycled Water Urban Irrigation Use and Implications for CSIP Yields | | |

The purpose of this memorandum is to provide a discussion of the future Regional Urban Water Augmentation Project (RUWAP) Recycled Water Project for urban irrigation and its effects on Castroville Seawater Intrusion Project (CSIP) water supplies, with and without the Pure Water Monterey Groundwater Replenishment Project (Proposed Project).

Municipal wastewater is currently collected and conveyed to the MRWPCA Regional Treatment Plant (RTP) for primary and secondary treatment. The secondary-treated effluent is then either sent to the Salinas Valley Reclamation Plant (SVRP) for tertiary treatment, or it is discharged to the ocean. The tertiary-treated (recycled) water is supplied to the CSIP for agricultural irrigation. The Proposed Project would develop additional sources of water supply which would be conveyed to the RTP, increasing the supply of secondary treated effluent. A portion of this secondary-treated effluent would be sent to a new Advanced Water Treatment Facility (AWT Facility), and the remainder would be available for use by the SVRP/CSIP.

The Marina Coast Water District (MCWD) commented on the Draft Environmental Impact Report (DEIR) for the Proposed Project that its future urban recycled water project should be included in the supply analysis. The future RUWAP Recycled Water Project was addressed within the cumulative analyses in the DEIR. Cumulative projects were not included in the calculations of the Proposed Project's source water and use quantities. In the Proposed Project source water and use analysis, treated municipal wastewater that would be used by CSIP and the future RUWAP Recycled Water Project is appropriately assumed to *not* be available as influent for the AWT Facility during the peak irrigation demand months of April through September. The CSIP and the MCWD have existing contractual rights to the treated municipal wastewater, therefore the peak season volumes of water currently (i.e., based on the applicable, recent, 2009-2013 of monthly average flow data) discharged to the ocean outfall were considered available only to the SVRP for recycled water production. The average flows to the ocean outfall in the months of October through March exceed the combined projected demands of the GWR, the urban recycled water project, and the average CSIP groundwater use, and were therefore included in the analysis as available supplies for the AWT Facility in those months.

MCWD and FORA have jointly pursued the Regional Urban Water Augmentation Project that includes both a desalination component and a Recycled Water Project (the Recycled Water Project is herein referred to as the RUWAP) to develop additional urban irrigation water supply for redevelopment of the former Fort Ord. In accordance with existing agreements (see Table 4.18-5) among MRWPCA, MCWRA, and MCWD, MCWD has the right to purchase recycled water from the SVRP, up to the annual volume of municipal wastewater from MCWD's service area treated at the RTP. MCWD has agreed to limit their use of recycled water to 300 acre-feet during the period of April through September. MRWPCA had committed an additional 650 acre-feet during the period May through August in a Memorandum of Understanding between MCWD and MRWPCA (2009 RUWAP MOU). In the 2009 RUWAP MOU, MCWD and MRWPCA each committed their respective recycled water rights to the RUWAP. The RUWAP Recycled Water Project has not been implemented due to lack of funding, user commitments and immediate need for additional water supply, although the system is designed and sections of the recycled water pipeline have been installed in conjunction with road improvement projects. In addition, budget for completing the RUWAP facilities is not included in the MCWD 5-Year Capital Improvements Program. Therefore, the Draft EIR appropriately describes and analyzes the RUWAP as a reasonably foreseeable future project for purposes of its cumulative impacts analysis, rather than as an existing condition or a future background condition. A description of the proposed RUWAP was provided on page 4.1-13 and a cumulative analysis was provided within each topical section of Chapter 4; for example, combined impacts on water and wastewater systems are analyzed on pages 4.18-37 through 4.18-38. For the purpose of the Proposed Project's EIR, the existing flows into and out of the Regional Treatment Plant (RTP) are shown in Figure 1.

The RUWAP was originally planned and approved to provide 1,500 AFY of recycled water[1] including 1,200 AFY to the former Fort Ord and 300 AFY to areas outside the former Fort Ord served by the City of Seaside or CalAm. The RUWAP Project Description was updated in two EIR Addenda, including Addendum #2 that enabled MCWD to increase the RUWAP Recycled Water Project potential yield to up to 1,727 AFY of recycled water to provide the ability to serve more customers within their service area. In 2013, MPWMD and MRWPCA partnered to pursue the Proposed Project in part because the urban recycled water project was not scheduled for implementation, but primarily due to the issuance of a Cease and Desist Order by the SWRCB[2] regarding unauthorized diversions of Carmel River water by CalAm. Based on the FORA recycled water allocation approval in Resolution 07-10 (May 2007), the MCWD 2010 UWMP (MCWD, 2011), and the MCWD customer demand analyses in the Recycled Water Project Basis of Design Report (RMC, 2009), the RUWAP recycled water demand is assumed to be 1,427 AFY for the purpose of the cumulative analysis of water supplies in this EIR, with contractual rights to wastewater capped at the agreed upon 650 AF of MRWPCA rights and 300 AFY from MCWD's rights during the months of April through September.

Under the Agreements listed in Table 4.18-5 as amended in this Final EIR to include the 2009 RUWAP MOU, implementation of the RUWAP Recycled Water Project without implementation of the Proposed GWR Project would change the monthly availability of recycled water for CSIP customers in the peak demand months, as shown in Table 1. See Figure 2 for a RTP flow schematic of this scenario.

The RUWAP would require modifications of the SVRP to meet low winter demands, so the average annual recycled water deliveries to CSIP would increase by 1,350 AFY (i.e., 14,345 AFY compared to 12,939 AFY). The remaining groundwater use within CSIP would shift from winter to summer.

1 Final EIR for the Regional Urban Water Augmentation Project, adopted 5/25/2005

2 SWRCB Order Number WR 2009-0060

**Table 1: Projected Recycled Water Use with RUWAP and No Proposed Project (acre-feet)**

| Source/ Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **RTP Inflows[1]** | 1,798 | 1,678 | 1,867 | 1,796 | 1,850 | 1,799 | 1,893 | 1,888 | 1,813 | 1,844 | 1,762 | 1,776 | 21,764 |
| **RUWAP** | 81 | 74 | 81 | 156 | 161 | 156 | 161 | 161 | 156 | 81 | 79 | 81 | 1,427 |
| **CSIP[2]** | 461 | 654 | 1,030 | 1,640 | 1,689 | 1,643 | 1,733 | 1,727 | 1,657 | 1,059 | 681 | 370 | 14,345 |
| **Outfall** | 1,256 | 950 | 756 | 0 | 0 | 0 | 0 | 0 | 0 | 703 | 1,003 | 1,326 | 5,992 |

NOTES:

1. The RTP inflows have decreased from these values in 2014 and the first half of 2015 due to drought and associated conservation. These averages may be adjusted in the future using newer data; however, for the purposes of this EIR, the baseline wastewater flows were established as 2009 to 2013 as the Draft EIR preparation began in early 2014 and that was the most recent data available at that time.
2. CSIP use in this table is the lesser of either (a) the average monthly SVRP and groundwater use, or (b) the RTP Inflow minus RUWAP.

The Proposed Project's DEIR includes two product water pipeline options for conveying water from the proposed AWT Facility to the Injection Well Facilities site (Sections 2.9 and 2.12). One option is to follow the planned RUWAP recycled water main alignment, and the other follows the TAMC rail right-of-way through Marina into Seaside, and then uses street rights-of-way to General Jim Moore Blvd. Under the RUWAP alignment option, parallel pipelines would be constructed (the RUWAP pipeline for tertiary-treated recycled water delivery to urban irrigation customers and the Proposed Project pipeline for advanced treated water conveyance for injection in the Seaside Groundwater Basin). Joint use of a shared pipeline is beyond the scope of the Proposed Project. However, this memorandum analyzes the potential yields a shared pipeline may have in the event that MRWPCA and MCWD pursue this configuration in the future. Figures 3 and 4, attached, show conceptual flow diagrams of these two configurations. The shared pipeline configuration would require MCWD to accept advanced treated water instead of tertiary-treated recycled water, which may affect the volume of water available for urban reuse. The reduction of recycled water quantity compared to the full delivery is based on the planning assumption that a certain amount of the wastewater influent to the AWT would be lost during the treatment process. Approximately 19% of the influent treated wastewater would be discharged to the ocean as AWT Facility by-product, called reverse osmosis concentrate.

The following monthly urban recycled water demand scenarios have been modeled to estimate the quantities of recycled water available for CSIP and the RUWAP. These scenarios vary according to how the recycled water (including quantity and quality) is produced and delivered. Table 2, below, shows the results of the water quantity analysis in terms of RUWAP cumulative demands for each scenario, and Table 3, attached, shows the resultant monthly CSIP flows for each scenario.

- **Recycled Water (RW) Scenario:** In this scenario, the RUWAP pipeline and the Proposed Project Product Water Conveyance pipeline are constructed separately, as contemplated in the Proposed Project's EIR. MCWD's customers receive the full assumed urban irrigation demand of 1,427 AFY produced by the SVRP and delivered with the RUWAP tertiary-treated recycled water ("purple') pipeline when the RUWAP is constructed. Values in the table reflect the average monthly deliveries of urban recycled water. This scenario would require modifications to the SVRP to meet low winter recycled water demands (<5 mgd and <460 AF/month).[3] See Figure 3, Conceptual Flow Schematic of Proposed Project plus RUWAP with Separate Pipeline, for a conceptual flow diagram.

[3] The proposed SVRP modifications would also be required for the Proposed Project and are thus included in Chapter 2, Project Description (see pages 2-64 through 2-66).

- **Advanced Water Treatment Product (AWT Product) Scenario:** In this scenario, MCWD and MRWPCA would agree in the future to share the Proposed Project Product Water Conveyance pipeline, and the full assumed MCWD recycled water demand of 1,427 AFY would be produced by the Proposed Project AWT Facility and delivered as purified recycled water, conveyed in the same pipe with the product water intended for Seaside Basin subsurface application. Values in the table reflect the average monthly influent required at the AWT Facility to produce the quantities of delivered water reflected in the RW Scenario. Under the AWT Product scenario, the AWT process loss associated with the RUWAP yield would need to be supplied from new sources. This is referred to as the "Shared Pipeline Scenario with Allocations met as Product Water." See Figure 4, Conceptual Flow Schematic of Proposed Project plus RUWAP with Shared Pipeline, for a conceptual flow diagram.

- **Advanced Water Treatment Influent (AWT Influent) Scenario:** In this scenario, MCWD and MRWPCA would agree to share a pipeline as shown in Figure 4, and the 1,427 AFY of RUWAP supply would be used as influent to the AWT Facility, producing a net yield of 1,156 AFY of purified recycled water (due to the 19% process loss as RO concentrate). This supply would be conveyed in the same pipe with the Proposed Project's product water intended for Seaside Basin subsurface application. Under this scenario, none of the new sources are used to supplement the RUWAP production. Values in the table reflect the net monthly deliveries of urban recycled water. This is referred to as the "Shared Pipeline Scenario with Allocations met as AWT Facility Influent."

- **Initial Recycled Water Demand (Init-RW) Scenario:** This scenario shows initial RUWAP deliveries of 540 AFY, delivered as tertiary-treated recycled water consistent with Figure 1. This total only includes current urban irrigation demands at locations along the RUWAP trunk main (i.e., the customers who could be served without constructing additional lateral pipelines). This scenario is included to reflect that full RUWAP MOU deliveries are not required at this time. In this scenario, the RUWAP pipeline and the Proposed Project Product Water Conveyance pipeline are constructed separately. Values in the table reflect the average monthly deliveries of urban recycled water. This scenario would require modifications to the SVRP to meet low winter recycled water demands

- **Initial AWT Demand (Init-AWT) Scenario:** In this scenario, MCWD and MRWPCA would agree in the future to share a pipeline as shown in Figure 3, and the initial 540 AFY of recycled water would be produced for existing MCWD customers that are immediately adjacent to the proposed Product Water Pipeline alignment (i.e., the RUWAP pipeline option). Approximately 666 AFY of AWT Influent would be required to produce this water, accounting for the 19% loss of RO concentrate as ocean discharge. Values in the table reflect the average monthly influent that would be required at the AWT Facility to produce the quantities of delivered water reflected in scenario Init-RW.

**Table 2: RUWAP Urban Recycled Water Use by Treatment and Delivery Scenario (acre-feet)**

| Scenario | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **RW** [1] | 81 | 74 | 81 | 156 | 161 | 156 | 161 | 161 | 156 | 81 | 79 | 81 | **1,427** |
| **AWT Product**[2] | 100 | 91 | 100 | 192 | 199 | 192 | 199 | 199 | 192 | 100 | 97 | 100 | **1,761** |
| **AWT Influent**[1] | 66 | 60 | 66 | 126 | 130 | 126 | 130 | 130 | 126 | 66 | 64 | 66 | **1,156** |
| **Init-RW** [1] | 31 | 28 | 31 | 59 | 61 | 59 | 61 | 61 | 59 | 31 | 30 | 31 | **540** |
| **Init-AWT**[2] | 38 | 35 | 38 | 73 | 75 | 73 | 75 | 75 | 73 | 38 | 37 | 38 | **666** |

NOTES:
1. Values reflect urban recycled water deliveries.
2. Values reflect influent supply to the AWT Facility

The DEIR for the Proposed Project includes estimates of 4,750 AFY of additional water which would become available for use in the CSIP in average years, and 5,290 AFY in drought years with a developed reserve (Section 2.1.1.3 and Appendix B). Those estimations do not include the implementation of the RUWAP. In accordance with the certified RUWAP EIR, existing MCWD and FORA RUWAP approvals, and agreements listed in Table 4.18-5, the RUWAP would use the same supply of secondary-treated municipal wastewater as is used to supply recycled water to CSIP, so implementing the RUWAP would reduce the supply available to CSIP in the peak demand months. The Proposed Pure Water Monterey Project would more than offset these reductions (that is, the supply to CSIP from new sources is two to three times greater than the volume used by RUWAP in any month). Table 3 (attached) shows the MCWD and CSIP recycled water demands and use implications of the RUWAP Recycled Water Project in combination with the Proposed Project under the various scenarios described above. As can be seen, the AWT Influent scenario in which the pipeline would be shared has the same effect on CSIP yields as the separate pipeline scenarios (which is also the current or No Project condition). If the MRWPCA and MCWD were to agree in the future to share the pipeline under the AWT Product scenario, the net new supply available to CSIP would be reduced compared to the Proposed Project without RUWAP in the peak demand months by approximately 220 acre-feet; however, CSIP would still receive 2,370 acre-feet more recycled water in the peak demand months than without the Proposed Project, but with RUWAP.

Figures 5 to 14 (attached) show the monthly flows into and out of the RTP under the scenarios shown in Table 3. Each month is represented by two columns. The left column shows inflows to the RTP, including municipal wastewater and new sources developed under the Proposed Project. The right column shows outflows and uses, including recycled water from the SVRP to CSIP, recycled water from the SVRP to RUWAP, Advanced Treated Water to GWR, and unused and/or brine flows to the ocean outfall. The figures are stacked two per page, with the upper figure showing the scenario without the RUWAP, and the lower figure showing the same scenario with the RUWAP. In Figure 7, the drought year CSIP deliveries exceed the monthly RTP inflows due to differences in the way daily flows were calculated in the data set. Data tables similar to the analysis Tables 8, 9 and 10 from Appendix B of the DEIR, *Memorandum: Pure Water Monterey Groundwater Replenishment Project – Proposed Source Water Availability, Yield, and Use*, are attached with the supporting monthly calculations for each scenario. Because the results are identical for the separate pipeline and the AWT Influent scenarios, tables are not included for the AWT Influent scenario.

In Appendix B of the Draft EIR, as revised in this Final EIR, the Proposed Project source water analyses assumed no use of any treated municipal wastewater as influent to the Advanced Water Treatment Facility during the peak demand months of April through September, and prioritized use of existing treated municipal effluent quantities by CSIP year round. Due to their contractual rights to municipal wastewater, peak season volumes of water currently discharged to the ocean outfall were assumed to be used exclusively as influent to the SVRP for CSIP irrigation. In addition, the EIR assumes that CSIP could use additional source water flows for recycling up to the existing supplemental groundwater use (based on monthly averages, 2009-2013). As described above, MCWD's RUWAP was described and analyzed as a cumulative project, and the Draft EIR considered whether the Proposed Project would have a considerable contribution to any significant cumulative impacts of implementation of all past, present, and reasonably foreseeable future projects. The analysis of the combined effects of the Proposed Project plus cumulative projects was provided at the end of each topical section within Chapter 4 of the Draft EIR. Implementation of the RUWAP would necessitate implementation of the SVRP modifications to meet the urban irrigation demands, and the remainder of the Proposed Project improvements would increase the availability of wastewater for recycling at the RTP; therefore, even considering any new information about MCWD desiring to implement their RUWAP in their comments on the Draft, the cumulative conclusions in the Draft EIR are adequate and appropriate.

The construction impacts of the Proposed Project plus cumulative projects in the Draft EIR assumes that the RUWAP would not be built simultaneously with the Proposed Project due to schedule urgency of completing the Proposed Project and the limited existing demand for urban recycled water (estimated to be 540 AFY total or 360 AF during April through September). Therefore, the construction impacts of the two projects would not be additive such that any construction impacts of either project would be worsened by the other project. Overall construction impacts would be reduced if MRWPCA and MCWD agree in the future to share a single pipeline compared to constructing separate pipelines for RUWAP and the AWT product water. In particular, construction of a single pipeline for both uses would reduce construction equipment and vehicle use, reduce timeframes during which sensitive receptors near the RUWAP alignment would be exposed to construction impacts including air pollutants and noise/vibration, and traffic impacts would be reduced in terms of duration of temporary increased volumes and transportation disruptions. However, the Draft EIR's analysis (of both construction and operational impacts) assumed that the Proposed Project product water conveyance pipeline would be built sooner and that a potential future RUWAP pipeline would be constructed at a later date (i.e., not within the same timeframe nor with any overlapping timeframes). The impacts of constructing the RUWAP pipeline separately were addressed in the RUWAP EIR as amended in the two EIR Addenda (MCWD/DD&A, 2004 with Addenda in 2005 and 2007). As requested in comments on the Draft EIR, total recycled water yields for RUWAP customers and CSIP irrigators have been estimated under numerous implementation scenarios. The potential environmental impacts of future operation with a shared pipeline would be fully analyzed in a separate CEQA process.

Attachments:

Figure 1, Existing Flows Into and Out of the RTP
Figure 2, Flows into and out of RTP with RUWAP and No Proposed GWR Project
Figure 3, Conceptual Flow Schematic of Proposed Project plus RUWAP with Separate Pipelines
Figure 4, Conceptual Flow Schematic of Proposed Project plus RUWAP with Shared Pipeline
Figure 5, Existing Condition with No Proposed Project (2009-2013)
Figure 6, Existing Condition with No Proposed Project plus RUWAP
Figure 7, Existing Condition with No Proposed Project, Drought Year (2013)
Figure 8, Existing Condition with No Proposed Project, Drought plus RUWAP
Figure 9, Proposed Project in a Normal Year Building a Drought Reserve
Figure 10, Proposed Project in a Normal Year Building a Drought Reserve plus RUWAP
Figure 11, Proposed Project in a Normal Year with a Full Reserve
Figure 12, Proposed Project in a Normal Year with a Full Reserve plus RUWAP
Figure 13, Proposed Project in a Drought Year
Figure 14, Proposed Project in a Drought Year plus RUWAP

Table 3, Estimated Annual Recycled Water Yields under Various Scenarios of MCWD Demand and Pipelines
Table 4A, Source Water Analysis, Diversion Pattern for a Normal Year Building a Drought Reserve, Full RUWAP Demand as Recycled Water
Table 4B, Source Water Analysis, Diversion Pattern for a Normal Year with a Full Reserve, Full RUWAP Demand as Recycled Water
Table 4C, Source Water Analysis, Diversion Pattern for a Drought Year starting with a Full Reserve, Full RUWAP Demand as Recycled Water
Table 5A, Source Water Analysis, Diversion Pattern for a Normal Year Building a Drought Reserve, Full RUWAP Demand as AWT Product
Table 5B, Source Water Analysis, Diversion Pattern for a Normal Year with a Full Reserve, Full RUWAP Demand as AWT Product
Table 5C, Source Water Analysis, Diversion Pattern for a Drought Year starting with a Full Reserve, Full RUWAP Demand as AWT Product
Table 6A, Source Water Analysis, Diversion Pattern for a Normal Year Building a Drought Reserve, Initial RUWAP Demand as Recycled Water
Table 6B, Source Water Analysis, Diversion Pattern for a Normal Year with a Full Reserve, Initial RUWAP Demand as Recycled Water
Table 6C, Source Water Analysis, Diversion Pattern for a Drought Year starting with a Full Reserve, Initial RUWAP Demand as Recycled Water
Table 7A, Source Water Analysis, Diversion Pattern for a Normal Year Building a Drought Reserve, Initial RUWAP Demand as AWT Product
Table 7B, Source Water Analysis, Diversion Pattern for a Normal Year with a Full Reserve, Initial RUWAP Demand as AWT Product
Table 7C, Source Water Analysis, Diversion Pattern for a Drought Year starting with a Full Reserve, Initial RUWAP Demand as AWT Product

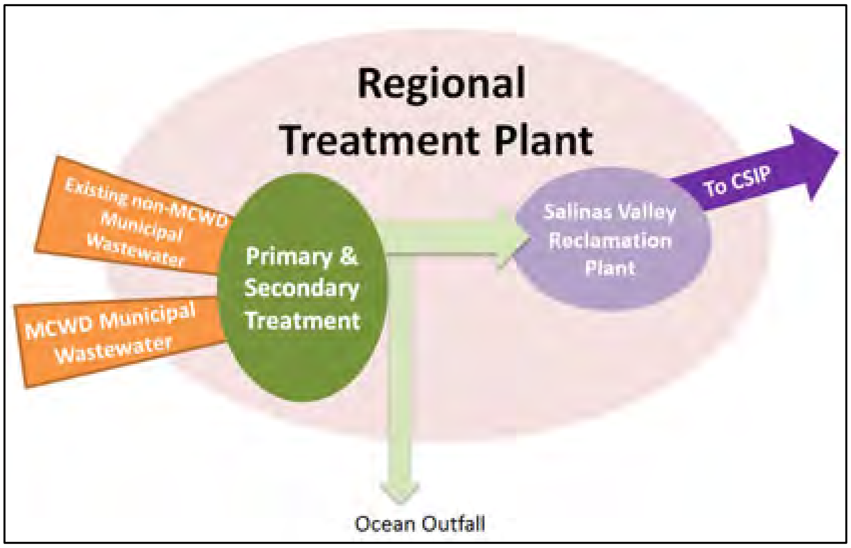



**Figure 1. Existing Flows Into and Out of the RTP**

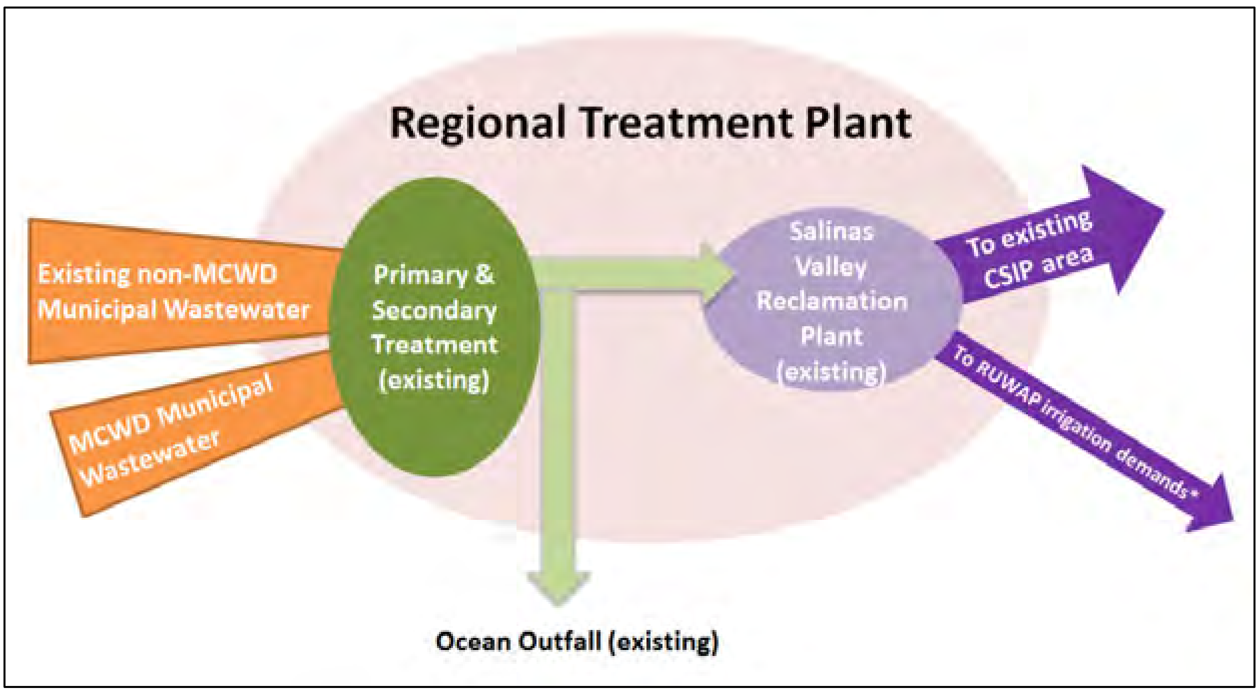



**Figure 2. Flows into and out of RTP with RUWAP and No Proposed Project**

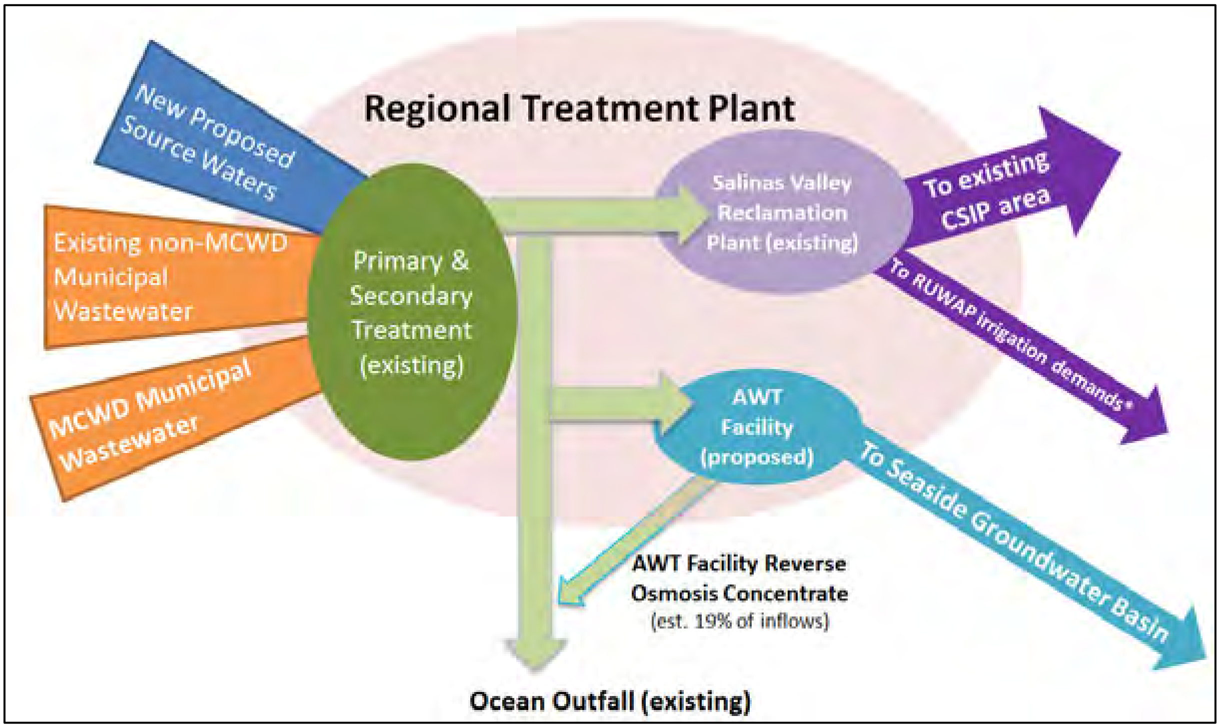



**Figure 3. Conceptual Flow Schematic of Proposed Project plus RUWAP with Separate Pipelines**

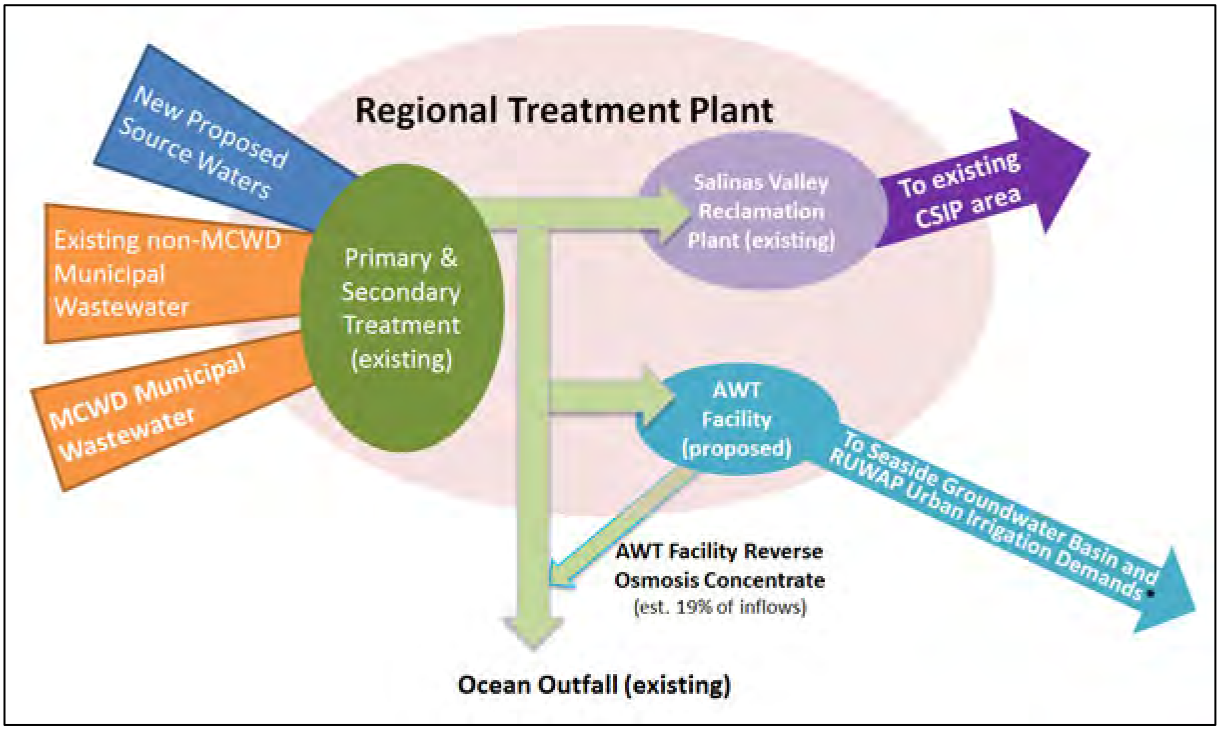
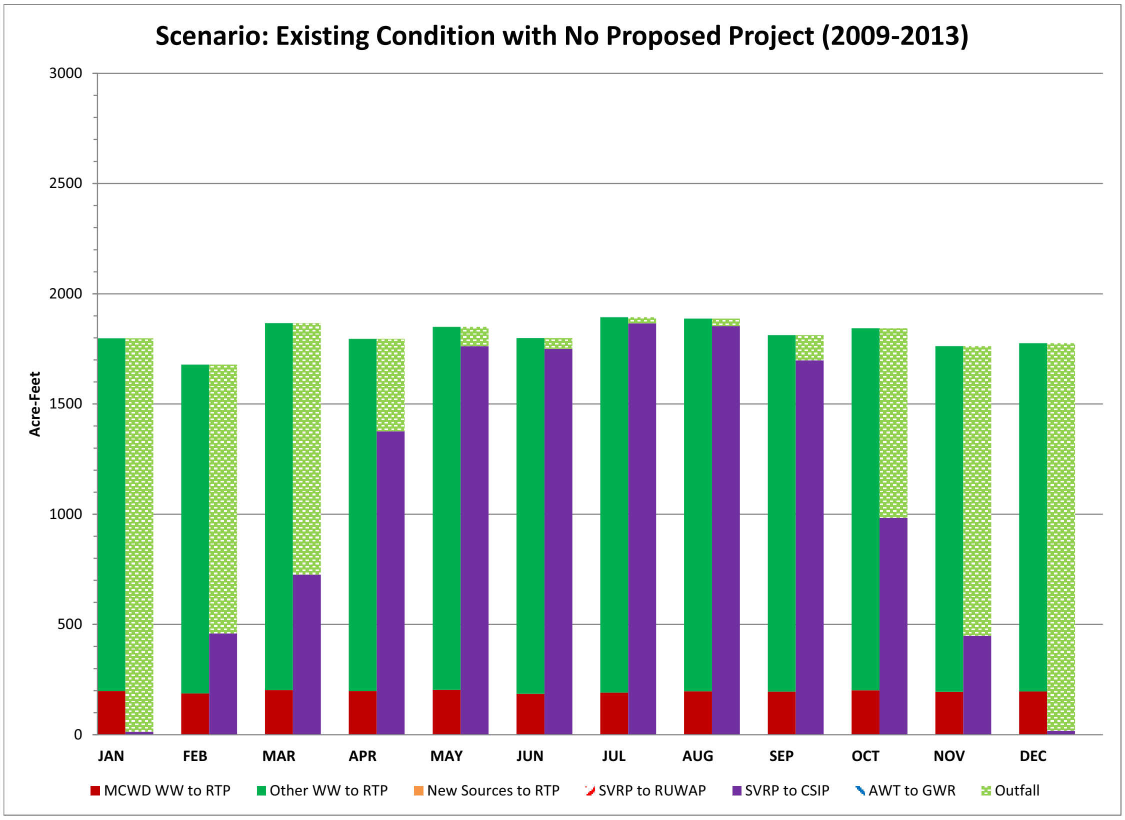



**Figure 4. Conceptual Flow Schematic of Proposed Project plus RUWAP with Shared Pipeline**

** = RUWAP deliveries would not exceed either: (1) the amounts in agreements in EIR Table 4.18-5, and (2) MCWD's municipal wastewater flows to the RTP. RUWAP urban irrigation deliveries are considered as part of a cumulative project, not part of the Proposed Project.(Note applies to both Figure 3 and Figure 4)*

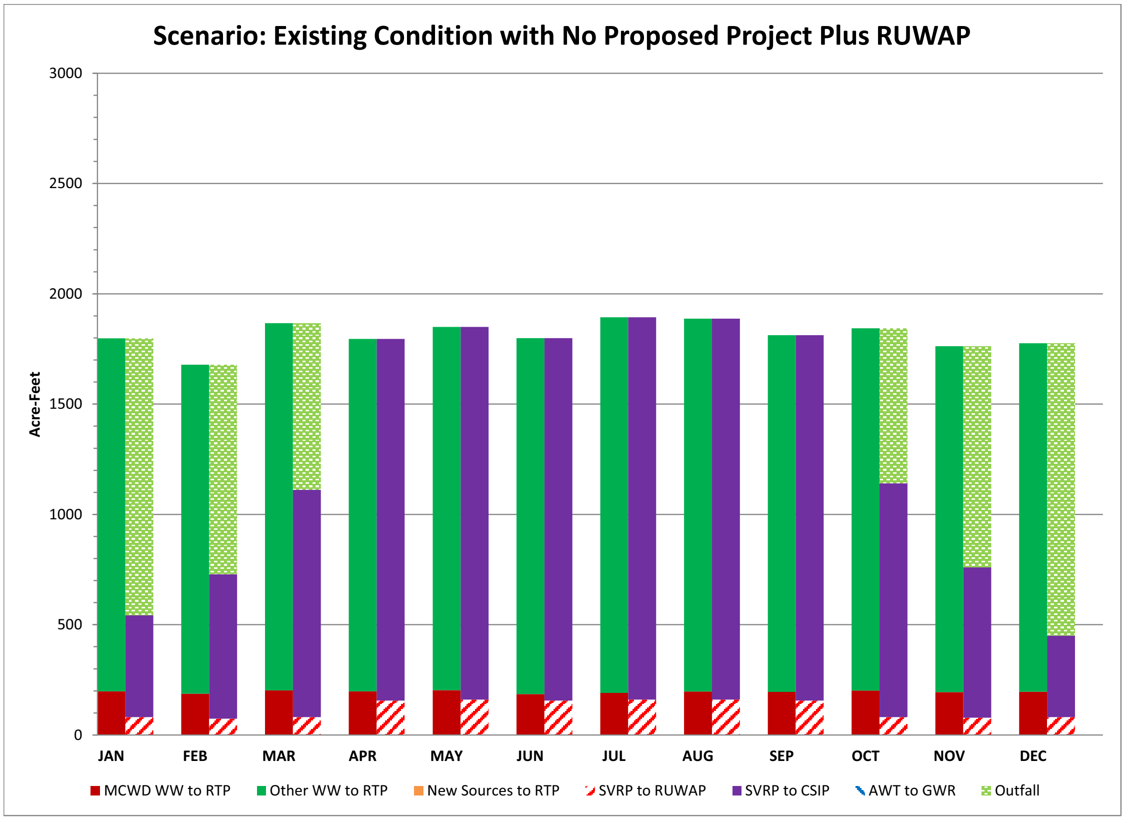
Figure 5




Left Column: RTP Inflows
Right Column: Uses and Outflows

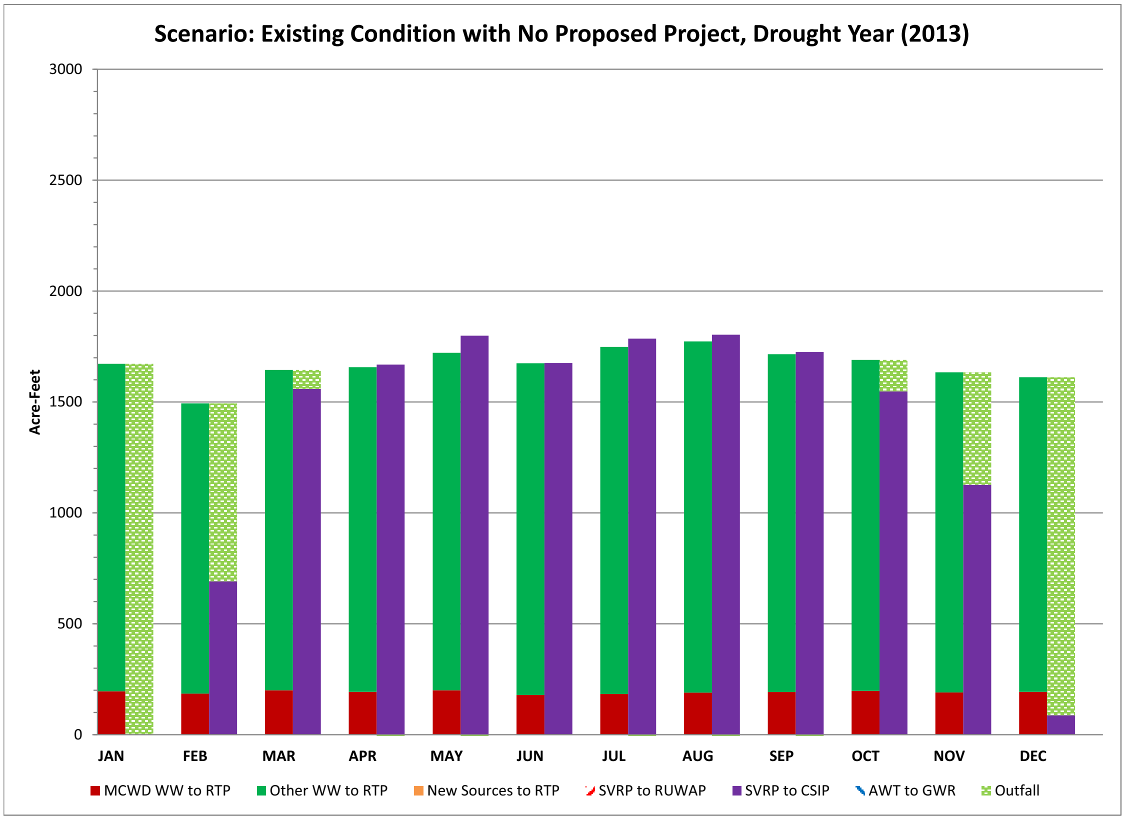


Figure 6




Left Column: RTP Inflows
Right Column: Uses and Outflows

**Figure 7**

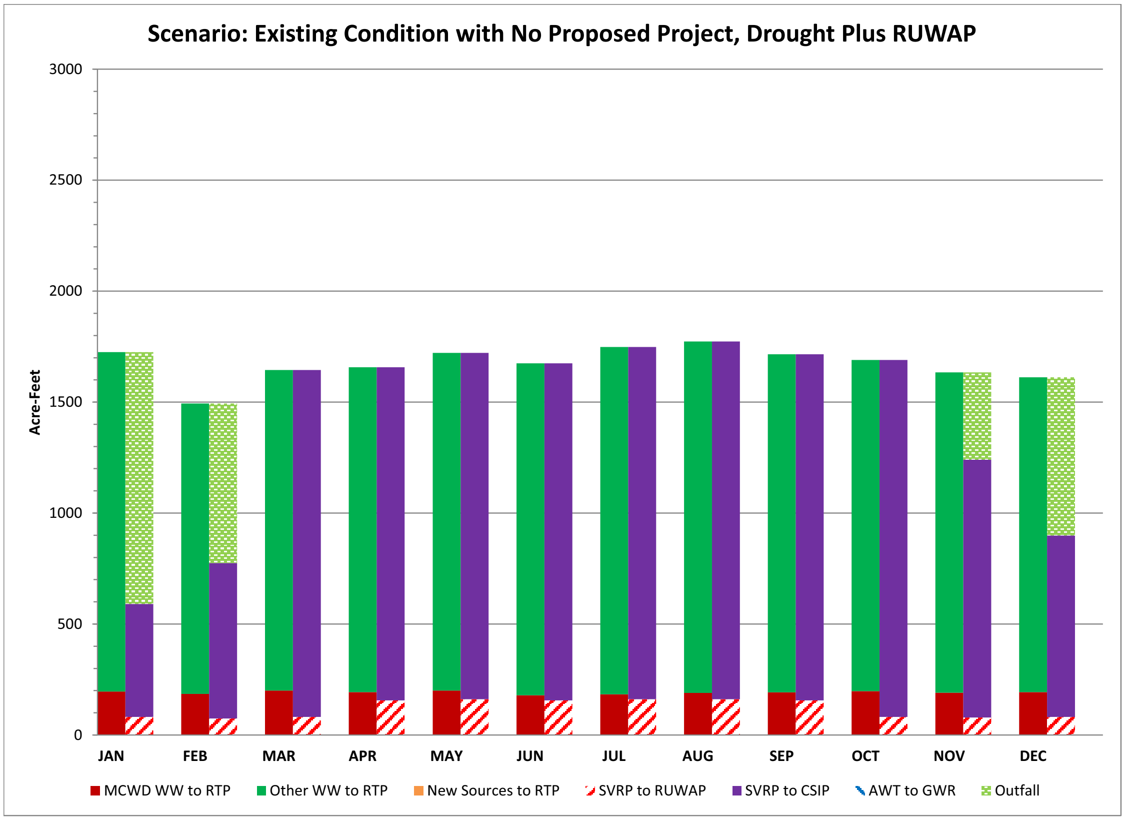



Left Column: RTP Inflows
Right Column: Uses and Outflows
Use exceeds supply in some months due to rounding errors.

Scenario 2 Ex Drought.xlsx/Chart1

8/10/2015

**Figure 8**

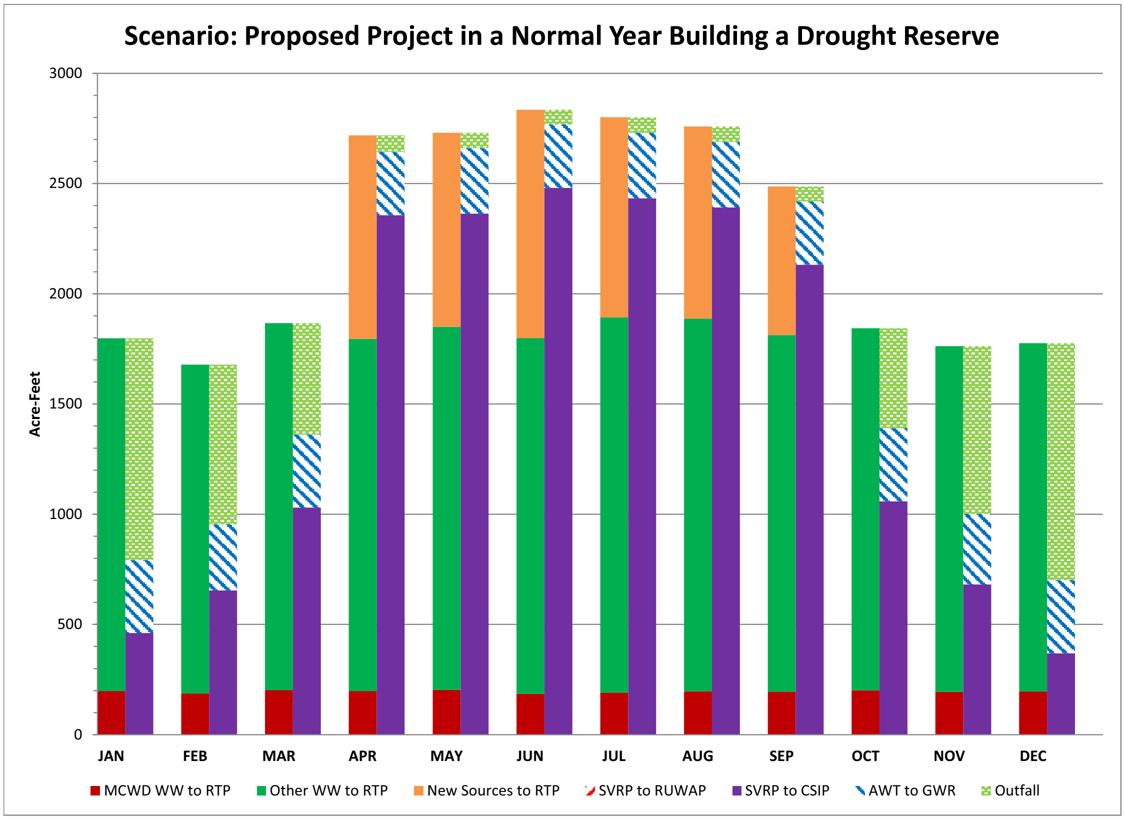



Left Column: RTP Inflows
Right Column: Uses and Outflows

Scenario 2A Ex Drought-RUWAP.xlsx/Chart1

8/10/2015

Figure 9

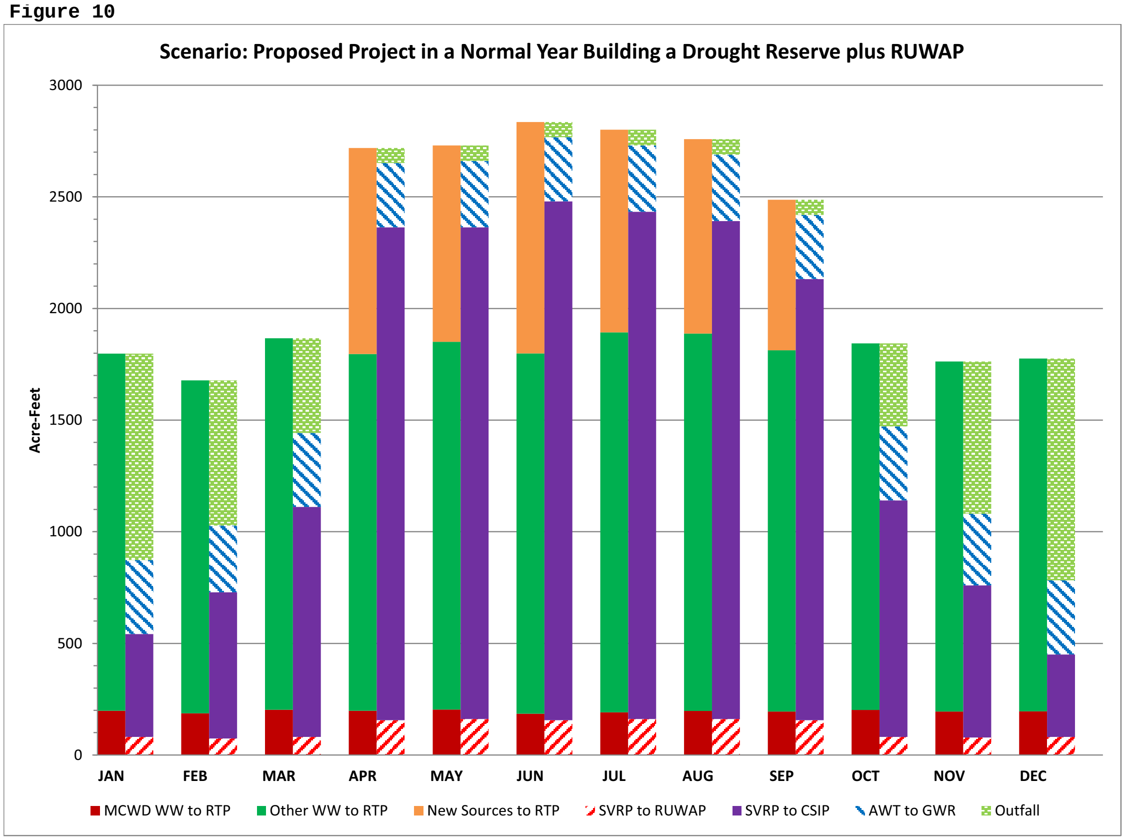



Scenario 3 Normal-Building.xlsx/Chart1

Left Column: RTP Inflows
Right Column: Uses and Outflows

8/10/2015

Figure 10

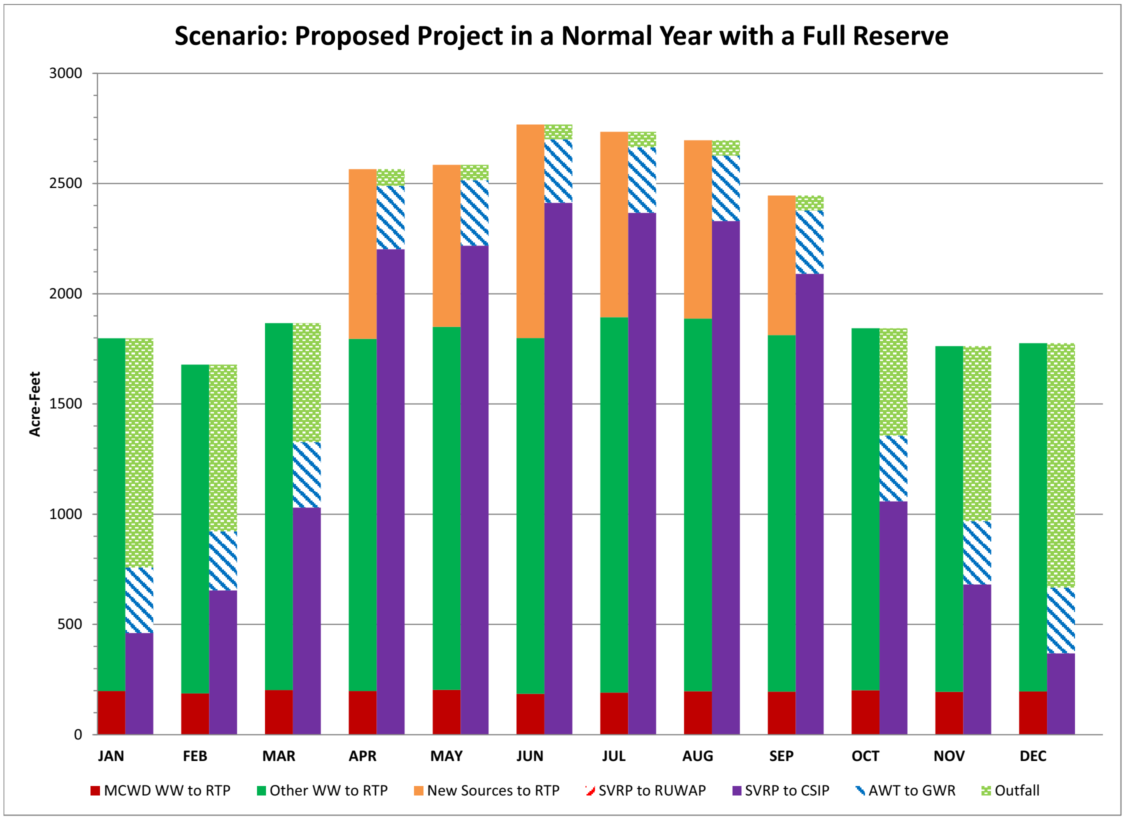



Scenario 3A Normal-Building-RUWAP.xlsx/Chart1

Left Column: RTP Inflows
Right Column: Uses and Outflows

8/10/2015

Figure 11

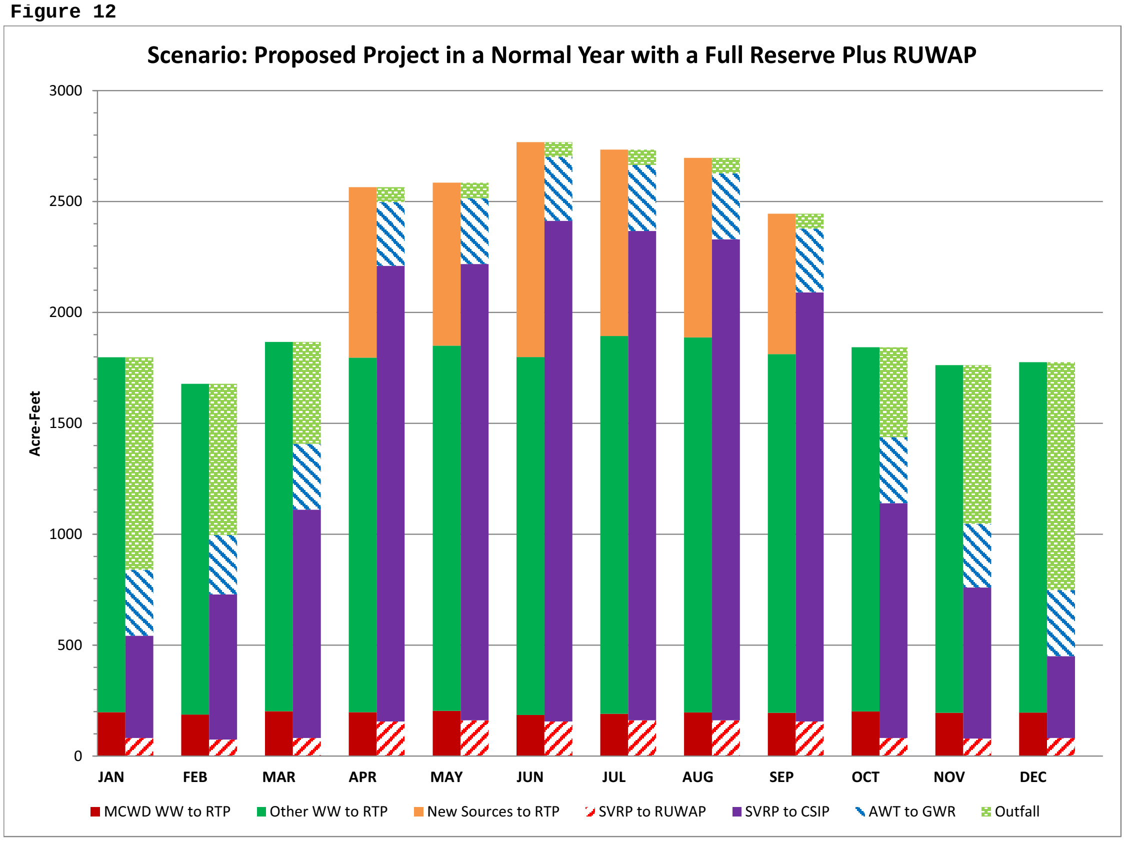



Scenario 4 Normal-Full.xlsx/Chart1

Left Column: RTP Inflows
Right Column: Uses and Outflows

8/10/2015

Figure 12

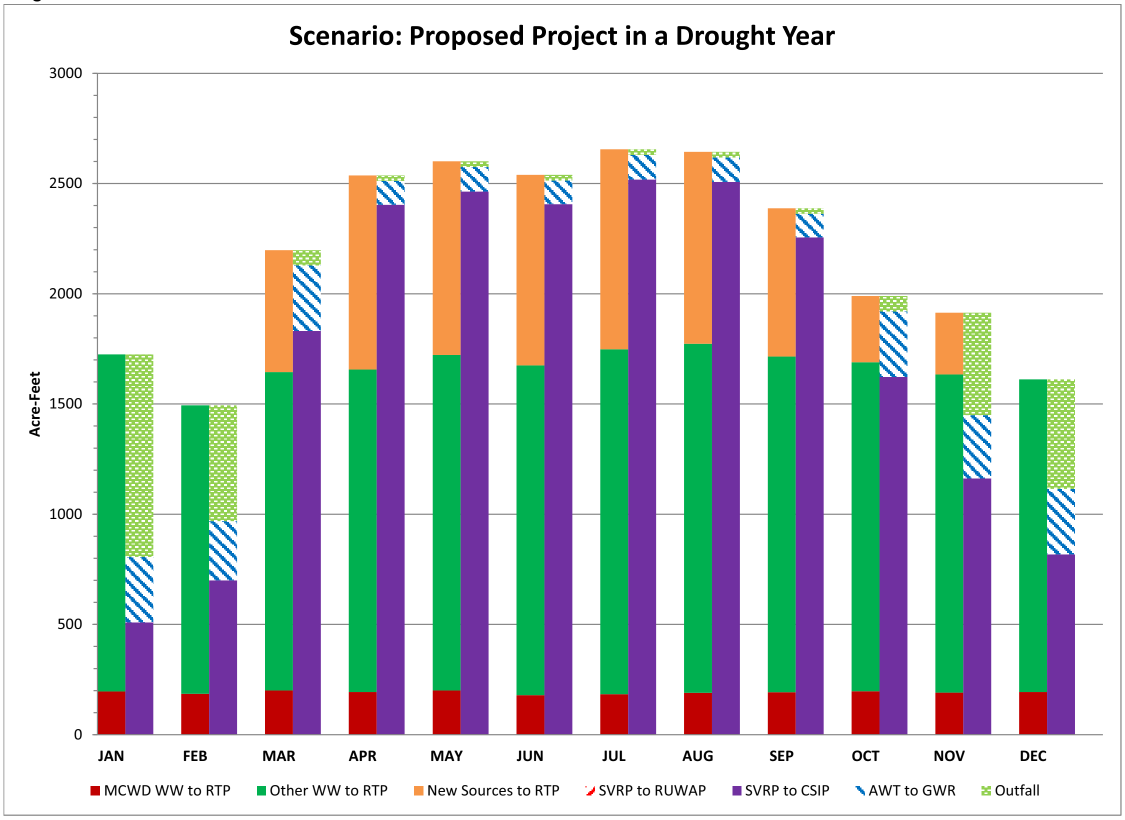



Scenario 4A Normal-Full-RUWAP.xlsx/Chart1

Left Column: RTP Inflows
Right Column: Uses and Outflows

8/10/2015

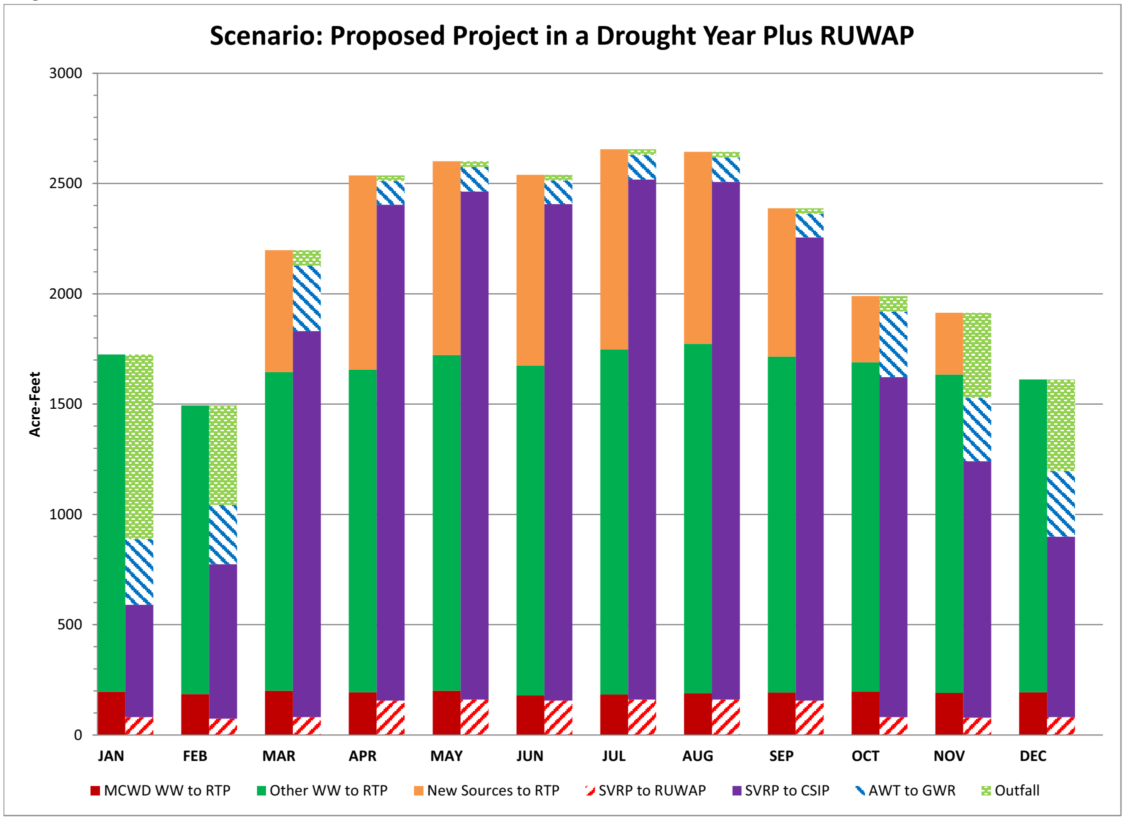
Figure 13




Left Column: RTP Inflows
Right Column: Uses and Outflows

Scenario 5 Drought.xlsx/Chart1 8/10/2015

Figure 14




Left Column: RTP Inflows
Right Column: Uses and Outflows

Scenario 5A Drought.xlsx/Chart1 8/10/2015

**Table 3. Estimated Annual Recycled Water Yields Under Various Scenarios of MCWD Demand and Pipelines**

| | | | | | | | | Shared Pipeline Scenarios | | | | | | Separate Pipelines Scenarios | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Existing | No Proposed Project with Long-Term MCWD Use (Note 1a) | | Proposed Project with No MCWD Use | | | Proposed Project with all MCWD Use Scenarios | Short-term MCWD Use (Note 1b) | | Product Water Flows = 2009 RUWAP MOU Quantities (Note 2a) | | AWT Influent Flows = 2009 RUWAP MOU Quantities (Note 2b) | | Short-term MCWD Demand (Note 1c) | | Long-term MCWD Demand (Note 2c) | |
| **Year Type (Notes 4 & 5)** | SVRP to CSIP (Note 3) | SVRP to MCWD | SVRP to CSIP | AWT to SGB (injection amount) | MCWD | SVRP to CSIP | AWT to SGB (injection amount) | AWT to MCWD | SVRP to CSIP | AWT to MCWD | SVRP to CSIP | AWT to MCWD | SVRP to CSIP | SVRP to MCWD | SVRP to CSIP | SVRP to MCWD | SVRP to CSIP |
| **April to September** | | | | | | | | | | | | | | | | | |
| Normal/wet building reserve | 10,310 | 950 | 10,090 | 1,755 | 0 | 14,160 | 1,755 | 360 | 13,720 | 950 | 12,990 | 770 | 13,210 | 360 | 13,810 | 950 | 13,210 |
| Normal/wet reserve full (Note 6) | | | | 1,755 | 0 | 13,620 | 1,755 | 360 | 13,190 | 950 | 12,460 | 770 | 12,680 | 360 | 13,270 | 950 | 12,680 |
| Drought year use reserve for CSIP | 10,460 | 950 | 9,340 | 855 | 0 | 14,560 | 855 | 360 | 14,110 | 950 | 13,380 | 770 | 13,610 | 360 | 14,200 | 950 | 13,610 |
| **Total Annual** | | | | | | | | | | | | | | | | | |
| Normal/wet building reserve | 13,000 | 1,427 | 14,340 | 3,700 | 0 | 18,410 | 3,700 | 540 | 17,980 | 1,427 | 17,250 | 1,156 | 17,470 | 540 | 18,060 | 1,427 | 17,470 |
| Normal/wet reserve full (Note 6) | | | | 3,500 | 0 | 17,880 | 3,500 | 540 | 17,440 | 1,427 | 16,710 | 1,156 | 16,940 | 540 | 17,530 | 1,427 | 16,940 |
| Drought year use reserve for CSIP | 15,470 | 1,427 | 15,700 | 2,500 | 0 | 21,200 | 2,500 | 540 | 20,680 | 1,427 | 19,830 | 1,156 | 20,090 | 540 | 20,780 | 1,427 | 20,090 |

**Notes:**

1a. This scenarios shows MCWD long-term demands (in accordance with the approved RUWAP Recycled Water Project and 2009 RUWAP MOU) and the resulting expected SVRP deliveries to CSIP without the Proposed Project implemented. This assumes the SVRP Modifications would be implemented as part of the RUWAP. T*he SVRP Modifications have not yet been built and thus are also a component of the Proposed Project* . Because there would be no drought reserve under this scenario, all normal/wet year deliveries would be the same.

1b. This scenario shows MCWD short-term demands and the expected SVRP deliveries to CSIP that might occur within the first 2 years of operation of the GWR Project with a pipeline shared with RUWAP. The estimated MCWD demand is based on existing customers along the RUWAP pipeline alignment- specifically, for Bayonet and Blackhorse Golf Courses, CSUMB sports fields, and Marina Heights streetscapes (MCWD, 2015).

1c. This scenario shows MCWD short-term demands and the resulting SVRP deliveries to CSIP that might occur within the first 2 years of operation of the GWR Project with separate pipelines for RUWAP and Proposed Project. The estimated MCWD demand is based on existing customers along the RUWAP pipeline alignment- specifically, for Bayonet and Blackhorse Golf Courses, CSUMB sports fields, and Marina Heights streetscapes (MCWD, 2015).

2a. This scenario shows the expected delivery to existing irrigation through CSIP plus planned/proposed demands from MCWD when adequate wastewater inflows from MCWD are sent to RTP to produce the full 2009 RUWAP MOU allotment (assuming shared pipeline for RUWAP and Proposed Project). Under this scenario, 1,761 AFY of MCWD wastewater inflow is needed for MCWD demands of 1,427 AFY due to 19% of treated water being discharged as reverse osmosis concentrate to the outfall. Specifically:

| AWT Facility Product Water Flows to meet 2009 RUWAP MOU Quantities | AWT Flows | | | |
|---|---|---|---|---|
| | **Influent** | **Product** | **Influent** | **Product** |
| | **APR-SEP (note 4)** | **APR-SEP (note 4)** | **Annual** | **Annual** |
| MCWD | 370 | 300 | 959 | 777 |
| MRWPCA | 802 | 650 | 802 | 650 |
| ***Total*** | ***1,172*** | ***950*** | ***1,761*** | ***1,427*** |

2b. This scenario shows the expected delivery to existing irrigation through CSIP plus planned/proposed demands when 950 AFY of wastewater inflows from MCWD are sent to RTP (assuming shared pipeline for RUWAP and Proposed Project). Under this scenario 1,427 AFY of MCWD wastewater inflow is used to produce 1,156 AFY for MCWD due to 19% of treated water being discharged as reverse osmosis concentrate to the outfall (AWT inflow for MCWD limited to 950 AF for April - September). Specifically:

| AWT Influent Flows limited to MCWD's 2009 RUWAP MOU Quantities | AWT Flows | | | |
|---|---|---|---|---|
| | **Influent** | **Product** | **Influent** | **Product** |
| | **APR-SEP (note 4)** | **APR-SEP (note 4)** | **Annual** | **Annual** |
| MCWD | 300 | 243 | 777 | 629.37 |
| MRWPCA | 650 | 526.5 | 650 | 526.5 |
| ***Total*** | ***950*** | ***770*** | ***1,427*** | ***1,156*** |

2c. Under this scenario, the assumed delivery to existing irrigation through CSIP plus planned/proposed demands when 950 AFY wastewater inflows from MCWD are sent to RTP. Under this scenario, 1,427 AFY of source water is needed for MCWD demands of 1,427 AFY because this scenario assumes MCWD recycled water comes from the SVRP and is delivered using separate pipelines.

3. Use of SVRP recycled water by CSIP irrigators for Normal/Wet years assumes the average SVRP deliveries to CSIP in 2009 – 2013. Use of SVRP recycled water for drought year conservatively assumes SVRP deliveries in 2013 as a baseline.

4. Under the 2009 RUWAP MOU, MCWD committed to provide 300 AFY from April to September while MRWPCA committed to provide 650 AFY from May to August. These calculations assume the 950 AFY spread across April to September and that MCWD's 300 AFY commitment would be used in April and September.

5. Since the CSIP system was built, CSIP irrigators have also received supply from CSIP supplemental groundwater wells (operated by MRWPCA) and, since 2009, from the Salinas River Diversion Facility (SRDF). These sources would continue to be available in the future under all scenarios (i.e., with no changes due to RUWAP nor the Proposed Project). The SRDF is expected to provide approximately 3,427 AFY to CSIP based on the full historical record of availability (a 5-year average, 2009 through 2013). Because the expected yields to CSIP from SRDF would not be affected by the Proposed Project nor by RUWAP, these yields are not included in the totals. Single drought year from SRDF to CSIP (2013) was 6,094 AFY; however, in multiple drought years no water is expected to be available from the SRDF (as demonstrated by years 2014 and 2015).

6. This asumes no diversion of at Tembladero Slough when the drought reserve is full.

## Table 4A: Source Water Analysis for the Pure Water Monterey Groundwater Replenishment Project

### Diversion Patterns for a Normal Water Year, Building a Drought Reserve, Full RUWAP Demand as Recycled Water

**All facilities built [1] - average water year conditions - all flows in acre-feet** — **7/28/2015**

| No. | SOURCES | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Existing RTP Inflows (Average 2009 to 2013)** | **1,798** | **1,678** | **1,867** | **1,796** | **1,850** | **1,799** | **1,893** | **1,888** | **1,813** | **1,844** | **1,762** | **1,776** | **21,764** |
| | **New Source Water** | | | | | | | | | | | | | |
| | *City of Salinas* | | | | | | | | | | | | | |
| 1 | Salinas Agricultural Wash Water [2] | 156 | 158 | 201 | 307 | 311 | 391 | 435 | 444 | 367 | 410 | 329 | 223 | 3,732 |
| | *Agricultural Wash Water (AWW) to Ponds [3]* | *156* | *158* | *201* | *0* | *0* | *0* | *0* | *0* | *0* | *410* | *329* | *223* | *1,477* |
| | *AWW directly to RTP* | *0* | *0* | *0* | *307* | *311* | *391* | *435* | *444* | *367* | *0* | *0* | *0* | *2,255* |
| 2 | Salinas Urban Storm Water Runoff [4] | 52 | 41 | 34 | 16 | 2 | 0 | 0 | 0 | 2 | 8 | 23 | 47 | 225 |
| | *Urban runoff to ponds* | *52* | *41* | *34* | *0* | *0* | *0* | *0* | *0* | *0* | *8* | *23* | *47* | *205* |
| | *Urban runoff to RTP* | *0* | *0* | *0* | *16* | *2* | *0* | *0* | *0* | *2* | *0* | *0* | *0* | *20* |
| 3 | Rainfall (on SIWTF, 121 acre pond area) [5] | 26 | 24 | 21 | 11 | 3 | 1 | 0 | 0 | 2 | 6 | 14 | 24 | 132 |
| 4 | Evaporation (from SIWTF, 121 acre pond area) [6] | (12) | (16) | (29) | (41) | (46) | (52) | | | | (28) | (15) | (12) | (251) |
| 5 | Percolation [7] | (143) | (129) | (143) | (138) | (143) | (138) | | | | (143) | (138) | (143) | (1,257) |
| 6 | SIWTF pond storage balance [8] | 684 | 763 | 847 | 647 | 362 | 0 | 0 | 0 | 0 | 253 | 466 | 605 | |
| 7 | Recovery of flow from SIWTF storage ponds to RTP | 0 | 0 | 0 | 32 | 100 | 172 | 0 | 0 | 0 | 0 | 0 | 0 | 304 |
| 8 | AWW and Salinas Runoff to RTP | 0 | 0 | 0 | 355 | 413 | 563 | 435 | 444 | 369 | 0 | 0 | 0 | 2,579 |
| | *Water Rights Applications to SWRCB* | | | | | | | | | | | | | |
| 9 | Blanco Drain [9] | 0 | 0 | 0 | 252 | 225 | 274 | 277 | 244 | 184 | 0 | 0 | 0 | 1,456 |
| 10 | Reclamation Ditch at Davis Road [10] | 0 | 0 | 0 | 162 | 97 | 132 | 129 | 121 | 80 | 0 | 0 | 0 | 721 |
| 11 | Tembladero Slough at Castroville [11] | 0 | 0 | 0 | 154 | 145 | 67 | 66 | 62 | 41 | 0 | 0 | 0 | 535 |
| 12 | City of Monterey - Diversion at Lake El Estero | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | **Subtotal New Waters Available** | **0** | **0** | **0** | **923** | **880** | **1,036** | **907** | **871** | **674** | **0** | **0** | **0** | **5,291** |
| | **Total Projected Water Supply** | **1,798** | **1,678** | **1,867** | **2,719** | **2,730** | **2,835** | **2,800** | **2,759** | **2,487** | **1,844** | **1,762** | **1,776** | **27,055** |

| No. | DEMANDS | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Average SVRP deliveries to CSIP (2009-2013) | 13 | 459 | 726 | 1,376 | 1,763 | 1,750 | 1,866 | 1,854 | 1,698 | 984 | 448 | 18 | 12,955 |
| 14 | FIVE YEAR AVERAGE CSIP AREA WELL WATER USE (2009-2013) | 448 | 195 | 304 | 412 | 324 | 606 | 519 | 504 | 300 | 75 | 233 | 352 | 4,272 |
| | **TOTAL CSIP Demand** | **461** | **654** | **1,030** | **1,788** | **2,087** | **2,356** | **2,385** | **2,358** | **1,998** | **1,059** | **681** | **370** | **17,227** |
| 15 | MCWD RUWAP [18] | 81 | 74 | 81 | 156 | 161 | 156 | 161 | 161 | 156 | 81 | 79 | 81 | 1427 |
| 16 | FEEDWATER AMOUNT AT RTP TO GWR PROJECT AWTF | 367 | 331 | 367 | 355 | 367 | 355 | 367 | 367 | 355 | 367 | 355 | 367 | 4,320 |
| 17 | FEEDWATER TO ESTABLISH CSIP AREA DROUGHT RESERVE (200 AFY AWTF PRODUCT WATER) [14] | 42 | 38 | 42 | | | | | | | 42 | 41 | 42 | 248 |
| 18 | **TOTAL TO GWR ADVANCED WATER TREATMENT FACILITY** | **409** | **369** | **409** | **355** | **367** | **355** | **367** | **367** | **355** | **409** | **396** | **409** | **4,568** |
| | **Total Projected Water Demand** | **951** | **1,098** | **1,520** | **2,299** | **2,615** | **2,867** | **2,913** | **2,885** | **2,509** | **1,549** | **1,156** | **860** | **23,222** |

| No. | Use of Source Water | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 | Secondary effluent to SVRP for CSIP [12] | 461 | 654 | 1,030 | 1,640 | 1,689 | 1,643 | 1,733 | 1,727 | 1,657 | 1,059 | 681 | 370 | 14,345 |
| 20 | New sources available to CSIP [13] | 0 | 0 | 0 | 568 | 513 | 681 | 540 | 504 | 319 | 0 | 0 | 0 | 3,125 |
| 21 | **Total Supply to CSIP** | **461** | **654** | **1,030** | **2,208** | **2,202** | **2,324** | **2,273** | **2,231** | **1,976** | **1,059** | **681** | **370** | **17,470** |
| | **Net CSIP Increase** | | | | | | | | | | | | | **4,514** |
| 22 | Secondary effluent to SVRP for MCWD RUWAP | 81 | 74 | 81 | 156 | 161 | 156 | 161 | 161 | 156 | 81 | 79 | 81 | 1,427 |
| 23 | Surface waters at RTP to AWT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 | Secondary effluent to AWT | 409 | 369 | 409 | 0 | 0 | 0 | 0 | 0 | 0 | 409 | 396 | 409 | 2,401 |
| 25 | AWW and Salinas urban runoff to AWT | 0 | 0 | 0 | 355 | 367 | 355 | 367 | 367 | 355 | 0 | 0 | 0 | 2,166 |
| 26 | **Feedwater to AWT** | **409** | **369** | **409** | **355** | **367** | **355** | **367** | **367** | **355** | **409** | **396** | **409** | **4,567** |
| | **Subtotal- all waters (including secondary effluent)** | **870** | **1,024** | **1,439** | **2,563** | **2,569** | **2,679** | **2,640** | **2,598** | **2,331** | **1,468** | **1,077** | **779** | **22,037** |

| No. | Item | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | FIVE YEAR AVERAGE WASTE WATER EFFLUENT TO OCEAN OUTFALL (2009-2013) [15] | 1,785 | 1,219 | 1,141 | 420 | 88 | 49 | 27 | 34 | 114 | 859 | 1,314 | 1,759 | 8,809 |
| 28 | WASTE WATER EFFLUENT TO OCEAN OUTFALL WITH PROPOSED DIVERSIONS TO CSIP/AWT/RUWAP [16] | 846 | 581 | 347 | 0 | (0) | 0 | (0) | (0) | 0 | 294 | 607 | 916 | 3,591 |
| 29 | NEW SUPPLIES IN EXCESS OF AWT DEMANDS FOR GWR [17] | (409) | (369) | (409) | 568 | 513 | 681 | 540 | 504 | 319 | (409) | (396) | (409) | 724 |
| 30 | AWT BRINE TO OCEAN OUTFALL | 78 | 70 | 78 | 67 | 70 | 67 | 70 | 70 | 67 | 78 | 75 | 78 | 868 |

**Notes**

1 Presumes all facilities associated with diversions are completed.

2 Table 2-1, p. 5, Schaaf & Wheeler Consulting Engineers. Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

3 Volume of effluent from City of Salinas agricultural wash water to be directed into ponds 1,2,3, and the aeration pond for storage.

4 Average monthly flow from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

5 Rainfall from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015. Pond area presumed to be Ponds 1,2, 3 + Aeration lagoon. No rainfall/evaporation or storage assigned to drying beds.

6 Table 3, Todd Groundwater, Draft Memorandum, Pure Water Monterey Groundwater Replenishment Project: Impacts of Changes in Percolation at the Salinas Industrial Wastewater Treatment Facility on Groundwater and the Salinas River, February 11, 2015.

7 Table 4, Ibid. Also confirmed in MPWMD Industrial Ponds Percolation and Evaporation Technical Memorandum 2015-01, July 2015.

8 Ponds 1,2,3 and aeration basin hold up to 1,065 acre-feet (one foot of freeboard). If flow to ponds would exceed the maximum volume, it is presumed that excess flow can be diverted to the RIBs or drying beds or flow can be diverted to the RTP. Presume that pond storage goes to zero sometime during the year (shown here starting in July).

9 Max diversion = 6 cfs diversion. See REVISED DRAFT BLANCO DRAIN YIELD STUDY, Schaaf and Wheeler, December 2014.

10 Max. diversion = 6 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Note that flow figures shown here are a combination of flow estimates in the S&W analysis made for the 2 cfs instream requirement Jan-May and 1 cfs instream requirement for June-Dec.

11 Max. diversion = 3 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Figures shown here are the difference between the combined Davis Road/TS diversion with Seasonal Bypass. This presumes the preference is to remove flow at Davis Road first, rather than bypass flow to Tembaldero Slough.

12 Includes secondary effluent wastewater currently used to produce recycled water at the Salinas Valley Reclamation Project (SVRP), and additional amounts which may be used during periods of low demand (<5 mgd) with the proposed improvements to the SVRP.

13 New source waters not used by AWT will be available to SVRP for CSIP.

14 A drought reserve of up to 1,000 AF would be created over five years by producing 200 AFY additional product water from the GWR Project AWTF during winter months and storing the water in the Seaside Basin. This would establish a "water bank" that the CSIP can draw on in droughts. The drought reserve would allow flow at the RTP for the GWR Project to be temporarily reduced during critically dry periods, thus freeing up more of the newly available inflows to the RTP to be sent to the CSIP area. Extraction from the Seaside Basin would continue at the average rate to supply the Monterey Peninsula.

15 Average monthly RTP discharge, 2009-2013 (reported by MRWPCA).

16 Secondary treated municpal effluent not used for SVRP or the AWT.

17 Excess is calculated as Line 13 minus Lines 16 & 17

18 RUWAP supply comes from existing RTP inflows, demands reflect Phase 1 project.

## Table 4B: Source Water Analysis for the Pure Water Monterey Groundwater Replenishment Project

### Diversion Pattern for a Normal Water Year when the Drought Reserve is Full, Full RUWAP Demand as Recycled Water

**All facilities built [1] - average water year conditions - all flows in acre-feet** — 7/28/2015

| # | SOURCES | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Existing RTP Inflows (Average 2009 to 2013)** | **1,798** | **1,678** | **1,867** | **1,796** | **1,850** | **1,799** | **1,893** | **1,888** | **1,813** | **1,844** | **1,762** | **1,776** | **21,764** |
| | **New Source Water** | | | | | | | | | | | | | |
| | *City of Salinas* | | | | | | | | | | | | | |
| 1 | Salinas Agricultural Wash Water [2] | 156 | 158 | 201 | 307 | 311 | 391 | 435 | 444 | 367 | 410 | 329 | 223 | 3,732 |
| | *Agricultural Wash Water (AWW) to Ponds [3]* | *156* | *158* | *201* | *0* | *0* | *0* | *0* | *0* | *0* | *410* | *329* | *223* | *1,477* |
| | *AWW directly to RTP* | *0* | *0* | *0* | *307* | *311* | *391* | *435* | *444* | *367* | *0* | *0* | *0* | *2,255* |
| 2 | Salinas Urban Storm Water Runoff [4] | 52 | 41 | 34 | 16 | 2 | 0 | 0 | 0 | 2 | 8 | 23 | 47 | 225 |
| | *Urban runoff to ponds* | *52* | *41* | *34* | *0* | *0* | *0* | *0* | *0* | *0* | *8* | *23* | *47* | *205* |
| | *Urban runoff to RTP* | *0* | *0* | *0* | *16* | *2* | *0* | *0* | *0* | *2* | *0* | *0* | *0* | *20* |
| 3 | Rainfall (on SIWTF, 121 acre pond area) [5] | 26 | 24 | 21 | 11 | 3 | 1 | 0 | 0 | 2 | 6 | 14 | 24 | 132 |
| 4 | Evaporation (from SIWTF, 121 acre pond area) [6] | (12) | (16) | (29) | (41) | (46) | (52) | | | | (28) | (15) | (12) | (251) |
| 5 | Percolation [7] | (143) | (129) | (143) | (138) | (143) | (138) | | | | (143) | (138) | (143) | (1,257) |
| 6 | SIWTF pond storage balance [8] | 684 | 763 | 847 | 647 | 362 | 0 | 0 | 0 | 0 | 253 | 466 | 605 | |
| 7 | Recovery of flow from SIWTF storage ponds to RTP | 0 | 0 | 0 | 32 | 100 | 172 | 0 | 0 | 0 | 0 | 0 | 0 | 304 |
| 8 | AWW and Salinas Runoff to RTP | 0 | 0 | 0 | 355 | 413 | 563 | 435 | 444 | 369 | 0 | 0 | 0 | 2,579 |
| | *Water Rights Applications to SWRCB* | | | | | | | | | | | | | |
| 9 | Blanco Drain [9] | 0 | 0 | 0 | 252 | 225 | 274 | 277 | 244 | 184 | 0 | 0 | 0 | 1,456 |
| 10 | Reclamation Ditch at Davis Road [10] | 0 | 0 | 0 | 162 | 97 | 132 | 129 | 121 | 80 | 0 | 0 | 0 | 721 |
| 11 | Tembladero Slough at Castroville [11] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | City of Monterey - Diversion at Lake El Estero | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | **Subtotal New Waters Available** | **0** | **0** | **0** | **769** | **735** | **969** | **841** | **809** | **633** | **0** | **0** | **0** | **4,756** |
| | **Total Projected Water Supply** | **1,798** | **1,678** | **1,867** | **2,565** | **2,585** | **2,768** | **2,734** | **2,697** | **2,446** | **1,844** | **1,762** | **1,776** | **26,520** |
| | **DEMANDS** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
| | Average SVRP deliveries to CSIP (2009-2013) | 13 | 459 | 726 | 1,376 | 1,763 | 1,750 | 1,866 | 1,854 | 1,698 | 984 | 448 | 18 | 12,955 |
| 14 | FIVE YEAR AVERAGE CSIP AREA WELL WATER USE (2009-2013) | 448 | 195 | 304 | 412 | 324 | 606 | 519 | 504 | 300 | 75 | 233 | 352 | 4,272 |
| | **TOTAL CSIP Demand** | **461** | **654** | **1,030** | **1,788** | **2,087** | **2,356** | **2,385** | **2,358** | **1,998** | **1,059** | **681** | **370** | **17,227** |
| 15 | MCWD RUWAP[18] | 81 | 74 | 81 | 156 | 161 | 156 | 161 | 161 | 156 | 81 | 79 | 81 | 1427 |
| 16 | FEEDWATER AMOUNT AT RTP TO GWR PROJECT AWTF | 367 | 331 | 367 | 355 | 367 | 355 | 367 | 367 | 355 | 367 | 355 | 367 | 4,320 |
| 17 | FEEDWATER TO ESTABLISH CSIP AREA DROUGHT RESERVE (200 AFY AWTF PRODUCT WATER) [14] | 0 | 0 | 0 | | | | | | | 0 | 0 | 0 | 0 |
| 18 | **TOTAL TO GWR ADVANCED WATER TREATMENT FACILITY** | **367** | **331** | **367** | **355** | **367** | **355** | **367** | **367** | **355** | **367** | **355** | **367** | **4,320** |
| | **Total Projected Water Demand** | **909** | **1,059** | **1,478** | **2,299** | **2,615** | **2,867** | **2,913** | **2,885** | **2,509** | **1,507** | **1,115** | **818** | **22,974** |
| | **Use of Source Water** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
| 19 | Secondary effluent to SVRP for CSIP [12] | 461 | 654 | 1,030 | 1,640 | 1,689 | 1,643 | 1,733 | 1,727 | 1,657 | 1,059 | 681 | 370 | 14,345 |
| 20 | New sources available to CSIP [13] | 0 | 0 | 0 | 414 | 368 | 614 | 474 | 442 | 278 | 0 | 0 | 0 | 2,590 |
| 21 | **Total Supply to CSIP** | **461** | **654** | **1,030** | **2,054** | **2,057** | **2,257** | **2,207** | **2,169** | **1,935** | **1,059** | **681** | **370** | **16,935** |
| | **Net CSIP Increase** | | | | | | | | | | | | | **3,979** |
| 22 | Secondary effluent to SVRP for MCWD RUWAP | 81 | 74 | 81 | 156 | 161 | 156 | 161 | 161 | 156 | 81 | 79 | 81 | 1,427 |
| 23 | Surface waters at RTP to AWT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 | Secondary effluent to AWT | 367 | 331 | 367 | 0 | 0 | 0 | 0 | 0 | 0 | 367 | 355 | 367 | 2,154 |
| 25 | AWW and Salinas urban runoff to AWT | 0 | 0 | 0 | 355 | 367 | 355 | 367 | 367 | 355 | 0 | 0 | 0 | 2,166 |
| 26 | **Feedwater to AWT** | **367** | **331** | **367** | **355** | **367** | **355** | **367** | **367** | **355** | **367** | **355** | **367** | **4,320** |
| | **Subtotal- all waters (including secondary effluent)** | **828** | **985** | **1,397** | **2,409** | **2,424** | **2,612** | **2,574** | **2,536** | **2,290** | **1,426** | **1,036** | **737** | **21,255** |
| 27 | FIVE YEAR AVERAGE WASTE WATER EFFLUENT TO OCEAN OUTFALL (2009-2013)[15] | 1,785 | 1,219 | 1,141 | 420 | 88 | 49 | 27 | 34 | 114 | 859 | 1,314 | 1,759 | 8,809 |
| 28 | WASTE WATER EFFLUENT TO OCEAN OUTFALL WITH PROPOSED DIVERSIONS TO CSIP/AWT/RUWAP [16] | 889 | 619 | 389 | 0 | (0) | 0 | (0) | (0) | 0 | 336 | 648 | 959 | 3,838 |
| 29 | NEW SUPPLIES IN EXCESS OF AWT DEMANDS FOR GWR [17] | (367) | (331) | (367) | 414 | 368 | 614 | 474 | 442 | 278 | (367) | (355) | (367) | 436 |
| 30 | AWT BRINE TO OCEAN OUTFALL | 70 | 63 | 70 | 67 | 70 | 67 | 70 | 70 | 67 | 70 | 67 | 70 | 821 |

**Notes**

1 Presumes all facilities associated with diversions are completed.

2 Table 2-1, p. 5, Schaaf & Wheeler Consulting Engineers. Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

3 Volume of effluent from City of Salinas agricultural wash water to be directed into ponds 1,2,3, and the aeration pond for storage.

4 Average monthly flow from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

5 Rainfall from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015. Pond area presumed to be Ponds 1,2, 3 + Aeration lagoon. No rainfall/evaporation or storage assigned to drying beds.

6 Table 3, Todd Groundwater, Draft Memorandum, Pure Water Monterey Groundwater Replenishment Project: Impacts of Changes in Percolation at the Salinas Industrial Wastewater Treatment Facility on Groundwater and the Salinas River, February 11, 2015.

7 Table 4, Ibid. Also confirmed in MPWMD Industrial Ponds Percolation and Evaporation Technical Memorandum 2015-01, July 2015.

8 Ponds 1,2,3 and aeration basin hold up to 1,065 acre-feet (one foot of freeboard). If flow to ponds would exceed the maximum volume, it is presumed that excess flow can be diverted to the RIBs or drying beds or flow can be diverted to the RTP. Presume that pond storage goes to zero sometime during the year (shown here starting in July).

9 Max diversion = 6 cfs diversion. See REVISED DRAFT BLANCO DRAIN YIELD STUDY, Schaaf and Wheeler, December 2014.

10 Max. diversion = 6 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Note that flow figures shown here are a combination of flow estimates in the S&W analysis made for the 2 cfs instream requirement Jan-May and 1 cfs instream requirement for June-Dec.

11 Max. diversion = 3 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Figures shown here are the difference between the combined Davis Road/TS diversion with Seasonal Bypass. This presumes the preference is to remove flow at Davis Road first, rather than bypass flow to Tembaldero Slough.

12 Includes secondary effluent wastewater currently used to produce recycled water at the Salinas Valley Reclamation Project (SVRP), and additional amounts which may be used during periods of low demand (<5 mgd) with the proposed improvements to the SVRP.

13 New source waters not used by AWT will be available to SVRP for CSIP.

14 A drought reserve of up to 1,000 AF would be created over five years by producing 200 AFY additional product water from the GWR Project AWTF during winter months and storing the water in the Seaside Basin. This would establish a "water bank" that the CSIP can draw on in droughts. The drought reserve would allow flow at the RTP for the GWR Project to be temporarily reduced during critically dry periods, thus freeing up more of the newly available inflows to the RTP to be sent to the CSIP area. Extraction from the Seaside Basin would continue at the average rate to supply the Monterey Peninsula.

15 Average monthly RTP discharge, 2009-2013 (reported by MRWPCA).

16 Secondary treated municpal effluent not used for SVRP or the AWT.

17 Excess is calculated as Line 13 minus Lines 16 & 17

18 RUWAP supply comes from existing RTP inflows, demands reflect Phase 1 project.

## Table 4C: Source Water Analysis for the Pure Water Monterey Groundwater Replenishment Project

### Diversion Pattern for a Drought Year Starting with a Full Reserve, Full RUWAP Demand as Recycled Water

**All facilities built [1] - average water year conditions - all flows in acre-feet** — 7/28/2015

| | SOURCES | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Minimum Year RTP Inflows (2013)** | *1,725* | *1,494* | *1,645* | *1,657* | *1,722* | *1,675* | *1,748* | *1,773* | *1,715* | *1,690* | *1,634* | *1,612* | **20,090** |
| | **New Source Water** | | | | | | | | | | | | | |
| | *City of Salinas* | | | | | | | | | | | | | |
| 1 | Salinas Agricultural Wash Water [2] | 156 | 158 | 201 | 307 | 311 | 391 | 435 | 444 | 367 | 410 | 329 | 223 | 3,732 |
| | *Agricultural Wash Water (AWW) to Ponds [3]* | *156* | *158* | *201* | *0* | *0* | *0* | *0* | *0* | *0* | *410* | *329* | *223* | *1,477* |
| | *AWW directly to RTP* | *0* | *0* | *0* | *307* | *311* | *391* | *435* | *444* | *367* | *0* | *0* | *0* | *2,255* |
| 2 | Salinas Urban Storm Water Runoff [4] | 17 | 14 | 11 | 5 | 1 | 0 | 0 | 0 | 1 | 3 | 8 | 16 | 76 |
| | *Urban runoff to ponds* | *17* | *14* | *11* | *0* | *0* | *0* | *0* | *0* | *0* | *3* | *8* | *16* | *69* |
| | *Urban runoff to RTP* | *0* | *0* | *0* | *5* | *1* | *0* | *0* | *0* | *1* | *0* | *0* | *0* | *7* |
| 3 | Rainfall (on SIWTF, 121 acre pond area) [5] | 11 | 6 | 4 | 3 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 4 | 36 |
| 4 | Evaporation (from SIWTF, 121 acre pond area) [6] | (12) | (16) | (29) | (41) | (46) | (52) | | | | (28) | (15) | (12) | (251) |
| 5 | Percolation [7] | (143) | (129) | (143) | (138) | (143) | (138) | | | | (143) | (138) | (143) | (1,257) |
| 6 | SIWTF pond storage balance [8] | 550 | 584 | 628 | 452 | 163 | (27) | 0 | 0 | 0 | 245 | 433 | 521 | |
| 7 | Recovery of flow from SIWTF storage ponds to RTP | 0 | 0 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| 8 | AWW and Salinas Runoff to RTP | 0 | 0 | 0 | 312 | 412 | 391 | 435 | 444 | 368 | 0 | 0 | 0 | 2,362 |
| | *Water Rights Applications to SWRCB* | | | | | | | | | | | | | |
| 9 | Blanco Drain [9] | 0 | 0 | 246 | 252 | 225 | 274 | 277 | 244 | 184 | 168 | 133 | 0 | 2,003 |
| 10 | Reclamation Ditch at Davis Road [10] | 0 | 0 | 165 | 162 | 97 | 132 | 129 | 121 | 80 | 87 | 98 | 0 | 1,071 |
| 11 | Tembladero Slough at Castroville [11] | 0 | 0 | 142 | 154 | 145 | 67 | 66 | 62 | 41 | 45 | 50 | 0 | 772 |
| 12 | City of Monterey - Diversion at Lake El Estero | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | **Subtotal New Waters Available** | **0** | **0** | **553** | **880** | **879** | **864** | **907** | **871** | **673** | **300** | **281** | **0** | **6,208** |
| | **Total Projected Water Supply** | **1,725** | **1,494** | **2,198** | **2,537** | **2,601** | **2,539** | **2,655** | **2,644** | **2,388** | **1,990** | **1,915** | **1,612** | **26,297** |

| | DEMANDS | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Max Year SVRP deliveries to CSIP (2013) | *0* | *692* | *1,558* | *1,669* | *1,799* | *1,675* | *1,786* | *1,803* | *1,725* | *1,548* | *1,127* | *88* | 15,469 |
| 14 | PEAK CSIP AREA WELL WATER USE (10/2013-09/2014) | *509* | *9* | *221* | *242* | *1,197* | *1,261* | *1,303* | *1,025* | *453* | *165* | *35* | *730* | 7,150 |
| | **TOTAL CSIP Demand** | **509** | **701** | **1,779** | **1,911** | **2,996** | **2,936** | **3,089** | **2,828** | **2,178** | **1,713** | **1,162** | **818** | **22,619** |
| 15 | MCWD RUWAP[18] | 81 | 74 | 81 | 156 | 161 | 156 | 161 | 161 | 156 | 81 | 79 | 81 | 1427 |
| 16 | FEEDWATER AMOUNT AT RTP TO GWR PROJECT AWTF | 367 | 331 | 367 | **133** | **137** | **133** | **137** | **137** | **133** | 367 | 355 | 367 | 2,963 |
| 17 | FEEDWATER TO ESTABLISH CSIP AREA DROUGHT RESERVE (200 AFY AWTF PRODUCT WATER) [14] | 0 | 0 | 0 | | | | | | | 0 | 0 | 0 | 0 |
| 18 | **TOTAL TO GWR ADVANCED WATER TREATMENT FACILITY** | **367** | **331** | **367** | **133** | **137** | **133** | **137** | **137** | **133** | **367** | **355** | **367** | **2,963** |
| | **Total Projected Water Demand** | **957** | **1,106** | **2,228** | **2,199** | **3,294** | **3,225** | **3,387** | **3,126** | **2,467** | **2,161** | **1,595** | **1,266** | **27,010** |

| | Use of Source Water | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 | Secondary effluent to SVRP for CSIP [12] | 509 | 701 | 1,564 | 1,501 | 1,561 | 1,519 | 1,587 | 1,612 | 1,560 | 1,541 | 1,162 | 818 | 15,635 |
| 20 | New sources available to CSIP [13] | 0 | 0 | 186 | 747 | 742 | 731 | 770 | 734 | 540 | 0 | 0 | 0 | 4,451 |
| 21 | **Total Supply to CSIP** | **509** | **701** | **1,750** | **2,248** | **2,303** | **2,251** | **2,357** | **2,346** | **2,100** | **1,541** | **1,162** | **818** | **20,085** |
| | **Net CSIP Increase** | | | | | | | | | | | | | **4,616** |
| 22 | Secondary effluent to SVRP for MCWD RUWAP | 81 | 74 | 81 | 156 | 161 | 156 | 161 | 161 | 156 | 81 | 79 | 81 | 1,427 |
| 23 | Surface waters at RTP to AWT | 0 | 0 | 367 | 0 | 0 | 0 | 0 | 0 | 0 | 300 | 281 | 0 | 948 |
| 24 | Secondary effluent to AWT | 367 | 331 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 67 | 74 | 367 | 1,206 |
| 25 | AWW and Salinas urban runoff to AWT | 0 | 0 | 0 | 133 | 137 | 133 | 137 | 137 | 133 | 0 | 0 | 0 | 809 |
| 26 | **Feedwater to AWT** | **367** | **331** | **367** | **133** | **137** | **133** | **137** | **137** | **133** | **367** | **355** | **367** | **2,963** |
| | **Subtotal- all waters (including secondary effluent)** | **876** | **1,032** | **2,117** | **2,381** | **2,440** | **2,383** | **2,494** | **2,483** | **2,233** | **1,908** | **1,517** | **1,185** | **23,049** |

| | | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | *DRY YEAR WASTEWATER EFFLUENT TO OCEAN OUTFALL (2013) [15]* | *1,725* | *802* | *87* | *0* | *0* | *0* | *0* | *0* | *0* | *142* | *507* | *1,607* | 4,870 |
| 28 | WASTE WATER EFFLUENT TO OCEAN OUTFALL WITH PROPOSED DIVERSIONS TO CSIP/AWT/RUWAP [16] | 768 | 388 | 0 | 0 | (0) | 0 | (0) | (0) | 0 | (0) | 319 | 346 | 1,822 |
| 29 | NEW SUPPLIES IN EXCESS OF AWT DEMANDS FOR GWR [17] | (367) | (331) | 186 | 747 | 742 | 731 | 770 | 734 | 540 | (67) | (74) | (367) | 3,244 |
| 30 | AWT BRINE TO OCEAN OUTFALL | 70 | 63 | 70 | 25 | 26 | 25 | 26 | 26 | 25 | 70 | 67 | 70 | 563 |

**Notes**

1 Presumes all facilities associated with diversions are completed.

2 Table 2-1, p. 5, Schaaf & Wheeler Consulting Engineers. Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

3 Volume of effluent from City of Salinas agricultural wash water to be directed into ponds 1,2,3, and the aeration pond for storage.

4 Assume dry year at 1/3 the average monthly values from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

5 Rainfall from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015. Pond area presumed to be Ponds 1,2, 3 + Aeration lagoon. No rainfall/evaporation or storage assigned to drying beds.

6 Table 3, Todd Groundwater, Draft Memorandum, Pure Water Monterey Groundwater Replenishment Project: Impacts of Changes in Percolation at the Salinas Industrial Wastewater Treatment Facility on Groundwater and the Salinas River, February 11, 2015.

7 Table 4, Ibid. Also confirmed in MPWMD Industrial Ponds Percolation and Evaporation Technical Memorandum 2015-01, July 2015.

8 Ponds 1,2,3 and aeration basin hold up to 1,065 acre-feet (one foot of freeboard). If flow to ponds would exceed the maximum volume, it is presumed that excess flow can be diverted to the RIBs or drying beds or flow can be diverted to the RTP. Presume that pond storage goes to zero sometime during the year (shown here starting in July).

9 Max diversion = 6 cfs diversion. See REVISED DRAFT BLANCO DRAIN YIELD STUDY, Schaaf and Wheeler, December 2014.

10 Max. diversion = 6 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Note that flow figures shown here are a combination of flow estimates in the S&W analysis made for the 2 cfs instream requirement Jan-May and 1 cfs instream requirement for June-Dec.

11 Max. diversion = 3 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Figures shown here are the difference between the combined Davis Road/TS diverison with Seasonal Bypass. This presumes the preference is to remove flow at Davis Road first, rather than bypass flow to Tembaldero Slough.

12 Includes secondary effluent wastewater currently used to produce recycled water at the Salinas Valley Reclamation Project (SVRP), and additional amounts which may be used during periods of low demand (<5 mgd) with the proposed improvements to the SVRP.

13 New source waters not used by AWT will be available to SVRP for CSIP.

14 A drought reserve of up to 1,000 AF would be created over five years by producing 200 AFY additional product water from the GWR Project AWTF during winter months and storing the water in the Seaside Basin. This would establish a "water bank" that the CSIP can draw on in droughts. The drought reserve would allow flow at the RTP for the GWR Project to be temporarily reduced during critically dry periods, thus freeing up more of the newly available inflows to the RTP to be sent to the CSIP area. Extraction from the Seaside Basin would continue at the average rate to supply the Monterey Peninsula.

15 Monthly RTP discharge during critically dry year (2013), reported by MRWPCA

16 Secondary treated municpal effluent not used for SVRP or the AWT.

17 Excess is calculated as Line 13 minus Lines 16 & 17

18 RUWAP supply comes from existing RTP inflows, demands reflect Phase 1 project.

## Table 5A: Source Water Analysis for the Pure Water Monterey Groundwater Replenishment Project

**Diversion Pattern for a Normal Water Year Building a Drought Reserve, Full RUWAP Demand as AWT Product**

**All facilities built [1] - average water year conditions - all flows in acre-feet** **7/28/2015**

| | **SOURCES** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Existing RTP Inflows (Average 2009 to 2013)** | **1,798** | **1,678** | **1,867** | **1,796** | **1,850** | **1,799** | **1,893** | **1,888** | **1,813** | **1,844** | **1,762** | **1,776** | **21,764** |
| | **New Source Water** | | | | | | | | | | | | | |
| | *City of Salinas* | | | | | | | | | | | | | |
| 1 | Salinas Agricultural Wash Water [2] | 156 | 158 | 201 | 307 | 311 | 391 | 435 | 444 | 367 | 410 | 329 | 223 | 3,732 |
| | *Agricultural Wash Water (AWW) to Ponds [3]* | *156* | *158* | *201* | *0* | *0* | *0* | *0* | *0* | *0* | *410* | *329* | *223* | *1,477* |
| | *AWW directly to RTP* | *0* | *0* | *0* | *307* | *311* | *391* | *435* | *444* | *367* | *0* | *0* | *0* | *2,255* |
| 2 | Salinas Urban Storm Water Runoff [4] | 52 | 41 | 34 | 16 | 2 | 0 | 0 | 0 | 2 | 8 | 23 | 47 | 225 |
| | *Urban runoff to ponds* | *52* | *41* | *34* | *0* | *0* | *0* | *0* | *0* | *0* | *8* | *23* | *47* | *205* |
| | *Urban runoff to RTP* | *0* | *0* | *0* | *16* | *2* | *0* | *0* | *0* | *2* | *0* | *0* | *0* | *20* |
| 3 | Rainfall (on SIWTF, 121 acre pond area) [5] | 26 | 24 | 21 | 11 | 3 | 1 | 0 | 0 | 2 | 6 | 14 | 24 | 132 |
| 4 | Evaporation (from SIWTF, 121 acre pond area) [6] | (12) | (16) | (29) | (41) | (46) | (52) | | | | (28) | (15) | (12) | (251) |
| 5 | Percolation [7] | (143) | (129) | (143) | (138) | (143) | (138) | | | | (143) | (138) | (143) | (1,257) |
| 6 | SIWTF pond storage balance [8] | 684 | 763 | 847 | 647 | 362 | 0 | 0 | 0 | 0 | 253 | 466 | 605 | |
| 7 | Recovery of flow from SIWTF storage ponds to RTP | 0 | 0 | 0 | 32 | 100 | 172 | 0 | 0 | 0 | 0 | 0 | 0 | 304 |
| 8 | AWW and Salinas Runoff to RTP | 0 | 0 | 0 | 355 | 413 | 563 | 435 | 444 | 369 | 0 | 0 | 0 | 2,579 |
| | *Water Rights Applications to SWRCB* | | | | | | | | | | | | | |
| 9 | Blanco Drain [9] | 0 | 0 | 0 | 252 | 225 | 274 | 277 | 244 | 184 | 0 | 0 | 0 | 1,456 |
| 10 | Reclamation Ditch at Davis Road [10] | 0 | 0 | 0 | 162 | 97 | 132 | 129 | 121 | 80 | 0 | 0 | 0 | 721 |
| 11 | Tembladero Slough at Castroville [11] | 0 | 0 | 0 | 154 | 145 | 67 | 66 | 62 | 41 | 0 | 0 | 0 | 535 |
| 12 | City of Monterey - Diversion at Lake El Estero | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | **Subtotal New Waters Available** | **0** | **0** | **0** | **923** | **880** | **1,036** | **907** | **871** | **674** | **0** | **0** | **0** | **5,291** |
| | **Total Projected Water Supply** | **1,798** | **1,678** | **1,867** | **2,719** | **2,730** | **2,835** | **2,800** | **2,759** | **2,487** | **1,844** | **1,762** | **1,776** | **27,055** |

| | **DEMANDS** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Average SVRP deliveries to CSIP (2009-2013) | 13 | 459 | 726 | 1,376 | 1,763 | 1,750 | 1,866 | 1,854 | 1,698 | 984 | 448 | 18 | 12,955 |
| 14 | FIVE YEAR AVERAGE CSIP AREA WELL WATER USE (2009-2013) | 448 | 195 | 304 | 412 | 324 | 606 | 519 | 504 | 300 | 75 | 233 | 352 | 4,272 |
| | **TOTAL CSIP Demand** | **461** | **654** | **1,030** | **1,788** | **2,087** | **2,356** | **2,385** | **2,358** | **1,998** | **1,059** | **681** | **370** | **17,227** |
| 15 | FEEDWATER AMOUNT AT RTP TO GWR PROJECT AWTF | 367 | 331 | 367 | 355 | 367 | 355 | 367 | 367 | 355 | 367 | 355 | 367 | 4,320 |
| 16 | FEEDWATER TO ESTABLISH CSIP AREA DROUGHT RESERVE (200 AFY AWTF PRODUCT WATER) [14] | 42 | 38 | 42 | | | | | | | 42 | 41 | 42 | 248 |
| 17 | FEEDWATER TO AWT FOR MCWD RUWAP[18] | 100 | 91 | 100 | 192 | 199 | 192 | 199 | 199 | 192 | 100 | 97 | 100 | 1761 |
| 18 | **TOTAL TO GWR ADVANCED WATER TREATMENT FACILITY** | **509** | **460** | **509** | **547** | **566** | **547** | **566** | **566** | **547** | **509** | **493** | **509** | **6,329** |
| | **Total Projected Water Demand** | **970** | **1,115** | **1,539** | **2,335** | **2,652** | **2,903** | **2,951** | **2,923** | **2,545** | **1,568** | **1,174** | **879** | **23,556** |

| | **Use of Source Water** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 | Secondary effluent to SVRP for CSIP [12] | 461 | 654 | 1,030 | 1,604 | 1,652 | 1,607 | 1,695 | 1,689 | 1,621 | 1,059 | 681 | 370 | 14,122 |
| 20 | New sources available to CSIP [13] | 0 | 0 | 0 | 568 | 513 | 681 | 540 | 504 | 319 | 0 | 0 | 0 | 3,125 |
| 21 | **Total Supply to CSIP** | **461** | **654** | **1,030** | **2,172** | **2,165** | **2,288** | **2,235** | **2,193** | **1,940** | **1,059** | **681** | **370** | **17,247** |
| | **Net CSIP Increase** | | | | | | | | | | | | | **4,292** |
| 22 | Surface waters at RTP to AWT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 | Secondary effluent to AWT | 409 | 369 | 409 | 0 | 0 | 0 | 0 | 0 | 0 | 409 | 396 | 409 | 2,401 |
| 24 | AWW and Salinas urban runoff to AWT | 0 | 0 | 0 | 355 | 367 | 355 | 367 | 367 | 355 | 0 | 0 | 0 | 2,166 |
| 25 | Secondary effluent to AWT for MCWD RUWAP | 100 | 91 | 100 | 192 | 199 | 192 | 199 | 199 | 192 | 100 | 97 | 100 | 1,761 |
| 26 | **Feedwater to AWT** | **509** | **460** | **509** | **547** | **566** | **547** | **566** | **566** | **547** | **509** | **493** | **509** | **6,328** |
| | **Subtotal- all waters (including secondary effluent)** | **970** | **1,115** | **1,539** | **2,719** | **2,730** | **2,835** | **2,800** | **2,759** | **2,487** | **1,568** | **1,174** | **879** | **23,576** |

| | | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | FIVE YEAR AVERAGE WASTE WATER EFFLUENT TO OCEAN OUTFALL (2009-2013)[15] | 1,785 | 1,219 | 1,141 | 420 | 88 | 49 | 27 | 34 | 114 | 859 | 1,314 | 1,759 | 8,809 |
| 28 | WASTE WATER EFFLUENT TO OCEAN OUTFALL WITH PROPOSED DIVERSIONS TO CSIP/AWT/RUWAP [16] | 827 | 563 | 328 | (0) | 0 | 0 | 0 | 0 | 0 | 275 | 588 | 897 | 3,479 |
| 29 | NEW SUPPLIES IN EXCESS OF AWT DEMANDS FOR GWR [17] | (409) | (369) | (409) | 568 | 513 | 681 | 540 | 504 | 319 | (409) | (396) | (409) | 724 |
| 30 | AWT BRINE TO OCEAN OUTFALL | 97 | 87 | 97 | 104 | 107 | 104 | 107 | 107 | 104 | 97 | 94 | 97 | 1,202 |

**Notes**

1 Presumes all facilities associated with diversions are completed.

2 Table 2-1, p. 5, Schaaf & Wheeler Consulting Engineers. Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

3 Volume of effluent from City of Salinas agricultural wash water to be directed into ponds 1,2,3, and the aeration pond for storage.

4 Average monthly flow from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

5 Rainfall from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015. Pond area presumed to be Ponds 1,2, 3 + Aeration lagoon. No rainfall/evaporation or storage assigned to drying beds.

6 Table 3, Todd Groundwater, Draft Memorandum, Pure Water Monterey Groundwater Replenishment Project: Impacts of Changes in Percolation at the Salinas Industrial Wastewater Treatment Facility on Groundwater and the Salinas River, February 11, 2015.

7 Table 4, Ibid.

8 Ponds 1,2,3 and aeration basin hold up to 1,065 acre-feet (one foot of freeboard). If flow to ponds would exceed the maximum volume, it is presumed that excess flow can be diverted to the RIBs or drying beds or flow can be diverted to the RTP. Presume that pond storage goes to zero sometime during the year (shown here starting in July).

9 Table 4, Ibid. Also confirmed in MPWMD Industrial Ponds Percolation and Evaporation Technical Memorandum 2015-01, July 2015.

10 Max. diversion = 6 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Note that flow figures shown here are a combination of flow estimates in the S&W analysis made for the 2 cfs instream requirement Jan-May and 1 cfs instream requirement for June-Dec.

11 Max. diversion = 3 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Figures shown here are the difference between the combined Davis Road/TS diversion with Seasonal Bypass. This presumes the preference is to remove flow at Davis Road first, rather than bypass flow to Tembaldero Slough.

12 Includes secondary effluent wastewater currently used to produce recycled water at the Salinas Valley Reclamation Project (SVRP), and additional amounts which may be used during periods of low demand (<5 mgd) with the proposed improvements to the SVRP.

13 New source waters not used by AWT will be available to SVRP for CSIP.

14 A drought reserve of up to 1,000 AF would be created over five years by producing 200 AFY additional product water from the GWR Project AWTF during winter months and storing the water in the Seaside Basin. This would establish a "water bank" that the CSIP can draw on in droughts. The drought reserve would allow flow at the RTP for the GWR Project to be temporarily reduced during critically dry periods, thus freeing up more of the newly available inflows to the RTP to be sent to the CSIP area. Extraction from the Seaside Basin would continue at the average rate to supply the Monterey Peninsula.

15 Average monthly RTP discharge, 2009-2013 (reported by MRWPCA).

16 Secondary treated municpal effluent not used for SVRP or the AWT.

17 Excess is calculated as Line 13 minus Lines 15 & 16

18 RUWAP supply comes from existing RTP inflows, demands reflect Phase 1 project.

## Table 5B: Source Water Analysis for the Pure Water Monterey Groundwater Replenishment Project

### Diversion Pattern for a Normal Water Year with a Full Reserve, Full RUWAP Demand as AWT Product

**All facilities built [1] - average water year conditions - all flows in acre-feet** — **7/28/2015**

| SOURCES | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Existing RTP Inflows (Average 2009 to 2013)** | **1,798** | **1,678** | **1,867** | **1,796** | **1,850** | **1,799** | **1,893** | **1,888** | **1,813** | **1,844** | **1,762** | **1,776** | **21,764** |
| **New Source Water** | | | | | | | | | | | | | |
| *City of Salinas* | | | | | | | | | | | | | |
| 1 Salinas Agricultural Wash Water [2] | 156 | 158 | 201 | 307 | 311 | 391 | 435 | 444 | 367 | 410 | 329 | 223 | 3,732 |
| *Agricultural Wash Water (AWW) to Ponds [3]* | *156* | *158* | *201* | *0* | *0* | *0* | *0* | *0* | *0* | *410* | *329* | *223* | *1,477* |
| *AWW directly to RTP* | *0* | *0* | *0* | *307* | *311* | *391* | *435* | *444* | *367* | *0* | *0* | *0* | *2,255* |
| 2 Salinas Urban Storm Water Runoff [4] | 52 | 41 | 34 | 16 | 2 | 0 | 0 | 0 | 2 | 8 | 23 | 47 | 225 |
| *Urban runoff to ponds* | *52* | *41* | *34* | *0* | *0* | *0* | *0* | *0* | *0* | *8* | *23* | *47* | *205* |
| *Urban runoff to RTP* | *0* | *0* | *0* | *16* | *2* | *0* | *0* | *0* | *2* | *0* | *0* | *0* | *20* |
| 3 Rainfall (on SIWTF, 121 acre pond area) [5] | 26 | 24 | 21 | 11 | 3 | 1 | 0 | 0 | 2 | 6 | 14 | 24 | 132 |
| 4 Evaporation (from SIWTF, 121 acre pond area) [6] | (12) | (16) | (29) | (41) | (46) | (52) | | | | (28) | (15) | (12) | (251) |
| 5 Percolation [7] | (143) | (129) | (143) | (138) | (143) | (138) | | | | (143) | (138) | (143) | (1,257) |
| 6 SIWTF pond storage balance [8] | 684 | 763 | 847 | 647 | 362 | 0 | 0 | 0 | 0 | 253 | 466 | 605 | |
| 7 Recovery of flow from SIWTF storage ponds to RTP | 0 | 0 | 0 | 32 | 100 | 172 | 0 | 0 | 0 | 0 | 0 | 0 | 304 |
| 8 AWW and Salinas Runoff to RTP | 0 | 0 | 0 | 355 | 413 | 563 | 435 | 444 | 369 | 0 | 0 | 0 | 2,579 |
| *Water Rights Applications to SWRCB* | | | | | | | | | | | | | |
| 9 Blanco Drain [9] | 0 | 0 | 0 | 252 | 225 | 274 | 277 | 244 | 184 | 0 | 0 | 0 | 1,456 |
| 10 Reclamation Ditch at Davis Road [10] | 0 | 0 | 0 | 162 | 97 | 132 | 129 | 121 | 80 | 0 | 0 | 0 | 721 |
| 11 Tembladero Slough at Castroville [11] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 City of Monterey - Diversion at Lake El Estero | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 **Subtotal New Waters Available** | **0** | **0** | **0** | **769** | **735** | **969** | **841** | **809** | **633** | **0** | **0** | **0** | **4,756** |
| **Total Projected Water Supply** | **1,798** | **1,678** | **1,867** | **2,565** | **2,585** | **2,768** | **2,734** | **2,697** | **2,446** | **1,844** | **1,762** | **1,776** | **26,520** |

| DEMANDS | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average SVRP deliveries to CSIP (2009-2013) | 13 | 459 | 726 | 1,376 | 1,763 | 1,750 | 1,866 | 1,854 | 1,698 | 984 | 448 | 18 | 12,955 |
| 14 FIVE YEAR AVERAGE CSIP AREA WELL WATER USE (2009-2013) | 448 | 195 | 304 | 412 | 324 | 606 | 519 | 504 | 300 | 75 | 233 | 352 | 4,272 |
| **TOTAL CSIP Demand** | **461** | **654** | **1,030** | **1,788** | **2,087** | **2,356** | **2,385** | **2,358** | **1,998** | **1,059** | **681** | **370** | **17,227** |
| 15 FEEDWATER AMOUNT AT RTP TO GWR PROJECT AWTF | 367 | 331 | 367 | 355 | 367 | 355 | 367 | 367 | 355 | 367 | 355 | 367 | 4,320 |
| 16 FEEDWATER TO ESTABLISH CSIP AREA DROUGHT RESERVE (200 AFY AWTF PRODUCT WATER) [14] | 0 | 0 | 0 | | | | | | | 0 | 0 | 0 | 0 |
| 17 FEEDWATER TO AWT FOR MCWD RUWAP[18] | 100 | 91 | 100 | 192 | 199 | 192 | 199 | 199 | 192 | 100 | 97 | 100 | 1761 |
| 18 **TOTAL TO GWR ADVANCED WATER TREATMENT FACILITY** | **467** | **422** | **467** | **547** | **566** | **547** | **566** | **566** | **547** | **467** | **452** | **467** | **6,081** |
| **Total Projected Water Demand** | **928** | **1,077** | **1,497** | **2,335** | **2,652** | **2,903** | **2,951** | **2,923** | **2,545** | **1,526** | **1,133** | **837** | **23,308** |

| Use of Source Water | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 Secondary effluent to SVRP for CSIP [12] | 461 | 654 | 1,030 | 1,604 | 1,652 | 1,607 | 1,695 | 1,689 | 1,621 | 1,059 | 681 | 370 | 14,122 |
| 20 New sources available to CSIP [13] | 0 | 0 | 0 | 414 | 368 | 614 | 474 | 442 | 278 | 0 | 0 | 0 | 2,590 |
| 21 **Total Supply to CSIP** | **461** | **654** | **1,030** | **2,018** | **2,020** | **2,221** | **2,169** | **2,131** | **1,899** | **1,059** | **681** | **370** | **16,712** |
| **Net CSIP Increase** | | | | | | | | | | | | | **3,757** |
| 22 Surface waters at RTP to AWT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 Secondary effluent to AWT | 367 | 331 | 367 | 0 | 0 | 0 | 0 | 0 | 0 | 367 | 355 | 367 | 2,154 |
| 24 AWW and Salinas urban runoff to AWT | 0 | 0 | 0 | 355 | 367 | 355 | 367 | 367 | 355 | 0 | 0 | 0 | 2,166 |
| 25 Secondary effluent to AWT for MCWD RUWAP | 100 | 91 | 100 | 192 | 199 | 192 | 199 | 199 | 192 | 100 | 97 | 100 | 1,761 |
| 26 **Feedwater to AWT** | **467** | **422** | **467** | **547** | **566** | **547** | **566** | **566** | **547** | **467** | **452** | **467** | **6,081** |
| **Subtotal- all waters (including secondary effluent)** | **928** | **1,077** | **1,497** | **2,565** | **2,585** | **2,768** | **2,734** | **2,697** | **2,446** | **1,526** | **1,133** | **837** | **22,793** |

| | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 FIVE YEAR AVERAGE WASTE WATER EFFLUENT TO OCEAN OUTFALL (2009-2013)[15] | 1,785 | 1,219 | 1,141 | 420 | 88 | 49 | 27 | 34 | 114 | 859 | 1,314 | 1,759 | 8,809 |
| 28 WASTE WATER EFFLUENT TO OCEAN OUTFALL WITH PROPOSED DIVERSIONS TO CSIP/AWT/RUWAP [16] | 870 | 602 | 370 | (0) | 0 | 0 | 0 | 0 | 0 | 317 | 629 | 940 | 3,727 |
| 29 NEW SUPPLIES IN EXCESS OF AWT DEMANDS FOR GWR [17] | (367) | (331) | (367) | 414 | 368 | 614 | 474 | 442 | 278 | (367) | (355) | (367) | 436 |
| 30 AWT BRINE TO OCEAN OUTFALL | 89 | 80 | 89 | 104 | 107 | 104 | 107 | 107 | 104 | 89 | 86 | 89 | 1,155 |

**Notes**

1 Presumes all facilities associated with diversions are completed.

2 Table 2-1, p. 5, Schaaf & Wheeler Consulting Engineers. Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

3 Volume of effluent from City of Salinas agricultural wash water to be directed into ponds 1,2,3, and the aeration pond for storage.

4 Average monthly flow from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

5 Rainfall from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015. Pond area presumed to be Ponds 1,2, 3 + Aeration lagoon. No rainfall/evaporation or storage assigned to drying beds.

6 Table 3, Todd Groundwater, Draft Memorandum, Pure Water Monterey Groundwater Replenishment Project: Impacts of Changes in Percolation at the Salinas Industrial Wastewater Treatment Facility on Groundwater and the Salinas River, February 11, 2015.

7 Table 4, Ibid.

8 Ponds 1,2,3 and aeration basin hold up to 1,065 acre-feet (one foot of freeboard). If flow to ponds would exceed the maximum volume, it is presumed that excess flow can be diverted to the RIBs or drying beds or flow can be diverted to the RTP. Presume that pond storage goes to zero sometime during the year (shown here starting in July).

9 Table 4, Ibid. Also confirmed in MPWMD Industrial Ponds Percolation and Evaporation Technical Memorandum 2015-01, July 2015.

10 Max. diversion = 6 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Note that flow figures shown here are a combination of flow estimates in the S&W analysis made for the 2 cfs instream requirement Jan-May and 1 cfs instream requirement for June-Dec.

11 Max. diversion = 3 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Figures shown here are the difference between the combined Davis Road/TS diversion with Seasonal Bypass. This presumes the preference is to remove flow at Davis Road first, rather than bypass flow to Tembaldero Slough.

12 Includes secondary effluent wastewater currently used to produce recycled water at the Salinas Valley Reclamation Project (SVRP), and additional amounts which may be used during periods of low demand (<5 mgd) with the proposed improvements to the SVRP.

13 New source waters not used by AWT will be available to SVRP for CSIP.

14 A drought reserve of up to 1,000 AF would be created over five years by producing 200 AFY additional product water from the GWR Project AWTF during winter months and storing the water in the Seaside Basin. This would establish a "water bank" that the CSIP can draw on in droughts. The drought reserve would allow flow at the RTP for the GWR Project to be temporarily reduced during critically dry periods, thus freeing up more of the newly available inflows to the RTP to be sent to the CSIP area. Extraction from the Seaside Basin would continue at the average rate to supply the Monterey Peninsula.

15 Average monthly RTP discharge, 2009-2013 (reported by MRWPCA).

16 Secondary treated municpal effluent not used for SVRP or the AWT.

17 Excess is calculated as Line 13 minus Lines 15 & 16

18 RUWAP supply comes from existing RTP inflows, demands reflect Phase 1 project.

## Table 5C: Source Water Analysis for the Pure Water Monterey Groundwater Replenishment Project

**Diversion Pattern for a Drought Year, Starting with a Full Drought Reserve, Full RUWAP Demand as AWT Product**

**All facilities built [1] - average water year conditions - all flows in acre-feet** — **7/28/2015**

| SOURCES | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Minimum Year RTP Inflows (2013)** | *1,725* | *1,494* | *1,645* | *1,657* | *1,722* | *1,675* | *1,748* | *1,773* | *1,715* | *1,690* | *1,634* | *1,612* | **20,090** |
| **New Source Water** | | | | | | | | | | | | | |
| *City of Salinas* | | | | | | | | | | | | | |
| 1 Salinas Agricultural Wash Water [2] | 156 | 158 | 201 | 307 | 311 | 391 | 435 | 444 | 367 | 410 | 329 | 223 | 3,732 |
| *Agricultural Wash Water (AWW) to Ponds [3]* | *156* | *158* | *201* | *0* | *0* | *0* | *0* | *0* | *0* | *410* | *329* | *223* | *1,477* |
| *AWW directly to RTP* | *0* | *0* | *0* | *307* | *311* | *391* | *435* | *444* | *367* | *0* | *0* | *0* | *2,255* |
| 2 Salinas Urban Storm Water Runoff [4] | 17 | 14 | 11 | 5 | 1 | 0 | 0 | 0 | 1 | 3 | 8 | 16 | 76 |
| *Urban runoff to ponds* | *17* | *14* | *11* | *0* | *0* | *0* | *0* | *0* | *0* | *3* | *8* | *16* | *69* |
| *Urban runoff to RTP* | *0* | *0* | *0* | *5* | *1* | *0* | *0* | *0* | *1* | *0* | *0* | *0* | *7* |
| 3 Rainfall (on SIWTF, 121 acre pond area) [5] | 11 | 6 | 4 | 3 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 4 | 36 |
| 4 Evaporation (from SIWTF, 121 acre pond area) [6] | (12) | (16) | (29) | (41) | (46) | (52) | | | | (28) | (15) | (12) | (251) |
| 5 Percolation [7] | (143) | (129) | (143) | (138) | (143) | (138) | | | | (143) | (138) | (143) | (1,257) |
| 6 SIWTF pond storage balance [8] | 550 | 584 | 628 | 452 | 163 | (27) | 0 | 0 | 0 | 245 | 433 | 521 | |
| 7 Recovery of flow from SIWTF storage ponds to RTP | 0 | 0 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| 8 AWW and Salinas Runoff to RTP | 0 | 0 | 0 | 312 | 412 | 391 | 435 | 444 | 368 | 0 | 0 | 0 | 2,362 |
| *Water Rights Applications to SWRCB* | | | | | | | | | | | | | |
| 9 Blanco Drain [9] | 0 | 0 | 246 | 252 | 225 | 274 | 277 | 244 | 184 | 168 | 133 | 0 | 2,003 |
| 10 Reclamation Ditch at Davis Road [10] | 0 | 0 | 165 | 162 | 97 | 132 | 129 | 121 | 80 | 87 | 98 | 0 | 1,071 |
| 11 Tembladero Slough at Castroville [11] | 0 | 0 | 142 | 154 | 145 | 67 | 66 | 62 | 41 | 45 | 50 | 0 | 772 |
| 12 City of Monterey - Diversion at Lake El Estero | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 **Subtotal New Waters Available** | **0** | **0** | **553** | **880** | **879** | **864** | **907** | **871** | **673** | **300** | **281** | **0** | **6,208** |
| **Total Projected Water Supply** | **1,725** | **1,494** | **2,198** | **2,537** | **2,601** | **2,539** | **2,655** | **2,644** | **2,388** | **1,990** | **1,915** | **1,612** | **26,297** |

| DEMANDS | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Max Year SVRP deliveries to CSIP (2013) | *0* | *692* | *1,558* | *1,669* | *1,799* | *1,675* | *1,786* | *1,803* | *1,725* | *1,548* | *1,127* | *88* | 15,469 |
| 14 PEAK CSIP AREA WELL WATER USE (10/2013-09/2014) | *509* | *9* | *221* | *242* | *1,197* | *1,261* | *1,303* | *1,025* | *453* | *165* | *35* | *730* | 7,150 |
| **TOTAL CSIP Demand** | **509** | **701** | **1,779** | **1,911** | **2,996** | **2,936** | **3,089** | **2,828** | **2,178** | **1,713** | **1,162** | **818** | **22,619** |
| 15 FEEDWATER AMOUNT AT RTP TO GWR PROJECT AWTF | 367 | 331 | 367 | **133** | **137** | **133** | **137** | **137** | **133** | 367 | 355 | 367 | 2,963 |
| 16 FEEDWATER TO ESTABLISH CSIP AREA DROUGHT RESERVE (200 AFY AWTF PRODUCT WATER) [14] | 0 | 0 | 0 | | | | | | | 0 | 0 | 0 | 0 |
| 17 FEEDWATER TO AWT FOR MCWD RUWAP[18] | 100 | 91 | 100 | 192 | 199 | 192 | 199 | 199 | 192 | 100 | 97 | 100 | 1761 |
| 18 **TOTAL TO GWR ADVANCED WATER TREATMENT FACILITY** | **467** | **422** | **467** | **325** | **336** | **325** | **336** | **336** | **325** | **467** | **452** | **467** | **4,724** |
| **Total Projected Water Demand** | **976** | **1,123** | **2,247** | **2,236** | **3,332** | **3,261** | **3,424** | **3,164** | **2,503** | **2,180** | **1,614** | **1,285** | **27,344** |

| Use of Source Water | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 Secondary effluent to SVRP for CSIP [12] | 509 | 701 | 1,545 | 1,464 | 1,523 | 1,483 | 1,550 | 1,575 | 1,523 | 1,522 | 1,162 | 818 | 15,375 |
| 20 New sources available to CSIP [13] | 0 | 0 | 186 | 747 | 742 | 731 | 770 | 734 | 540 | 0 | 0 | 0 | 4,451 |
| 21 **Total Supply to CSIP** | **509** | **701** | **1,731** | **2,212** | **2,265** | **2,214** | **2,320** | **2,309** | **2,063** | **1,522** | **1,162** | **818** | **19,825** |
| **Net CSIP Increase** | | | | | | | | | | | | | **4,356** |
| 22 Surface waters at RTP to AWT | 0 | 0 | 367 | 0 | 0 | 0 | 0 | 0 | 0 | 300 | 281 | 0 | 948 |
| 23 Secondary effluent to AWT | 367 | 331 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 67 | 74 | 367 | 1,206 |
| 24 AWW and Salinas urban runoff to AWT | 0 | 0 | 0 | 133 | 137 | 133 | 137 | 137 | 133 | 0 | 0 | 0 | 809 |
| 25 Secondary effluent to AWT for MCWD RUWAP | 100 | 91 | 100 | 192 | 199 | 192 | 199 | 199 | 192 | 100 | 97 | 100 | 1,761 |
| 26 **Feedwater to AWT** | **467** | **422** | **467** | **325** | **336** | **325** | **336** | **336** | **325** | **467** | **452** | **467** | **4,724** |
| **Subtotal- all waters (including secondary effluent)** | **976** | **1,123** | **2,198** | **2,537** | **2,601** | **2,539** | **2,655** | **2,644** | **2,388** | **1,990** | **1,614** | **1,285** | **24,550** |

| | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 *DRY YEAR WASTEWATER EFFLUENT TO OCEAN OUTFALL (2013) [15]* | *1,725* | *802* | *87* | *0* | *0* | *0* | *0* | *0* | *0* | *142* | *507* | *1,607* | 4,870 |
| 28 WASTE WATER EFFLUENT TO OCEAN OUTFALL WITH PROPOSED DIVERSIONS TO CSIP/AWT/RUWAP [16] | 749 | 371 | 0 | (0) | 0 | (0) | 0 | 0 | 0 | 0 | 301 | 327 | 1,748 |
| 29 NEW SUPPLIES IN EXCESS OF AWT DEMANDS FOR GWR [17] | (367) | (331) | 186 | 747 | 742 | 731 | 770 | 734 | 540 | (67) | (74) | (367) | 3,244 |
| 30 AWT BRINE TO OCEAN OUTFALL | 89 | 80 | 89 | 62 | 64 | 62 | 64 | 64 | 62 | 89 | 86 | 89 | 898 |

**Notes**

1 Presumes all facilities associated with diversions are completed.

2 Table 2-1, p. 5, Schaaf & Wheeler Consulting Engineers. Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

3 Volume of effluent from City of Salinas agricultural wash water to be directed into ponds 1,2,3, and the aeration pond for storage.

4 Assume dry year at 1/3 the average monthly values from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

5 Rainfall from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015. Pond area presumed to be Ponds 1,2, 3 + Aeration lagoon. No rainfall/evaporation or storage assigned to drying beds.

6 Table 3, Todd Groundwater, Draft Memorandum, Pure Water Monterey Groundwater Replenishment Project: Impacts of Changes in Percolation at the Salinas Industrial Wastewater Treatment Facility on Groundwater and the Salinas River, February 11, 2015.

7 Table 4, Ibid.

8 Ponds 1,2,3 and aeration basin hold up to 1,065 acre-feet (one foot of freeboard). If flow to ponds would exceed the maximum volume, it is presumed that excess flow can be diverted to the RIBs or drying beds or flow can be diverted to the RTP. Presume that pond storage goes to zero sometime during the year (shown here starting in July).

9 Table 4, Ibid. Also confirmed in MPWMD Industrial Ponds Percolation and Evaporation Technical Memorandum 2015-01, July 2015.

10 Max. diversion = 6 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Note that flow figures shown here are a combination of flow estimates in the S&W analysis made for the 2 cfs instream requirement Jan-May and 1 cfs instream requirement for June-Dec.

11 Max. diversion = 3 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Figures shown here are the difference between the combined Davis Road/TS diversion with Seasonal Bypass. This presumes the preference is to remove flow at Davis Road first, rather than bypass flow to Tembaldero Slough.

12 Includes secondary effluent wastewater currently used to produce recycled water at the Salinas Valley Reclamation Project (SVRP), and additional amounts which may be used during periods of low demand (<5 mgd) with the proposed improvements to the SVRP.

13 New source waters not used by AWT will be available to SVRP for CSIP.

14 A drought reserve of up to 1,000 AF would be created over five years by producing 200 AFY additional product water from the GWR Project AWTF during winter months and storing the water in the Seaside Basin. This would establish a "water bank" that the CSIP can draw on in droughts. The drought reserve would allow flow at the RTP for the GWR Project to be temporarily reduced during critically dry periods, thus freeing up more of the newly available inflows to the RTP to be sent to the CSIP area. Extraction from the Seaside Basin would continue at the average rate to supply the Monterey Peninsula.

15 Monthly RTP discharge during critically dry year (2013), reported by MRWPCA

16 Secondary treated municpal effluent not used for SVRP or the AWT.

17 Excess is calculated as Line 13 minus Lines 15 & 16

18 RUWAP supply comes from existing RTP inflows, demands reflect Phase 1 project.

## Table 6A: Source Water Analysis for the Pure Water Monterey Groundwater Replenishment Project

### Diversion Patterns for a Normal Water Year, Building a Drought Reserve, Initial RUWAP Demand as Recycled Water

| | All facilities built [1] - average water year conditions - all flows in acre-feet | | | | | | | | | | | | | 7/28/2015 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **SOURCES** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
| | **Existing RTP Inflows (Average 2009 to 2013)** | **1,798** | **1,678** | **1,867** | **1,796** | **1,850** | **1,799** | **1,893** | **1,888** | **1,813** | **1,844** | **1,762** | **1,776** | **21,764** |
| | **New Source Water** | | | | | | | | | | | | | |
| | *City of Salinas* | | | | | | | | | | | | | |
| 1 | Salinas Agricultural Wash Water [2] | 156 | 158 | 201 | 307 | 311 | 391 | 435 | 444 | 367 | 410 | 329 | 223 | 3,732 |
| | *Agricultural Wash Water (AWW) to Ponds [3]* | *156* | *158* | *201* | *0* | *0* | *0* | *0* | *0* | *0* | *410* | *329* | *223* | *1,477* |
| | *AWW directly to RTP* | *0* | *0* | *0* | *307* | *311* | *391* | *435* | *444* | *367* | *0* | *0* | *0* | *2,255* |
| 2 | Salinas Urban Storm Water Runoff [4] | 52 | 41 | 34 | 16 | 2 | 0 | 0 | 0 | 2 | 8 | 23 | 47 | 225 |
| | *Urban runoff to ponds* | *52* | *41* | *34* | *0* | *0* | *0* | *0* | *0* | *0* | *8* | *23* | *47* | *205* |
| | *Urban runoff to RTP* | *0* | *0* | *0* | *16* | *2* | *0* | *0* | *0* | *2* | *0* | *0* | *0* | *20* |
| 3 | Rainfall (on SIWTF, 121 acre pond area) [5] | 26 | 24 | 21 | 11 | 3 | 1 | 0 | 0 | 2 | 6 | 14 | 24 | 132 |
| 4 | Evaporation (from SIWTF, 121 acre pond area) [6] | (12) | (16) | (29) | (41) | (46) | (52) | | | | (28) | (15) | (12) | (251) |
| 5 | Percolation [7] | (143) | (129) | (143) | (138) | (143) | (138) | | | | (143) | (138) | (143) | (1,257) |
| 6 | SIWTF pond storage balance [8] | 684 | 763 | 847 | 647 | 362 | 0 | 0 | 0 | 0 | 253 | 466 | 605 | |
| 7 | Recovery of flow from SIWTF storage ponds to RTP | 0 | 0 | 0 | 32 | 100 | 172 | 0 | 0 | 0 | 0 | 0 | 0 | 304 |
| 8 | AWW and Salinas Runoff to RTP | 0 | 0 | 0 | 355 | 413 | 563 | 435 | 444 | 369 | 0 | 0 | 0 | 2,579 |
| | *Water Rights Applications to SWRCB* | | | | | | | | | | | | | |
| 9 | Blanco Drain [9] | 0 | 0 | 0 | 252 | 225 | 274 | 277 | 244 | 184 | 0 | 0 | 0 | 1,456 |
| 10 | Reclamation Ditch at Davis Road [10] | 0 | 0 | 0 | 162 | 97 | 132 | 129 | 121 | 80 | 0 | 0 | 0 | 721 |
| 11 | Tembladero Slough at Castroville [11] | 0 | 0 | 0 | 154 | 145 | 67 | 66 | 62 | 41 | 0 | 0 | 0 | 535 |
| 12 | City of Monterey - Diversion at Lake El Estero | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | **Subtotal New Waters Available** | **0** | **0** | **0** | **923** | **880** | **1,036** | **907** | **871** | **674** | **0** | **0** | **0** | **5,291** |
| | **Total Projected Water Supply** | **1,798** | **1,678** | **1,867** | **2,719** | **2,730** | **2,835** | **2,800** | **2,759** | **2,487** | **1,844** | **1,762** | **1,776** | **27,055** |
| | **DEMANDS** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
| | Average SVRP deliveries to CSIP (2009-2013) | 13 | 459 | 726 | 1,376 | 1,763 | 1,750 | 1,866 | 1,854 | 1,698 | 984 | 448 | 18 | 12,955 |
| 14 | FIVE YEAR AVERAGE CSIP AREA WELL WATER USE (2009-2013) | 448 | 195 | 304 | 412 | 324 | 606 | 519 | 504 | 300 | 75 | 233 | 352 | 4,272 |
| | **TOTAL CSIP Demand** | **461** | **654** | **1,030** | **1,788** | **2,087** | **2,356** | **2,385** | **2,358** | **1,998** | **1,059** | **681** | **370** | **17,227** |
| 15 | MCWD RUWAP[18] | 31 | 28 | 31 | 59 | 61 | 59 | 61 | 61 | 59 | 31 | 30 | 31 | 540 |
| 16 | FEEDWATER AMOUNT AT RTP TO GWR PROJECT AWTF | 367 | 331 | 367 | 355 | 367 | 355 | 367 | 367 | 355 | 367 | 355 | 367 | 4,320 |
| 17 | FEEDWATER TO ESTABLISH CSIP AREA DROUGHT RESERVE (200 AFY AWTF PRODUCT WATER) [14] | 42 | 38 | 42 | | | | | | | 42 | 41 | 42 | 248 |
| 18 | **TOTAL TO GWR ADVANCED WATER TREATMENT FACILITY** | **409** | **369** | **409** | **355** | **367** | **355** | **367** | **367** | **355** | **409** | **396** | **409** | **4,568** |
| | **Total Projected Water Demand** | **901** | **1,052** | **1,470** | **2,202** | **2,515** | **2,770** | **2,813** | **2,785** | **2,412** | **1,499** | **1,107** | **809** | **22,335** |
| | **Use of Source Water** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
| 19 | Secondary effluent to SVRP for CSIP [12] | 461 | 654 | 1,030 | 1,737 | 1,789 | 1,740 | 1,833 | 1,827 | 1,754 | 1,059 | 681 | 370 | 14,935 |
| 20 | New sources available to CSIP [13] | 0 | 0 | 0 | 568 | 513 | 681 | 540 | 504 | 319 | 0 | 0 | 0 | 3,125 |
| 21 | **Total Supply to CSIP** | **461** | **654** | **1,030** | **2,305** | **2,302** | **2,421** | **2,373** | **2,331** | **2,073** | **1,059** | **681** | **370** | **18,060** |
| | **Net CSIP Increase** | | | | | | | | | | | | | **5,104** |
| 22 | Secondary effluent to SVRP for MCWD RUWAP | 31 | 28 | 31 | 59 | 61 | 59 | 61 | 61 | 59 | 31 | 30 | 31 | 540 |
| 23 | Surface waters at RTP to AWT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 | Secondary effluent to AWT | 409 | 369 | 409 | 0 | 0 | 0 | 0 | 0 | 0 | 409 | 396 | 409 | 2,401 |
| 25 | AWW and Salinas urban runoff to AWT | 0 | 0 | 0 | 355 | 367 | 355 | 367 | 367 | 355 | 0 | 0 | 0 | 2,166 |
| 26 | **Feedwater to AWT** | **409** | **369** | **409** | **355** | **367** | **355** | **367** | **367** | **355** | **409** | **396** | **409** | **4,567** |
| | **Subtotal- all waters (including secondary effluent)** | **870** | **1,024** | **1,439** | **2,660** | **2,669** | **2,776** | **2,740** | **2,698** | **2,428** | **1,468** | **1,077** | **779** | **22,627** |
| 27 | FIVE YEAR AVERAGE WASTE WATER EFFLUENT TO OCEAN OUTFALL (2009-2013)[15] | 1,785 | 1,219 | 1,141 | 420 | 88 | 49 | 27 | 34 | 114 | 859 | 1,314 | 1,759 | 8,809 |
| 28 | WASTE WATER EFFLUENT TO OCEAN OUTFALL WITH PROPOSED DIVERSIONS TO CSIP/AWT/RUWAP [16] | 897 | 627 | 397 | 0 | (0) | 0 | (0) | (0) | 0 | 345 | 656 | 967 | 3,888 |
| 29 | NEW SUPPLIES IN EXCESS OF AWT DEMANDS FOR GWR [17] | (409) | (369) | (409) | 568 | 513 | 681 | 540 | 504 | 319 | (409) | (396) | (409) | 724 |
| 30 | AWT BRINE TO OCEAN OUTFALL | 78 | 70 | 78 | 67 | 70 | 67 | 70 | 70 | 67 | 78 | 75 | 78 | 868 |

**Notes**

1 Presumes all facilities associated with diversions are completed.

2 Table 2-1, p. 5, Schaaf & Wheeler Consulting Engineers. Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

3 Volume of effluent from City of Salinas agricultural wash water to be directed into ponds 1,2,3, and the aeration pond for storage.

4 Average monthly flow from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

5 Rainfall from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015. Pond area presumed to be Ponds 1,2, 3 + Aeration lagoon. No rainfall/evaporation or storage assigned to drying beds.

6 Table 3, Todd Groundwater, Draft Memorandum, Pure Water Monterey Groundwater Replenishment Project: Impacts of Changes in Percolation at the Salinas Industrial Wastewater Treatment Facility on Groundwater and the Salinas River, February 11, 2015.

7 Table 4, Ibid. Also confirmed in MPWMD Industrial Ponds Percolation and Evaporation Technical Memorandum 2015-01, July 2015.

8 Ponds 1,2,3 and aeration basin hold up to 1,065 acre-feet (one foot of freeboard). If flow to ponds would exceed the maximum volume, it is presumed that excess flow can be diverted to the RIBs or drying beds or flow can be diverted to the RTP. Presume that pond storage goes to zero sometime during the year (shown here starting in July).

9 Max diversion = 6 cfs diversion. See REVISED DRAFT BLANCO DRAIN YIELD STUDY, Schaaf and Wheeler, December 2014.

10 Max. diversion = 6 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Note that flow figures shown here are a combination of flow estimates in the S&W analysis made for the 2 cfs instream requirement Jan-May and 1 cfs instream requirement for June-Dec.

11 Max. diversion = 3 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Figures shown here are the difference between the combined Davis Road/TS diversion with Seasonal Bypass. This presumes the preference is to remove flow at Davis Road first, rather than bypass flow to Tembaldero Slough.

12 Includes secondary effluent wastewater currently used to produce recycled water at the Salinas Valley Reclamation Project (SVRP), and additional amounts which may be used during periods of low demand (<5 mgd) with the proposed improvements to the SVRP.

13 New source waters not used by AWT will be available to SVRP for CSIP.

14 A drought reserve of up to 1,000 AF would be created over five years by producing 200 AFY additional product water from the GWR Project AWTF during winter months and storing the water in the Seaside Basin. This would establish a "water bank" that the CSIP can draw on in droughts. The drought reserve would allow flow at the RTP for the GWR Project to be temporarily reduced during critically dry periods, thus freeing up more of the newly available inflows to the RTP to be sent to the CSIP area. Extraction from the Seaside Basin would continue at the average rate to supply the Monterey Peninsula.

15 Average monthly RTP discharge, 2009-2013 (reported by MRWPCA).

16 Secondary treated municpal effluent not used for SVRP or the AWT.

17 Excess is calculated as Line 13 minus Lines 16 & 17

18 RUWAP supply comes from existing RTP inflows, demands reflect existing urban irrigation customers along trunk main.

**Table 6B: Source Water Analysis for the Pure Water Monterey Groundwater Replenishment Project**

**Diversion Pattern for a Normal Water Year when the Drought Reserve is Full, Initial RUWAP Demand as Recycled Water**

| # | All facilities built [1] - average water year conditions - all flows in acre-feet | | | | | | | | | | | | 7/28/2015 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **SOURCES** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
| | **Existing RTP Inflows (Average 2009 to 2013)** | **1,798** | **1,678** | **1,867** | **1,796** | **1,850** | **1,799** | **1,893** | **1,888** | **1,813** | **1,844** | **1,762** | **1,776** | **21,764** |
| | **New Source Water** | | | | | | | | | | | | | |
| | *City of Salinas* | | | | | | | | | | | | | |
| 1 | Salinas Agricultural Wash Water [2] | 156 | 158 | 201 | 307 | 311 | 391 | 435 | 444 | 367 | 410 | 329 | 223 | 3,732 |
| | *Agricultural Wash Water (AWW) to Ponds [3]* | *156* | *158* | *201* | *0* | *0* | *0* | *0* | *0* | *0* | *410* | *329* | *223* | *1,477* |
| | *AWW directly to RTP* | *0* | *0* | *0* | *307* | *311* | *391* | *435* | *444* | *367* | *0* | *0* | *0* | *2,255* |
| 2 | Salinas Urban Storm Water Runoff [4] | 52 | 41 | 34 | 16 | 2 | 0 | 0 | 0 | 2 | 8 | 23 | 47 | 225 |
| | *Urban runoff to ponds* | *52* | *41* | *34* | *0* | *0* | *0* | *0* | *0* | *0* | *8* | *23* | *47* | *205* |
| | *Urban runoff to RTP* | *0* | *0* | *0* | *16* | *2* | *0* | *0* | *0* | *2* | *0* | *0* | *0* | *20* |
| 3 | Rainfall (on SIWTF, 121 acre pond area) [5] | 26 | 24 | 21 | 11 | 3 | 1 | 0 | 0 | 2 | 6 | 14 | 24 | 132 |
| 4 | Evaporation (from SIWTF, 121 acre pond area) [6] | (12) | (16) | (29) | (41) | (46) | (52) | | | | (28) | (15) | (12) | (251) |
| 5 | Percolation [7] | (143) | (129) | (143) | (138) | (143) | (138) | | | | (143) | (138) | (143) | (1,257) |
| 6 | SIWTF pond storage balance [8] | 684 | 763 | 847 | 647 | 362 | 0 | 0 | 0 | 0 | 253 | 466 | 605 | |
| 7 | Recovery of flow from SIWTF storage ponds to RTP | 0 | 0 | 0 | 32 | 100 | 172 | 0 | 0 | 0 | 0 | 0 | 0 | 304 |
| 8 | AWW and Salinas Runoff to RTP | 0 | 0 | 0 | 355 | 413 | 563 | 435 | 444 | 369 | 0 | 0 | 0 | 2,579 |
| | *Water Rights Applications to SWRCB* | | | | | | | | | | | | | |
| 9 | Blanco Drain [9] | 0 | 0 | 0 | 252 | 225 | 274 | 277 | 244 | 184 | 0 | 0 | 0 | 1,456 |
| 10 | Reclamation Ditch at Davis Road [10] | 0 | 0 | 0 | 162 | 97 | 132 | 129 | 121 | 80 | 0 | 0 | 0 | 721 |
| 11 | Tembladero Slough at Castroville [11] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | City of Monterey - Diversion at Lake El Estero | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | **Subtotal New Waters Available** | **0** | **0** | **0** | **769** | **735** | **969** | **841** | **809** | **633** | **0** | **0** | **0** | **4,756** |
| | **Total Projected Water Supply** | **1,798** | **1,678** | **1,867** | **2,565** | **2,585** | **2,768** | **2,734** | **2,697** | **2,446** | **1,844** | **1,762** | **1,776** | **26,520** |
| | **DEMANDS** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
| | Average SVRP deliveries to CSIP (2009-2013) | 13 | 459 | 726 | 1,376 | 1,763 | 1,750 | 1,866 | 1,854 | 1,698 | 984 | 448 | 18 | 12,955 |
| 14 | FIVE YEAR AVERAGE CSIP AREA WELL WATER USE (2009-2013) | 448 | 195 | 304 | 412 | 324 | 606 | 519 | 504 | 300 | 75 | 233 | 352 | 4,272 |
| | **TOTAL CSIP Demand** | **461** | **654** | **1,030** | **1,788** | **2,087** | **2,356** | **2,385** | **2,358** | **1,998** | **1,059** | **681** | **370** | **17,227** |
| 15 | MCWD RUWAP[18] | 31 | 28 | 31 | 59 | 61 | 59 | 61 | 61 | 59 | 31 | 30 | 31 | 540 |
| 16 | FEEDWATER AMOUNT AT RTP TO GWR PROJECT AWTF | 367 | 331 | 367 | 355 | 367 | 355 | 367 | 367 | 355 | 367 | 355 | 367 | 4,320 |
| 17 | FEEDWATER TO ESTABLISH CSIP AREA DROUGHT RESERVE (200 AFY AWTF PRODUCT WATER) [14] | 0 | 0 | 0 | | | | | | | 0 | 0 | 0 | 0 |
| 18 | **TOTAL TO GWR ADVANCED WATER TREATMENT FACILITY** | **367** | **331** | **367** | **355** | **367** | **355** | **367** | **367** | **355** | **367** | **355** | **367** | **4,320** |
| | **Total Projected Water Demand** | **859** | **1,013** | **1,428** | **2,202** | **2,515** | **2,770** | **2,813** | **2,785** | **2,412** | **1,457** | **1,066** | **767** | **22,087** |
| | **Use of Source Water** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
| 19 | Secondary effluent to SVRP for CSIP [12] | 461 | 654 | 1,030 | 1,737 | 1,789 | 1,740 | 1,833 | 1,827 | 1,754 | 1,059 | 681 | 370 | 14,935 |
| 20 | New sources available to CSIP [13] | 0 | 0 | 0 | 414 | 368 | 614 | 474 | 442 | 278 | 0 | 0 | 0 | 2,590 |
| 21 | **Total Supply to CSIP** | **461** | **654** | **1,030** | **2,151** | **2,157** | **2,354** | **2,307** | **2,269** | **2,032** | **1,059** | **681** | **370** | **17,525** |
| | **Net CSIP Increase** | | | | | | | | | | | | | **4,569** |
| 22 | Secondary effluent to SVRP for MCWD RUWAP | 31 | 28 | 31 | 59 | 61 | 59 | 61 | 61 | 59 | 31 | 30 | 31 | 540 |
| 23 | Surface waters at RTP to AWT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 24 | Secondary effluent to AWT | 367 | 331 | 367 | 0 | 0 | 0 | 0 | 0 | 0 | 367 | 355 | 367 | 2,154 |
| 25 | AWW and Salinas urban runoff to AWT | 0 | 0 | 0 | 355 | 367 | 355 | 367 | 367 | 355 | 0 | 0 | 0 | 2,166 |
| 26 | **Feedwater to AWT** | **367** | **331** | **367** | **355** | **367** | **355** | **367** | **367** | **355** | **367** | **355** | **367** | **4,320** |
| | **Subtotal- all waters (including secondary effluent)** | **828** | **985** | **1,397** | **2,506** | **2,524** | **2,709** | **2,674** | **2,636** | **2,387** | **1,426** | **1,036** | **737** | **21,845** |
| 27 | FIVE YEAR AVERAGE WASTE WATER EFFLUENT TO OCEAN OUTFALL (2009-2013)[15] | 1,785 | 1,219 | 1,141 | 420 | 88 | 49 | 27 | 34 | 114 | 859 | 1,314 | 1,759 | 8,809 |
| 28 | WASTE WATER EFFLUENT TO OCEAN OUTFALL WITH PROPOSED DIVERSIONS TO CSIP/AWT/RUWAP [16] | 939 | 665 | 439 | 0 | (0) | 0 | (0) | (0) | 0 | 387 | 696 | 1,009 | 4,135 |
| 29 | NEW SUPPLIES IN EXCESS OF AWT DEMANDS FOR GWR [17] | (367) | (331) | (367) | 414 | 368 | 614 | 474 | 442 | 278 | (367) | (355) | (367) | 436 |
| 30 | AWT BRINE TO OCEAN OUTFALL | 70 | 63 | 70 | 67 | 70 | 67 | 70 | 70 | 67 | 70 | 67 | 70 | 821 |

**Notes**

1 Presumes all facilities associated with diversions are completed.

2 Table 2-1, p. 5, Schaaf & Wheeler Consulting Engineers. Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

3 Volume of effluent from City of Salinas agricultural wash water to be directed into ponds 1,2,3, and the aeration pond for storage.

4 Average monthly flow from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

5 Rainfall from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015. Pond area presumed to be Ponds 1,2, 3 + Aeration lagoon. No rainfall/evaporation or storage assigned to drying beds.

6 Table 3, Todd Groundwater, Draft Memorandum, Pure Water Monterey Groundwater Replenishment Project: Impacts of Changes in Percolation at the Salinas Industrial Wastewater Treatment Facility on Groundwater and the Salinas River, February 11, 2015.

7 Table 4, Ibid. Also confirmed in MPWMD Industrial Ponds Percolation and Evaporation Technical Memorandum 2015-01, July 2015.

8 Ponds 1,2,3 and aeration basin hold up to 1,065 acre-feet (one foot of freeboard). If flow to ponds would exceed the maximum volume, it is presumed that excess flow can be diverted to the RIBs or drying beds or flow can be diverted to the RTP. Presume that pond storage goes to zero sometime during the year (shown here starting in July).

9 Max diversion = 6 cfs diversion. See REVISED DRAFT BLANCO DRAIN YIELD STUDY, Schaaf and Wheeler, December 2014.

10 Max. diversion = 6 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Note that flow figures shown here are a combination of flow estimates in the S&W analysis made for the 2 cfs instream requirement Jan-May and 1 cfs instream requirement for June-Dec.

11 Max. diversion = 3 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Figures shown here are the difference between the combined Davis Road/TS diverison with Seasonal Bypass. This presumes the preference is to remove flow at Davis Road first, rather than bypass flow to Tembaldero Slough.

12 Includes secondary effluent wastewater currently used to produce recycled water at the Salinas Valley Reclamation Project (SVRP), and additional amounts which may be used during periods of low demand (<5 mgd) with the proposed improvements to the SVRP.

13 New source waters not used by AWT will be available to SVRP for CSIP.

14 A drought reserve of up to 1,000 AF would be created over five years by producing 200 AFY additional product water from the GWR Project AWTF during winter months and storing the water in the Seaside Basin. This would establish a "water bank" that the CSIP can draw on in droughts. The drought reserve would allow flow at the RTP for the GWR Project to be temporarily reduced during critically dry periods, thus freeing up more of the newly available inflows to the RTP to be sent to the CSIP area. Extraction from the Seaside Basin would continue at the average rate to supply the Monterey Peninsula.

15 Average monthly RTP discharge, 2009-2013 (reported by MRWPCA).

16 Secondary treated municpal effluent not used for SVRP or the AWT.

17 Excess is calculated as Line 13 minus Lines 16 & 17

18 RUWAP supply comes from existing RTP inflows, demands reflect existing urban irrigation customers along trunk main.

## Table 6C: Source Water Analysis for the Pure Water Monterey Groundwater Replenishment Project

### Diversion Pattern for a Drought Year Starting with a Full Reserve, Initial RUWAP Demand as Recycled Water

**All facilities built [1] - average water year conditions - all flows in acre-feet** — 7/28/2015

| # | SOURCES | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Minimum Year RTP Inflows (2013)** | *1,725* | *1,494* | *1,645* | *1,657* | *1,722* | *1,675* | *1,748* | *1,773* | *1,715* | *1,690* | *1,634* | *1,612* | **20,090** |
| | **New Source Water** | | | | | | | | | | | | | |
| | *City of Salinas* | | | | | | | | | | | | | |
| 1 | Salinas Agricultural Wash Water [2] | 156 | 158 | 201 | 307 | 311 | 391 | 435 | 444 | 367 | 410 | 329 | 223 | 3,732 |
| | *Agricultural Wash Water (AWW) to Ponds [3]* | *156* | *158* | *201* | *0* | *0* | *0* | *0* | *0* | *0* | *410* | *329* | *223* | *1,477* |
| | *AWW directly to RTP* | *0* | *0* | *0* | *307* | *311* | *391* | *435* | *444* | *367* | *0* | *0* | *0* | *2,255* |
| 2 | Salinas Urban Storm Water Runoff [4] | 17 | 14 | 11 | 5 | 1 | 0 | 0 | 0 | 1 | 3 | 8 | 16 | 76 |
| | *Urban runoff to ponds* | *17* | *14* | *11* | *0* | *0* | *0* | *0* | *0* | *0* | *3* | *8* | *16* | *69* |
| | *Urban runoff to RTP* | *0* | *0* | *0* | *5* | *1* | *0* | *0* | *0* | *1* | *0* | *0* | *0* | *7* |
| 3 | Rainfall (on SIWTF, 121 acre pond area) [5] | 11 | 6 | 4 | 3 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 4 | 36 |
| 4 | Evaporation (from SIWTF, 121 acre pond area) [6] | (12) | (16) | (29) | (41) | (46) | (52) | | | | (28) | (15) | (12) | (251) |
| 5 | Percolation [7] | (143) | (129) | (143) | (138) | (143) | (138) | | | | (143) | (138) | (143) | (1,257) |
| 6 | SIWTF pond storage balance [8] | 550 | 584 | 628 | 452 | 163 | (27) | 0 | 0 | 0 | 245 | 433 | 521 | |
| 7 | Recovery of flow from SIWTF storage ponds to RTP | 0 | 0 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| 8 | AWW and Salinas Runoff to RTP | 0 | 0 | 0 | 312 | 412 | 391 | 435 | 444 | 368 | 0 | 0 | 0 | 2,362 |
| | *Water Rights Applications to SWRCB* | | | | | | | | | | | | | |
| 9 | Blanco Drain [9] | 0 | 0 | 246 | 252 | 225 | 274 | 277 | 244 | 184 | 168 | 133 | 0 | 2,003 |
| 10 | Reclamation Ditch at Davis Road [10] | 0 | 0 | 165 | 162 | 97 | 132 | 129 | 121 | 80 | 87 | 98 | 0 | 1,071 |
| 11 | Tembladero Slough at Castroville [11] | 0 | 0 | 142 | 154 | 145 | 67 | 66 | 62 | 41 | 45 | 50 | 0 | 772 |
| 12 | City of Monterey - Diversion at Lake El Estero | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | **Subtotal New Waters Available** | **0** | **0** | **553** | **880** | **879** | **864** | **907** | **871** | **673** | **300** | **281** | **0** | **6,208** |
| | **Total Projected Water Supply** | **1,725** | **1,494** | **2,198** | **2,537** | **2,601** | **2,539** | **2,655** | **2,644** | **2,388** | **1,990** | **1,915** | **1,612** | **26,297** |

| # | DEMANDS | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Max Year SVRP deliveries to CSIP (2013) | *0* | *692* | *1,558* | *1,669* | *1,799* | *1,675* | *1,786* | *1,803* | *1,725* | *1,548* | *1,127* | *88* | 15,469 |
| 14 | PEAK CSIP AREA WELL WATER USE (10/2013-09/2014) | *509* | *9* | *221* | *242* | *1,197* | *1,261* | *1,303* | *1,025* | *453* | *165* | *35* | *730* | 7,150 |
| | **TOTAL CSIP Demand** | **509** | **701** | **1,779** | **1,911** | **2,996** | **2,936** | **3,089** | **2,828** | **2,178** | **1,713** | **1,162** | **818** | **22,619** |
| 15 | MCWD RUWAP[18] | 31 | 28 | 31 | 59 | 61 | 59 | 61 | 61 | 59 | 31 | 30 | 31 | 540 |
| 16 | FEEDWATER AMOUNT AT RTP TO GWR PROJECT AWTF | 367 | 331 | 367 | **133** | **137** | **133** | **137** | **137** | **133** | 367 | 355 | 367 | 2,963 |
| 17 | FEEDWATER TO ESTABLISH CSIP AREA DROUGHT RESERVE (200 AFY AWTF PRODUCT WATER) [14] | 0 | 0 | 0 | | | | | | | 0 | 0 | 0 | 0 |
| 18 | **TOTAL TO GWR ADVANCED WATER TREATMENT FACILITY** | **367** | **331** | **367** | **133** | **137** | **133** | **137** | **137** | **133** | **367** | **355** | **367** | **2,963** |
| | **Total Projected Water Demand** | **907** | **1,060** | **2,177** | **2,102** | **3,194** | **3,128** | **3,287** | **3,026** | **2,370** | **2,111** | **1,547** | **1,215** | **26,123** |

| # | Use of Source Water | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 | Secondary effluent to SVRP for CSIP [12] | 509 | 701 | 1,614 | 1,598 | 1,661 | 1,616 | 1,687 | 1,712 | 1,656 | 1,592 | 1,162 | 818 | 16,326 |
| 20 | New sources available to CSIP [13] | 0 | 0 | 186 | 747 | 742 | 731 | 770 | 734 | 540 | 0 | 0 | 0 | 4,451 |
| 21 | **Total Supply to CSIP** | **509** | **701** | **1,800** | **2,345** | **2,403** | **2,347** | **2,457** | **2,446** | **2,197** | **1,592** | **1,162** | **818** | **20,777** |
| | **Net CSIP Increase** | | | | | | | | | | | | | **5,307** |
| 22 | Secondary effluent to SVRP for MCWD RUWAP | 31 | 28 | 31 | 59 | 61 | 59 | 61 | 61 | 59 | 31 | 30 | 31 | 540 |
| 23 | Surface waters at RTP to AWT | 0 | 0 | 367 | 0 | 0 | 0 | 0 | 0 | 0 | 300 | 281 | 0 | 948 |
| 24 | Secondary effluent to AWT | 367 | 331 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 67 | 74 | 367 | 1,206 |
| 25 | AWW and Salinas urban runoff to AWT | 0 | 0 | 0 | 133 | 137 | 133 | 137 | 137 | 133 | 0 | 0 | 0 | 809 |
| 26 | **Feedwater to AWT** | **367** | **331** | **367** | **133** | **137** | **133** | **137** | **137** | **133** | **367** | **355** | **367** | **2,963** |
| | **Subtotal- all waters (including secondary effluent)** | **876** | **1,032** | **2,167** | **2,478** | **2,540** | **2,480** | **2,594** | **2,583** | **2,329** | **1,959** | **1,517** | **1,185** | **23,740** |

| # | | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 | *DRY YEAR WASTEWATER EFFLUENT TO OCEAN OUTFALL (2013) [15]* | *1,725* | *802* | *87* | *0* | *0* | *0* | *0* | *0* | *0* | *142* | *507* | *1,607* | 4,870 |
| 28 | WASTE WATER EFFLUENT TO OCEAN OUTFALL WITH PROPOSED DIVERSIONS TO CSIP/AWT/RUWAP [16] | 819 | 434 | 0 | 0 | (0) | 0 | (0) | (0) | 0 | 0 | 368 | 396 | 2,017 |
| 29 | NEW SUPPLIES IN EXCESS OF AWT DEMANDS FOR GWR [17] | (367) | (331) | 186 | 747 | 742 | 731 | 770 | 734 | 540 | (67) | (74) | (367) | 3,244 |
| 30 | AWT BRINE TO OCEAN OUTFALL | 70 | 63 | 70 | 25 | 26 | 25 | 26 | 26 | 25 | 70 | 67 | 70 | 563 |

**Notes**

1 Presumes all facilities associated with diversions are completed.

2 Table 2-1, p. 5, Schaaf & Wheeler Consulting Engineers. Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

3 Volume of effluent from City of Salinas agricultural wash water to be directed into ponds 1,2,3, and the aeration pond for storage.

4 Assume dry year at 1/3 the average monthly values from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

5 Rainfall from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015. Pond area presumed to be Ponds 1,2, 3 + Aeration lagoon. No rainfall/evaporation or storage assigned to drying beds.

6 Table 3, Todd Groundwater, Draft Memorandum, Pure Water Monterey Groundwater Replenishment Project: Impacts of Changes in Percolation at the Salinas Industrial Wastewater Treatment Facility on Groundwater and the Salinas River, February 11, 2015.

7 Table 4, Ibid. Also confirmed in MPWMD Industrial Ponds Percolation and Evaporation Technical Memorandum 2015-01, July 2015.

8 Ponds 1,2,3 and aeration basin hold up to 1,065 acre-feet (one foot of freeboard). If flow to ponds would exceed the maximum volume, it is presumed that excess flow can be diverted to the RIBs or drying beds or flow can be diverted to the RTP. Presume that pond storage goes to zero sometime during the year (shown here starting in July).

9 Max diversion = 6 cfs diversion. See REVISED DRAFT BLANCO DRAIN YIELD STUDY, Schaaf and Wheeler, December 2014.

10 Max. diversion = 6 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Note that flow figures shown here are a combination of flow estimates in the S&W analysis made for the 2 cfs instream requirement Jan-May and 1 cfs instream requirement for June-Dec.

11 Max. diversion = 3 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Figures shown here are the difference between the combined Davis Road/TS diverison with Seasonal Bypass. This presumes the preference is to remove flow at Davis Road first, rather than bypass flow to Tembaldero Slough.

12 Includes secondary effluent wastewater currently used to produce recycled water at the Salinas Valley Reclamation Project (SVRP), and additional amounts which may be used during periods of low demand (<5 mgd) with the proposed improvements to the SVRP.

13 New source waters not used by AWT will be available to SVRP for CSIP.

14 A drought reserve of up to 1,000 AF would be created over five years by producing 200 AFY additional product water from the GWR Project AWTF during winter months and storing the water in the Seaside Basin. This would establish a "water bank" that the CSIP can draw on in droughts. The drought reserve would allow flow at the RTP for the GWR Project to be temporarily reduced during critically dry periods, thus freeing up more of the newly available inflows to the RTP to be sent to the CSIP area. Extraction from the Seaside Basin would continue at the average rate to supply the Monterey Peninsula.

15 Monthly RTP discharge during critically dry year (2013), reported by MRWPCA

16 Secondary treated municpal effluent not used for SVRP or the AWT.

17 Excess is calculated as Line 13 minus Lines 16 & 17

18 RUWAP supply comes from existing RTP inflows, demands reflect existing urban irrigation customers along trunk main.

## Table 7A: Source Water Analysis for the Pure Water Monterey Groundwater Replenishment Project

### Diversion Pattern for a Normal Water Year Building a Drought Reserve, Initial RUWAP Demand as AWT Product

**All facilities built [1] - average water year conditions - all flows in acre-feet** — **7/28/2015**

| **SOURCES** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Existing RTP Inflows (Average 2009 to 2013)** | **1,798** | **1,678** | **1,867** | **1,796** | **1,850** | **1,799** | **1,893** | **1,888** | **1,813** | **1,844** | **1,762** | **1,776** | **21,764** |
| **New Source Water** | | | | | | | | | | | | | |
| *City of Salinas* | | | | | | | | | | | | | |
| 1 Salinas Agricultural Wash Water [2] | 156 | 158 | 201 | 307 | 311 | 391 | 435 | 444 | 367 | 410 | 329 | 223 | 3,732 |
| *Agricultural Wash Water (AWW) to Ponds [3]* | *156* | *158* | *201* | *0* | *0* | *0* | *0* | *0* | *0* | *410* | *329* | *223* | *1,477* |
| *AWW directly to RTP* | *0* | *0* | *0* | *307* | *311* | *391* | *435* | *444* | *367* | *0* | *0* | *0* | *2,255* |
| 2 Salinas Urban Storm Water Runoff [4] | 52 | 41 | 34 | 16 | 2 | 0 | 0 | 0 | 2 | 8 | 23 | 47 | 225 |
| *Urban runoff to ponds* | *52* | *41* | *34* | *0* | *0* | *0* | *0* | *0* | *0* | *8* | *23* | *47* | *205* |
| *Urban runoff to RTP* | *0* | *0* | *0* | *16* | *2* | *0* | *0* | *0* | *2* | *0* | *0* | *0* | *20* |
| 3 Rainfall (on SIWTF, 121 acre pond area) [5] | 26 | 24 | 21 | 11 | 3 | 1 | 0 | 0 | 2 | 6 | 14 | 24 | 132 |
| 4 Evaporation (from SIWTF, 121 acre pond area) [6] | (12) | (16) | (29) | (41) | (46) | (52) | | | | (28) | (15) | (12) | (251) |
| 5 Percolation [7] | (143) | (129) | (143) | (138) | (143) | (138) | | | | (143) | (138) | (143) | (1,257) |
| 6 SIWTF pond storage balance [8] | 684 | 763 | 847 | 647 | 362 | 0 | 0 | 0 | 0 | 253 | 466 | 605 | |
| 7 Recovery of flow from SIWTF storage ponds to RTP | 0 | 0 | 0 | 32 | 100 | 172 | 0 | 0 | 0 | 0 | 0 | 0 | 304 |
| 8 AWW and Salinas Runoff to RTP | 0 | 0 | 0 | 355 | 413 | 563 | 435 | 444 | 369 | 0 | 0 | 0 | 2,579 |
| *Water Rights Applications to SWRCB* | | | | | | | | | | | | | |
| 9 Blanco Drain [9] | 0 | 0 | 0 | 252 | 225 | 274 | 277 | 244 | 184 | 0 | 0 | 0 | 1,456 |
| 10 Reclamation Ditch at Davis Road [10] | 0 | 0 | 0 | 162 | 97 | 132 | 129 | 121 | 80 | 0 | 0 | 0 | 721 |
| 11 Tembladero Slough at Castroville [11] | 0 | 0 | 0 | 154 | 145 | 67 | 66 | 62 | 41 | 0 | 0 | 0 | 535 |
| 12 City of Monterey - Diversion at Lake El Estero | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 **Subtotal New Waters Available** | **0** | **0** | **0** | **923** | **880** | **1,036** | **907** | **871** | **674** | **0** | **0** | **0** | **5,291** |
| **Total Projected Water Supply** | **1,798** | **1,678** | **1,867** | **2,719** | **2,730** | **2,835** | **2,800** | **2,759** | **2,487** | **1,844** | **1,762** | **1,776** | **27,055** |

| **DEMANDS** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average SVRP deliveries to CSIP (2009-2013) | 13 | 459 | 726 | 1,376 | 1,763 | 1,750 | 1,866 | 1,854 | 1,698 | 984 | 448 | 18 | 12,955 |
| 14 FIVE YEAR AVERAGE CSIP AREA WELL WATER USE (2009-2013) | 448 | 195 | 304 | 412 | 324 | 606 | 519 | 504 | 300 | 75 | 233 | 352 | 4,272 |
| **TOTAL CSIP Demand** | **461** | **654** | **1,030** | **1,788** | **2,087** | **2,356** | **2,385** | **2,358** | **1,998** | **1,059** | **681** | **370** | **17,227** |
| 15 FEEDWATER AMOUNT AT RTP TO GWR PROJECT AWTF | 367 | 331 | 367 | 355 | 367 | 355 | 367 | 367 | 355 | 367 | 355 | 367 | 4,320 |
| 16 FEEDWATER TO ESTABLISH CSIP AREA DROUGHT RESERVE (200 AFY AWTF PRODUCT WATER) [14] | 42 | 38 | 42 | | | | | | | 42 | 41 | 42 | 248 |
| 17 FEEDWATER TO AWT FOR MCWD RUWAP[18] | 38 | 35 | 38 | 73 | 75 | 73 | 75 | 75 | 73 | 38 | 37 | 38 | 666 |
| 18 **TOTAL TO GWR ADVANCED WATER TREATMENT FACILITY** | **447** | **404** | **447** | **428** | **442** | **428** | **442** | **442** | **428** | **447** | **432** | **447** | **5,234** |
| **Total Projected Water Demand** | **908** | **1,058** | **1,477** | **2,216** | **2,529** | **2,784** | **2,827** | **2,800** | **2,426** | **1,506** | **1,114** | **817** | **22,462** |

| **Use of Source Water** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 Secondary effluent to SVRP for CSIP [12] | 461 | 654 | 1,030 | 1,723 | 1,775 | 1,726 | 1,818 | 1,813 | 1,740 | 1,059 | 681 | 370 | 14,851 |
| 20 New sources available to CSIP [13] | 0 | 0 | 0 | 568 | 513 | 681 | 540 | 504 | 319 | 0 | 0 | 0 | 3,125 |
| 21 **Total Supply to CSIP** | **461** | **654** | **1,030** | **2,291** | **2,288** | **2,407** | **2,358** | **2,317** | **2,059** | **1,059** | **681** | **370** | **17,976** |
| **Net CSIP Increase** | | | | | | | | | | | | | **5,020** |
| 22 Surface waters at RTP to AWT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 Secondary effluent to AWT | 409 | 369 | 409 | 0 | 0 | 0 | 0 | 0 | 0 | 409 | 396 | 409 | 2,401 |
| 24 AWW and Salinas urban runoff to AWT | 0 | 0 | 0 | 355 | 367 | 355 | 367 | 367 | 355 | 0 | 0 | 0 | 2,166 |
| 25 Secondary effluent to AWT for MCWD RUWAP | 38 | 35 | 38 | 73 | 75 | 73 | 75 | 75 | 73 | 38 | 37 | 38 | 666 |
| 26 **Feedwater to AWT** | **447** | **404** | **447** | **428** | **442** | **428** | **442** | **442** | **428** | **447** | **432** | **447** | **5,234** |
| **Subtotal- all waters (including secondary effluent)** | **908** | **1,058** | **1,477** | **2,719** | **2,730** | **2,835** | **2,800** | **2,759** | **2,487** | **1,506** | **1,114** | **817** | **23,210** |

| | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 FIVE YEAR AVERAGE WASTE WATER EFFLUENT TO OCEAN OUTFALL (2009-2013)[15] | 1,785 | 1,219 | 1,141 | 420 | 88 | 49 | 27 | 34 | 114 | 859 | 1,314 | 1,759 | 8,809 |
| 28 WASTE WATER EFFLUENT TO OCEAN OUTFALL WITH PROPOSED DIVERSIONS TO CSIP/AWT/RUWAP [16] | 890 | 620 | 390 | 0 | (0) | 0 | (0) | (0) | 0 | 337 | 649 | 960 | 3,846 |
| 29 NEW SUPPLIES IN EXCESS OF AWT DEMANDS FOR GWR [17] | (409) | (369) | (409) | 568 | 513 | 681 | 540 | 504 | 319 | (409) | (396) | (409) | 724 |
| 30 AWT BRINE TO OCEAN OUTFALL | 85 | 77 | 85 | 81 | 84 | 81 | 84 | 84 | 81 | 85 | 82 | 85 | 994 |

**Notes**

1 Presumes all facilities associated with diversions are completed.

2 Table 2-1, p. 5, Schaaf & Wheeler Consulting Engineers. Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

3 Volume of effluent from City of Salinas agricultural wash water to be directed into ponds 1,2,3, and the aeration pond for storage.

4 Average monthly flow from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

5 Rainfall from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015. Pond area presumed to be Ponds 1,2, 3 + Aeration lagoon. No rainfall/evaporation or storage assigned to drying beds.

6 Table 3, Todd Groundwater, Draft Memorandum, Pure Water Monterey Groundwater Replenishment Project: Impacts of Changes in Percolation at the Salinas Industrial Wastewater Treatment Facility on Groundwater and the Salinas River, February 11, 2015.

7 Table 4, Ibid.

8 Ponds 1,2,3 and aeration basin hold up to 1,065 acre-feet (one foot of freeboard). If flow to ponds would exceed the maximum volume, it is presumed that excess flow can be diverted to the RIBs or drying beds or flow can be diverted to the RTP. Presume that pond storage goes to zero sometime during the year (shown here starting in July).

9 Table 4, Ibid. Also confirmed in MPWMD Industrial Ponds Percolation and Evaporation Technical Memorandum 2015-01, July 2015.

10 Max. diversion = 6 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Note that flow figures shown here are a combination of flow estimates in the S&W analysis made for the 2 cfs instream requirement Jan-May and 1 cfs instream requirement for June-Dec.

11 Max. diversion = 3 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Figures shown here are the difference between the combined Davis Road/TS diversion with Seasonal Bypass. This presumes the preference is to remove flow at Davis Road first, rather than bypass flow to Tembaldero Slough.

12 Includes secondary effluent wastewater currently used to produce recycled water at the Salinas Valley Reclamation Project (SVRP), and additional amounts which may be used during periods of low demand (<5 mgd) with the proposed improvements to the SVRP.

13 New source waters not used by AWT will be available to SVRP for CSIP.

14 A drought reserve of up to 1,000 AF would be created over five years by producing 200 AFY additional product water from the GWR Project AWTF during winter months and storing the water in the Seaside Basin. This would establish a "water bank" that the CSIP can draw on in droughts. The drought reserve would allow flow at the RTP for the GWR Project to be temporarily reduced during critically dry periods, thus freeing up more of the newly available inflows to the RTP to be sent to the CSIP area. Extraction from the Seaside Basin would continue at the average rate to supply the Monterey Peninsula.

15 Average monthly RTP discharge, 2009-2013 (reported by MRWPCA).

16 Secondary treated municpal effluent not used for SVRP or the AWT.

17 Excess is calculated as Line 13 minus Lines 15 & 16

18 RUWAP supply comes from existing RTP inflows, demands reflect existing urban irrigation customers along trunk main.

## Table 7B: Source Water Analysis for the Pure Water Monterey Groundwater Replenishment Project

**Diversion Pattern for a Normal Water Year with a Full Reserve, Initial RUWAP Demand as AWT Product**

**All facilities built [1] - average water year conditions - all flows in acre-feet** **7/28/2015**

| **SOURCES** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Existing RTP Inflows (Average 2009 to 2013)** | **1,798** | **1,678** | **1,867** | **1,796** | **1,850** | **1,799** | **1,893** | **1,888** | **1,813** | **1,844** | **1,762** | **1,776** | **21,764** |
| | | | | | | | | | | | | | |
| **New Source Water** | | | | | | | | | | | | | |
| *City of Salinas* | | | | | | | | | | | | | |
| 1 Salinas Agricultural Wash Water [2] | 156 | 158 | 201 | 307 | 311 | 391 | 435 | 444 | 367 | 410 | 329 | 223 | 3,732 |
| *Agricultural Wash Water (AWW) to Ponds [3]* | *156* | *158* | *201* | *0* | *0* | *0* | *0* | *0* | *0* | *410* | *329* | *223* | *1,477* |
| *AWW directly to RTP* | *0* | *0* | *0* | *307* | *311* | *391* | *435* | *444* | *367* | *0* | *0* | *0* | *2,255* |
| 2 Salinas Urban Storm Water Runoff [4] | 52 | 41 | 34 | 16 | 2 | 0 | 0 | 0 | 2 | 8 | 23 | 47 | 225 |
| *Urban runoff to ponds* | *52* | *41* | *34* | *0* | *0* | *0* | *0* | *0* | *0* | *8* | *23* | *47* | *205* |
| *Urban runoff to RTP* | *0* | *0* | *0* | *16* | *2* | *0* | *0* | *0* | *2* | *0* | *0* | *0* | *20* |
| 3 Rainfall (on SIWTF, 121 acre pond area) [5] | 26 | 24 | 21 | 11 | 3 | 1 | 0 | 0 | 2 | 6 | 14 | 24 | 132 |
| 4 Evaporation (from SIWTF, 121 acre pond area) [6] | (12) | (16) | (29) | (41) | (46) | (52) | | | | (28) | (15) | (12) | (251) |
| 5 Percolation [7] | (143) | (129) | (143) | (138) | (143) | (138) | | | | (143) | (138) | (143) | (1,257) |
| 6 SIWTF pond storage balance [8] | 684 | 763 | 847 | 647 | 362 | 0 | 0 | 0 | 0 | 253 | 466 | 605 | |
| 7 Recovery of flow from SIWTF storage ponds to RTP | 0 | 0 | 0 | 32 | 100 | 172 | 0 | 0 | 0 | 0 | 0 | 0 | 304 |
| 8 AWW and Salinas Runoff to RTP | 0 | 0 | 0 | 355 | 413 | 563 | 435 | 444 | 369 | 0 | 0 | 0 | 2,579 |
| *Water Rights Applications to SWRCB* | | | | | | | | | | | | | |
| 9 Blanco Drain [9] | 0 | 0 | 0 | 252 | 225 | 274 | 277 | 244 | 184 | 0 | 0 | 0 | 1,456 |
| 10 Reclamation Ditch at Davis Road [10] | 0 | 0 | 0 | 162 | 97 | 132 | 129 | 121 | 80 | 0 | 0 | 0 | 721 |
| 11 Tembladero Slough at Castroville [11] | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 City of Monterey - Diversion at Lake El Estero | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 **Subtotal New Waters Available** | **0** | **0** | **0** | **769** | **735** | **969** | **841** | **809** | **633** | **0** | **0** | **0** | **4,756** |
| | | | | | | | | | | | | | |
| **Total Projected Water Supply** | **1,798** | **1,678** | **1,867** | **2,565** | **2,585** | **2,768** | **2,734** | **2,697** | **2,446** | **1,844** | **1,762** | **1,776** | **26,520** |

| **DEMANDS** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Average SVRP deliveries to CSIP (2009-2013) | 13 | 459 | 726 | 1,376 | 1,763 | 1,750 | 1,866 | 1,854 | 1,698 | 984 | 448 | 18 | 12,955 |
| 14 FIVE YEAR AVERAGE CSIP AREA WELL WATER USE (2009-2013) | 448 | 195 | 304 | 412 | 324 | 606 | 519 | 504 | 300 | 75 | 233 | 352 | 4,272 |
| **TOTAL CSIP Demand** | **461** | **654** | **1,030** | **1,788** | **2,087** | **2,356** | **2,385** | **2,358** | **1,998** | **1,059** | **681** | **370** | **17,227** |
| | | | | | | | | | | | | | |
| 15 FEEDWATER AMOUNT AT RTP TO GWR PROJECT AWTF | 367 | 331 | 367 | 355 | 367 | 355 | 367 | 367 | 355 | 367 | 355 | 367 | 4,320 |
| 16 FEEDWATER TO ESTABLISH CSIP AREA DROUGHT RESERVE (200 AFY AWTF PRODUCT WATER) [14] | 0 | 0 | 0 | | | | | | | 0 | 0 | 0 | 0 |
| 17 FEEDWATER TO AWT FOR MCWD RUWAP[18] | 38 | 35 | 38 | 73 | 75 | 73 | 75 | 75 | 73 | 38 | 37 | 38 | 666 |
| 18 **TOTAL TO GWR ADVANCED WATER TREATMENT FACILITY** | **405** | **366** | **405** | **428** | **442** | **428** | **442** | **442** | **428** | **405** | **392** | **405** | **4,986** |
| | | | | | | | | | | | | | |
| **Total Projected Water Demand** | **866** | **1,020** | **1,435** | **2,216** | **2,529** | **2,784** | **2,827** | **2,800** | **2,426** | **1,464** | **1,073** | **774** | **22,214** |

| **Use of Source Water** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 Secondary effluent to SVRP for CSIP [12] | 461 | 654 | 1,030 | 1,723 | 1,775 | 1,726 | 1,818 | 1,813 | 1,740 | 1,059 | 681 | 370 | 14,851 |
| 20 New sources available to CSIP [13] | 0 | 0 | 0 | 414 | 368 | 614 | 474 | 442 | 278 | 0 | 0 | 0 | 2,590 |
| 21 **Total Supply to CSIP** | **461** | **654** | **1,030** | **2,137** | **2,143** | **2,340** | **2,292** | **2,255** | **2,018** | **1,059** | **681** | **370** | **17,441** |
| **Net CSIP Increase** | | | | | | | | | | | | | **4,485** |
| | | | | | | | | | | | | | |
| 22 Surface waters at RTP to AWT | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 23 Secondary effluent to AWT | 367 | 331 | 367 | 0 | 0 | 0 | 0 | 0 | 0 | 367 | 355 | 367 | 2,154 |
| 24 AWW and Salinas urban runoff to AWT | 0 | 0 | 0 | 355 | 367 | 355 | 367 | 367 | 355 | 0 | 0 | 0 | 2,166 |
| 25 Secondary effluent to AWT for MCWD RUWAP | 38 | 35 | 38 | 73 | 75 | 73 | 75 | 75 | 73 | 38 | 37 | 38 | 666 |
| 26 **Feedwater to AWT** | **405** | **366** | **405** | **428** | **442** | **428** | **442** | **442** | **428** | **405** | **392** | **405** | **4,986** |
| **Subtotal- all waters (including secondary effluent)** | **866** | **1,020** | **1,435** | **2,565** | **2,585** | **2,768** | **2,734** | **2,697** | **2,446** | **1,464** | **1,073** | **774** | **22,427** |

| | Jan | Feb | Mar | Apr | May | June | July | Aug | Sep | Oct | Nov | Dec | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 27 FIVE YEAR AVERAGE WASTE WATER EFFLUENT TO OCEAN OUTFALL (2009-2013)[15] | 1,785 | 1,219 | 1,141 | 420 | 88 | 49 | 27 | 34 | 114 | 859 | 1,314 | 1,759 | 8,809 |
| 28 WASTE WATER EFFLUENT TO OCEAN OUTFALL WITH PROPOSED DIVERSIONS TO CSIP/AWT/RUWAP [16] | 932 | 658 | 432 | 0 | (0) | 0 | (0) | (0) | 0 | 380 | 689 | 1,002 | 4,093 |
| 29 NEW SUPPLIES IN EXCESS OF AWT DEMANDS FOR GWR [17] | (367) | (331) | (367) | 414 | 368 | 614 | 474 | 442 | 278 | (367) | (355) | (367) | 436 |
| 30 AWT BRINE TO OCEAN OUTFALL | 77 | 69 | 77 | 81 | 84 | 81 | 84 | 84 | 81 | 77 | 74 | 77 | 947 |

**Notes**

1 Presumes all facilities associated with diversions are completed.

2 Table 2-1, p. 5, Schaaf & Wheeler Consulting Engineers. Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

3 Volume of effluent from City of Salinas agricultural wash water to be directed into ponds 1,2,3, and the aeration pond for storage.

4 Average monthly flow from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

5 Rainfall from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015. Pond area presumed to be Ponds 1,2, 3 + Aeration lagoon. No rainfall/evaporation or storage assigned to drying beds.

6 Table 3, Todd Groundwater, Draft Memorandum, Pure Water Monterey Groundwater Replenishment Project: Impacts of Changes in Percolation at the Salinas Industrial Wastewater Treatment Facility on Groundwater and the Salinas River, February 11, 2015.

7 Table 4, Ibid.

8 Ponds 1,2,3 and aeration basin hold up to 1,065 acre-feet (one foot of freeboard). If flow to ponds would exceed the maximum volume, it is presumed that excess flow can be diverted to the RIBs or drying beds or flow can be diverted to the RTP. Presume that pond storage goes to zero sometime during the year (shown here starting in July).

9 Table 4, Ibid. Also confirmed in MPWMD Industrial Ponds Percolation and Evaporation Technical Memorandum 2015-01, July 2015.

10 Max. diversion = 6 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Note that flow figures shown here are a combination of flow estimates in the S&W analysis made for the 2 cfs instream requirement Jan-May and 1 cfs instream requirement for June-Dec.

11 Max. diversion = 3 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Figures shown here are the difference between the combined Davis Road/TS diversion with Seasonal Bypass. This presumes the preference is to remove flow at Davis Road first, rather than bypass flow to Tembaldero Slough.

12 Includes secondary effluent wastewater currently used to produce recycled water at the Salinas Valley Reclamation Project (SVRP), and additional amounts which may be used during periods of low demand (<5 mgd) with the proposed improvements to the SVRP.

13 New source waters not used by AWT will be available to SVRP for CSIP.

14 A drought reserve of up to 1,000 AF would be created over five years by producing 200 AFY additional product water from the GWR Project AWTF during winter months and storing the water in the Seaside Basin. This would establish a "water bank" that the CSIP can draw on in droughts. The drought reserve would allow flow at the RTP for the GWR Project to be temporarily reduced during critically dry periods, thus freeing up more of the newly available inflows to the RTP to be sent to the CSIP area. Extraction from the Seaside Basin would continue at the average rate to supply the Monterey Peninsula.

15 Average monthly RTP discharge, 2009-2013 (reported by MRWPCA).

16 Secondary treated municpal effluent not used for SVRP or the AWT.

17 Excess is calculated as Line 13 minus Lines 15 & 16

18 RUWAP supply comes from existing RTP inflows, demands reflect existing urban irrigation customers along trunk main.

**Table 7C: Source Water Analysis for the Pure Water Monterey Groundwater Replenishment Project**

**Diversion Pattern for a Drought Year, Starting with a Full Drought Reserve, Initial RUWAP Demand as AWT Product**

| # | All facilities built [1] - average water year conditions - all flows in acre-feet | | | | | | | | | | | | | 7/28/2015 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **SOURCES** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
| | **Minimum Year RTP Inflows (2013)** | ***1,725*** | ***1,494*** | ***1,645*** | ***1,657*** | ***1,722*** | ***1,675*** | ***1,748*** | ***1,773*** | ***1,715*** | ***1,690*** | ***1,634*** | ***1,612*** | **20,090** |
| | **New Source Water** | | | | | | | | | | | | | |
| | *City of Salinas* | | | | | | | | | | | | | |
| 1 | Salinas Agricultural Wash Water [2] | 156 | 158 | 201 | 307 | 311 | 391 | 435 | 444 | 367 | 410 | 329 | 223 | 3,732 |
| | *Agricultural Wash Water (AWW) to Ponds [3]* | *156* | *158* | *201* | *0* | *0* | *0* | *0* | *0* | *0* | *410* | *329* | *223* | *1,477* |
| | *AWW directly to RTP* | *0* | *0* | *0* | *307* | *311* | *391* | *435* | *444* | *367* | *0* | *0* | *0* | *2,255* |
| 2 | Salinas Urban Storm Water Runoff [4] | 17 | 14 | 11 | 5 | 1 | 0 | 0 | 0 | 1 | 3 | 8 | 16 | 76 |
| | *Urban runoff to ponds* | *17* | *14* | *11* | *0* | *0* | *0* | *0* | *0* | *0* | *3* | *8* | *16* | *69* |
| | *Urban runoff to RTP* | *0* | *0* | *0* | *5* | *1* | *0* | *0* | *0* | *1* | *0* | *0* | *0* | *7* |
| 3 | Rainfall (on SIWTF, 121 acre pond area) [5] | 11 | 6 | 4 | 3 | 0 | 0 | 0 | 0 | 1 | 2 | 5 | 4 | 36 |
| 4 | Evaporation (from SIWTF, 121 acre pond area) [6] | (12) | (16) | (29) | (41) | (46) | (52) | | | | (28) | (15) | (12) | (251) |
| 5 | Percolation [7] | (143) | (129) | (143) | (138) | (143) | (138) | | | | (143) | (138) | (143) | (1,257) |
| 6 | SIWTF pond storage balance [8] | 550 | 584 | 628 | 452 | 163 | (27) | 0 | 0 | 0 | 245 | 433 | 521 | |
| 7 | Recovery of flow from SIWTF storage ponds to RTP | 0 | 0 | 0 | 0 | 100 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| 8 | AWW and Salinas Runoff to RTP | 0 | 0 | 0 | 312 | 412 | 391 | 435 | 444 | 368 | 0 | 0 | 0 | 2,362 |
| | *Water Rights Applications to SWRCB* | | | | | | | | | | | | | |
| 9 | Blanco Drain [9] | 0 | 0 | 246 | 252 | 225 | 274 | 277 | 244 | 184 | 168 | 133 | 0 | 2,003 |
| 10 | Reclamation Ditch at Davis Road [10] | 0 | 0 | 165 | 162 | 97 | 132 | 129 | 121 | 80 | 87 | 98 | 0 | 1,071 |
| 11 | Tembladero Slough at Castroville [11] | 0 | 0 | 142 | 154 | 145 | 67 | 66 | 62 | 41 | 45 | 50 | 0 | 772 |
| 12 | City of Monterey - Diversion at Lake El Estero | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | **Subtotal New Waters Available** | **0** | **0** | **553** | **880** | **879** | **864** | **907** | **871** | **673** | **300** | **281** | **0** | **6,208** |
| | **Total Projected Water Supply** | **1,725** | **1,494** | **2,198** | **2,537** | **2,601** | **2,539** | **2,655** | **2,644** | **2,388** | **1,990** | **1,915** | **1,612** | **26,297** |
| | **DEMANDS** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
| | Max Year SVRP deliveries to CSIP (2013) | *0* | *692* | *1,558* | *1,669* | *1,799* | *1,675* | *1,786* | *1,803* | *1,725* | *1,548* | *1,127* | *88* | 15,469 |
| 14 | PEAK CSIP AREA WELL WATER USE (10/2013-09/2014) | *509* | *9* | *221* | *242* | *1,197* | *1,261* | *1,303* | *1,025* | *453* | *165* | *35* | *730* | 7,150 |
| | **TOTAL CSIP Demand** | **509** | **701** | **1,779** | **1,911** | **2,996** | **2,936** | **3,089** | **2,828** | **2,178** | **1,713** | **1,162** | **818** | **22,619** |
| 15 | FEEDWATER AMOUNT AT RTP TO GWR PROJECT AWTF | 367 | 331 | 367 | **133** | **137** | **133** | **137** | **137** | **133** | 367 | 355 | 367 | 2,963 |
| 16 | FEEDWATER TO ESTABLISH CSIP AREA DROUGHT RESERVE (200 AFY AWTF PRODUCT WATER) [14] | 0 | 0 | 0 | | | | | | | 0 | 0 | 0 | 0 |
| 17 | FEEDWATER TO AWT FOR MCWD RUWAP[18] | 38 | 35 | 38 | 73 | 75 | 73 | 75 | 75 | 73 | 38 | 37 | 38 | 666 |
| 18 | **TOTAL TO GWR ADVANCED WATER TREATMENT FACILITY** | **405** | **366** | **405** | **205** | **212** | **205** | **212** | **212** | **205** | **405** | **392** | **405** | **3,630** |
| | **Total Projected Water Demand** | **914** | **1,066** | **2,184** | **2,116** | **3,208** | **3,142** | **3,301** | **3,040** | **2,384** | **2,118** | **1,554** | **1,222** | **26,249** |
| | **Use of Source Water** | **Jan** | **Feb** | **Mar** | **Apr** | **May** | **June** | **July** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Total** |
| 19 | Secondary effluent to SVRP for CSIP [12] | 509 | 701 | 1,607 | 1,584 | 1,647 | 1,602 | 1,673 | 1,698 | 1,643 | 1,585 | 1,162 | 818 | 16,228 |
| 20 | New sources available to CSIP [13] | 0 | 0 | 186 | 747 | 742 | 731 | 770 | 734 | 540 | 0 | 0 | 0 | 4,451 |
| 21 | **Total Supply to CSIP** | **509** | **701** | **1,793** | **2,331** | **2,389** | **2,334** | **2,443** | **2,432** | **2,183** | **1,585** | **1,162** | **818** | **20,678** |
| | **Net CSIP Increase** | | | | | | | | | | | | | **5,209** |
| 22 | Surface waters at RTP to AWT | 0 | 0 | 367 | 0 | 0 | 0 | 0 | 0 | 0 | 300 | 281 | 0 | 948 |
| 23 | Secondary effluent to AWT | 367 | 331 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 67 | 74 | 367 | 1,206 |
| 24 | AWW and Salinas urban runoff to AWT | 0 | 0 | 0 | 133 | 137 | 133 | 137 | 137 | 133 | 0 | 0 | 0 | 809 |
| 25 | Secondary effluent to AWT for MCWD RUWAP | 38 | 35 | 38 | 73 | 75 | 73 | 75 | 75 | 73 | 38 | 37 | 38 | 666 |
| 26 | **Feedwater to AWT** | **405** | **366** | **405** | **205** | **212** | **205** | **212** | **212** | **205** | **405** | **392** | **405** | **3,630** |
| | **Subtotal- all waters (including secondary effluent)** | **914** | **1,066** | **2,198** | **2,537** | **2,601** | **2,539** | **2,655** | **2,644** | **2,388** | **1,990** | **1,554** | **1,222** | **24,308** |
| 27 | *DRY YEAR WASTEWATER EFFLUENT TO OCEAN OUTFALL (2013) [15]* | *1,725* | *802* | *87* | *0* | *0* | *0* | *0* | *0* | *0* | *142* | *507* | *1,607* | 4,870 |
| 28 | WASTE WATER EFFLUENT TO OCEAN OUTFALL WITH PROPOSED DIVERSIONS TO CSIP/AWT/RUWAP [16] | 811 | 428 | 0 | 0 | (0) | 0 | (0) | (0) | 0 | 0 | 361 | 389 | 1,990 |
| 29 | NEW SUPPLIES IN EXCESS OF AWT DEMANDS FOR GWR [17] | (367) | (331) | 186 | 747 | 742 | 731 | 770 | 734 | 540 | (67) | (74) | (367) | 3,244 |
| 30 | AWT BRINE TO OCEAN OUTFALL | 77 | 69 | 77 | 39 | 40 | 39 | 40 | 40 | 39 | 77 | 74 | 77 | 690 |

**Notes**

1 Presumes all facilities associated with diversions are completed.

2 Table 2-1, p. 5, Schaaf & Wheeler Consulting Engineers. Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

3 Volume of effluent from City of Salinas agricultural wash water to be directed into ponds 1,2,3, and the aeration pond for storage.

4 Assume dry year at 1/3 the average monthly values from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015.

5 Rainfall from Revised Draft, Groundwater Replenishment Project, Salinas River Inflow Impacts, Prepared for Denise Duffy & Associates, February 2015. Pond area presumed to be Ponds 1,2, 3 + Aeration lagoon. No rainfall/evaporation or storage assigned to drying beds.

6 Table 3, Todd Groundwater, Draft Memorandum, Pure Water Monterey Groundwater Replenishment Project: Impacts of Changes in Percolation at the Salinas Industrial Wastewater Treatment Facility on Groundwater and the Salinas River, February 11, 2015.

7 Table 4, Ibid.

8 Ponds 1,2,3 and aeration basin hold up to 1,065 acre-feet (one foot of freeboard). If flow to ponds would exceed the maximum volume, it is presumed that excess flow can be diverted to the RIBs or drying beds or flow can be diverted to the RTP. Presume that pond storage goes to zero sometime during the year (shown here starting in July).

9 Table 4, Ibid. Also confirmed in MPWMD Industrial Ponds Percolation and Evaporation Technical Memorandum 2015-01, July 2015.

10 Max. diversion = 6 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Note that flow figures shown here are a combination of flow estimates in the S&W analysis made for the 2 cfs instream requirement Jan-May and 1 cfs instream requirement for June-Dec.

11 Max. diversion = 3 cfs. See REVISED DRAFT RECLAMATION DITCH YIELD STUDY, Schaaf and Wheeler, March 2015. Figures shown here are the difference between the combined Davis Road/TS diversion with Seasonal Bypass. This presumes the preference is to remove flow at Davis Road first, rather than bypass flow to Tembaldero Slough.

12 Includes secondary effluent wastewater currently used to produce recycled water at the Salinas Valley Reclamation Project (SVRP), and additional amounts which may be used during periods of low demand (<5 mgd) with the proposed improvements to the SVRP.

13 New source waters not used by AWT will be available to SVRP for CSIP.

14 A drought reserve of up to 1,000 AF would be created over five years by producing 200 AFY additional product water from the GWR Project AWTF during winter months and storing the water in the Seaside Basin. This would establish a "water bank" that the CSIP can draw on in droughts. The drought reserve would allow flow at the RTP for the GWR Project to be temporarily reduced during critically dry periods, thus freeing up more of the newly available inflows to the RTP to be sent to the CSIP area. Extraction from the Seaside Basin would continue at the average rate to supply the Monterey Peninsula.

15 Monthly RTP discharge during critically dry year (2013), reported by MRWPCA

16 Secondary treated municpal effluent not used for SVRP or the AWT.

17 Excess is calculated as Line 13 minus Lines 15 & 16

18 RUWAP supply comes from existing RTP inflows, demands reflect existing urban irrigation customers along trunk main.

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# Appendix CC new

# Fish Passage Analysis, Reclamation Ditch at San Jon Road and Galiban Creek at Laurel Rd

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3 Quail Run Circle, Suite 101
Salinas, CA 93907-2348
(831) 833-4848
FAX (831) 833-2424
swmb@swsv.com

# TECHNICAL MEMORANDUM

**TO: Bob Holden, MRWPCA** **DATE: September 16, 2015**

**FROM: Andrew A. Sterbenz, PE; Andrew Racz, EIT** **JOB #: MRWP.01.14:004**

**SUBJECT: Fish Passage Analysis: Reclamation Ditch at San Jon Rd. and Gabilan Creek at Laurel Rd.**

---

**INTRODUCTION:**

This technical memo assesses hydraulic conditions through structures that may pose as obstacles to upstream and downstream anadramous fish migration in the Reclamation Dich/Gabilan Creek watershed. Two sites are analyzed: the Reclamation Ditch at the San Jon Road bridge/weir, and Gabilan Creek at the Laurel Road culvert. The purpose of the analysis is to determine (1) whether these structures pose obstacles to fish passage, and if so, under what range of flows, (2) whether withdrawals of up to 6 cfs from the Reclamation Ditch for the Pure Water Monterey Groundwater Replenishment Project will reduce the likelihood of fish passage between Monterey Bay and upstream habitat, and (3) if this is found to be the case, the range of flows at which withdrawals should be curtailed in order to maintain fish passage.

**SITE 1: RECLAMATION DITCH AT SAN JON ROAD**

The structure at San Jon Rd. is a single-span concrete bridge over a trapezoidal concrete-lined channel. The low chord of the bridge sits approximately 10’ above the channel bed, and channel’s cross section tapers from 40’ below the bridge deck to 12’ at its base. Flow through the culvert is further constricted by a flow gage (USGS 11152650) consisting of a rectangularly-notched concrete weir, dimenstions 8’ wide x 2’ high. There is a 0.6’ deep lip on the upstream side of the weir. On its downstream side, the weir discharges onto a concrete apron that widens from 8’ to 12’ and experiences a vertical drop of approximately 1.0’ over 20.5’ of flow distance. The apron discharges onto a riprap (12”-24” boulders) lined channel. Riprap extends approximately 24’ downstream, and the streambed elevation drops an additional 2.4’ over this distance. Downstream of the riprap, the channel bed transitions to deposited sediment, and the slope flattens significantly.

**FishXing Model:**

*FishXing v3.0* is a publicly available modeling program from the US Forest Service. The program allows the user to model flow through various stream/road crossing structures. It also allows the user to evaluate the ability of fish and other aquatic species to navigate these structures based on species-specific physiological parameters such as minimum required water depth, swimming speed and endurance. FishXing was initially used to calculate water surface profiles through the San Jon Road weir to determine what ranges of flows might allow for successful upstream passage of adult steelhead.

For adult steelhead, the following default species parameters were used:

- Length: 18"
- Prolonged Speed: 8 ft/s;
- Prolonged time to exhaustion: 10 min
- Burst Speed: 16 ft/s
- Burst time to exhaustion: 5 s
- Minimum depth: 0.5 ft
- Maximum leap speed: 16 ft/s

A simple model of flow throuh a 2' x 8' concrete channel representing the notch of the weir was created in FishXing. Results indicated that migrating steelhead could traverse the weir at flows between 45 – 150 cfs. At lower flow rates, water depth was insufficient to allow fish passage. At higher flow rates, high velocities resulted in fish exhaustion.

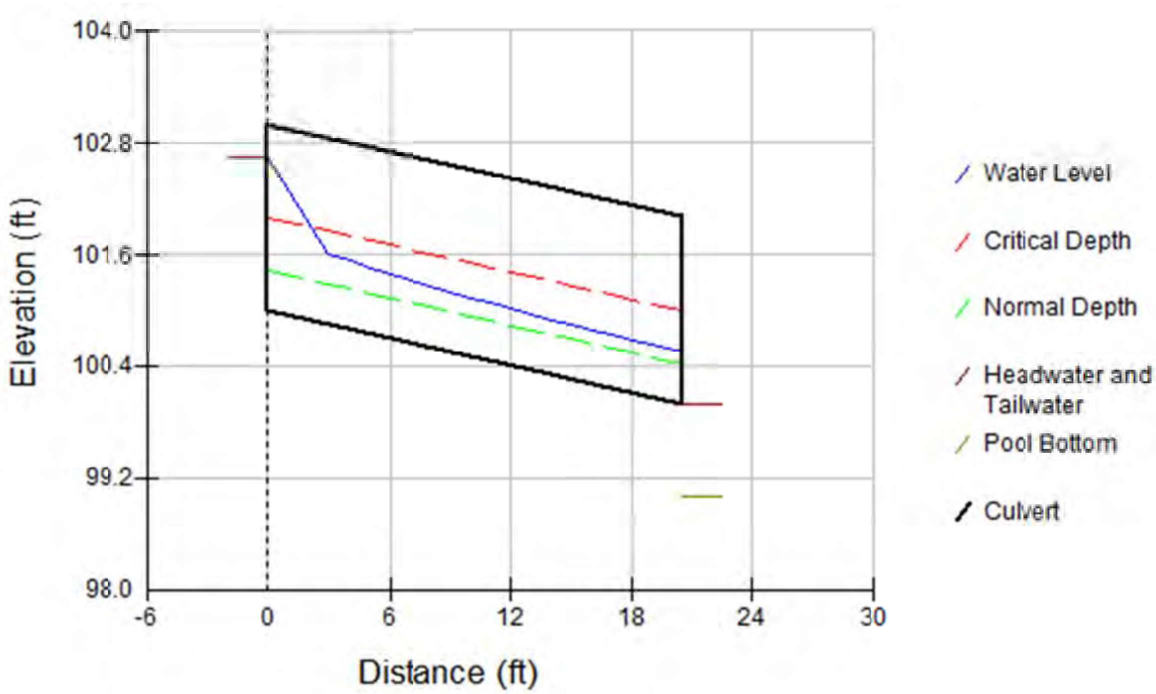


**Figure 1:** Water surface profile results for 45 cfs of flow through the rectangular weir at San Jon Road, generated by FishXing.

The FishXing model is an oversimplification of the San Jon Road weir geometry. This simple model depicts only the notch of the weir. It does not accurately depict flow behavior when backwater overtops the notch, nor does it consider how flow behavess downstream of the weir as it crosses over the concrete apron and riprap. Field observations have shown that, beginning at approximately 70 cfs, flow overtops the 2' high wall of the weir notch, and begins occupying the entire cross sectional width of the culvert (see Figure 2B). Thus, the upper bound for fish passage as calculated by FishXing (150 cfs) is not a reliable result. At lower flows, the shallowest water depths that impede upstream fish migration have been observed to occur not through the weir notch, but over the concrete apron. In short, the geometry of the San Jon Road structure is too complicated to model using FishXing. In the following section, we create a more detailed and reliable Hydrologic Engineering Centers River Analysis System (HEC-RAS) model to more precisely determine passage flows.

**HEC-RAS Model Design:**

The weir, apron and riprap were surveyed in the field, and individual cross sections representing these features' geometry and roughness were created in the model. The bridge over the weir/culvert was not modeled, as flow rates in question do not reach the height of the bridge deck's low chord. Cross sections approximately 500' upstream and downstream of the bridge were imported from the existing regional model of the Reclamation Ditch watershed. Bed slopes at these outlying cross sections were used to determine the model's boundary conditons using normal depth. Flow was modeled for 10 flow rates between 10 and 240 cfs (Table 1). For reference, the 10-year storm event at this location is >600 cfs (FEMA Flood Study).

**Model Results:**

***Weir***: At flow rates below approximately 70 cfs, all flow passes through the rectangular notch of the weir. When flows exceed this value, the weir is overtopped and flow occupies the entire channel width. This result is in line with field observations (see Figure 2B below).

***Apron***: In all cases, the concrete apron contains the point of shallowest flow. At flow rates below approximately 240 cfs, the shallowest flow is at the downstream lip of the apron. At higher flows, depth is shallowest immediately below the weir. Flow depth over the apron increases with flow rate, from a depth of about 2" at 10 cfs to >1' when flow exceeds approximately 160 cfs.

At all flow rates, flow velocity reaches its maximum at the downstream lip of the apron. Flow velocities at this location range from approximately 5 ft/s at Q=10 cfs, to >12 ft/s at Q=240 cfs. A cross-sectional profile of flow shows the fastest velocities along the centerline of the apron, where flow remains supercritical for all flow rates. Flow transitions to subcritical at the apron-riprap transition, as well as along the margins of the apron (see Figure 2 photos). As a result of this phenomenon, the apron never becomes fully sumberged by tailwater in the downstream channel, even at very high discharge rates.

***Riprap***: Flow transitions from supercritical to subcritical over the riprip-lined channel immediately downstream of the weir. This transition occurs closer to the apron at low flows and farther downstream at higher flows. At flow rates below approximately 150 cfs, the longitudinal water surface profile over the riprap is positive, and water cascades downstream over the riprap. At around 150 cfs, the water surface profile over the riprap is parallel to that of the tailwater. As flow rates increase to above 150 cfs, the hydraulic jump propogates downstream, and the water surface profile over the riprap tilts upstream toward the lip of the apron.

**Fish Passage Analysis:**

Typical flow values in the Reclamation Ditch are <5 cfs, with larger flows occurring during and after storm events. Because urban runoff comprises a significant portion of these larger flows, storm hydrographs on the Reclamation Ditch exhibit characteristically "flashy" behavior, with storm peaks typically only lasting from 12-48 hours. Flow depths cited by Hagar (Technical Memo, 2/28/15) for the passage of adult and juvenile salmonids (0.6' and 0.4' respectively) occur at corresponding discharges of approximately 75 and 40 cfs (Figures 3, 4, 6). For adult upstream migration, 75 cfs of flow corresponds to a flow velocity of 9 ft/s (Figure 5). Although this flow is too rapid for sustained upstream propulsion, high enough speeds can be achieved for short bursts (up to 5 seconds to clear the length of the approximately 40-foot obstacle. For the purposes of this study, we will assume that velocity does not pose a barrier to fish passage, and we will rely on minimum flows. In order to divert up to 6 cfs of flow while still maintaining the required 75 and 40 cfs instream, flow diversions could occur when flows are below 75 cfs or in excess of 81 cfs (adult migration season), and below 40 cfs or in excess of 46 cfs (juvenille migration).


(A)


(B)

**Figure 2:** Field images of flow through the San Jon Road weir at flow rates of (A) 30 cfs and (B) 65 cfs.

| Flow rate (cfs) | HEC-RAS ID | Minimum flow depth (ft) | Maximum flow velocity (ft/s) |
|---|---|---|---|
| 10 | PF 1 | 0.17 | 4.8 |
| 20 | PF 2 | 0.27 | 6.0 |
| 30 | PF 3 | 0.35 | 6.8 |
| 50 | PF 4 | 0.48 | 8.0 |
| 70 | PF 5 | 0.58 | 8.8 |
| 100 | PF 6 | 0.72 | 9.9 |
| 130 | PF 7 | 0.85 | 10.7 |
| 160 | PF 8 | 0.97 | 11.2 |
| 200 | PF 9 | 1.12 | 11.7 |
| 240 | PF 10 | 1.22 | 12.1 |

**Table 1:** Minimum depths of flow and maximum flow velocities for modeled flow rates in the Reclamation Ditch at San Jon Road.

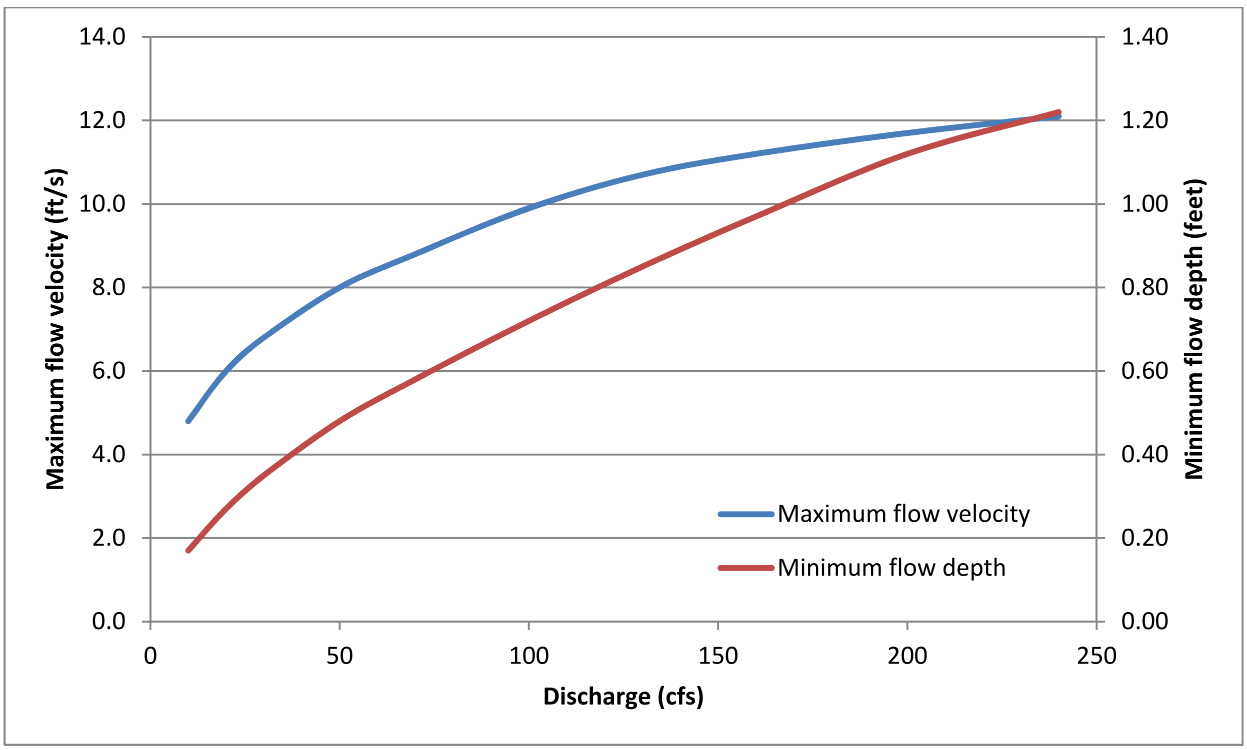


**Figure 3:** Modeled rating curves for minimum flow depth and maximum flow velocitiy in the Reclamation Ditch at San Jon Road.

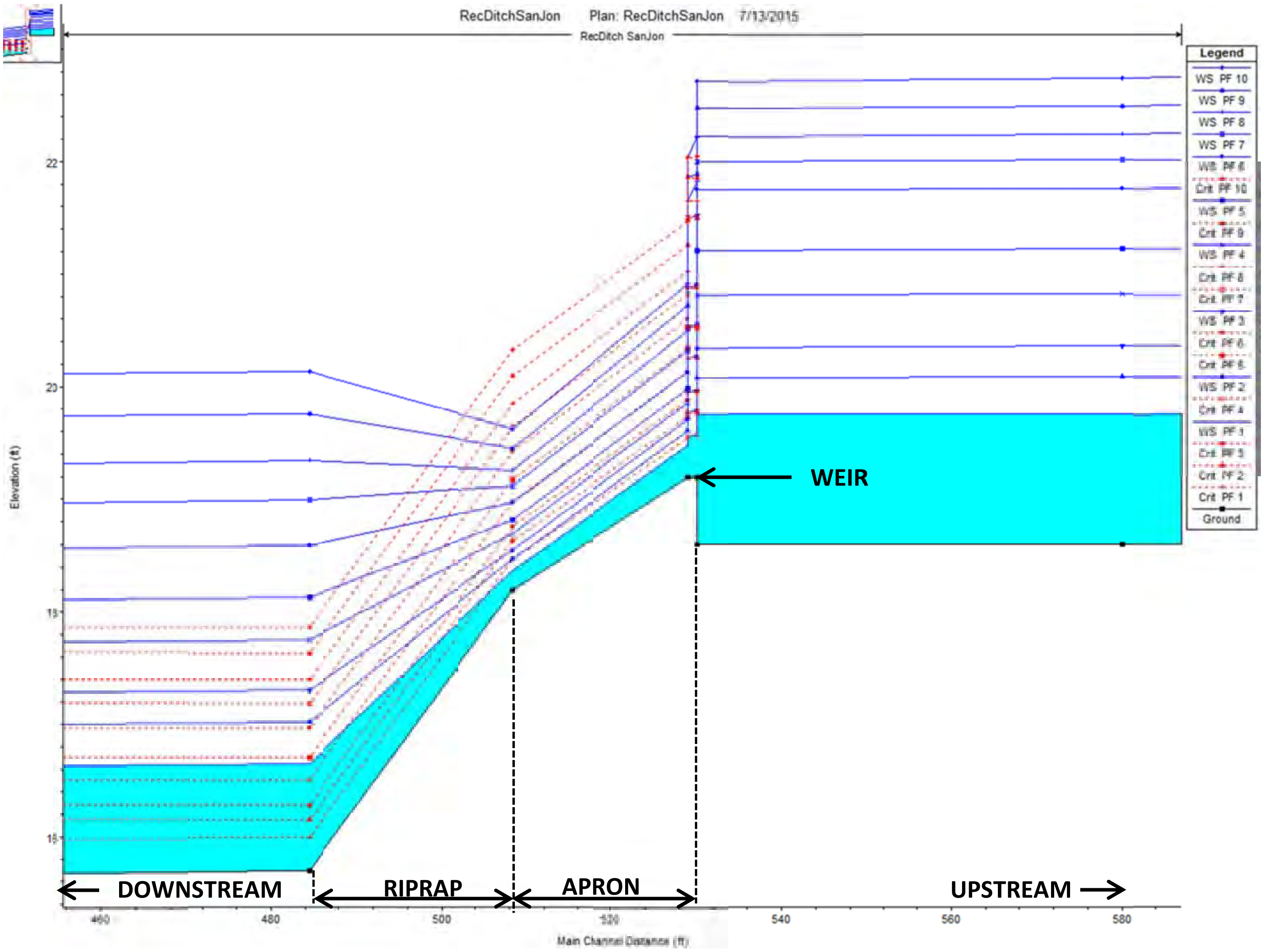


**Figure 4:** Longitudinal water surface and energy profiles for ten modeled flow rates, 10 cfs – 240 cfs. See Table 1 for corresponding profile ID flow rates.

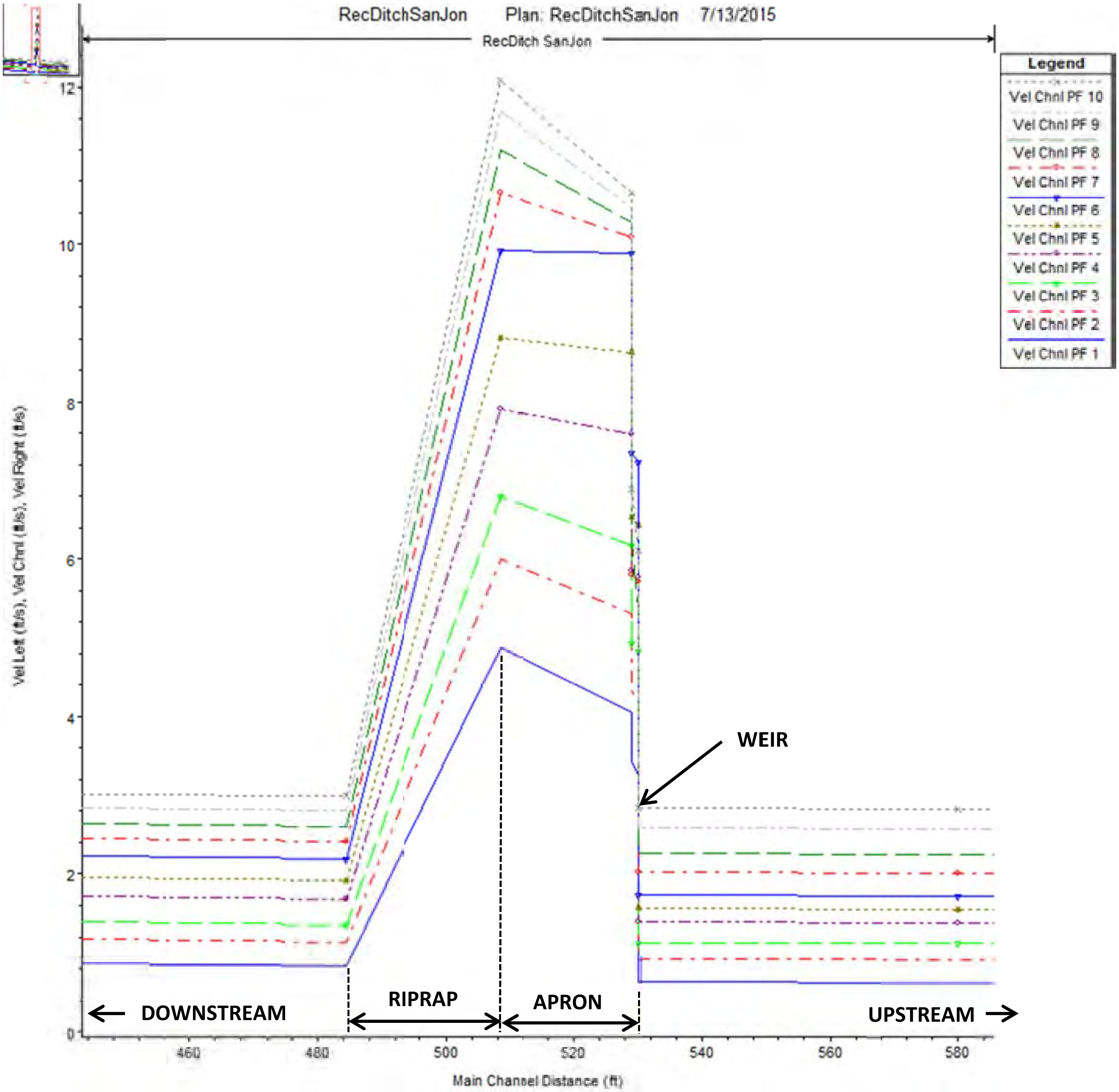


**Figure 5:** HEC-RAS model output for channel velocity through weir structure. See Table 1 for corresponding profile ID flow rates.

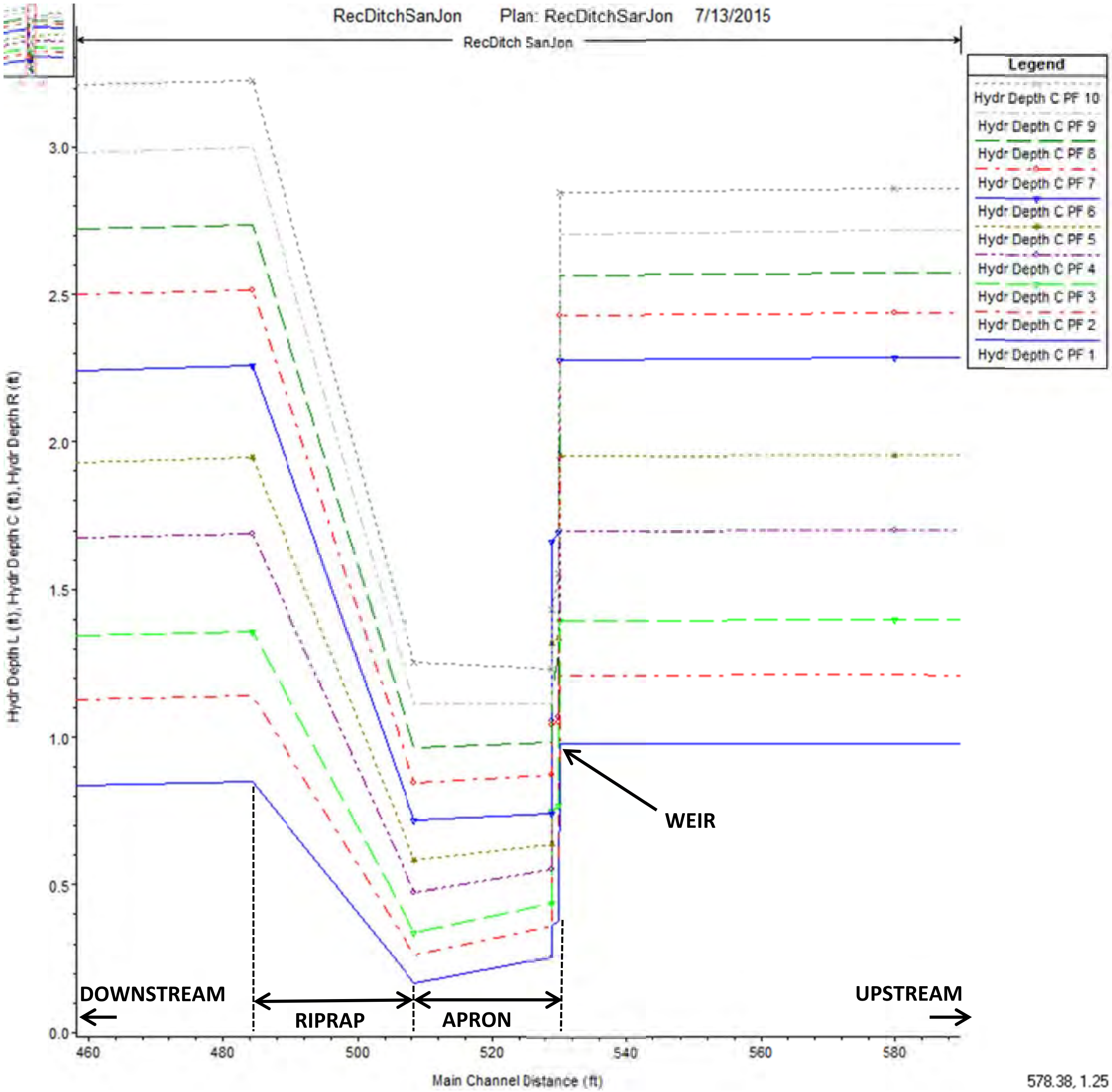


**Figure 6:** HEC-RAS model output for channel flow depth through weir structure. See Table 1 for corresponding profile ID flow rates.

**PART II: GABILAN CREEK AT LAUREL ROAD**

The only identified habitat in the Reclamation Ditch watershed suitable for steelhead spawning is the upper, undeveloped reach of Gabilan Creek in the hills north of Salinas. Gabilan Creek is a seasonal stream, flowing only after rain events and during wet winters and springs. Upon entering the city, Gabilan Creek passes through a series of bridges and culverts and is surrounded by mostly suburban and commercial development and some greenspace. This reach of the creek receives urban stormwater runoff from the surrounding area. Gabilan Creek's confluence with the Reclamation Ditch occurs in what is the bed of normally-dry Carr Lake in central Salinas, just downstream of a set of twin culverts beneath Laurel Road. Between Laurel Road and San Jon Road, all other road crossings are either bridges or low-slope box culverts that do not pose obstacles to fish passage. As a logical following to the San Jon Road weir analysis, we apply similar methods to examine flow requirements for fish passage through the Laurel Road culverts, the next possible upstream obstruction.

The structure at Laurel Rd. consists of two elliptical corrugated steel culverts, dimensions 7.5' x 10'. The culverts run a length of approximately 100' beneath Laurel Road, dropping 0.45' over this distance (average slope of 0.45%). The culverts discharge at-grade to a field of loosely spaced 12-24" riprap boulders that line the channel bed to approximately 24' downstream of the culvert outlet. The channel bed drops an additonal 2.4' over this distance. Downstream of the riprap, the channel bed transitions to coarse sand and the slope flattens significantly as it approaches the Carr Lake bed.

**Figure 7:** Image of the Laurel Road culverts, downstream end, on September 4, 2014.

**FishXing Model**:

Preliminary analysis using FishXing indicated upstream fish passage through the culverts might be possible between flows of 18 – 500 cfs. As was the case at the San Jon Road site, FishXing calculates flows through the culverts, but does not model the culverts and riprap/channel as a single system, and is thus of limited use. This is particularly true at this crossing, as maximum flow velocities and minimum flow depths occur not within the culverts, but over the riprap.

**HEC-RAS Model Design:**

The culverts and riprap-lined channel were surveyed in the field, and individual cross sections representing these features' geometry and roughness were created in the model. Cross sections approximately 2000' upstream and downstream of the bridge were modeled based on elevation and survey data from the 2009 FEMA Flood Insurance Study of Monterey County. Bed slopes at these outlying cross sections were used to determine the model's boundary conditons using normal depth. Flow was modeled for 16 flow rates between 10 and 1000 cfs (Table 2). For reference, the 10-year storm event at this location is 600 cfs (FEMA Flood Study).

**Model Results:**

***Culverts***: The twin culverts below Laurel Road have the capacity to accommodate flows in excess of 800 cfs before backwater fully submerges the culvert entrance. At all flow rates modeled, flow through the culverts remains subcritical, only transitioning to supercritical at the culvert outlet.

***Riprap***: When flow exits the culverts and begins flowing across the riprap, flow becomes supercritical, increasing in velocity and decreasing in depth. For all flow rates modeled, the maximum flow velocity and minimum flow depth is reached at the downstream limit of the riprap-lined channel, approximately 24' downstream of the culvert outlet. Flow depth over the riprap increases with flow rate, from a minimum depth of about 1" at 10 cfs to >2' when flow exceeds approximately 800 cfs. Flow velocities at this location range from approximately 5 ft/s at Q=10 cfs, to 17 ft/s at Q=1000 cfs.

**Fish Passage Analysis:**

Flow depths cited for the passage of adult and juvenile salmonids (0.6' and 0.4' respectively) occur at corresponding discharges of approximately 180 and 110 cfs (Figures 8, 9, 11). For adult upstream migration, 180 cfs of flow corresponds to a flow velocity of 11.5 ft/s (Figure 10). This value is too likely too rapid for sustained swimming, but may be acheivable for short bursts through the riprap field. FishXing indicated that should a fish succeed in entering the culvert, it could continue upstream without succombing to exhaustion so long as flows remained below approximately 500 cfs. For the purposes of this study, we will assume that velocity is not prohibitive to upstream fish passage.

During an approximately seven-year period from 2007 – 2014, the USGS maintained an operable gage (USGS 11152600) on Gabilan Creek at Old Stage Road, approximately 3.5 miles north of the Laurel Road crossing (see Figure 12). Flows at that location are sporadic, and were only recorded to exceed 180 cfs on one occasion in the record. Gabilan Creek watershed comprises approximately 40% of the Reclamation Ditch watershed upstream of San Jon Road. Out migration of smolts riding on storm flows should therefore not be hindered by a 6 cfs diversion at Davis Road, because a storm producinging 110 cfs at Laurel Drive would exceed 200 cfs at San Jon Road. Upstream migration of adults is more greatly restricted by conditions in Gabilan Creek than by conditions in the Reclamation Ditch. Fish passing San Jon Road and the Davis Road diversion point may still be stranded in Carr Lake awaiting sufficient flows to ascend Gabilan Creek. This is the existing condition in the system, and should not be affected by diversions so long as passage at the San Jon Road gage is accomodated.

| Flow rate (cfs) | HEC-RAS ID | Minimum flow depth (ft) | Maximum flow velocity (ft/s) |
|---|---|---|---|
| 10 | PF 1 | 0.09 | 4.7 |
| 20 | PF 2 | 0.14 | 6.2 |
| 30 | PF 3 | 0.18 | 7.2 |
| 50 | PF 4 | 0.25 | 8.5 |
| 70 | PF 5 | 0.32 | 9.4 |
| 100 | PF 6 | 0.41 | 10.3 |
| 130 | PF 7 | 0.50 | 11.1 |
| 160 | PF 8 | 0.58 | 11.6 |
| 200 | PF 9 | 0.69 | 12.2 |
| 240 | PF 10 | 0.79 | 12.8 |
| 300 | PF 11 | 0.93 | 13.4 |
| 400 | PF 12 | 1.16 | 14.2 |
| 500 | PF 13 | 1.37 | 14.9 |
| 600 | PF 14 | 1.58 | 15.6 |
| 800 | PF 15 | 1.95 | 16.4 |
| 1000 | PF 16 | 2.30 | 17.1 |

**Table 2:** Minimum depths of flow and maximum flow velocities for modeled flow rates for Gabilan Creek at Laurel Road crossing.

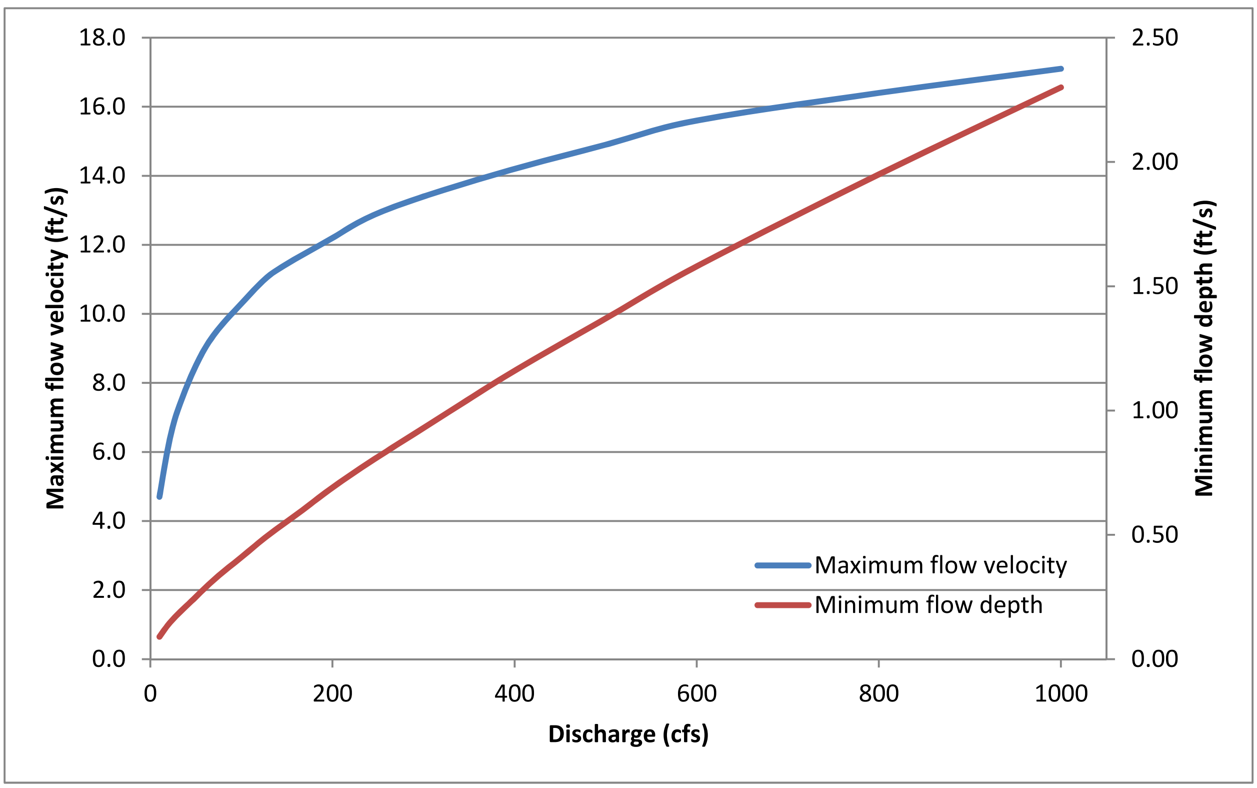


**Figure 8:** Rating curves for minimum flow depth and maximum flow velocitiy at Laurel Road crossing.

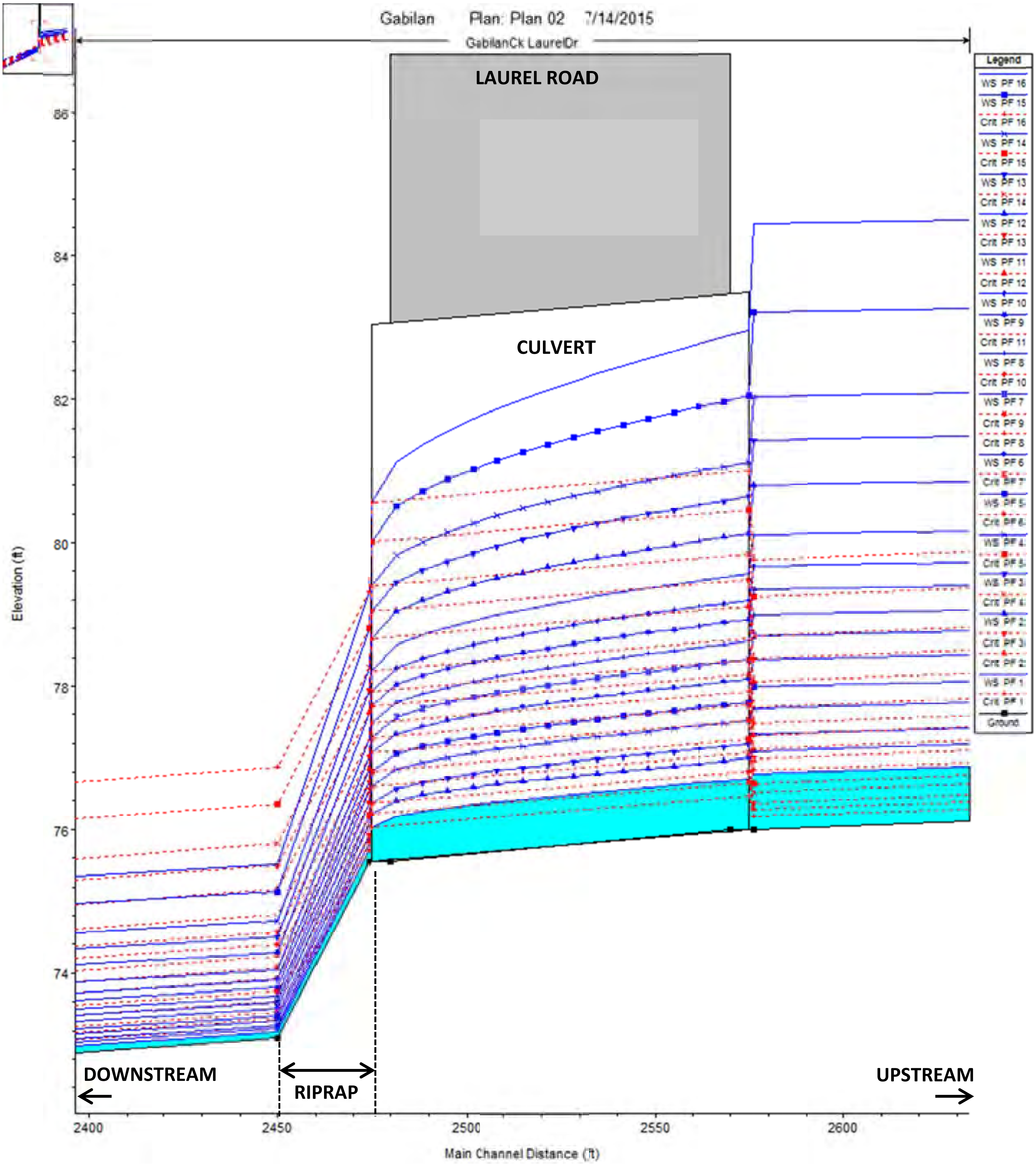


**Figure 9:** Longitudinal water surface and energy profiles for sixteen modeled flow rates, 10 cfs – 1000 cfs. See Table 2 for corresponding profile ID flow rates.

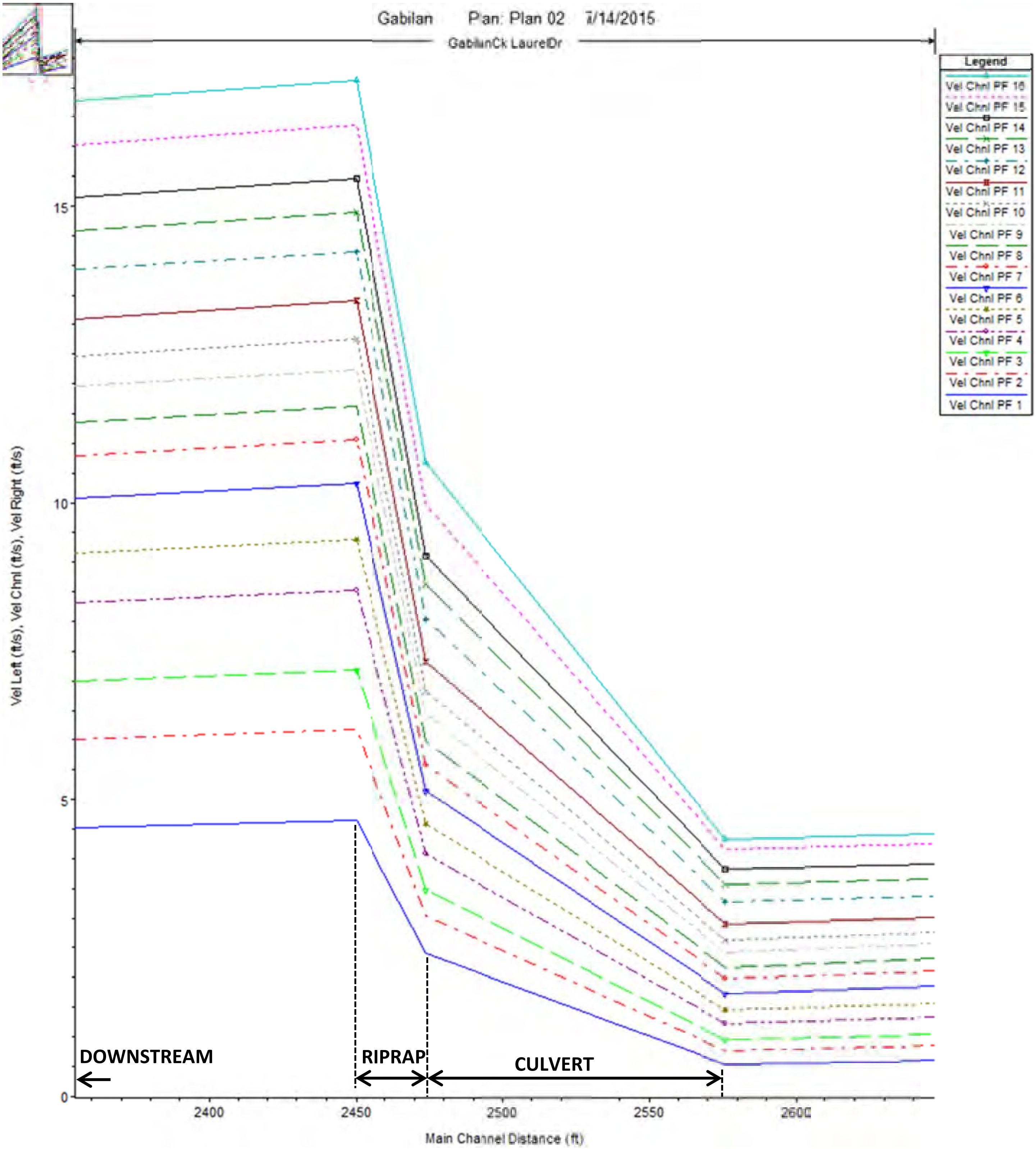


**Figure 10:** HEC-RAS model output for channel flow velocity through Laurel Road culverts. See Table 2 for corresponding profile ID flow rates.

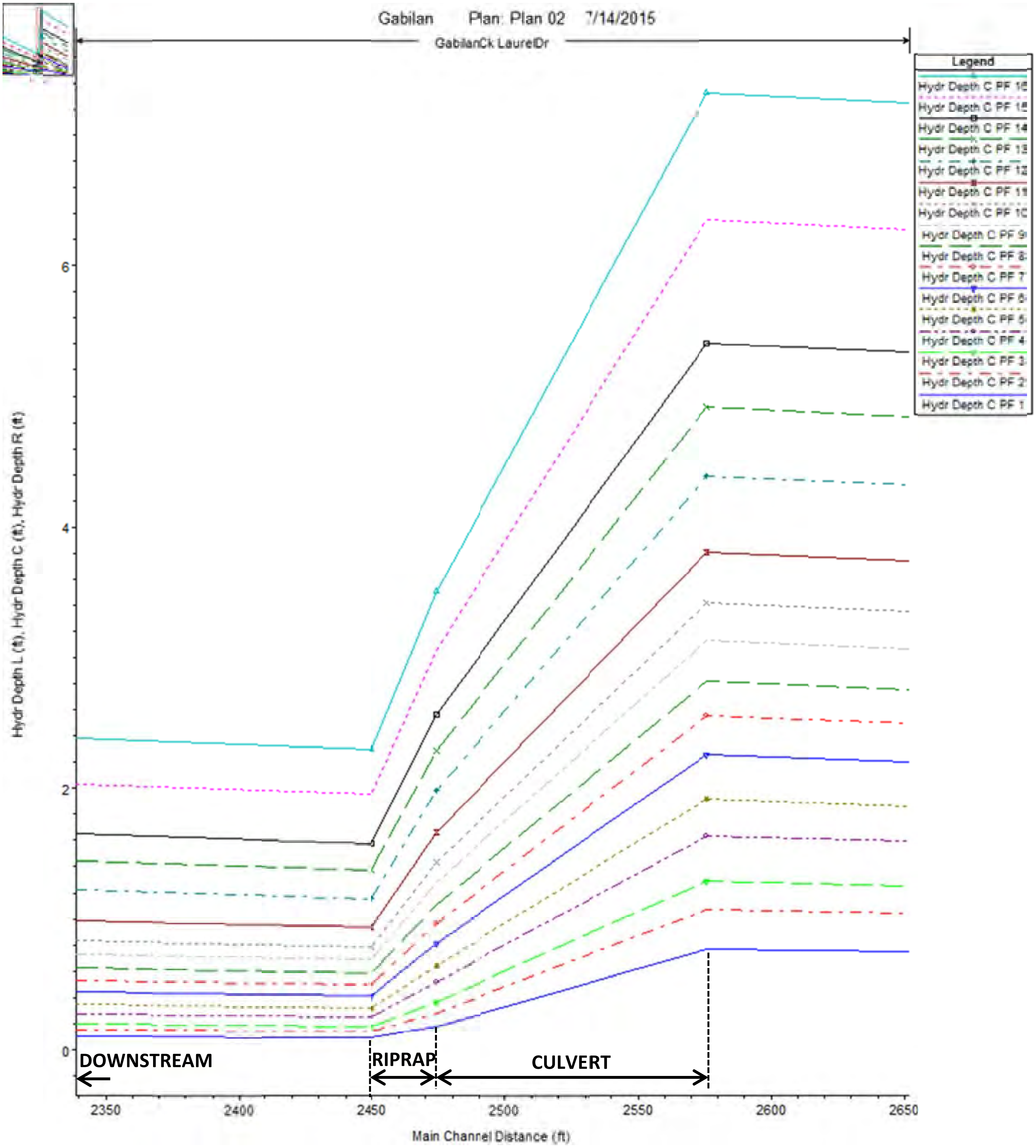


**Figure 11:** HEC-RAS model output for channel flow depth through Laurel Road culverts. See Table 2 for corresponding profile ID flow rates.

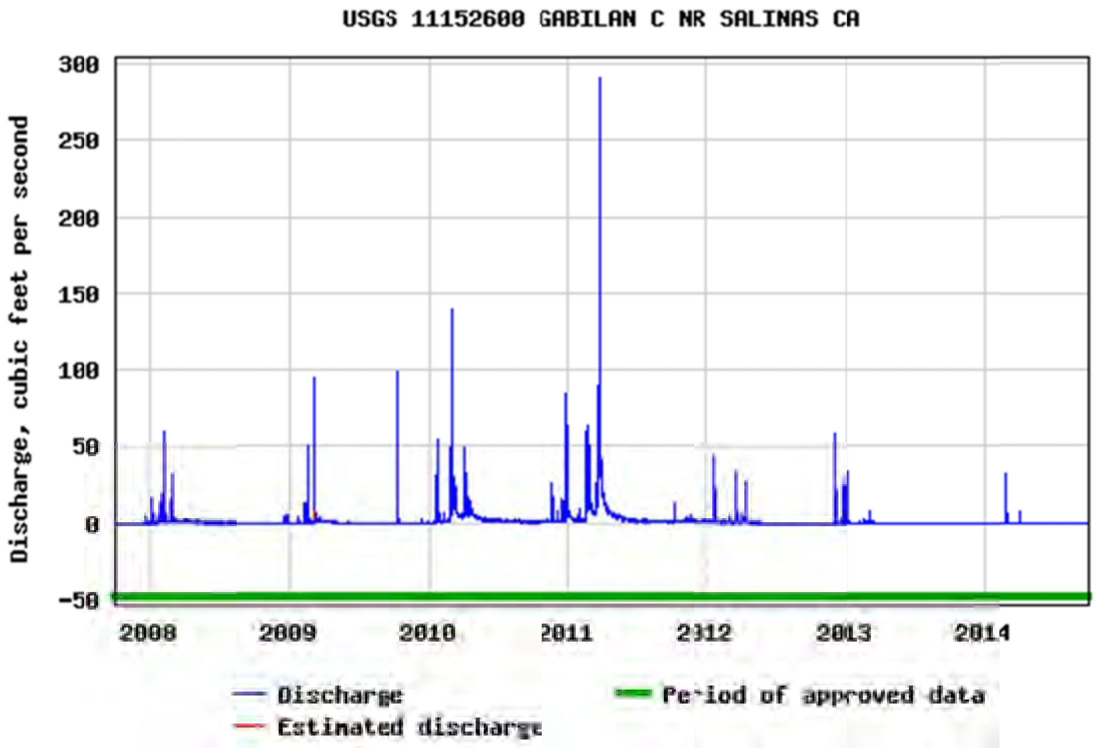


**Figure 12:** USGS stream gage record for Gabilan Creek, 10/1/2007 – 9/29/2014.

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# Appendix DD new

# Consideration of Water Right Application 32263 in the Pure Water Monterey Project EIR

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Schaaf & Wheeler
CONSULTING CIVIL ENGINEERS

3 Quail Run Circle, Suite 101
Salinas, CA 93907-2348
831-883-4848
FAX 831-758-6328
asterbenz@swsv.com

# MEMORANDUM

| | | | |
|---|---|---|---|
| TO: | Bob Holden, MRWPCA | DATE: | August 10, 2015<br>Updated Sept. 23, 2015 |
| CC: | Alison Imamura, Denise Duffy & Assoc. | | |
| FROM: | Andrew Sterbenz, PE | JOB #: | MRWP.01.14 |
| SUBJECT: | Consideration of Water Right Application 32263 in the Pure Water Monterey Project EIR | | |

The Monterey County Water Resources Agency (MCWRA) submitted Water Rights Application No. 32263 on April 9, 2014 to the State Water Resources Control Board (SWRCB), for a diversion of up to 25,000 acre-feet per year (AFY) from the Reclamation Ditch/Tembladero Slough (RD/TS) and the Blanco Drain (combined total). On July 29, 2015, the MCWRA submitted Applications 32263A through 32263E, separating the request by diversion location and use. The purpose of this memorandum is to relate applications 32263A through 32263E to the Pure Water Monterey Project, identify discrepancies and discuss whether the revised applications need to be discussed in the final EIR.

The separate applications are listed in Table 1, below. Applications A, B and C are for the three surface water diversions for the Pure Water Monterey (PWM) Project. The PWM values are included in the table for comparison. The water right application values are the maximum annual diversions, while the PWM values are the average annual diversions, so the values for A, B and C align correctly with the values in the PWM DEIR. These applications refer to the yield studies included in the PWM DEIR as the basis for the water availability. Therefore, there is no inconsistency between applications A, B and C and the PWM DEIR.

**Table 1, Applications 32263A-E and PWM GWR Use**

| Application | Diversion Point | Amount (AFY)1 | Maximum Rate (cfs) | PWM (AFY)2 | PWM Max Rate (cfs) |
|---|---|---|---|---|---|
| 32263A | Blanco Drain | 3,000 | 6 | 2,620 | 6 |
| 32263B | RD at Davis Rd | 2,000 | 6 | 1,522 | 6 |
| 32263C | TS at Castroville | 1,500 | 3 | 1,135 | 3 |
| 32263D | Multiple3 | 9,800 | 30 | NA | |
| 32263E | Multiple3 | 8,700 | 55 | NA | |
| Total | | 25,000 | | 5,277 | |

1. Water Right application value is maximum annual diversion
2. DEIR value is average annual diversion
3. Includes all three diversion points from 32263A-C

Applications 32263D and E are for the remaining flows in the Reclamation Ditch/Tembladero Slough and the Blanco Drain. The estimation of total available flows in those streams was included as Attachment 3 to Application 32263D and as Attachment 1 to Application 32263E (same item, different sequential label). The estimates are shown in Table 2, below, in the column labeled MCWRA Estimate. These values reflect average year conditions. As can be seen, the average year available flow is less than the 25,000 AFY requested in the water rights applications, indicating that proposed water rights, if approved, would allow capturing all or most of the flows even during wet years. The MCWRA flow estimations contained several mathematical errors (addressed in a separate memorandum to MCWRA). The Revised Estimate column in Table 2 shows the corrected yields, using the methodology as explained in the applications. This methodology is slightly different than the methodology used by Schaaf & Wheeler in the water availability studies, so the results are similar but not equal.

**Table 2: Estimated Available Flows, Average Year Conditions**

| Source | MCWRA Estimate (AFY) | Revised Estimate (AFY) |
|---|---|---|
| Blanco Drain | 6,500 | 2,996 |
| RD/TS at Castroville | 15,937 | 10,064 |
| Total | 22,437 | 13,060 |

Making the correction above significantly reduces the estimation of flows available for water right applications 32263D and E. Additionally, not all of the existing flow in the Reclamation Ditch/Tembladero Slough system can be considered available for diversion. Several resource agencies (the Coastal Commission, the Central Coast RWQCB and NOAA NMFS) commented on the PWM DEIR that minimum flows must be maintained in the Reclamation Ditch and Tembladero Slough for steelhead migration and maintenance of wetland habitats. This does not preclude the diversion of peak storm flows when they occur, but would limit dry-season diversions under applications 32263D and E.

The PWM DEIR did not include a cumulative effects discussion of full use of water right application 32263 (25,000 AFY) because the original application did not provide any detail as to the place of use, the location and methods of diversion nor the need for storage reservoirs. It would have been purely speculative to discuss the portion of that water right application outside the PWM Project components. Item 3, Project Description, of Applications 32263D and E, both include the statement: “MCWRA has not yet defined a final project proposal but will be exploring options and conduct a feasibility study to determine the necessary course of action. A CEQA document would then be prepared for this project.” Based on those statements, there is still not enough information available to prepare a cumulative effect analysis for inclusion in the Final EIR.

# Appendix EE new

# Resumes and Qualifications from Key EIR Contributors

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Schaaf & Wheeler
CONSULTING CIVIL ENGINEERS

3 Quail Run Circle, Suite 101
Salinas, CA 93907-2348
831-883-4848
FAX 831-758-6328
asterbenz@swsv.com

# MEMORANDUM

| | | | |
|---|---|---|---|
| TO: | Bob Holden, MRWPCA | DATE: | August 10, 2015<br>Updated Sept. 23, 2015 |
| CC: | Alison Imamura, Denise Duffy & Assoc. | | |
| FROM: | Andrew Sterbenz, PE | JOB #: | MRWP.01.14 |

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| 32263D | Multiple$_3$ | 9,800 | 30 | NA | |
| 32263E | Multiple$_3$ | 8,700 | 55 | NA | |
| Total | | 25,000 | | 5,277 | |

1. Water Right application value is maximum annual diversion
2. DEIR value is average annual diversion
3. Includes all three diversion points from 32263A-C

Applications 32263D and E are for the remaining flows in the Reclamation Ditch/Tembladero Slough and the Blanco Drain. The estimation of total available flows in those streams was included as Attachment 3 to Application 32263D and as Attachment 1 to Application 32263E (same item, different sequential label). The estimates are shown in Table 2, below, in the column labeled MCWRA Estimate. These values reflect average year conditions. As can be seen, the average year available flow is less than the 25,000 AFY requested in the water rights applications, indicating that proposed water rights, if approved, would allow capturing all or most of the flows even during wet years. The MCWRA flow estimations contained several mathematical errors (addressed in a separate memorandum to MCWRA). The Revised Estimate column in Table 2 shows the corrected yields, using the methodology as explained in the applications. This methodology is slightly different than the methodology used by Schaaf & Wheeler in the water availability studies, so the results are similar but not equal.

**Table 2: Estimated Available Flows, Average Year Conditions**

| Source | MCWRA Estimate (AFY) | Revised Estimate (AFY) |
|---|---|---|
| Blanco Drain | 6,500 | 2,996 |
| RD/TS at Castroville | 15,937 | 10,064 |
| Total | 22,437 | 13,060 |

Making the correction above significantly reduces the estimation of flows available for water right applications 32263D and E. Additionally, not all of the existing flow in the Reclamation Ditch/Tembladero Slough system can be considered available for diversion. Several resource agencies (the Coastal Commission, the Central Coast RWQCB and NOAA NMFS) commented on the PWM DEIR that minimum flows must be maintained in the Reclamation Ditch and Tembladero Slough for steelhead migration and maintenance of wetland habitats. This does not preclude the diversion of peak storm flows when they occur, but would limit dry-season diversions under applications 32263D and E.

The PWM DEIR did not include a cumulative effects discussion of full use of water right application 32263 (25,000 AFY) because the original application did not provide any detail as to the place of use, the location and methods of diversion nor the need for storage reservoirs. It would have been purely speculative to discuss the portion of that water right application outside the PWM Project components. Item 3, Project Description, of Applications 32263D and E, both include the statement: “MCWRA has not yet defined a final project proposal but will be exploring options and conduct a feasibility study to determine the necessary course of action. A CEQA document would then be prepared for this project.” Based on those statements, there is still not enough information available to prepare a cumulative effect analysis for inclusion in the Final EIR.

# List of Experts by Section

## Air Quality and Greenhouse Gas:

*Illingworth & Rodkin, Inc.*

**James A Reyff**

## Biological Resources: Fisheries

*HDR Engineers, Inc.*

**William M. Snider and Adrian E. Pitts**

## Biological Resources: Terrestrial

*DD&A*

**Josh Harwayne, Erin Harwayne, Matthew Johnson**

## Cultural Resources

*Archaeological Consulting*

**Gary S. Breschini PH.D.**

## Geology, Soils, and Seismicity

*Ninyo & Moore*

**Peter Connolly, PG**

## Hydrology and Water Quality: Groundwater

*Todd Groundwater*

**Phyllis Stanin, PG, CEG, CHG, and Gus Yates, CEG, CHG**

## Hydrology/Water Quality: Surface Water

*Schaaf and Wheeler Consulting Civil Engineers*

**Daniel Schaaf, P.E., and Andrew Sterbenz, P.E.**

## Noise and Vibration

*Illingworth & Rodkin, Inc.*

**Michael S. Thill**

## Water Quality Permitting and Regulatory Compliance

*Nellor Environmental Associates*

**Margaret H. Nellor, P.E,. DBE, WBE, HUB**

## Water Resources and Water Recycling Specialist

**Bahman Sheikh, PH.D., P.E.**

## Water Treatment/Water Quality Engineer

*Trussell Technologies*

**Gordon Williams, PH.D., P.E.**

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# Air Quality and Greenhouse Gas

## James A. Reyff, Illingworth & Rodkin

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**ILLINGWORTH & RODKIN, INC.**
Acoustics • Air Quality
*1 Willowbrook Court, Suite 120*
*Petaluma, California 94954*
*Tel: 707-794-0400* *Fax: 707-794-0405*
*www.Illingworthrodkin.com* *jreyff@illingworthrodkin.com*

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# JAMES A. REYFF

Mr. Reyff is a Meteorologist with expertise in the areas of air quality and acoustics. His expertise includes meteorology, air quality emissions estimation, transportation/land use air quality studies, air quality field studies, greenhouse gas studies and environmental noise studies. He is familiar with federal, state and local air quality and noise regulations and has developed effective working relationships with many regulatory agencies.

During the past 26 years, Mr. Reyff has prepared Air Quality Technical Reports for over 20 major Caltrans highway projects and conducted over 200 air quality analyses for other land use development projects. These projects included microscale analyses, calculation of project emissions (e.g., ozone precursor pollutants, fine particulate matter, diesel particulate matter, and greenhouse gases), health risk assessments, and preparation of air quality conformity determinations. Mr. Reyff has advised decisions of federal and local air quality agencies regarding impact assessment methodologies and air quality conformity issues. He has conducted air quality evaluations for specific plans and General Plan updates and advised City and County staff on these topics.

Mr. Reyff has been responsible for a variety of meteorological and air quality field investigations in support of air permitting and compliance determinations. He has conducted air quality analyses of diesel generators in support of regulatory permitting requirements and environmental compliance issues. Mr. Reyff has designed and implemented meteorological and air quality monitoring programs throughout the Western United States including Alaska. Programs include field investigations to characterize baseline levels of air toxics in rural areas, as well as regulatory air quality and meteorological monitoring. He was the Meteorologist involved in a long-term monitoring program at the Port of Oakland that evaluated meteorological conditions and fine particulate matter concentrations in neighborhoods adjacent to the Port.

Mr. Reyff has conducted over 15 major acoustical technical studies for transportation systems. He has managed several research studies for Caltrans including a noise study that evaluated long-range diffraction and reflection of traffic noise from sound walls under different meteorological conditions. Mr. Reyff has also evaluated noise from power plants, quarries and other industrial facilities. He has also been actively involved in research regarding underwater sound effects from construction on fish and marine mammals.

## PROFESSIONAL EXPERIENCE

| | |
|---|---|
| 1995-Present | Illingworth & Rodkin, Inc. |
| Senior Consultant | Petaluma, California |
| 1989-1995 | Woodward-Clyde Consultants (URS) |
| Project Meteorologist | Oakland, California |
| 1988-1989 | Oceanroutes (Weather News) |
| Post Voyage Route Analyst | Sunnyvale, California |

## EDUCATION

| | |
|---|---|
| 1986 | San Francisco State University |
| B.S. | Major: Geoscience (Meteorology) |

## PROFESSIONAL SOCIETIES

American Meteorological Society

Institute of Noise Control Engineering

## AWARDS

FHWA Environmental Excellence Award – 2005
Caltrans Excellence in Transportation, Environment - 2005

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# Biological Resources: Fisheries

William M. Snider and Adrian E. Pitts, HDR

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# William M. Snider

Senior Fisheries Biologist

**Education**
Bachelor of Science, Fishery Sciences, University of California Davis, 1972

**HDR Tenure**
8 Years

**Industry Tenure**
40-plus Years

## *Professional Experience*

Mr. Snider has 40 years experience as a fishery biologist with an emphasis in stream habitat and fisheries assessments, stream habitat restoration, and fish-habitat relationships, as well as related regulatory and permitting requirements, including ESA consultation and water right procedures. Much of his experience is in development and application of methods to assess and ameliorate the effect of water development projects, stream flow allocations, habitat restoration, or related instream activities on fishery resources. His work has emphasized evaluating the life histories, population needs, and habitat requirements of federal- and state-listed anadromous and resident salmonids.

## *Project Experience*

**Monterey Regional Water Pollution Control Agency, Monterey Peninsula Groundwater Replenishment Project. -** Mr. Snider is the Consultant Team Lead for the fish impact assessment and environmental document preparation for the Monterey Peninsula Groundwater Replenishment Project. As technical lead, his responsibilities included identifying potential impact mechanisms and species to be evaluated, developing impact assessment methodologies, and evaluating operations-related impacts on aquatic species in the Salinas River.

**Carmel River Water Rights, Eastwood Project. –** Mr. Snider is the lead fishery biologist in an ongoing water rights proceeding addressing potential effects of changes in location and use of an existing water right on steelhead in the Carmel River.

**Santa Felicia Dam Fish Passage Project – United Water Conservation District**. Mr. Snider is the facilitator for a panel of experts in the fields of fishery biology and engineering that is developing and evaluating alternative fish passage and related restoration treatments for the Southern California Steelhead DPS pursuant to requirements of a NMFS biological opinion for the Santa Felicia FERC relicensing on the Santa Clara River, Ventura County. Mr. Snider brings over 35 years of experience concerning salmonid stream habitat needs, including evaluation of habitat needs in context of restoration options specific to local and population constraints and needs.

**US Forest Service, Steelhead Monitoring, Tracking and Reporting Program for Los Padres National Forest**. HDR is supporting the FS with their Steelhead Monitoring, Tracking, and Reporting Program (Program) for Los Padres NF, which is necessary to prevent irreparable harm to the species by ensuring the adverse impact to steelhead will not rise to the level of jeopardy, as defined under the federal ESA. HDR created a strategy to develop and implement a forest-wide steelhead trout population monitoring, tracking, and reporting program and to apply that strategy to define and implement the Program. Mr. Snider served as the technical lead in developing the steelhead monitoring plan.

**Merced River Hydroelectric Power Project– Merced Irrigation District**. Mr. Snider is the lead fishery biologist in an ongoing FERC Relicensing process assisting the Merced Irrigation District address a variety of fish and stream habitat issues on the Merced River. Mr. Snider is leading the effort to prepare a biological assessment pursuant to ESA Section 7 that addresses potential project effects on federal listed fish populations and designated critical habitat. He is also leading the Merced River Technical Advisory Committee that provides federal and state agencies and NGOs opportunity to discuss fishery and related management activities on the Merced River, including the Merced River Hydroelectric Project to acquire and apply information on habitat and fish populations to address protection, mitigation and restoration options for native and introduced fish species.

**Longfin Smelt Incidental Take Permit and CEQA Compliance—California Department of Water Resources**. Mr. Snider was the Project Manager and technical lead assisting DWR in obtaining an incidental take permit for longfin smelt, including preparation and processing of supporting CEQA documents, for the continued operation of the State Water Project. The project included development and application of an effects analysis to identify and evaluate SWP-associated take of longfin smelt as it relates to jeopardy of the longfin smelt populations to survive and recover.

**Lower American River Instream Flow Evaluation—California Department of Fish and Game.** Project Manager and Technical Lead of a long-term evaluation of the instream flow requirements for Chinook salmon, steelhead, and other fishes of the lower American River. Flow habitat relationships were evaluated using an IFIM approach that included collecting and processing data to compare fish habitat availability as a function of flow (PHABSIM) and evaluations to validate and calibrate these relationships by conducting a suite of studies on the relationships among the species life stage performance and habitat conditions primarily characterized by flow, temperature, channel morphology. Mr. Snider authored numerous technical reports presenting the results of these investigations that provided the foundation for the *American River Water Forum Aquatic Resources of the Lower American River: Baseline Report* (February 2001) and ultimately the draft flow management standard.

**Central Valley Chinook Salmon and Steelhead Recovery Plan—National Marine Fisheries Service.** Mr. Snider is assisting the National Marine Fisheries Service prepare a recovery plan addressing the Central Valley's three protected salmonid populations: winter-run Chinook salmon, spring-run Chinook salmon and steelhead. Preparation has involved conducting public workshops, development of a threats assessment and evaluation and identification of recovery actions to be considered for the Sacramento-San Joaquin Delta and its tributaries.

**Klamath Water Rights—Somach, Simmons and Dunn.** Mr. Snider is providing strategic assistance and technical support associated with the Klamath River Water Rights Adjudication. The cases involve: (1) the Klamath River instream flows required for anadromous salmonid passage between the Oregon-California border and Upper Klamath Lake; and (2) the upper Klamath Lake water surface elevations required for six target fish species, including Lost River sucker, shortnose sucker, Klamath largescale sucker, rainbow trout, and Coho and Chinook salmon.

**Instream Flow Program—California Department of Fish and Game.** Mr. Snider evaluated existing, and developed and assessed new, instream flow investigation procedures and conducted flow requirement investigations on streams throughout the state. He provided technical support to CDFG staff regarding instream flow evaluation methods and results. He initiated and led a coho salmon habitat needs investigation incorporating a variety of investigative tools to Coho populations situated at the two ends of their present range along the California coast. He also participated in a multi-agency team to assist Alameda County Superior Court reduce uncertainties surrounding the instream flow needs of salmon and steelhead in the lower American River. Mr. Snider was the project manager and technical lead for flow and habitat evaluations on the Carmel River (Monterey County), Brush Creek (Mendocino County), Lagunitas Creek (Marin County), Scott Creek (Santa Cruz County), Sacramento River (Keswick Dam to Red Bluff), Yuba River (lower Yuba County), lower Stanislaus River (Stanislaus County), Merced River (Merced County), Alameda Creek (Alameda

County), Truckee River and tributaries downstream of Lake Tahoe to Nevada Stateline, and all tributaries to Lake Tahoe.

**Coastal Lagoon Dynamics, and Aquatic Habitat Assessment—California Department of Transportation.** Mr. Snider is the Task Order Manager and Technical Lead for this Caltrans project. HDR is investigating the potential effects of bridge replacement on aquatic habitat in two coastal lagoons in Santa Cruz County. HDR is preparing a technical report to assist permitting and regulatory compliance requirements. The report will address the potential relationships between bridge design and lagoon dynamics as they relate to habitat requirements of species at risk within the Central California Coast.

**Lower American River Operations Group Member—California Department of Fish and Game**. Technical representative to the lower American River operation advisory group. Provided expertise involving fishery flow requirements in the lower American River to assist the Bureau of Reclamation identify real-time and short-term planning needs for instream fishery resources relative to current hydrological, reservoir storage, cold water pool, and fish population conditions.

**Lower American River Fish and Habitat Evaluations—Bureau of Reclamation and the U.S. Fish and Wildlife Service.** Project manager and technical lead of evaluations of flow fluctuation effects on anadromous and resident fishes, instream flow requirements, channel dynamics, and spawning gravel management and restoration under contract with the Bureau of Reclamation and the U.S. Fish and Wildlife Service. Authored technical reports addressing effect of flow fluctuation on rearing and spawning within the lower American River, quantity, quality, and distribution and use of salmonid spawning habitat in the lower American River.

**Lower American River EDF v EBMUD Special Master Technical Team Member—California Department of Fish and Game**. Technical representative to the fishery technical team established as a result of the Hodge Decision, the Superior Court decision addressing the fishery and other resource flow requirements in the lower American River relative to EBMUD entitlement to divert water from the Folsom Dam Complex. Mr. Snider was an expert witness for the Department of Fish and Game during the SWRCB hearing and then the EDF v EBMUD litigation in the Alameda County Superior Court. Project manager and technical lead for numerous, multi-year investigations of lower American River fishery resources, identified and overseen by the Special Master team, and under contract with the Sacramento County and EBMUD. Evaluations included Chinook salmon and steelhead spawning population and habitat evaluations, anadromous and resident rearing habitat requirements, and juvenile salmonid emigration.

**Coast-wide California Road Crossing and Fish Passage Survey and Evaluation—Caltrans.** Program Manager and Technical Lead. Prepared information to assist in development and application of protocols to assess fish passage for salmonids along California's coast.

**BDCP EIR/EIS—California Department of Water Resources.** Mr. Snider is the technical lead for analyses being conducted to identify effects of the Bay Delta Conservation Plan on fishery and aquatic resources within the San Francisco Bay Delta and its tributaries. The BDCP includes major changes in the operation of water facilities within the Delta and its tributaries, changes in water conveyance through the Delta, and extensive restoration of aquatic habitats within the rivers, bays, floodplains and other wetlands that adjoin the Delta and support unique and valuable fish and wildlife. The analyses will include development and application of various methods to address a suite of potential changes in habitat conditions on an assortment of listed fish species, including Delta and longfin smelt, Chinook salmon, steelhead, sturgeon and native minnows. Analyses will also address the influences of hydrology, hydrodynamics, and other stressors associated primarily with water development, on the ecosystems of the Delta, the estuary, and the tributary reservoirs and streams.

**Statewide Fish Passage Inventory—California Department of Transportation (Caltrans).** Mr. Snider is providing design guidance emphasizing a systematic approach to evaluation, selection, and design of the preferred fish passage solution that helps to streamline the environmental review and permitting processes. Additionally, HDR is providing technical support in the areas of hydrology, hydraulics, geomorphology, civil engineering, structural engineering, and technical writing.

**Stream Evaluation Program—California Department of Fish and Game.** Mr. Snider was the Senior Environmental Scientist and Supervisor responsible for managing the state of California's stream evaluation program to achieve its mission of developing, implementing, and applying flow and other habitat investigation methods to improve understanding of salmonid population and habitat needs.

**Environmental Staff Support—California Department of Transportation.** HDR currently holds an on-call contract to provide environmental support services to Caltrans through 2008. One of the current task orders includes support to the Caltrans Office of Biological Studies and Technical Assistance in developing policy, guidance, and documents. Mr. Snider oversees the environmental staff assigned to Caltrans.

**Environmental Documentation for Sacramento-San Joaquin Delta Assessments—U.S. Bureau of Reclamation.** Prepared environmental documents assessing the effects of the Environmental Water Account on the fisheries and aquatic ecosystem of the Sacramento-San Joaquin Delta and its tributaries. The assessments identified current conditions limiting fishery resources, including federally and state listed fish populations, including Chinook salmon, steelhead, green sturgeon, and delta smelt. Established and applied approaches to assess effects and integrated the findings into CEQA, NEPA and ESA required documents.

**Coho Programmatic Documents for Permitting Highway Maintenance Projects, California's North Coast—Caltrans.** Program Manager and Technical Lead. Developed information on effects and potential avoidance and mitigation measures regarding various effects of highway maintenance and construction on fish populations. The evaluated effects included noise and vibration, streambed alteration, water quality, and fish passage.

# Adrian E. Pitts

Northern California Fisheries Business Class Manager

**Education**
Bachelor of Science, Biology, University of California Davis, 1997

Master of Science, Conservation/Renew Nat Resrces, California State Univ Sac (Degree not complete)

**Professional Affiliations**
American Fisheries Society

**HDR Tenure**
12 Years

**Industry Tenure**
17 Years

## Professional Experience

Mr. Pitts is an aquatic scientist who specializes fisheries biology with specific emphasis on aquatic resources impact assessments. He has 15 years of experience in the areas of wetland delineation, aquatic bioassessment, terrestrial and aquatic special-status species habitat surveys, and terrestrial and fisheries impacts assessments. He has extensive knowledge of the California and federal regulatory environment, including the California Environmental Quality Act (CEQA), National Environmental Policy Act (NEPA), California and federal Endangered Species Acts (ESAs), and the Clean Water Act (CWA).

### *HDR Project Experience*

**Monterey Regional Water Pollution Control Agency, Pure Water Monterey Groundwater Replenishment Project.** Mr. Pitts is the project manager and quality control reviewer for the fish impact assessment and environmental document preparation for the Pure Water Monterey Groundwater Replenishment Project that proposes diverting surface water from several sources for groundwater replenishment. As the project manager, Mr. Pitts managed HDR's technical staff and coordinated project delivery with the client. As the quality control reviewer, Mr. Pitts supported HDR's technical lead in identifying potential impact mechanisms and species to be evaluated, developing impact assessment methodologies, and evaluating operations-related impacts on aquatic species in the Salinas River.

**Carmel River Water Rights, Eastwood-Odello Project.** Mr. Pitts is the project manager and quality control reviewer in an ongoing water rights proceeding addressing potential effects of changes in location and use of an existing water right on steelhead in the Carmel River. Mr. Pitts manages HDR's technical staff and coordinates project delivery with the client. In his technical role, Mr. Pitts supports developing impact assessment methodologies, and evaluating potential flow changes in the Carmel River.

**US Forest Service, Steelhead Monitoring, Tracking and Reporting Program for Los Padres National Forest**. HDR supported the Forest Service by leading the development of their Steelhead Monitoring, Tracking, and Reporting Program (Program) for Los Padres National Forest (LPNF), which was necessary to monitor LPNF activities and prevent irreparable harm to the species. HDR created a strategy to develop and implement a forest-wide steelhead population monitoring, tracking, and reporting program and to apply that strategy to define and implement the Program. Mr. Pitts served as the project manager for HDR and served as a senior scientist working closely with HDR's technical lead and Los Padres NF staff to develop the steelhead monitoring plan and present the proposed plan to the National Marine Fisheries Service and California Department of Fish and Wildlife

**California Department of Transportation, Statewide Fish Passage Inventory.** Mr. Pitts currently serves as a technical adviser to HDR's team that is conducting reconnaissance and detailed fish passage assessment field surveys along the highways of Santa Cruz, Marin, and San Mateo counties. Mr. Pitts also advises the HDR team on field safety protocols and procedures, data management, data analysis, and GIS activities.

**Merced River Hydroelectric Power Project– Merced Irrigation District**. Mr. Pitts serves as a senior scientist and endangered species advisor to HDR's team in an ongoing

FERC Relicensing process assisting the Merced Irrigation District address a variety of fish and stream habitat issues on the Merced River. Mr. Pitts served a lead role in preparing a biological assessment pursuant to ESA Section 7 that addresses potential project effects on federal listed fish populations and designated critical habitat. Additionally, Mr. Pitts served as a senior reviewer for development of study plans and study plan reports evaluating Merced River aquatic resources.

**USACE San Francisco District, South San Francisco Bay Shoreline Study**. Mr. Pitts served as the senior Quality Control reviewer for the the aquatic species analysis for a programmatic Environmental Impact Statement (EIS) and Biological Assessment (BA) for the San Francisco Corps of Engineers District's Shoreline Phase 1 Project. This project includes construction of new levees and berms, replacement and installation of in-stream structures, creation of new tidal salt marshes, importing and placement of dredged material, tidal wetland creation and restoration, and creation of recreation facilities in the San Francisco Bay. Fish species potentially affected by the project include state and federally listed estuarine and anadromous species including longfin smelt and the Central California Coast Distinct Population Segment of Steelhead.

**USACE Sacramento District – Folsom Water Control Manual Update**. HDR is supporting the USACE Sacramento District as they develop a new Water Control Manual for the safe and efficient operation of Folsom Dam after the construction of the Joint Federal Project auxiliary spillway. Doing so will require detailed analysis of impacts to seasonal storage variations and how those impacts affect water supply, power generation, and critical environmental factors such as temperature, sedimentation, water quality, etc. HDR's resource specialists will utilize existing hydrologic, hydraulic, water temperature, and water quality models, as well as develop, apply, and integrate, new models to evaluate the impacts of implementing the new water control manual. Mr. Pitts is serving as the fisheries technical lead. He and his team are developing new approaches to evaluating flow and water temperature-related impacts on steelhead and fall-run Chinook salmon in the lower American River.

**Yuba County Water Agency, Lower Yuba River Accord. Lower Yuba River Accord Environmental Impact Report/Environmental Impact Statement (EIR/EIS).** Mr. Pitts was part of the HDR team that provided environmental compliance services for the proposed Lower Yuba River Accord (Yuba Accord), comprised of a coalition of over 15 agricultural, environmental, and fisheries interests, including state and federal agencies. The proposed Yuba Accord is a collaborative settlement initiative, which proposes new instream flow requirements for the lower Yuba River that will significantly increase protection for the rivers fisheries resources and will improve habitat conditions for lower Yuba River Chinook salmon and steelhead. The proposed Yuba Accord also will represent the first major long-term water acquisition by the State of California for the CALFED Bay-Delta Program Environmental Water Account, and will improve water supply reliability for the major resource agencies. Mr. Pitts was responsible for and prepared the Terrestrial Resources chapter of the EIR/EIS.

**Yuba County Water Agency, River Management Team, Monitoring and Evaluation Program.** Following certification of the Yuba Accord EIR, on March 18, 2008, the State Water Resources Control Board approved a consensus-based, comprehensive program, known as the Lower Yuba River Accord (Yuba Accord). The Yuba Accord established a River Management Team (RMT), which includes representatives of YCWA, NMFS, USFWS, CDFG, PG&E, and NGOs. The RMT, through a consensus-based process, guides the expenditure of over $6 million through 2016, primarily for monitoring and evaluation of lower Yuba River fisheries and habitat. Mr. Pitts serves as HDR's project manager for the program and assists HDR's technical lead and support team. Recently, Mr. Pitts supported the development of the Monitoring and Evaluation (M&E) Program Interim Report that presented over five years of monitoring data and ultimately intends on determining whether implementation of the Yuba Accord is maintaining fish in good condition (consistent with Fish & Game Code § 5937) and achieving viable salmonid populations (VSP) (addressing NMFS recovery planning).

**California Department of Water Resources and US Bureau of Reclamation, North-of-Delta Offsite Storage (NODOS) Investigation.** Mr. Pitts served as HDR's project manager and the EIR/EIS Consultant Team Lead for the Fish and Aquatic Resources impact assessment and environmental document preparation for the North of Delta Offstream Storage (NODOS) Investigations Project conducted by DWR and the US Bureau of Reclamation. As HDR's lead author, his responsibilities included identifying potential impact mechanisms and species to be evaluated, developing impact assessment methodologies, and evaluating operations and construction-related impacts on aquatic species in the Sacramento River, Feather River, American River, and two intermittent creeks in the construction area. Building on his previous experience, Adrian's team refined and updated the tools they developed for the Bay Delta Conservation Plan EIR/EIS to further streamline the process of evaluating large amounts of empirical and modeled data, thereby saving time and money during the NODOS Investigations Project evaluation.

Mr. Pitts also participated on the multi-agency, multidisciplinary Environmental Coordination Advisory Team (ECAT) to identify resource agency concerns and act as a liaison between DWR and the California Department of Fish and Game, US Fish and Wildlife Service, and the National Marine Fisheries Service.

**California Department of Water Resources, Bay Delta Conservation Plan Environmental Studies.** Mr. Pitts served two major roles on the Environmental Impact Report/Environmental Impact Statement (EIR/EIS) consultant team. As the team lead for the Fish and Aquatic Resources impact assessment, his responsibilities included identifying species to be evaluated and issues of concern in the Sacramento-San Joaquin River Delta and its major tributaries. Additionally, Mr. Pitts led the team in researching and developing life history characterizations, developing impact assessment methodologies, and evaluating operations, construction, and restoration-related impacts on aquatic species. Adrian's team developed previously unused tools to conduct evaluations of large amounts of empirical and modeled data quickly, accurately, and cost effectively.

Prior to leading the Fish and Aquatic Resources team, Mr. Pitts led the consultant team's support of DWR's survey efforts. As the environmental survey lead, he worked closely with DWR senior staff and species experts to develop and implement a survey approach for special status birds, mammals, reptiles, amphibians, plants, and invertebrates, and to provide technical and administrative support to DWR survey teams.

**El Dorado Irrigation District, Environmental Assessment for Long-Term Warren Act Contract.** Mr. Pitts served as HDR's technical lead conducting analysis of potential water temperature and flow-related impacts on steelhead and fall-run Chinook salmon in an Environmental Assessment/FONSI for the U.S. Bureau of Reclamation to enter into a long-term (40-year) contract with the El Dorado Irrigation District (EID) to facilitate the delivery of up to 17,000 acre-feet per year non-Central Valley Project (CVP) water through Folsom Reservoir for municipal and industrial uses in the western portion of El Dorado County. The source of non-CVP water is EIDs direct diversion rights for waters of the South Fork American River at the Kyburz diversion dam, and rights for diversion to storage from Caples Lake in Alpine County, Silver Lake in Amador County, and Lake Aloha in El Dorado County, granted in Water Rights Permit 21112 by the State Water Resources Control Board (SWRCB). The water rights covered in Water Rights Permit 21112 are made available by the operation of existing facilities of Federal Energy Regulatory Commission El Dorado Hydroelectric Project No. 184 within the South Fork American River Basin.

**California Department of Water Resources and US Bureau of Reclamation, Yolo Bypass EIR/EIS.** HDR is initiating preparation of the planning and environmental documentation for NEPA/CEQA compliance for the Yolo Bypass Seasonal Floodplain Habitat Restoration and Fish Passage Improvements Project. Specific tasks include preparation of a Biological Assessment (BA), an Incidental Take Permit (ITP), and the EIR/EIS, as well as agency coordination and permitting support, as necessary. Mr. Pitts is currently serving as HDR's technical lead for fisheries and aquatic resources.

**Mammoth Community Water District, Mammoth Creek Environmental Impact Report.** Mr. Pitts was the project manager for preparation of the Mammoth Creek EIR, which addressed proposed changes in Mammoth Creek bypass flow requirements, management constraints, point of measurement, and place of use. Mr. Pitts led the HDR team to revise and update sections of a prior Draft EIR, which was issued in 2000. HDR was responsible for developing and applying an operations model for the Districts surface water diversions from Mammoth Creek.

As part of a collaborative effort led by the District, Mr. Pitts coordinated with key stakeholders including the Los Angeles Department of Water and Power, California Department of Fish and Game, California Trout, and the Town of Mammoth Lakes to ensure that their concerns were addressed in the EIR and to help gain consensus regarding many aspects of the project. Mr. Pitts also led HDRs internal team to provide support during the public scoping process and aid the District in developing the Proposed Project and Alternatives. Mr. Pitts participated in Mammoth Creek EIR Technical Committee meetings to assist in the development of the hydrologic operations model, identify data and existing studies for inclusion into the EIR, and to provide updates on the CEQA environmental process. Additionally, Mr. Pitts assisted with an analysis of 16 years of fish population survey data and authored a review of the Hot Creek Stressor Identification process, which identified trends in trout populations, including the relationship of trout abundance to flows, and evaluated the condition of Mammoth Creek benthic macroinvertebrates.

**California Department of Water Resources, Oroville Facilities FERC Relicensing.** Mr. Pitts provided technical, analytical, and agency consultation support services for the Federal Energy Regulation Commission (FERC) relicensing process for the hydroelectric facilities at Lake Oroville. He assisted in the preparation of environmental documentation required to support DWR's application for relicensing. Mr. Pitts prepared the aquatic resources sections of the Preliminary Draft Environmental Assessment (PDEA), including assisting in the development of the methodology for the aquatic resources analysis. He also assisted in the analysis of potential protection, mitigation, and enhancement measures related to aquatic resources, and evaluated issues associated with federally listed threatened and endangered fish species, and fish and wildlife agency Section 10(j) recommendations. The PDEA summarized and incorporated the analyses related to fish habitat, upstream passage, predation, and disease prepared by HDR during completion of the study plan reports for aquatic resources. r. Pitts contributed to the alternatives evaluation and the discussion of unavoidable adverse and cumulative effects.

Prior to his work on the PDEA, Mr. Pitts led an internal team in the development and implementation of fisheries resources and aquatic ecology study plans that were designed to analyze potential project effects on Feather River and Lake Oroville fish habitat, fish disease, fish passage, and fish predation. The study plans included tasks designed to investigate and evaluate anadromous fish habitat requirements, distribution of anadromous fish in the Feather River, resident fish habitat components, resident fish distribution, the feasibility of providing fish passage above Oroville Dam, fish interactions, and predation. In addition to his coordination role, Mr. Pitts responsibilities included authorship and implementation of the study plans, including performing relevant literature reviews, analyzing data, developing analysis strategies, conducting field studies, and drafting technical reports to satisfy the study plans. Mr. Pitts authored study plans for anadromous salmonids, specifically, spring-run Chinook salmon holding habitat characterization, steelhead spawning survey methodology, and steelhead rearing temperatures.

**Placer County Water Agency, Auburn Tunnel Outlet Modification Project.** HDR provided environmental services to support several phases of the Auburn Tunnel Outlet Modification Project for the Placer County Water Agency. The project involves improving the outlet structure for the Auburn Ravine tunnel to reduce the accumulation of fine sediments entering Auburn Ravine.

Mr. Pitts served as the project manager leading the HDR team to complete the environmental documentation under the California Environmental Quality Act and Endangered Species Act compliance documentation. Additionally, Mr. Pitts assisted with strategic planning to refine the design of the outlet structure and associated facilities, and provided support to the Placer County Water Agency during the environmental permitting process.

**Santa Clara Valley Water District, Anderson Dam Seismic Retrofit Planning and Environmental Consultant Services.** Assisted in the development and preparation of planning study documents, including the Problem Definition Report, Planning Study Report, and CEQA/NEPA documents, as well as permitting. The ultimate outcome of the planning services will be to recommend a preferred alternative to: resolve the seismic deficiencies in the dam embankment from the maximum creditable earthquake; resolve and remediate, if necessary, the outlet works for the potential fault rupture risk from a maximum creditable earthquake; and review and revise, as needed, the Probable Maximum Flood (PMF) and routing study to address possible deficiencies with the spillway.

**Santa Clara Valley Water District, Three Creeks Habitat Conservation Plan and Fisheries and Aquatic Habitat Collaborative Effort (FAHCE) EIR.** The Santa Clara Valley Water District is preparing a Habitat Conservation Plan (HCP) pursuant to a multi-stakeholder settlement agreement, the FAHCE Settlement Agreement. Mr. Pitts served as the project manager for the preparation of an Effects Assessment for the Three Creeks HCP, and as a senior scientist leading the evaluation of fisheries resources in the FAHCE Settlement Agreement EIR. The HCP was prepared to obtain incidental take authorization under the federal Endangered Species Act for ongoing water supply operations in three watersheds in Santa Clara County, CA. As the project manager for HDR, Mr. Pitts led the team that developed the effects assessment approach and conducted the effects assessment identifying the effects of water supply operations and conservation measures on Central California Coast steelhead. Mr. Pitts also is leading the team conducting operations modeling and evaluation of fisheries resources as part of the CEQA compliance process.

**Somach, Simmons & Dunn, Bear Canyon Creek Fish Passage Project.** Mr. Pitts was the project manager for the preparation of an EA/IS and Endangered Species Act compliance documentation for fish passage improvements and changes to reservoir operations on Bear Canyon Creek, located on the Rubicon (formerly Niebaum-Copola) Estate Winery in the Napa Valley.

As the project manager for HDR, Mr. Pitts coordinated with resource agency representatives, including the California Department of Fish and Game and the National Marine Fisheries Service, to facilitate collaboration among stakeholders and to support the project proponents in development of the passage facility design and reservoir operations plan. Additionally, Mr. Pitts led the HDR team that conducted analyses of potential environmental impacts associated with construction of the fish passage facilities and reservoir operations, including detailed analyses of potential effects on state and federally listed threatened and endangered species.

**Somach, Simmons & Dunn, Chico Ranch/Llano Seco Rancho Pumping Plant Maintenance of Channel Alignment River Mile 192.5 EA/IS.** Mr. Pitts served as the project manager for the preparation of an Environmental Assessment/Initial Study (EA/IS) and Action Specific Implementation Plan (ASIP) for the Rancho Llano Seco Channel

Alignment Temporary Maintenance Project on the Sacramento River. The project involved placement of longitudinal rock toe and tree revetment on the west bank, and removal of a debris island on the east bank of the Sacramento River near the confluence with Big Chico Creek.

Mr. Pitts managed the efforts of HDR staff to update an existing EA/IS and ASIP to address the potential environmental impacts associated with the project. Specifically, Mr. Pitts and the HDR team, in cooperation with the California Department of Fish and Game, U.S. Fish and Wildlife Service, and National Marine Fisheries Service, identified the analytical methodology and conducted the analyses to address potential impacts on fisheries terrestrial biological resources in and adjacent to the Sacramento River, including potential impacts on several state and federally listed threatened and endangered species. Mr. Pitts also led the team in the evaluation of non-biological resources in the EA/IS and diligently supported the project proponent and their attorneys to allow for the timely completion of the environmental permitting process. Construction of the M&T Ranch, Rancho Llano Seco Temporary Channel Maintenance Project was completed during November 2007.

**U.S. Bureau of Reclamation/Department of Water Resources/CDM, Action Specific Implementation Plan for the Environmental Water Account EIS/EIR.** Mr. Pitts assisted in the preparation of the Action Specific Implementation Plan, which must be approved by NMFS, USFWS and CDFG, to implement the Environmental Water Account. The EWA is one component of the long-term comprehensive plan adopted in the CALFED Bay-Delta Program Record of Decision. The overall purpose of the EWA is to increase water supply reliability and to provide sufficient protections, combined with the Ecosystem Restoration Program and the regulatory baseline, to address CALFED's ecosystem quality needs in the areas of fishery protection, restoration, and recovery. The ASIP is a document established by the CALFED Bay-Delta Program that will fulfill the requirements of, and initiate project-level compliance with, the federal and California ESAs and the Natural Community Conservation Planning Act. Tiering off the CALFED Multi-Species Conservation Strategy, Mr. Pitts assisted in preparation of environmental settings sections, specifically with regard to spring-run Chinook salmon analyses in Butte Creek. Mr. Pitts also prepared water quality settings for southern California reservoirs.

**Yuba County Water Agency, Biological Assessment for Yuba River Development Project Proposed License Amendment.** Mr. Pitts assisted in the preparation of the fisheries analyses for this project. YCWA is seeking to reduce flow fluctuations caused by emergency outages at the Narrows II Powerhouse by installing a synchronous full-flow bypass; reduced flow fluctuations would reduce stranding juvenile spring-run and steelhead and dewatering redds of these species. YCWA also is seeking to extend the flow reduction and fluctuation criteria to year-round to protect the steelhead/rainbow trout spawning life stage. Mr. Pitts analyzed the impacts of constructing the bypass on spring-run Chinook salmon and steelhead.

**Yuba County Water Agency, Deadwood Creek Monitoring Project**. Mr. Pitts assisted in the preparation of the final report for a six-year monitoring program for Deadwood Creek. Brown trout, rainbow trout, and benthic invertebrate populations were monitored, and substrate characterization was performed. The monitoring was conducted to determine whether the required minimum flows provide adequate protection for Deadwood Creek fisheries resources, and to evaluate long-term project-caused effects to Deadwood Creek trout populations.

**Yuba County Water Agency, Biological Assessment for Yuba River Development Project Proposed License Amendment.** Mr. Pitts assisted in the preparation of the fisheries analyses for this project. YCWA is seeking to reduce flow fluctuations caused by emergency outages at the Narrows II Powerhouse by installing a synchronous full-flow bypass; reduced flow fluctuations would reduce stranding juvenile spring-run and steelhead and dewatering redds of these species. YCWA also is seeking to extend the flow reduction and fluctuation criteria to year-round to protect the steelhead/rainbow trout spawning life stage. Mr. Pitts analyzed the impacts of constructing the bypass to spring-run Chinook salmon and steelhead, as well as the cumulative impacts to fisheries.

### *Non-HDR Project Experience*

**U.S. Forest Service, Eldorado National Forest, Section Dredge Monitoring.** Mr. Pitts led a team conducting a field investigation of the channel morphology and benthic invertebrate communities of five streams in the upper Cosumnes River Watershed. On each of the study reaches, affected areas were identified and mapped, and impacts to the physical habitat were recorded. Following protocols outlined in the California Stream Bioassessment Procedure, Mr. Pitts and his team then collected invertebrate samples from riffles upstream and downstream from affected sites on two of the streams. Upon completion of the laboratory analysis, Mr. Pitts analyzed the metrics produced by the laboratory in an attempt to determine if suction dredging had adverse effects on the benthic populations downstream from known mining claims within the study area.

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## Biological Resources: Terrestrial

**Josh Harwayne, Erin Harwayne, Matt Johnson, DD&A**

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# Josh Harwayne

***Senior Environmental Scientist / NRD Manager***

## Education

Master of Arts, Ecology and Systematic Biology, San Francisco State University, 1999 (course work)

Bachelor of Science, Botany, San Francisco State University, 1997

## Work Experience

*Senior Project Manager - Natural Resources Department Project Manager*, DD&A

*Environmental Consultant, Wetland* Research Associates, Inc.

*Laboratory and Field Manager*, Romberg Tiburon Center for Environmental Studies - Laboratory for Wetland and Estuarine Biology

## Professional Affiliations

Association of Environmental Professionals
California Botanical Society
California Native Plant Society
Society of Wetland Scientists
Friends of the Jepson Herbarium
Society for Ecological Restoration

## Registrations/Certificates

Advanced Habitat Restoration Workshop for California Red-legged Frog (Elkhorn Slough Coastal Training Program)

California Red-legged Frog Workshop (Elkhorn Slough Coastal Training Program)

California Tiger Salamander Workshop (Elkhorn Slough Coastal Training Program)

Coastal Policy Workshop (Elkhorn Slough Coastal Training Program)

40-hour ACOE Wetland Delineation Training (co-taught course)
40-hour ACOE Advanced Wetland Delineation Training
Native Grass Identification (California Native Grass

Mr. Harwayne serves as the Natural Resources Division Project Manager and is the senior staff biologist for DD&A. In addition to directing biological data collection, analysis and documentation, Mr. Harwayne is responsible for development and management of new projects, document quality control, staff development, marketing development, contracting, and maintaining project budgets and schedules. With over 16 years of consulting experience, he brings to the firm the highest level of technical, analytical and management skills.

His technical capabilities are as follows:

- Initial Studies/Mitigated Negative Declarations (IS/MND)
- Environmental Assessments/Finding of No Significant Impact (EA/FONSI)
- Environmental Impact Reports (EIR)
- Environmental Impact Statements (EIS)
- Biological Assessments (BA)
- Natural Environment Studies (NES)
- Wetland Delineation Reports
- Wetland Banking Documents
- Mitigation Monitoring and Reporting Programs (MMRP)
- Habitat Conservation Plans (HCP)

- Expert botany, wildlife, and wetland science experience gained working on a wide variety of projects involving special-status species and sensitive habitats.

- Proficiency in conducting biological surveys, including protocol-level surveys for special-status wildlife and plant species such as the California tiger salamander, California red-legged frog, burrowing owl, sand gilia, Monterey spineflower, and seaside bird's beak.

- Experience working closely with resource and regulatory agencies in permitting projects of varying size and complexity, including:

    - California Department of Fish and Wildlife (DFW)
    - U.S. Fish and Wildlife Service (Service)
    - California Department of Transportation
    - Regional Water Quality Control Board
    - Army Corps of Engineers (ACOE)
    - California Coastal Commission

- Project Management with complex permitting processes, including Clean Water Act Sections 401 and 404, DFG 1602, federal Endangered Species Act Section 7 and 10 consultation and permit processes, State Endangered Species Act Section 2081 Incidental Take Permit, and fully protected species.

- Wetland delineations per ACOE and Coastal Act criteria and the design of wetland mitigation and restoration projects.

- Expertise in preparing scopes, managing subconsultants, and keeping projects within established budgets and timeframes.

- Regularly guest lectures on vernal pool ecology, wetland ecology, environmental regulatory requirements, and native plant identification at California State University Monterey Bay (CSUMB) and Monterey Peninsula Community College (MPC).

Association)
Wetland Plant Identification (Jepson Herbarium)
Vernal Pool Ecology (Jepson Herbarium)
CEQA/NEPA Documentation (UC Davis Extension)
Streambed Alteration Agreements (UC Davis Extension)
USFWS Federal Recovery Permit TE-091857-0 - California tiger salamander and California red-legged frog
CDFW Scientific Collection Permit 006622

## Project Experience:

### Water Resources Projects:

- *Storm Drain Improvements Project IS, City of Carmel-by-the-Sea*
- *Salinas River Vegetation Maintenance Project, Monterey County Water Resources Agency*
- *Castroville Storm Drain Master Plan Improvements Project, Monterey County Department of Public Works*

### ESA Section 10 Permits and Section 7 Consultation Projects:

- *Santa Lucia Preserve Habitat Conservation Plan*
- *Malcolm Ranch Habitat Conservation Plan*
- *Fort Ord Habitat Conservation Plan Species Distribution and Impact Analysis*
- *ALBA Wetland Restoration Section 7 and State Safe Harbors Agreement*
- *Carmel Hill Bike Trail Section 7*
- *Garrett Road Rehabilitation and California Red-legged Frog Pond Restoration Section 7*

### Educational Projects:

- *Endangered Species Act Workshop, MCWD*
- *Guest Lecture on vernal Pool Ecology and Wetland Ecology and Regulatory Environment, CSUMB*
- *Guest Lecture on California Native Plant Identification, MPC*

### Biological and Wetland Assessment Projects:

- *The First Tee EIR, City of Seaside*
- *Biological Report and Wetland Delineation, City of Seaside*
- *Biological Assessment for General Plan Update, City of Monterey*
- *Snowcreek Biological Assessment Town of Mammoth Lakes, Chadmar, Inc.*
- *Thorne Road Bridge NES, Monterey County Department of Public Works*
- *National Refractory Wetland Assessment*

### Permitting and Condition Compliance Monitoring Projects:

- *Bridge Improvement Projects, San Benito County Public Works*
- *Highway 25, Quincy Engineering*
- *Stone Creek Shopping Village, City of Del Rey Oaks*
- *Seaside Highlands Housing Development, City of Seaside*
- *Bayer Tank Demolition and Inertia Project, Marina Coast Water District*

# Erin Harwayne, AICP

***Senior Environmental Scientist / Planner / Project Manager***

## Education

Bachelor of Science, Earth Systems Science & Policy (Marine and Coastal Ecology), California State University Monterey Bay, 2000

Continuing Education, Land Use/Natural Resources Topics, through University of California Extension Program and CLE International

## Experience

*Environmental Scientist/Planner/ Project Manager,* DD&A

*Research Assistant,* Monterey Bay National Marine Sanctuary

## Professional Affiliations

Member, Association for Environmental Professionals
Member, American Planning Association
Member, California Native Plant Society

## Registrations/Certifications

American Institute of Certified Planners (AICP)
CEQA and NEPA Intensive Workshop Certifications
Fairy and Tadpole Shrimp Identification Class and Service Test Certification
PADI Certified SCUBA Diver
Service Federal Recovery Permit No. TE-091857-0 - California tiger salamander
DFG Research Permit for Listed Plant Species No. 04-08-RP - Sand gilia
DFG Scientific Collection Permit No. CS-007722 - Aquatic invertebrates

With over 15 years at DD&A, Erin Harwayne, AICP, has managed and prepared numerous environmental documents in compliance with CEQA and NEPA for a wide variety of projects involving educational facilities, natural resources management, water supply and distribution, military base reuse, public works, and transportation and transit infrastructure. She has experience preparing all types and levels of environmental documents, including:

- Initial Studies/Mitigated Negative Declarations (IS/MND)
- Environmental Assessments/Finding of No Significant Impact (EA/FONSI)
- Environmental Impact Reports (EIR)
- Environmental Impact Statements (EIS)
- Biological Assessments (BA)
- Natural Environment Studies (NES)
- Wetland Delineation Reports
- Mitigation Monitoring and Reporting Programs (MMRPs)

Integrating her extensive background in ecology with land use planning, Ms. Harwayne utilizes an innovative approach toward solving complex environmental issues.

Her technical capabilities are as follows:

- Adeptness in regulatory permitting processes, including Clean Water Act Section 401 and 404, California Department of Fish and Wildlife (DFW) 1602 Lake and Stream Alteration Program, Federal Endangered Species Act Section 7 consultation and Section 10 permit processes, California Endangered Species Act Section 2081 Incidental Take Permits, and Coastal Development Permits.
- Management and preparation of environmental documents in accordance with CEQA and NEPA requirements and local, state, and federal policies and regulations
- Proficiency in conducting biological surveys, including protocol-level surveys for special-status wildlife and plant species such as the San Joaquin kit fox, California tiger salamander, black legless lizard, California red-legged frog, vernal pool crustaceans (fairy and tadpole shrimp), sand gilia, Monterey spineflower, and seaside bird's beak
- Experience in conducting wetland delineations per United States Army Corps of Engineers (ACOE) and California Coastal Act criteria
- Expertise in the environmental review processes for the California State University and University of California systems
- Excellent communication and presentation skills
- Highly skilled in technical writing and editing
- Expertise in preparing scopes, managing sub-consultants, and keeping projects within established budgets and timeframes

**Project Experience:**

**ESA Section 10 Permits and Section 7 Consultation Projects:**

- *Fort Ord Habitat Conservation Plan EIR and EIS – Fort Ord Reuse Authority and the U.S. Fish and Wildlife Service*
- *Monterey Bay Regional Desalination Project Biological Assessment – MCWD, Cal-American Water, and U.S. Bureau of Reclamation*
- *Recycled Water Project Biological Assessment – MCWD and U.S. Bureau of Reclamation*
- *Santa Lucia Preserve Habitat Conservation Plan EA – Rancho San Carlos*

*Partnership and the U.S. Fish and Wildlife Service*
- *Marina Heights DFG Incidental Take Permit – The Chadmar Group*
- *Endangered Species Act Educational Workshop and Staff Training – MCWD*

**Educational Facility Projects:**
- *2007 Master Plan and Near-Term Projects EIR – California State University Monterey Bay/Board of Trustees*
- *West Campus Building Demolition Project – CSUMB*
- *North Quad Student Housing IS/MND – CSUMB*
- *Outdoor Pool IS/MND – CSUMB*
- *North Campus Housing EIR – CSUMB*
- *Land Exchange Addendum to Master Plan EIR, CSUMB*
- *Environmental and Constraints Analyses for Building Demolition Pilot Project, Library Project, Visitor's Center Project, Sports Complex Project, Co-Generation Plant, and Telecommunications Infrastructure Upgrade Project – CSUMB*

**Biological, Wetland Assessment, and NES Projects:**
- *Haskell's Landing – City of Goleta, The Chadmar Group*
- *Veteran's Cemetery – Fort Ord Reuse Authority*
- *Monterey Downs Horse Park – Monterey Downs, LLC*
- *Whispering Oaks Business Park and MST Facility – Monterey Salinas Transit*
- *Regional Water Augmentation EIR – MCWD*
- *Marina Station EIR – City of Marina*
- *Seaside Main Gate EIR – City of Seaside*
- *LaTourette Subdivision EIR – County of Monterey*
- *Gilroy General Plan Update EIR – City of Gilroy*
- *Regency Center EIR – City of Gilroy*
- *Biological Assessment for the General Plan Update – City of Monterey*
- *Arroyo Seco Road Guardrail NES – Monterey County Department of Public Works*
- *Highway 25 Safety Improvement NES - Caltrans District 4 and Council of San Benito County Governments*

**Water Facilities Projects:**
- *Storm Drain Improvements Project IS/MND – City of Carmel-by-the-Sea*
- *Tank Design and Improvements Project EA/IS – MCWD*
- *Water Supply Master Plan EIR – MCWD*
- *Castroville Storm Drain Master Plan Improvements Project – Monterey County Department of Public Works*
- *Pond A-4 Sediment Storage Environmental Analysis – Santa Clara Valley Water District*

**Linear Projects:**
- *Monterey Bay Peninsula Light Rail Project – Transportation Agency for Monterey County*
- *Eastside Parkway Biological Study – Fort Ord Reuse Authority*
- *Uvas Creek Park Preserve Trail Improvements IS/MND – City of Gilroy*
- *Carmel Valley Class I Bicycle Trail IS/MND – Monterey County Department of Public Works*

Carmel Valley Road Improvements IS/MND – Monterey County Department of Public Works

# Matthew P. Johnson

***Associate Environmental Scientist / GIS Manager***

## Education

Bachelor of Science, Earth Systems Science and Policy, California State University of Monterey Bay, Seaside, California, 2001

Microsoft Certified Systems Engineer, New Horizons Computer Learning Center

## Work Experience

*Associate Environmental Scientist / Geographic Information Systems Manager,* DD&A

*Geographic Information Systems Research Analyst,* California Department of Fish and Game, Marine Region

## Professional Affiliations

Central Coast Joint Data Committee
Monterey Peninsula Audubon Society

## Registrations/Certificates

Trimble Certified GPS Operator
Wetlands Regulation and Mitigation Training Seminar
Special Status Amphibians and Reptiles of Northern California
The Western Section of Wildlife Society Annual Meeting and Symposium
USFWS Federal Recovery Permit TE-091857-0 - California tiger salamander and California red-legged frog (authorized individual)
CDFG Scientific Collection permit SC-007701 -: Mammals, Reptiles, Amphibians, and Freshwater/terrestrial invertebrates
CEQA Basics Workshop (AEP)
40 Hour HAZWOPER Certification
ESRI User Conference
Navigating the Environmental Compliance Process in Coastal California, Elkhorn Slough Workshop

Mr. Johnson has 14 years of experience working in the environmental field as an Associate Environmental Scientist, with a background in environmental science and policy. During his tenure at DD&A Mr. Johnson has also served as the manager of the Geographic Information Systems (GIS) department. At DD&A his responsibilities include project management, rare plant surveys, protocol-level wildlife surveys, biological monitoring, and wetland delineations; preparation of biological reports, Mitigation Monitoring and Restoration Plans, CEQA documents and regulatory permit applications; Global Positioning System (GPS) data collection; Geographic Information Systems (GIS) analysis; and graphics support for biological and planning documents. Mr. Johnson holds state and federal permits to handle multiple listed wildlife species and is expert in conducting protocol presence/absence surveys for California red-legged for, California tiger salamander, and additional wildlife species.

He has experience in several GIS software platforms and their application to land planning policy and regulation. He has also worked with a variety of GIS datasets from several different agencies including; USGS, CCC, SPOT, MBARI, Digital Globe, several counties and cities, and several universities in the California State system.

His technical expertise is demonstrated in his background projects and training:

- Experience working closely with resource and regulatory agencies in permitting projects of varying size and complexity, including:
  - California Department of Fish and Wildlife (DFW)
  - U.S. Fish and Wildlife Service (Service)
  - National Marine Fisheries Service (NOAA Fisheries)
  - Army Corps of Engineers (ACOE)
  - California Department of Transportation
  - Regional Water Quality Control Board
- Extensive experience conducting biological monitoring, pre-construction wildlife surveys on a variety of projects, and biological trainings to inform construction crews and other project team members of the sensitive resources present within project sites and the protection measures afforded to them.
- Proficiency in conducting biological surveys, including protocol-level surveys for special-status wildlife and plant species such as the California tiger salamander, California red-legged frog, sand gilia, Monterey spineflower, and seaside bird’s beak.
- Technical experience includes preparing biological reports for a broad range of environmental documentation in accordance with CEQA and NEPA requirements and local, State, and federal policies and regulations, including the Clean Water Act and the federal and state Endangered Species Acts, including:
  - Biological Assessments (BA)
  - Natural Environment Studies (NES)
  - Wetland Delineation Reports
  - Mitigation Monitoring and Reporting Programs (MMRP)
  - Permit Applications for CDFG, ACOE, USFWS, etc.
- Botany, wildlife, and wetland science experience gained working on a wide variety of projects involving special-status species and sensitive habitats.

Matthew P. Johnson
*Associate Environmental Scientist/GIS Manager*

**Project Experience:**

**Water Facilities Projects:**
- *Tank Design and Improvements Project EA/IS – MCWD*
- *Montevina Water Treatment Plant IS/MND, San Jose Water Company*
- *Rinconada Water Treatment Plant EIR, Santa Clara Valley Water District*
- *Ostwald Pipeline Replacement Project IS/MND, San Jose Water Company*
- *Pure Water Groundwater Replenishment Biological Surveys, Monterey Regional Water Pollution Control Agency*

**Linear Projects:**
- *Carmel Valley Class I Bicycle Trail IS/MND – Monterey County Department of Public Works*
- *Carmel Valley Road Improvements IS/MND – Monterey County Department of Public Works*
- *Highway 25 Safety Improvement NES - Caltrans District 4 and Council of San Benito County Governments*

**ESA Section 10 Permits and Section 7 Consultation Projects:**
- *Fort Ord Habitat Conservation Plan EIR and EIS – Fort Ord Reuse Authority and the U.S. Fish and Wildlife Service*
- *Monterey Bay Regional Desalination Project Biological Assessment – MCWD, Cal-American Water, and U.S. Bureau of Reclamation*
- *Santa Lucia Preserve Habitat Conservation Plan EA – Rancho San Carlos Partnership and the U.S. Fish and Wildlife Service*

**Biological, Wetland Assessment, and NES Projects:**
- *Haskell's Landing – City of Goleta, The Chadmar Group*
- *Whispering Oaks Business Park and MST Facility – Monterey Salinas Transit*
- *Marina Station EIR – City of Marina*
- *Seaside Main Gate EIR – City of Seaside*
- *Mazda Raceway/Laguna Seca Recreation Area Protocol-level CTS Surveys, Monterey County Department of Parks and Recreation*
- *Ferrini Ranch Bio Assessment, Bollenbacker & Kelton, Inc.*
- *Fort Ord Natural Reserve OU-1 Rare Plant Survey and Reporting, HGL, Inc.*
- *Fort Ord Wildlife Surveys, Shaw Environmental, Inc.*
- *Fort Ord Dune State Park Rare Plant Surveys, California State Parks*
- *Snowcreek Biological Assessment Town of Mammoth Lakes, Chadmar, Inc.*
- *Thorne Road Bridge NES, Monterey County Department of Public Works*
- *Los Gatos Creek Trail Reach 5B/C NES/BA, City of San Jose*

**Biological Monitoring Projects:**
- *Sand Gilia Restoration Monitoring, UC MBEST*
- *OU-1 FONR Well Removal Biological Monitoring Project, HGL Inc.*
- *Implementation of the EIR Mitigation, Monitoring and Reporting Plan at the Ridgemark Wastewater Treatment and Recycled Water Improvement Project, Sunnyslope Water District*
- *ITSI Biological Support Services, ITSI Gilbane*
- *MCWD Well 32 & 33 Biological Monitoring, MCWD*
- *Gilroy Three Trails Biological Monitoring, City of Gilroy*
- *Raptor Nest Monitoring, CSUMB*
- *Pre-Construction Surveys and On-Site Biological Monitoring Services for CSUMB Demolition, CSUMB*
- *Noble Gulch Sewer Improvement Project, HDR*

## Cultural Resources

## Gary S. Breschini, PH.D

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# GARY S. BRESCHINI, PH.D.

## ARCHAEOLOGIST

### Education

| | |
|---|---|
| Ph.D. | Washington State University, 1983 (Anthropology) |
| M.A. | Washington State University, 1975 (Anthropology) |
| B.A. | University of California, Santa Barbara, 1971 (English) |

### Professional Experience

Dr. Breschini is field director or principal investigator for over 4,500 archaeological reconnaissance, excavation, evaluation, overview, mitigation, and research projects. With extensive experience in archaeology, cultural resource management, rock art documentation, and human osteology in Central and Northern California, Dr. Breschini has been published and continues to publish in journals pertinent to his profession, and has written the text for the archaeology sections of environmental documents (NEPA and CEQA) since 1975.

### Professional Certifications

- Accredited expertise in Archaeological Field Research (Society of Professional Archaeologists)
- Accepted for inclusion in the Directory of California Archaeological Consultants (Society for California Archaeology - 1979)
- Life Credentials in Anthropology, Board of Governors, California Community Colleges, 1975

### Professional Memberships

- American Association of Physical Anthropologists
- Society for American Archaeology
- Society for California Archaeology
- Society of Professional Archaeologists

### Teaching Experience

- Washington State University
- Hartnell Community College
- Cabrillo Community College
- Monterey Peninsula College

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**Hydrology and Water Quality: Groundwater**

**Phyliss Stanin, PG, CEG, CHG, Todd Groundwater**

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TODD GROUNDWATER

# Phyllis Stanin, PG, CEG, CHG

Vice President and Principal Geologist

**EDUCATION**

MS, Environmental Management, Hydrogeology thesis, University of San Francisco
BS, Geology, University of North Carolina

**REGISTRATIONS**

Professional Geologist California, No. 5311
Certified Engineering Geologist California, No. 1899
Certified Hydrogeologist California, No. 482
Registered Geologist Arizona, No. 45605

## PROFESSIONAL SUMMARY

Phyllis Stanin has been a professional geologist for more than 35 years with expertise in hydrogeology and groundwater basin management, and a particular emphasis on managed aquifer recharge (MAR) and conjunctive use. She also has experience with groundwater resource development including production and injection wells, geophysical applications, aquifer testing, and monitoring. She has conducted numerous regional hydrogeologic assessments using advanced analytical and numerical modeling tools. Her expertise also includes fate and transport of contaminants in groundwater including constituents of emerging concern. She has performed geologic investigations in seven states across the U.S. and conducted independent research on impacts to groundwater flow from geologic faults. Groundwater projects demonstrating the variety of her experience are described below.

### Managed Aquifer Recharge (MAR)

*Groundwater Banking and Groundwater Model Construction, Kern County CA*
Ms. Stanin is Project Manager for an evaluation of groundwater banking operations in Kern County, California. This ongoing project involves the development of a regional groundwater flow model to assess the effects of the groundwater banking projects on the Kern Fan. The MODFLOW groundwater model covers a 430 square mile area, and comprises a three-layer aquifer system using over 1 million model cells. Calibration to dynamic flow conditions over the period 1986-2010 was completed in 2013; as of 2015, a revised model calibration is underway.

*Aquifer Characterization and Recharge Feasibility Study, City of Modesto, Stanislaus County, CA*

Ms. Stanin is the project manager for an ongoing groundwater study for the City of Modesto. The project is the first step in the City's Managed Aquifer Recharge (MAR) Program to develop strategies for recharge of treated surface water for subsequent recovery. For part of the recharge analysis, Todd Groundwater is modifying and applying the USGS MERSTAN model, a regional groundwater flow model developed by USGS using the One-Water Hydrologic Model code. This is one of the first groundwater models constructed in this platform, which incorporates numerous modules for the improved simulation of surface water-groundwater interaction.

*Groundwater Replenishment Project, Monterey Regional Water Pollution Control Agency (MRWPCA), Monterey County, CA*

Ms. Stanin has served as the project manager and lead hydrogeologist on this project, which involves planned recharge of highly treated recycled water into the Seaside Groundwater Basin. Detailed hydrogeologic assessments have been completed over several years including the evaluation of target aquifers, recharge methods, and injection and recovery sites. Todd Groundwater also completed a preliminary design for vadose zone wells to recharge the shallow aquifer and deep injection wells for replenishment of the deeper aquifer. The conceptual design was completed with the application of a steady state numerical model constructed by Todd Groundwater. Ms. Stanin has worked with the Division of Drinking Water (DDW) on project design and the monitoring well program. CEQA compliance is underway with the preparation of an EIR with MRWPCA as the lead agency; Ms. Stanin is also providing technical support for the EIR (2008 – 2015).

*Recharge Optimization Studies, Rancho California Water District, Riverside County, CA*

Ms. Stanin was Project Manager of two studies to optimize recharge basin percolation for the Rancho California Water District in Riverside County. The studies were conducted on the Lower *Valle De Los Caballos* (VDC) and Upper VDC recharge basins. The Lower VDC project involved a field investigation of percolation basin properties, vadose zone testing and impacts of groundwater elevations on percolation. A hydrogeologic conceptual model and local-scale groundwater model were used to optimize the amount of water that could be recharged under varying groundwater conditions. The Upper VDC project also involved the construction and application of a local-scale model to optimize recharge over 110 acres of basins. The fate of recharge water including downgradient and vertical transport was modeled to determine the amount of recharge being captured by local wells. Various optimization strategies were modeled to balance short-term treatment objectives with long-term storage. The project also involved the recommendation of a well maintenance program and meetings with regulators from the Department of Public Health on the District's permit (2009 – 2012).

*Hydrogeologic Investigation of Recharge Potential, Western Municipal Water District, Riverside County, CA*

Ms. Stanin served as Project Manager for a hydrogeologic investigation to evaluate the potential for recharge at five sites in the Arlington Basin for Western Municipal Water District. Sites were evaluated for the enhancement of groundwater recharge with stormwater, recycled water, and/or imported water. The project involved the design and implementation of a field program to assess lithology, textures, infiltration rates, hydraulic and geotechnical properties of the vadose zone beneath the sites. Analytical modeling was conducted to examine mounding and transmitting capacities. Subsequently, two sites have been selected for additional investigation and preliminary design (2011 – 2012).

*Edwards Aquifer Optimization Study, Edwards Aquifer Authority, San Antonio, TX*
Ms. Stanin was project manager and lead hydrogeologist for a multi-year study of enhanced recharge strategies within this extensive karst aquifer system. The study applied a five-county MODFLOW groundwater model developed by the USGS to evaluate volumes and sources of potential recharge, wellfield siting and design for recovery, and the potential for recirculating water through the aquifer to increase residence time in the aquifer (2006 – 2009).

*Recharge Feasibility and Salt Loading Studies, City of Corona, Riverside County, CA*
Ms. Stanin has provided hydrogeologic support to the City on a variety of projects. In a recharge feasibility study, she directed a hydrogeologic investigation of a property in the city, which has been identified by the city and Western Municipal Water District as a potential recharge site for imported water. The investigation involved soil borings, laboratory analyses, and single-ring infiltrometer testing. Groundwater modeling was conducted to assess potential mounding and groundwater response to various enhanced recharge scenarios. In a separate project, she also served as Technical Director for an evaluation of salt loading associated with potential recharge projects involving imported water. This study combined details of the basin water budget with sources and sinks of total dissolved solids (TDS) and nitrate in the Temescal Groundwater Basin in Riverside County. The project incorporated an organized approach to the analysis developed by the Santa Ana Regional Watershed Protection Agency (SAWPA) and the Regional Water Quality Control Board. TDS modeling indicated that, while salt loading would increase on a mass basis, the lower concentrations of TDS in imported water would be beneficial overall to TDS levels in groundwater (2009 – 2010).

*Hayfield Groundwater Storage Project, Metropolitan Water District of Southern California, Riverside County, CA*
As Project Manager for Todd Groundwater, Ms. Stanin directed several phases of the Hayfield Groundwater Basin Storage project for Metropolitan Water District. The storage project involved recharge of excess Colorado River water into the basin for subsequent recovery. Initial projects focused on planning and facilities feasibility studies. In order to develop a hydrogeologic conceptual model of the undeveloped basin, Ms. Stanin designed and implemented an exploratory borehole and test well program, involving installation of 9 test wells and two monitoring wells, geophysical and flow logging, aquifer testing, and groundwater sampling. Ms. Stanin conducted the hydrogeologic assessment of the field program results and was able to identify areas for optimized recovery of banked Colorado River water (2002 – 2004).

**Groundwater Basin Management Plans (GWMP)**

*Groundwater Management Plan, Kern Delta Water District, Kern County, CA*

Ms. Stanin has assisted the Kern Delta Water District with a variety of groundwater support services. Recently, she was the project manager and primary author of the District's Groundwater Management Plan Update. The project involved a re-assessment of aquifers, development of a water budget, and documentation of numerous conjunctive use activities including a formal groundwater banking project with the Metropolitan Water District of Southern California and other water agencies. The plan was adopted in September 2013.

*Groundwater Management Plan, City of Corona, Riverside County, CA*

For the last 10 years, Ms. Stanin has assisted the City of Corona with a variety of groundwater projects. She was the primary author of the City's first GWMP. The City relies on groundwater for about one-half of the total water supply and had experienced declining water levels in some portions of their service area. The plan involved original geologic mapping and delineation of the City's most productive aquifers, characterization of groundwater quality, and development of a groundwater balance. She also served as Project Manager for the construction and application of a MODFLOW groundwater flow model, which was applied to evaluate various management strategies of managed aquifer recharge. The results of the analysis was that the basin could be sustainably managed with a variety of conjunctive use strategies. The final Groundwater Management Plan was adopted in 2008.

*Groundwater Management Plan, Wheeler Ridge-Maricopa Water Storage District (WRMWSD), Kern County, CA*

Ms. Stanin assisted WRMWSD with the preparation of the District's first GWMP. The plan included a District-wide assessment of recent and historical water levels and groundwater quality. The plan included an analysis of the District's contract for the State Water Project and various Kern County banking programs in which the District had invested. The analysis recommended conditions under which surface water, banked water, or groundwater would be prioritized for use. The plan was adopted in November 2007.

*Development of Basin-Wide Monitoring Plan, San Benito County Water District (SBCWD), CA*

Ms. Stanin was Project Manager for the development of a basin-wide water quality monitoring program for SBCWD. The project involved the development of a GIS-compatible database of current and historical water quality data from more than 50 water systems, more than 30 facilities with groundwater monitoring, and other state and local agencies. The database and GIS are being used to assess current and historical water quality conditions in the basin. The results of the water quality assessment also are being used to optimize groundwater management activities and monitoring in the basin. The program was funded by an AB303 grant, which was obtained through a joint effort by the SBCWD and Todd Groundwater (2002 – 2004).

**Groundwater Resource Development**

*Groundwater Exploration Studies, City of Corona, Riverside County, CA*

Over the last decade, Ms. Stanin has provided hydrogeologic support to the City on a variety of projects. Recently, she served as Project Manager and Lead Hydrogeologist for an exploratory borehole/monitoring well program to identify favorable areas for future water supply wells for the City of Corona. The project involved the design and implementation of a field program to drill six boreholes and install five monitoring wells to delineate aquifer units in areas of limited groundwater data. The successful drilling and testing program included geologic and geophysical logging, aquifer thickness and elevation mapping, water level monitoring and mapping, water quality sampling and analysis, and isotopic and geochemical analyses. The study produces target areas for water supply wells and recommendations on well design (2012 – 2013).

*Groundwater Development for Ecosystem Restoration, California Department of Fish and Game, Camp Cady, San Bernardino County, CA*

Ms. Stanin was project manager for a groundwater investigation at Camp Cady, on the Mojave River, east of Barstow, CA. The goal of the project was to determine if damaged riparian vegetation that previously supported a thriving ecosystem could be restored by groundwater irrigation. Declines in shallow groundwater levels, among other factors, had eliminated vegetation in some areas. To evaluate if deep pumping could provide supplemental supply during critical dry times without lowering shallow water levels, a series of 11 shallow piezometers and four monitoring well clusters were installed. Project results indicated that groundwater pumping below the regional aquitard was feasible in favorable areas with careful planning. Recommended locations, well design, and project costs were also provided (2011 – 2013).

*Hayfield Groundwater Storage Project, Metropolitan Water District of Southern California, Riverside County, CA*

Ms. Stanin served as Project Manager for the design, drilling, installation, and testing of a large-diameter production well to recover stored water in the western portion of the groundwater basin. The project resulted in a high-yielding well producing 3,000 gpm with less than 30 feet of drawdown (2009 – 2010).

*Well 231 Replacement Project, Rancho California Water District, Riverside County, CA*

Ms. Stanin is currently serving as Principal-in-Charge for an evaluation of groundwater quality conditions in the Lower Pauba Valley to site a replacement municipal production well. The District has lost production recently due to elevated total dissolved solids (TDS), arsenic and fluoride concentrations. Todd Groundwater has identified stratigraphic intervals associated with some of the elevated constituents and is preparing a Preliminary Design Report to target specific aquifer zones for development. Todd Groundwater is also designing a test well to evaluate the vertical distribution of certain constituents in more detail. That well will serve as a future monitoring well for the replacement production well (2014 – 2015).

*Groundwater Characterization of Mining Dewatering and Bedrock Wells, Idaho Maryland Mining Corp. (IMMC), Grass Valley, Nevada County, CA*

Ms. Stanin served as the Project Manager and lead hydrogeologist for an evaluation of dewatering impacts from the Idaho Maryland Mine in Nevada County, CA. The IMMC had planned to re-open the previously-abandoned mine for additional gold mining operations.

Todd Groundwater provided hydrogeologic support to IMMC including an assessment of groundwater conditions and potential impacts from dewatering of mine workings on local bedrock wells. The assessment supported the preliminary dewatering design and provided an impacts analysis for the project EIR (2006 – 2011).

*Depth-Specific Monitoring and Aquifer Characterization, San Benito County Water District*
Ms. Stanin served as Project Manager for an aquifer characterization analysis including the installation and testing of a deep nested monitoring well in the Gilroy-Hollister Groundwater Basin. The well was needed to characterize the vertical distribution of boron and other constituents of concern with depth to identify future development areas. Todd Groundwater designed, installed, and tested a 770-foot nested monitoring well with five depth-discrete intervals. Depth-specific sampling and advanced geophysical logging, including a combined magnetic resonance tool, allowed for the identification of depths to avoid for future development based on elevated boron concentrations (2005 – 2007).

*Groundwater Characterization and Modeling, City and County of Honolulu, Oahu, HI*
Ms. Stanin was the Project Manager and lead hydrogeologist for the City and County of Honolulu Hawaii's well optimization program. This study included the evaluation of the aquifer system, a regional water balance, and detailed spatial and temporal correlation of groundwater pumping and upconing in water supply wells. The project also involved development of a 3-D numerical groundwater model to be used as an ongoing management tool by the Board of Water Supply (2004 – 2006).

*City of Dallas, Long-Range Water Supply Plan (LRWSP), Dallas Water Utilities, Dallas, TX*
As a subconsultant to HDR Engineering, Ms. Stanin served as project manager and lead hydrogeologist for a regional groundwater assessment. Although the City had historically relied exclusively on surface water reservoirs for water supply, options for supplemental groundwater supplies were evaluated as part of the LRWSP. The evaluation involved major and minor aquifers in a 13-county area of northeast Texas. Development strategies were analyzed by updating and applying the Water Availability Models (WAMs), consisting of two MODFLOW groundwater flow models developed by the Texas Water Development Board. Strategies included pumping groundwater for direct use, conveyance to surface water reservoirs, and non-potable use of shallow groundwater beneath the City (2012 – 2015).

**Regional Hydrogeologic Characterization**

*Groundwater Basin Conceptual Model, Bighorn-Desert View Water Agency and Mojave Water Agency, San Bernardino County, CA*
Ms. Stanin was project manager for development of regional hydrogeologic conceptual models and assessment of the feasibility of a managed aquifer recharge (MAR) project for three high desert basins. Hydrogeologic data were used to estimate groundwater storage and identify areas with coarse-grained lithology and favorable groundwater quality. Water levels were mapped across the basins with a particular emphasis on impacts from faulting or shallow bedrock. The study found that the Ames Valley basin would benefit most from a MAR project, given the occurrence of coarse-grained sediments beneath two major washes downgradient of geologic faults (2006 – 2007).

*Groundwater Basin Conceptual Model, Baja and Centro Subareas, Mojave River Groundwater Basin, Mojave Water Agency, San Bernardino County, CA*

Ms. Stanin was project manager for a multi-year study of two subareas comprising over 2,000 acres in the lower portion of the adjudicated Mojave River Groundwater Basin. The project included synthesized findings from historical studies dating back to early 1900s with analyses of new geologic, groundwater level and water quality data into one comprehensive document, which will be used to support future groundwater management planning, including managed aquifer recharge of imported State Water Project water. The project included conceptual and numerical groundwater flow model development and review; characterization of basin geometry, aquifer properties, impacts of hydraulic (fault) barriers on groundwater flow, groundwater water level trend analysis, evaluation of impacts of local and regional pumping and dam construction on surface water flows and downstream recharge along Mojave River; transient basin subarea water balance development; MODFLOW model water budget extraction and review; groundwater quality characterization; and water demand forecasting (2010 – 2013).

**Groundwater Support to Environmental Impact Reports (EIR)**

*Division of Oil, Gas, and Geothermal Resources (DOGGR) SB 4 EIR, Analysis of Oil and Gas Well Stimulation Treatments in California*

As a subconsultant to Aspen Environmental Group, Ms. Stanin led the Todd Groundwater analysis of groundwater impacts from well stimulation (including hydraulic fracturing) for the state-wide programmatic EIR. Working with DOGGR as the lead agency, Ms. Stanin developed a methodology for describing the environmental setting and impacts analysis of California groundwater from well stimulation including development and application of significance criteria. She also assisted with the development of project standards and alternatives. The DEIR was released in January 2015.

*Kern River Water Allocation Plan (WAP) EIR, Kern Delta Water District, Kern County, CA*

As a subconsultant to ESA Water, Ms. Stanin led the analysis of groundwater impacts from implementation of the District's Kern River WAP. The WAP consisted of a series of prioritized management actions for the full use of the District's entitlement to river water for irrigation and recharge in spreading basins. The EIR project involved a detailed assessment of river diversions and use over an 11-year study period and potential impacts to groundwater when other parties replaced previously-released river water with groundwater. The impacts analysis focused on water levels and water budgets north and south of the Kern River. As of 2015, a supplemental EIR is in preparation.

**Contaminant Hydrogeology and Groundwater Quality Studies**

*South Basin Groundwater Protection Project for Orange County Water District, CA*

Ms. Stanin directed this assessment of impacts to water supply wells from perchlorate and volatile organic compounds (VOCs). Data from 55 potential contaminant sources within a 1.5 mile radius of the wells were incorporated into the analysis. The evaluation also included a regional assessment, documenting groundwater flow directions from the 1950s to the present as pumping patterns changed throughout the groundwater basin. Capture zones were analyzed for impacted wells. An analysis of inorganic water quality data and pumping data revealed that contaminant concentrations went up during non-pumping conditions and co-varied with key inorganic constituents in shallow groundwater. These data led to a preliminary assessment of contaminant migration pathways and identification of key data gaps. A workplan was developed to address data gaps (2006 - 2007).

*Evaluation of Perchlorate Plume, Rancho Cordova, CA*

Ms. Stanin provided hydrogeologic and litigation support for an industrial facility near Rancho Cordova. This area is characterized by commingled perchlorate plumes with impacts to offsite water supply wells. Technical evaluations directed by Ms. Stanin included groundwater contaminant characterization, plume delineation, source identification, and water supply impacts.

*Evaluation of Perchlorate Impacts to Municipal Wells, Santa Clarita Valley, CA*

Ms. Stanin provided hydrogeologic and litigation support for four water agencies with water supply wells impacted by perchlorate near Santa Clarita in Southern California. Her work involved an evaluation of the fate and transport of contaminants including perchlorate from a nearby industrial facility including impacts to surface water and groundwater. The study also evaluated use of pumping water supply wells for plume containment and other remedial strategies. Ms. Stanin has also served as a technical representative of the water companies to state and local agencies. This work included a technical presentation of perchlorate in water supply wells to Assemblyman Keith Richman and technical presentations to DTSC and working with DTSC to develop remedial options.

*Fate and Transport of NDMA for WateReuse Foundation*

Ms. Stanin served as Lead Hydrogeologic Investigator for a research project on the fate and transport of NDMA in the saturated zone. The project was funded by the WateReuse Foundation and participating water agencies and was conducted in concert with researchers from the University of California Berkeley, University of California Riverside, Arizona State University, and Todd Engineers (now Todd Groundwater). NDMA occurrence in groundwater was analyzed at four sites in California to analyze evidence of degradation or attenuation of NDMA in the saturated zone. NDMA releases were from historical industrial sources, artificial recharge of chlorinated wastewater into spreading basins, and the injection of treated wastewater into hydraulic barriers for seawater intrusion. Results were published in WateReuse publication *Investigation of N-Nitrosodimethylamine (NDMA) Fate and Transport*, 2006 (ISBN: 0-9747586-6-3).

*Environmental Investigations, San Gabriel Valley Superfund Site, Los Angeles County, CA*

Ms. Stanin served as project manager for environmental investigations and remedial measures for a landfill site in the San Gabriel Basin. This included a regional groundwater investigation over a 50 square-mile area of the basin, analysis of conjunctive use at the Santa Fe Spreading Grounds, and evaluation of the impacts on local groundwater flow directions and contaminant transport. The project also involved hydrogeologic support for construction and calibration of a three-dimensional finite difference flow model. Work also included specific hydrogeologic evaluations, groundwater modeling, identification and evaluation of Potential Responsible Parties (PRPs), allocation alternatives, impacts to water supply wells, and support on numerous regulatory, technical, and Superfund issues. Todd subsequently provided compliance with the site's Monitoring and Mitigation Program.

**Underground Injection Control (UIC) Program Experience**

*Class I UIC Permit, California Specialty Cheeses, San Joaquin County, CA*
Ms. Stanin prepared a successful Class I UIC permit application package for California Specialty Cheeses for deep injection of cheese processing wastes near Lathrop, CA. The application included an independent geologic assessment of subsurface stratigraphy and lithology, structural setting, target zones for injection, preparation of response plan, and estimated injection capacity. The application was approved by the U.S. Environmental Protection Agency, Region IX, with only minor modification. The Class I permit was only the third such permit that had been issued in California at that time. Follow on work included planning for the drilling and installation for injection wells (2005 – 2007).

*Deep Injection Feasibility Study, City of Goodyear, Maricopa County, AZ*
Ms. Stanin was project manager for a feasibility study for deep injection of brine generated from the City's groundwater treatment program. The study involved an assessment of the regional geology and hydrogeology, including research on potential injection near a subsurface salt deposit. The project also involved assessment of the U.S. Environmental Protection Agency's (USEPA) UIC regulations for Arizona. Preliminary costs and recommendations for additional investigation were provided. Limitations and data gaps were identified to assist the City with additional evaluation, if warranted (2006).

**Groundwater Expert Witness and Peer Review Experience**

*Expert on a Confidential Well Failure, Kern County, CA*
Ms. Stanin provided expert witness and deposition testimony for a consulting firm being sued for failure of a deep irrigation well. The case involved a review of regional groundwater conditions, construction, production, and specific capacity data for nearby irrigation wells, and daily records of drilling, development, and testing. The case also involved Standard of Care practices for well drilling. The case settled favorably for the defendant. (2013 – 2014).

*Court-appointed Expert on Groundwater Impacts near Stockton, CA*
Ms. Stanin provided expert hydrogeologic support to the Eastern District in US District Court during a settlement conference between plaintiffs and defendants. The support involved a written assessment of the source of soil and groundwater contamination at a former industrial site including transport and timing of release. Support for the settlement conference included development of a timeline for remedial activities and regulatory compliance (2012).

*Expert on Groundwater Fate and Transport, Orange County Water District, Orange County, CA*
Ms. Stanin provided expert witness and litigation support services to Orange County Water

District regarding impacts to water supply wells from perchlorate and volatile organic compounds (VOCs). The case, Orange County Water District, plaintiff, vs. Sabic Innovative Plastics US, LLC, et al., defendants, was filed in California Superior Court, County of Orange in 2008. Ms. Stanin provided six days of deposition testimony from April through November 2009 regarding the analysis of potential sources of contaminants.

*Expert on Groundwater Fate and Transport, Santa Clarita, CA*
Ms. Stanin provided expert witness and litigation support services to four water companies with water supply wells impacted by perchlorate near Santa Clarita, California. The case, Castaic Lake Water Agency, Newhall County Water District, Santa Clarita Water Company, and Valencia Water Company, plaintiffs, vs. Whittaker Corporation; Santa Clarita, LLC; Remediation Financial, Inc.; and Does 1-10, Inclusive, defendants, was filed in United States District Court, Central District of California. Project work involved an evaluation of the fate and transport of contaminants including perchlorate from a nearby industrial facility including impacts to surface water and groundwater. Ms. Stanin assisted with preparation of an expert report, several Declarations, and provided deposition testimony (2003 – 2007).

*Groundwater Expert/Peer Review Panel for Redwood City, CA*
Ms. Stanin was asked to evaluate the feasibility of drilling water supply wells associated with a proposed development on San Francisco Bay, referred to as the Saltworks project. The evaluation process examined the feasibility of the proposed sources of supply to determine if the City should proceed with the development of an Environmental Impact Report (EIR) in compliance with CEQA. Ms. Stanin also conducted an assessment of potential groundwater use and well locations to provide back-up water supply to the City (2009 – 2011).

*Expert on Landfill Litigation Loss of Permit, Harris County, TX*
Ms. Stanin provided expert witness and litigation support for a lawsuit against an insurance company for groundwater contamination and loss of an operating permit (Browning Ferris Industries vs. Certain Underwriters of Lloyds of London, et al.). Project work involved the examination of California Chapter 15 permitting requirements over time and groundwater contaminant fate and transport evaluations. Ms. Stanin provided an expert report, numerous affidavits, and deposition testimony (2004-2008).

*Litigation Support, Municipal Landfill, Fresno County, CA*
Ms. Stanin served as an Expert Witness on groundwater contamination in a civil litigation against a hazardous waste hauler for asbestos disposal in a landfill in Fresno, California. Technical components of the project include characterization of local groundwater contamination, regional groundwater flow, and vadose zone contaminant transport (1997).

*Peer Review of Contamination Characterization, Los Angeles County, CA*
Ms. Stanin provided a peer review and hydrogeologic analysis for a metals recycling facility in Los Angeles County. Analysis included groundwater elevation and contaminant plume mapping, identification of chemicals of concern including VOCs and petroleum hydrocarbons, evaluation of soil gas data, meeting with regulatory agencies, and preparation of a site-wide technical report.

**Publications / Panels / Presentations**

*Approach to Groundwater Impacts Analysis, DOGGR SB 4 EIR*, Invited Speaker, Groundwater Resources Association Symposium, Oil Gas and Groundwater in California, Wise Production and Protection of our Valuable Natural Resources, February 18, 2015.

*Groundwater Replenishment in the Seaside Basin: Increasing Basin Yield with Recycled Water*, 14th Biennial Symposium on Managed Aquifer Recharge, Groundwater Resources Association and Arizona Hydrological Society, July 31, 2014.

*Recharge in the Ames Valley: Making it Happen*, with D. Craig and E. Lin, Todd Engineers and M. West, Bighorn-Desert View Water Agency, Managed Aquifer Recharge Symposium, Increasing Opportunities for Groundwater Storage, National Water Resources Institute (NWRI), January 26, 2011.

*Deep Well Injection for Brine Disposal*, invited Speaker on Challenges and Progress in Developing Brackish Groundwater as a Sustainable Water Supply Panel, 9th Annual Multi-State Salinity Coalition Summit, January 2009.

*Benefits of Recycled Water Recharge of a Coastal Groundwater Basin*, with T.G. Cole, R.B. Chalmers, and R.B. Holden, proceedings of the WateReuse Association Annual Conference, Seattle, WA, September 2009.

*Complexities of Using Recycled Water to Recharge an Over-drafted Groundwater Basin*, with T.G. Cole, R.B. Chalmers, and R.B. Holden, proceedings of the WateReuse Association Annual Conference, Newport Beach, CA, March 2008.

*Storing Water in California Desert Basins: Selection of Managed Aquifer Recharge Sites in the Ames Valley Groundwater Basin San Bernardino County, CA*, with E. Lin, A. Garcia, and L. Eckhart, at “Increasing Groundwater Storage to Meet California’s Future Demand: Challenges and Solutions”, Groundwater Resources Association, 3rd Symposium in the Groundwater Resource Series, June 2007.

*Investigation of N-Nitrosodimethylamine (NDMA) Fate and Transport*, WateReuse Foundation publication 02-002-01, IBSN: 0-9747586-6-3, Copyright 2006 (Research Project Team Member with Todd Engineers, University of California Berkeley, University of California Riverside, and Arizona State University funded by WateReuse Foundation).

*Challenges for Recharge of Recycled Water, at “Assessment, Use, and Management of Groundwater in Areas of Limited Supply*,” Groundwater Resources Association (GRA) 15th Annual GRA Meeting and Conference, San Diego, California, September 21, 2006.

*The Occurrence, Fate, and Transport of NDMA in California Groundwater, Five Case Studies*, at "Emerging Contaminants in Groundwater: A Continually Moving Target," Groundwater Resources Association (GRA) 18th Symposium on Groundwater Contaminants, Concord, California, June 7-8, 2006.

*Stable and Other Isotope Techniques for Perchlorate Source Identification*, with W. Motzer, T. Mohr, S. McCraven, Environmental Forensics, v. 7, no. 4, pp 89-100, March 2006.

*Perchlorate: 20th Century Contaminant – 21st Century Solutions*, with W. Motzer, Southwest Hydrology, v.2, n. 6 (November/December 2003 issue), pp.24-26.

*Hayfield Conjunctive Use*, at "Sustaining Groundwater Resources, the Critical Vision," Groundwater Resources Association (GRA) 11th Annual GRA Meeting and Conference, Newport Beach, California, September 18-19, 2002.

East Meets West – National Water Solutions, invited Speaker on Water Quantity Issues Panel, Water Resources Conference, Holland & Knight, University of Florida, October 2001.

*Optimizing Groundwater Management Strategies in the Edwards Aquifer*, with D.K. Todd, in Proceedings of the World Water and Environmental Resources Congress, May 20-24, 2001, Orlando, Florida, Don Phelps and Gerald Sehlke, editors.

*Challenges to Conjunctive Use Programs*, with D.K. Todd and I. Priestaf, invited Conference Talk Conjunctive Use: Successful Experiences and New Frontiers, educational conference sponsored by Association of Ground Water Agencies and the American Ground Water Trust, April 11-12, 2001, Ontario, California.

**Professional Contributions**

Managed Aquifer Recharge (MAR) Standards Committee, American Society of Civil Engineers (ASCE) and Environmental Water Resources Institute (EWRI), MAR Guidelines Development Subcommittee, 2004 to present.

American Water Works Association (AWWA), Member of the Water Resources Management Delegation to Cuba, 2002.

## Hydrology and Water Quality: Surface Water

**Schaaf and Wheeler Consulting Civil Engineers**
**(Daniel Schaaf, P.E. and Andrew Sterbenz, P.E.)**

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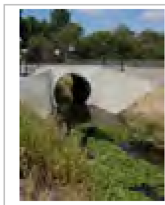
# Schaaf & Wheeler

Schaaf & Wheeler is a 32-person civil engineering firm, with 17 California registered professional engineers. Our experienced engineers comprehensively resolve water resources issues throughout California and the western United States. Our projects generally range from large flood control projects and FEMA flood insurance studies to local agency public works infrastructure projects – water, recycled water, sewer, and storm drain planning and design. Although certified by the State of California as a small business enterprise (certification #40527), Schaaf & Wheeler has a broad reach. Our engineers operate from four locations: Salinas, Santa Clara, San Francisco, and Santa Rosa.

*Schaaf & Wheeler ranks among the top 25 engineering firms in Silicon Valley, as compiled by the San José Business Journal (December 2014) and is the only firm listed to focus exclusively on water projects.*





## Areas of Focus

Schaaf & Wheeler has ten areas of focus within the water resources discipline.

- Hydrology and hydraulics analyses, including site evaluations and modeling;
- Flood control analyses, including floodplain studies and channel design, filing of letters of map revision, and FEMA coordination;
- Watershed assessments, erosion and sediment control, and bioengineered channel stabilization;
- Stormwater management and drainage services, including master planning, engineering, and design of urban storm drain systems and pump stations;
- Water quality, including design or review of best management practices (BMPs) for storm water treatment and hydromodification flow control facilities;
- Potable water system master planning, modeling, engineering; and design of supply, storage, collection and distribution systems, including tanks and booster stations;
- Waste water system master planning, engineering, and design of conveyance systems, including lift stations;
- Recycled water systems planning, engineering, and design; including reclamation feasibility studies and customer retrofits;
- Construction management, construction site observation, construction inspection services, value engineering, construction cost analysis, and constructability reviews;
- Project management, including management of subconsultants, containment of schedule and cost, and communications with client and stakeholders.

## Experience in Monterey County

Schaaf & Wheeler has prepared numerous reports and studies in Monterey County:

- Reclamation Ditch: Development of the HEC-RAS model of the Reclamation Ditch for the Monterey County Water Resources Agency. Prepared the Zone 9 Impact Fee Study and Nexus Report for development stormwater impact fees.
- Salinas River Lagoon Fish Screen, 2009-2011, Old Salinas River
- Potrero Road Tide Gate Configuration and Performance Study, 2000, Old Salinas River
- Carr Lake Multi-Purpose Flood Control Study, 2002, portion of the Reclamation Ditch system
- Bryant Canyon Flood Control Improvements (Soledad), 2005-2007, tributary to the Salinas River
- Castroville Pump Station, 2005, tributary to Moro Cojo Slough.
- Blanco Drain Pump Station, 2007, tributary to Salinas River
- Espinosa Pump Station, 2007-2008, tributary to the Reclamation Ditch
- Santa Rita Pump Station, 2003-2004, tributary to Reclamation Ditch.
- Jarvis Lateral Erosion Protection, 2007-2008, tributary to Santa Rita Creek.
- Upper Merritt Lake Hydraulic Analysis, 2012, floodplain study.
- City of Seaside, Dry Weather Stormwater Diversion Pump Station Design, 2008-2010.
- CSU-Monterey Bay, Storm Water Master Plan, 2005.
- Fort Ord Stormwater System Assessments, 2000, prepared for the Fort Ord Reuse Authority.

## Daniel J. Schaaf, PE – Vice President - Schaaf & Wheeler

**Education**

BSCE, San Jose State University

MSCE (Water Resources Engineering), San Jose State University

**Licenses**

Registered Civil Engineer, California #C57617

**Affiliations**

American Society of Civil Engineers

Floodplain Management Association

**Daniel J. Schaaf, PE** has 20 years of project experience encompassing the areas of flood control and drainage, surface water hydrology, and physical and numerical modeling. Dan has managed several large hydrology/hydraulics, flood control and drainage projects. He is skilled in open channel hydraulics, coastal and estuary processes, 1D and 2D modeling, floodplain mapping and storm drain master planning. He is currently working on implementing modeling projects that integrate pipe and surface flows using sophisticated 2D modeling software. He has performed several FEMA Flood Insurance Studies and Letters of Map Revisions for clients throughout California. He is proficient in modeling and GIS software: GeoHEC-HMS, GeoHEC-RAS, TRIM3D, RMA-2, RMA-10, MIKE 11, MIKE 21, MIKE-URBAN, MOUSE, EPA SWMM, Cybernet, InfoSWMM, InfoWorks, QUAL2E, EPA-Net, ArcGIS 10.0, Spatial Analyst, 3D Analyst, AutoCAD Map and ArcIMS.

### Major Project Accomplishments

#### Planning and Design

Storm Drain Master Plan – City of East Palo Alto (2014)
North Bayshore Storm Drain Master Plan – City of Mountain View (2014)
North San Jose Drainage Master Plan - City of San Jose (2013)
Stormwater Master Plan - City of Los Altos (2011)
Stormwater Master Plan - County of Santa Cruz (2009-2010)
El Charro Specific Plan Channel Design – City of Livermore (2005-2010)
Northside Pump Station Design - City of Alameda, Public Works Department (2010)
Storm Drain Master Plan and Sea Level Rise Study – City of Alameda (2008-2010)
Storm Drain Master Plan - City of Paso Robles (2007)
Program Management for Storm Drain CIP– City of Belmont Public Works (2005)
Storm Drain Master Plan - City of San Mateo (2004)
Storm Drain Master Plan and Subsequent Update – City of Livermore (2003)

#### Hydrology and Hydraulics

Hydrologic & Hydraulic Model for Zone 7 Watershed – Zone 7 Water Agency (2014)
Greenwood Road Culvert Replacement Hydrologic Study – County of Napa (2014)
Oakville Cross Road Bridge Replacement No-Rise Study - County of Napa (2014)
Groundwater Replenishment Project EIR Hydrology - Urban Runoff Capture at Lake El Estero – City of Monterey (2013 -2014)
Review of Hydraulic Model for Lower Carmel River – Carmel Area Wastewater District (2013 – 2014)
City of Sebastopol Northeast Area Specific Plan EIR – Placeworks (2005 – 2008)
Isabel Interchange, Livermore, Storm Drain Alignments – Mark Thomas & Associates (2006)
Pajaro River Breaching Alternatives - County of Santa Cruz (2006-2007)
El Charro Specific Plan Hydrology Study - City of Livermore (2005-2009)
Napa Sonoma Salt Marsh Restoration - US Army Corps of Engineers (1999)
Highway 46/101 Drainage Study - City of Paso Robles (2008-2009)

#### Floodplain Management

Livermore Airport Flood Protection Planning – City of Livermore (2015)
Dam Break Analyses and Inundation Mapping for Little Grass Valley, Sly Creek, and Lost Creek Dams – South Feather Water Agency (2015)
Bear Gulch Station 46 Tank Failure Inundation Study – California Water Resource Company (2015)
Silicon Valley BART Extension Floodplain Study - Valley Transit Athority (2012)
San Tomas Aquino Flood Study - Santa Clara Valley Water District (2012)

Last Updated: August 25, 2015

Salt Creek Floodplain Analysis - Private Owner Redding (2012)
Flood Analysis and Bayfront Levee Wave Analysis - City of San Mateo (2010)
Arroyo Las Positas and Arroyo Mocho CLOMR - City of Livermore (2011)
Southern California Wildfire Post Fire Flood Study - FEMA (2003 and 2007)
Phelps Creek LOMR - UC Sanata Barbara (2009); Soscol Gateway Drainage Study - City of Napa (2005)
Hooke Creek Flood Insurance Study - San Bernardino County, FEMA (2005)
Mint Canyon Flood Insurance Study - Los Angeles County, FEMA (2008)

**River and Stream Enhancement**

Altamont Creek Oil Removal Study - City of Livermore (2009-2010)
East Arm Mountain Lake Enhancement, San Francisco - The Presidio Trust (2005)
Reclamation Ditch Channel Study - Monterey County Water Resources Agency (Ongoing)
South Bay Pond Interim Management Plan - Cargill Salt (2000-2004)

## Andrew A. Sterbenz, P.E. – Senior Engineer – Schaaf & Wheeler

### Education

BSCE, Massachusetts Institute of Technology

MSCE, University of Texas at San Antonio

### Licenses

Registered Civil Engineer
California #C69703
Texas #93537

### Affiliations

American Water Works Association

Society of American Military Engineers

American Public Works Association

Monterey Bay Water Works Association

**Andrew A. Sterbenz, P.E.** has over 25 years of experience managing engineering organizations and solving engineering problems, and is recognized for developing and implementing creative solutions to complex problems. In 2006-2007 and 2012-2013 he served as the full-time District Engineer for the Marina Coast Water District, managing a $150 million water and sewer capital improvements budget that includes the development of new groundwater, recycled and desalinated water supplies for the former Fort Ord. He has prepared long-range water supply plans in California and Texas. Plans include the projection of population and water demands, the assessment of current water supply availability, and the analysis of water management strategies to meet projected shortages. He is adept at analyzing, researching, planning, coordinating and executing strategies to achieve organizational goals. Andy has prepared detailed plans and specifications for bidding and construction for public agencies, and managed construction projects for the client agencies. He has conducted environmental studies and remediation design, and assisted with environmental permitting. He is well experienced with state and federal environmental regulations.

### Major Project Accomplishments

#### Water and Wastewater Systems Planning and Design

Pure Water Monterey Groundwater Replenishment Project – Denise Duffy & Assoc. – Monterey County, CA (2013-2015)
Reclamation Ditch Yield Study – Monterey Penninsula Water Management District - Monterey County, CA (2013-2014)
Blanco Drain Yield Study – Monterey Penninsula Water Management District - Monterey County, CA (2013-2014)
Aptos Booster Pump Station – Soquel Creek Water District – Aptos, CA (2012-2015)
McGregor Drive Booster Pump Station – Soquel Creek Water District – Capitola, CA (2012-2015)Interim District Engineer - Marina Coast Water District - Marina, CA (2006-2007, 2012-2013)
Soquel Drive Cast Iron Main Replacement-Soquel Creek Water District-Soquel, CA (2012)
Watkins Gate Well and Pipeline– Marina Coast Water District – Marina, CA (2011-2012)
Stonegate Water Supply Project – San Benito County Public Works-Hollister, CA (2011-2013)
Castroville Community Plan Infrastructure Estimate – Monterey County Redevelopment Agency – Monterey, CA (2009-2010)
Sewer Feasibility Study for Commercial Parkway – Monterey County Redevelopment Agency – Castroville, CA (2010)
Boronda Meadows General Development Plan Peer Review – PMC, Inc. – Salinas, CA (2010)
Modular Wastewater Treatment System - LOGCAP – Balkans, Yugoslavia (1999)

#### Water Delivery Systems

Raw Water Pump Station Design and Construction - Coastal Water Authority - Houston, Texas (2000)
Moses Bayou 84-Inch Siphon - Gulf Coast Water Authority - Texas City, Texas (2001)
System Water Audit - Gulf Coast Water Authority - Texas City, Texas (1999)

#### Water Supply Planning

2010 Urban Water Management Plan – Marina Coast Water District – Marina, CA (2010-2011)
Regional Urban Water Augmentation Project - Marina Coast Water District - Marina, CA (2006-2007)
Region H Water Plans (2001 and 2006) - San Jacinto River Authority - Conroe, Texas (1998-2001, 2002-2006)

Colorado River Water Availability Model - Texas Natural Resource Consv. Comm. – Austin, TX (2002)

**Stormwater Planning and Design**

Bryant Canyon Channel – Monterey County Water Resources Agency – Soledad, CA (2013 –2014)
Wrigley-Ford Creeks Maintenance Project – City of Milpitas – Milpitas, CA (2011-2012)
Reclamation Ditch Repair at Alisal St – Monterey County Water Resources Agency – Salinas, CA (2009)
Pajaro River Levee Maintenance Design – Monterey County Water Resources Agency – Salinas, CA (2009)

# Noise and Vibration

Michael S. Thill, Illingworth & Rodkin

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ILLINGWORTH & RODKIN, INC.
Acoustics • Air Quality
*1 Willowbrook Court, Suite 120*
*Petaluma, California 94954*
*Tel: 707-794-0400* *Fax: 707-794-0405*
*www.Illingworthrodkin.com* *mthill@illingworthrodkin.com*

**MICHAEL S. THILL**

Mr. Thill is a principal of the firm with 17 years of professional experience in the field of acoustics. His expertise includes performing field research, analyzing data, and noise modeling. He has conducted numerous field surveys in a variety of acoustical environments to quantify airborne noise levels, groundborne vibration levels, and hydro-acoustic noise levels. He has analyzed and summarized complex sets of data for inclusion into noise models. Mr. Thill has been trained, and is a regular user of FHWA's Traffic Noise Model (TNM), and is familiar with federal and State procedures for preparing highway noise study reports.

Mr. Thill has authored technical noise reports for various land use proposals including residential, commercial, educational, and industrial developments. He has managed the General Plan Update noise studies for several communities in California and has recommended policy language in order to maintain compatible noise levels community-wide. Some of his recent major projects have included the assessment of noise and vibration from quarry expansion projects, groundwater recharge projects, and winery projects where operations and special events have been of concern in rural settings. He has vast experience explaining acoustical concepts and the results of his analyses in public forums to the general public and project decision-makers.

Mr. Thill has also led traffic noise investigations for major transportation projects including the Route 4 Bypass project (2003 to 2013) and the I-680/Route 4 Interchange project (2014 to 2015) in Contra Costa County, California. He managed the noise study reports the US Highway 101 and State Route 85 Express Lanes projects for the Santa Clara County Valley Transit Authority (2011 to 2013), proposed along 66 miles, combined, of project study area between Mountain View and Morgan Hill, California. In 2015, Mr. Thill is leading the analyses of noise impacts and noise abatement for the US Highway 101 / State Route 84 Interchange Project in Redwood City, California and the US Highway 101 / Hearn Avenue Interchange Project in Santa Rosa, California.

**PROFESSIONAL EXPERIENCE**

| | |
|---|---|
| 2009 - Present<br>Principal | Illingworth & Rodkin, Inc.<br>Petaluma, California |
| 2005 - 2009<br>Senior Consultant | Illingworth & Rodkin, Inc.<br>Petaluma, California |
| 1998 - 2005<br>Staff Consultant | Illingworth & Rodkin, Inc.<br>Petaluma, California |

**EDUCATION**

| | |
|---|---|
| 1998 | University of California at Santa Barbara<br>B.S., Major: Environmental Science |

**PROFESSIONAL SOCIETIES**

Institute of Noise Control Engineering
Association of Environmental Professionals

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# Nutrient Response

**Margaret Nellor, P.E., D.B.E., W.B.E., H.U.B. Gordon Williams, PH.D, P.E.**
**Bahman Sheikh, PH.D., P.E.**

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**MARGARET H. NELLOR, PE, DBE, WBE, HUB**
**NELLOR ENVIRONMENTAL ASSOCIATES, INC**
**4024 WALNUT CLAY DRIVE**
**AUSTIN, TX 78731**
**512.374.9330**
**margie@nellorenvironmental.com**

## SUMMARY

Ms. Nellor has over 38 years of professional experience in the environmental field including water and wastewater quality management; water recycling (potable reuse and non-potable reuse); regulatory permitting and compliance; regulatory and legislative policy development and analysis; research; and source control and pollution prevention. She is also very active in professional activities related to the environmental profession.

## PROFESSIONAL EXPERIENCE

2005 – Present: *Nellor Environmental Associates, Inc.*
President, Nellor Environmental Associates, Inc. (NEA), an environmental engineering consulting firm that provides technical services and assistance related to water reclamation and wastewater management. NEA has been certified as a Disadvantaged Business Enterprise in Texas and California, and as a Women's Business Enterprise by the City of Austin, Texas. Specific areas of experience include:

- Permitting/Regulatory Assistance - Ms. Nellor has provided technical review and analysis, developed formal regulatory comments, and prepared hearing testimony for numerous wastewater discharge and water reuse permits, including the seven permitted potable reuse projects in California (Montebello Forebay Groundwater Recharge Project, Chino Basin Groundwater Recharge Project, Groundwater Replenishment System, West Coast Basin Barrier Project, Alamitos Barrier Project, Dominguez Gap Barrier Project, and the Cambria Emergency Water Supply Project). Examples include:
  - Engineering Report and water recycling permit for the expansion of the Alamitos Barrier Project
  - NPDES Permits for the City of Los Angeles, CA: D.C. Tillman Water Reclamation Plant, Los Angeles/Glendale Water Reclamation Plant, Terminal Island Water Reclamation Plant and Hyperion Treatment Plant
  - NPDES Permits for the County Sanitation Districts of Los Angeles County's Joint Water Pollution Control Plant and Whittier Narrows Water Reclamation Plant
  - NPDES Permit for the West Basin Municipal Water District's Demonstration Desalination Project
  - NPDES Permit for the Las Virgenes Municipal Water District
  - NPDES Permit, General Permit, and Los Angeles County Storm Water Permit for the Castaic Lake Water Agency
  - NPDES Permit for the Newhall Ranch Water Reclamation Plant
  - Waste Discharge and Water Recycling Requirements for the City of Los Angeles, CA Donald C. Tillman and Los Angeles Glendale Water Reclamation Plants
  - Waste Discharge and Water Recycling Requirements and technical assistance for the West Basin Municipal Water District's West Basin Coast Basin Barrier Recycled Water Project Expansion
  - Waste Discharge and Water Recycling Requirements for the for the County Sanitation Districts of Los Angeles County's Lancaster Water Reclamation Plant
  - Permitting Issues Related to Groundwater Recharge for the for the County Sanitation Districts of Los Angeles County's Palmdale Water Reclamation Plant
  - Mandatory Minimum Penalties for the County Sanitation Districts of Los Angeles County's Valencia Water Reclamation Plant
  - Technical Assitance for Enforcement Actions or Litigation Related to NPDES Permits and Industrial Waste Permits
  - Regulatory Assistance for City of Phoenix 23rd Ave. and 91st Ave. Treatment Plants
  - Regulatory Assistance for the City of Vacaville, CA
  - Regulatory Options for Wet Weather Discharges for the Lake Arrowhead Community Services

District

- Policies/Regulations - Ms. Nellor has worked on numerous policies, regulations, and special studies including water recycling criteria, water quality standards, salt nutrient management plans, antidegradation regulations, whole effluent toxicity testing, impairment determinations, and total maximum daily loads. She serves as an advisor to the California Division of Drinking Water for the development of Groundwater Recharge and Reuse Regulations, has served as a technical advisor to WateReuse California for the development of the Water Recycling Policy and the Scientific Advisory Panel for Constituents of Emerging Concern (CECs), and was a co-author of *Direct Potable Reuse: the Path Forward* sponsored by the WateReuse Association, the WateReuse Research Foundation, and the National Water Research Institute. She is also providing technical advise to the Texas Commission on Environmental Quality regarding potable reuse. Other examles include:
  - U.S. EPA's Recreational Water Quality Criteria
  - U.S. EPA's Draft Guidance for Implementing Methylmercury Water Quality Criterion
  - California State Water Resources Control Board Recycled Water Policy and CEC Monitoring
  - California State Water Resources Control Board General Irrigation Permit
  - California State Water Resources Control Board Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (SIP and Amendments)
  - California State Water Resources Control Board Chlorine Residual Policy
  - California State Water Resources Control Board's Effluent Dependent Water Bodies and Mercury Workgroup
  - California State Water Resources Control Board Ocean Plan Amendments and Triennial Reviews (including the Brine Discharge Policy)
  - California State Water Resources Control Board Proposed Methylmercury Water Quality Objectives for Inland Surface Waters and Enclosed Bays and Estuaries
  - California State Water Resources Control Board Proposed San Francisco Bay-Delta Mercury Offset Policy
  - Los Angeles Regional Water Quality Control Board Basin Plan and Triennial Reviews

- Planning and Compliance Strategies – Ms. Nellor has worked on numerous projects to identify, evaluate, develop, and recommend the most cost effective options for water recycling and wastewater management. She specializes in analyzing the impacts of regulations on compliance and implementation strategies, including master planning studies for potable reuse projects, salt/nutrient management, source control, CEQA/NEPA reviews, and antidegradation. Projects include:
  - PURE Water Monterey Groundwater Replenishment Project Environmental Impact Report
  - Texas Water Development Board Evaluating the Potential for Direct Potable Reuse in California
  - Texas Water Development Board State of Technology of Water Reuse, 2011 Water Reuse Research Agenda, and History of Water Reuse in Texas
  - Texas Water Development Board Direct Potable Reuse Resource Document
  - City of Lancaster, CA Groundwater Recharge Feasibility Study and Fatal Flaw Analysis
  - City of Oceanside, CA Indirect Potable Reuse and Pathogen Removal Study
  - Metropolitan Water District of Southern California's Joint Groundwater Replenishment Feasibility Study
  - Alternatives Assessment and Preliminary Design for the Water Replenishment District of Southern California's Groundwater Reliability Improvement Program
  - As-Needed Engineering Technical Services Consultant for Pure Water San Diego Program
  - California Environmental Quality Act public health and regulatory assistance for the Central and West Coast Basin Groundwater Master Plan and the Monterey Peninsula Groundwater Replenishment Project
  - City of Los Angeles Groundwater Recharge Master Planning Process
  - City of San Diego Surface Water Augmentation Demonstration Project
  - Eastern Municipal Water District Indirect Potable Reuse Phase I Facilities Planning Study
  - East Valley Water District Indirect Potable Reuse Feasibility Study and Implementation Program
  - Rancho California Water District Indirect Potable Reuse Conceptual Design Study
  - South Sacramento County Agriculture & Habitat Lands Recycled Water Project Programmatic

Feasibility Study
- Upper San Gabriel Valley Water District Indirect Potable Reuse Feasibility Study
- Santa Clara Valley Water District Potable Reuse Project Plan
- Recycled Water Recharge Feasibility Study
- Montebello Forebay Groundwater Recharge Project Expansion
- Central and West Basin Salt Nutrient Management Plan
- White Paper for the National Water Research Institute on the *Status of the Water Recycling 2030: Recommendations of California's Recycled Water Task Force*
- White Paper for WateReuse California on *Public and Political Acceptance of Direct Potable Reuse*
- California State Implementation Policy Database Development
- Government Accounting Office Study on the Cost of Federal Water Requirements
- San Jose / Santa Clara Salinity Study
- Southern California Water Recycling Projects Initiative Water Quality Technical Memorandum No. 5 *Potential Salinity Impacts to Recycled Water*
- Water Recycling Site Inspection Program, Regulations and User Handbook for the County Sanitation Districts of Los Angeles County
- Water Sofener Rebate Program for County Sanitation Districts of Los Angeles County
- Upper Santa Clara River Chloride Total Maximum Daily Load
- City of Austin TX Water Utility - Assessment of Requirements for Auxiliary Water
- Copper Analytical Issues for the City of Santa Rosa, CA
- Monograph on Adaptive Implementation of TMDLs

- Source Control – Ms. Nellor has worked on numerous projects to related to evaluating and recommending source control strategies; Projects include:
    - Review and evaluation of the City of Los Angeles source control program related to compliance with California Department of Public Heath draft groundwater recharge regulations.
    - Review and evaluation of the Orange County Water District's source control program and Santa Ana Watershed Project authority's source control programs related to increased use of recycled water for the Groundwater Replenishment Project.
    - Development of national strategy for the National Association of Clean Water Agencies regarding development of local limits for conventional and nonconventional pollutants.

- Research - Ms. Nellor is involved with a number of research projects related to the use of recycled water and management of wastewater, and serves on numerous project advisory committees. She was the Principal Investigator for WateReuse Research Foundation projects WRF-06-018 *Tools to Assess and Understand the Relative Risks of Indirect Potable Reuse Projects* and WRF-08-01 *Developing Standards/Criteria for Various End Uses of Recycled Water*. She was on the research team for WRF projects 09-02 *Framework for Informed Planning Decisions Regarding Potable Reuse and Dual Pipe Systems* and 10-14 *The Future of Purple Pipes: Exploring the Best Use of Non-Potable Recycled Water in Diversified Urban Water Systems*. She also participated as a contributor to the WateReuse Research Foundation's *Best Practices for Developing Indirect Potable Reuse Projects*. She has served on research advisory committees for the WateReuse Research Foundation and the Water Environment Research Foundation.

1995 – 2005: *County Sanitation Districts of Los Angeles County*
The Sanitation Districts provide for the wastewater and solid waste management needs of over 5 million people in 78 cities and portions of Los Angeles County, California. Ms. Nellor was the Assistant Department Head of Technical Services. This position is responsible for the overall administration of the agency's water reclamation and research programs and water quality permit and compliance programs for the agency's wastewater, biosolids, and solid waste management facilities. She was responsible for managing all water recycling and wastewater permitting activities, including permit amendments, revisions, petitions, and litigation. She was responsible for liaison activities with federal, state and local governmental agencies on legislative and regulatory issues, including the Los Angeles Basin Plan, the California Toxics Rule, the State Implementation Plan, the California Ocean Plan, and the State Mandatory Minimum Penalty Program. Ms. Nellor was also the co-project manager for a Water Research Foundation $10 million

water recycling research project related to the efficacy and sustainability of using recycled water for groundwater replenishment.

1991 – 1995: *Orange County Sanitation District*
The District provides for the wastewater management needs of over 2 million people in Orange County, California. Ms. Nellor was the Acting Head of the Technical Services Department, which was responsible for the agency's air and wastewater quality, permitting and compliance programs, research programs, source control and pollution prevention programs, and recycling activities (water and biosolids). She was also responsible for liaison activities with federal, state and local governmental agencies on legislative and regulatory issues. During her tenure at the District, she also served as the head of the agency's source control program.

1977 – 1991: *County Sanitation Districts of Los Angeles County*
Ms. Nellor was responsible for managing the agency's source control and industrial pretreatment program. During her tenure at the Sanitation Districts, she held other positions responsible for water recycling permitting and implementation; wastewater management, permitting and compliance activities; and water recycling research. Ms. Nellor was the project manager of a $3 million water recycling research project related to the health effects of using recycled water for groundwater replenishment.

**EDUCATION:**
M.S. Environmental Health Engineering
B.S. Civil Engineering, University of Texas at Austin

**REGISTRATION**: Registered Civil Engineer
California (No. 31997)
Texas (No. 95405)

**CERTIFICATION**:
Texas: Disadvantaged Business Enterprise and City of Austin Women's Business Enterprise
California: Disadvantaged Business Enterprise

**AWARDS**
Association of Metropolitan Sewerage Agencies President's Award
Order of the Silver Cover, California Water Pollution Control Association
University of Texas Civil and Architectural Engineering Academy of Distinguished Alumni
WateReuse Association, CA Section, Recycled Water Advocate of the Year, 2005
National Association of Clean Water Agencies, 2006 Distinguished Performance Award
National Association of Clean Water Agencies Hall of Fame

**SOCIETIES**
American Society of Civil Engineers
Association of Clean Water Agencies
- Served on Board of Directors
- Served as Chair Regulatory Policy Committee
- Served as Co-Chair Mercury Workgroup, current member
- Member Emerging Contaminants Workgroup
- Member Pathogen Workgroup

Environmental Protection Agency's Effluent Guidelines Task Force
- Served as Co-Chair
- Served as member

Tri-TAC
- Past Chair (1996-99)
- Member

Water Environment Association of Texas
Water Environmental Federation
- Water Reuse Committee

Long Range Planning Committee (2005-2006)
Chair Pollution Prevention Committee (1993-1995)
Chair, Ad Hoc Source Control Committee (1991-1993)

Water Environment Research Foundation
Research Council (2001-2007)
Trace Organics Issue Area Team

WateReuse Association
Board of Directors (1997 – 2008)
Past President (2001 -2003)
Regulatory Committee
Potable Reuse Committee

WateReuse Foundation
Past Vice President Board of Directors (2000 – 2005)
Research Advisory Committee (2005-2010)

University of Texas Engineering Foundation Advisory Council of the College of Engineering (2005 – 2008)

## PUBLICATIONS

Over 40 technical publications, papers, and contributions to books and manuals of practice (*see* attachment).

## Papers and Publications

Nellor, M.H., Soller, J.A., McDonald, E.T., Cruz, C.J. (2015) Health risk associated with direct potable reuse – evaluation through quantitative relative risk assessment case studies. *Environmental Science: Water Research & Technology*, DOI: 10.1039/C5EW00038F.

Chang, H.C., Fu, P.L.K, Nellor, M.H. (2014) Multi-barrier treatment makes a recycled water project possible in Los Angeles County. WE&T, 27, 8, 64-68.

Chang, H.C., Fu, P.L.K, Nellor, M.H. (2014) A Case Study of Multi Barrier Treatment Based on the Expanded Alamitos Barrier Recycled Water Project in Los Angeles County, California. Proceedings WEFTEC 2014, Sept. 27-Oct.1, 2014, New Orleans, LA.

Chang, H.C., Fu, P., Johnson, T.A., Nellor, M.H. (2013) Implementing California's New Draft Groundwater Replenishment Reuse Regulations and 2013 Amended Recycled Water Policy, Los Angeles County CA. Proceedings WEFTEC 2013, Oct. 5-9, 2013, Chicago, IL.

Chang, H.C., Fu, P., Johnson, T.A., Nellor, M.H. (2013) Implementing California's New Draft Groundwater Replenishment Reuse Regulations and 2013 Amended Recycled Water Policy, Los Angeles County, California. Proceedings of the WateReuse 2013 California Annual Conference, March 17-19, 2013, Monterey, CA.

Bickford, G. and Nellor, M. 2012 (but published 2013). *The Future of Purple Pipes: Exploring the Best Use of Non-potable Recycled Water in Diversified Urban Water Systems*. WateReuse Research Foundation, Alexandria, VA.

Nellor, M., Soller, J., Bruce, G., Fox, P, Skrepnek, G., Flander, L. (2013) *Overview of WRF-06-16: Tools to Assess the Risks of Indirect Potable Reuse Projects*. WateReuse Research Foundation, Alexandria, VA.

Fox, P., Lim, S.J., Flander, L., Speirs-Bridge, A., Skrepnek, G., Soller, J., Nellor, M. (2012) *Development and Application of Tools to Assess and Understand the Relative Risks of Regulated Chemicals in Indirect Potable Reuse Projects: Predicting Future Contaminants of Concern for Indirect Potable Water Reuse*, Volume 3, WateReuse Research Foundation, Alexandria, VA.

Soller, J.A. and Nellor, M.H. (2011) *Development and Application of Tools to Assess and Understand the Relative Risks of Regulated Chemicals in Indirect Potable Reuse Projects: the Chino Basin Groundwater Recharge Project*, *Tools to Assess and Understand the Relative Risks of Indirect Potable Reuse and Aquifer Storage & Recovery Projects*, Volume 1b, WaterReuse Research Foundation: Alexandria, VA.

Soller, J.A. and Nellor, M.H. (2011) *Development and Application of Tools to Assess and Understand the Relative Risks of Regulated Chemicals in Indirect Potable Reuse Project: the Montebello Forebay Groundwater Recharge Project*, *Tools to Assess and Understand the Relative Risks of Indirect Potable Reuse and Aquifer Storage & Recovery Projects*, Volume 1a, WaterReuse Research Foundation: Alexandria, VA.

Tchobanoglous, G, Leverenz, H., Nellor, M., Crook, J. (2011) *Direct Potable Reuse: A Path Forward*. WateReuse Research Foundation, National Water Research Institute, WateReuse California, Alexandria, VA.

Bruce, G.M., Pleus, R.C., Peterson, M.K., Nellor, M.H. Soller, J.A. (2010) *Development and Application of Tools to Assess and Understand the Relative Risks of Drugs and Other Chemicals in Indirect Potable Reuse, Tools to Assess and Understand the Relative Risks of Indirect Potable Reuse and Aquifer Storage & Recovery Projects, Volume 2,* WaterReuse Research Foundation: Alexandria, VA.

Nellor, M. and Larson, B. (2010) *Assessment of Approaches to Achieve Nationally Consistent Reclaimed Water Standards White Paper*. WaterReuse Research Foundation: Alexandria, VA.

Nellor, M. and Larson, B. (2010) *Assessment of Approaches to Achieve Nationally Consistent Reclaimed Water Standards White Paper*. Conference Proceedings, WateReuse Symposium, September 14, 2010, Washington, D.C.

Nellor, M. H. and Millan, M. (2010) *Public and Political Acceptance of Direct Potable Reuse*, White Paper prepared for WateReuse California, Sacramento, CA.

Soller, J., Nellor, M., Bruce, G., Fox, P., Skrepnek, G., Flander, L. (2010) *Tools to Assess the Risks of Indirect Potable Reuse Projects*. *Conference Proceedings*, WateReuse Symposium, September 13, 2010, Washington, D.C.

Fox, P., Skrepnek, G., Flanders, L., Nellor, M., Soller, J., Bruce, G. (2009) *Predicting Future Contaminants of Concern for Indirect Potable Water Reuse*. *Conference Proceedings*, WateReuse Symposium, September 13-16, 2009, Seattle, WA.

Aladjem, D., Bolland, D., Davis, M., Dembegiotes, G., Larson, R., Michalczyk, B., Nellor, M., Pawson, M.G. (2009) Assuring a Clean Abundant Water Supply - Developing California's Recycled Water Policy through a Stakeholder Process. *Conference Proceedings*, WateReuse Symposium, September 13-16, 2009, Seattle, WA.

Nellor, M. H. (2009) *Views on the Status of Water Recycling 2030: Recommendations of California's Recycled Water Task Force*. NWRI White Paper, Fountain Valley, CA.

Nellor, M.H. and Daniel, U. (2008) When Policies Collide: The California Ocean Plan versus Water Reuse and Desalination. *Proceedings California Section WateReuse Association Conference*, March 2008, Newport Beach, CA.

Fox, P., Houston, S., Westerhoff, P., Nellor, M., Yanko, W., Baird, R., Rincon, M., Gully, J., Carr, S., Arnold, R., Lansey, K., Quanrud, D., Ela, W., Amy, G., Reinhard, M., Drewes, J. (2006) *Advances in Soil Aquifer Treatment for Sustainable Reuse*. AWWA Research Foundation and American Water Works Association, Denver, CO.

Kuo, J., Chen, C, Nellor, M. (2003), Standardized Collimated Beam Testing Protocol for Water/Wastewater Ultraviolet Disinfection. *Journal of Environmental Engineering*, 129:774-779.

Fox, P., Drewes, J.E., Nellor M.H. (2000), Watershed Analysis of Water Reuse Systems. *Proceedings Water Reuse Conference of the American Water Works Association/Water Environment Federation*, Water Reuse 2000, San Antonio, TX.

Fox, P., Houston, S., Westerhoff, P., Drewes, J., Nellor, M., Yanko, W., Baird, R., Rincon, M., Arnold, R., Lansey, K., Bassett, R., Gerba, C., Karpiscak, M., Amy, G., Reinhard, M. (2001) *An Investigation of Soil Aquifer Treatment for Sustainable Water Reuse*. AWWA Research Foundation and American Water Works Association, Denver, CO.

Drewes, J.E., Fox, P., Nellor, M.H. (2000), Efficiency and Sustainability of Soil-Aquifer Treatment for Indirect Potable Reuse of Reclaimed Water. *Water, Sanitation and Health*. London: IWA Publishing, 227-232.

Drewes, J.E., Rauch, T., Rincon, M., Nellor, M.H., Fox, P. (1999) A Watershed Guided Approach for Water Quality Assurance in Indirect Potable Reuse Systems: Experiences from Field Studies in Arizona and California. *Proceedings WateReuse Foundation's Annual Water Reuse Research Conference*, Monterey, CA.

Drewes, J.E. Fox, P. Nellor, M.H. (1998), Efficiency and Sustainability of Soil-Aquifer Treatment for Indirect Potable Reuse of Reclaimed Water. *WHO Conference Water, Sanitation, and Health: Resolving Conflicts Between Drinking Water Demands and Pressures From Society's Wastes*, Germany.

Drewes, J.E., Fox, P. Nellor, M. (1998), Efficiency and Sustainability of Soil-Aquifer Treatment for Indirect Potable Reuse of Reclaimed Water. *Proceedings WateReuse Foundation's Annual Water Reuse Research Conference*, Monterey, CA.

Hartling, E.C. and Nellor, M.H. (1998), Water Recycling in Los Angeles County. In *Water Reclamation and Reuse*. Water Quality Management Library, Volume 10. Edited by Takashi Asano.

Leserman, J.R., Nellor, M., Fox, P., Arnold, R.G., Amy, G.L. (1997), Soil Aquifer Treatment of Reclaimed Wastewater. *Proceedings American Water Resources Association, Conjunctive Use of Water Resources: Aquifer Storage and Recovery*, Long Beach, CA, 321-329.

Tran, J.H. and Nellor, M.H. (1994) Direct Copper Plating Without the Electroless Copper Solution. *Proceedings 67th Annual Water Environment Federation Conference*, Chicago, Illinois.

Baird, J.D., Renescu, A. and Nellor, M.H. (1993), Pollution Prevention Program in the Canning Industry. A Strategy for Success. *Proceedings 66th Annual Water Environment Federation Conference*, Anaheim, California.

Renescu, A. and Nellor, M.H. (1993), Dynamic Pollution Prevention Program Provides Results. *Industrial Wastewater*, 1:2:46-51.

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Nellor, M.H., Dryden, F.D., and Chen, C. (1979), Health Effects of Groundwater Recharge. *Proceedings of Water Reuse Symposium*. AWWA Research Foundation, Denver, CO.

MISCELLANEOUS:

Contributing author for *Direct Potable Reuse Research Document*, prepared for the Texas Water Development Board, May 1015.

Contributing author for *State of Technology for Water Reuse*, prepared for the Texas Water Development Board, August 2010.

Contributing author for *Using Reclaimed Water to Augment Potable Water Resources*, prepared by a Joint Task Force of Water Environment Federation and the American Water Works Association, 2008.

Contributing author for *Adaptive Implementation of Water Quality Improvement Plans: Opportunities and Challenges*, Nicholas School of the Environment and Earth Sciences, Duke University, June 25, 2007.

Contributing author for *Managing Wastewater in Coastal Urban Areas*. National Research Council. National Academy Press, Washington, D.C., 1993.

Contributing author for the 1980 and 1989 Editions of the Water Pollution Control Federation's *Water Reuse Manual of Practice*.

# Gordon Williams, Ph.D., P.E.

## Education

•Ph.D. Civil & Environmental Engineering, *University of California, Berkeley*
•M.S., Civil & Environmental Engineering, *University of California, Berkeley*
•B.S., Civil Engineering, *Virginia Tech, Blacksburg*

## Registration

Civil Engineer, State of California – No. 78671

## Summary

Dr. Gordon Williams is a Supervising Engineer at Trussell Technologies, and a B.S. from Virginia Tech and a M.S. and Ph.D. from the University of California at Berkeley. Dr. Williams has 10 years wastewater and water reuse experience. In his doctoral work, Dr. Williams studied granular-media rapid-depth filtration for water reuse and focused on understanding how loading rate impacts tertiary filter performance. As a result of his research, several California wastewater treatment facilities are able to maximize their recycled water production by operating at loading rates up to 7.5 gpm/ft$^2$, which is 50% higher than the 5 gpm/ft$^2$ limit specified by the California Title-22 Water Recycling Criteria. Williams also has expertise in understanding pathogen reduction through tertiary treatment and has identified particle association as an important factor in the removal of viruses through tertiary granular-media filtration. His recent projects have included: increasing the filtration rate for the Daly City water reclamation plant, determining the media configuration for the City of Santa Cruz's filter rehabilitation, and designing a new tertiary filter filtration system for the City of Corona.

## Employment History

*Trussell Technologies, Inc.*
•Principal Engineer I (01/15-present)
•Supervising Engineer III (1/14-12/14)
•Supervising Engineer II (01/12 – 12/13)
•Supervising Engineer I (01/11 - 12/11)
•Senior Engineer III (1/09 - 1/10)
•Senior Engineer I, (11/08 – 12/08)
*University of California at Berkeley*
•Graduate Student Researcher, University of California, Berkeley (2003-2008)
•Graduate Student Instructor, University of California, Berkeley (2005)

## Project Experience (Selected Projects)

**WQTS / East Bay Municipal Utility District (EBMUD)**

Sobrante and Upper San Leandro Water Treatment Plants Ozone Application Point Study Year: 2014

The East Bay Municipal Water District (EBMUD) was one of the pioneers in applying ozone to municipal drinking water treatment for reducing both disinfection by-products and taste & odor compounds. When EBMUD installed their existing ozonation systems at the Sobrante and Upper San Leandro Water Treatment Plants (WTPs) in the early 1990's, the most common practice was to add ozone to the settled water prior to filtration. More than twenty years later, EBMUD is in the planning phase of replacing the aging ozone generators with new high-efficiency ozone generators, and replacing the existing air feed systems with liquid oxygen systems (LOX). As part of this project, EBMUD is re-evaluating the ozone addition point to determine if a change from intermediate ozonation to pre-ozonation is in the District's best interest. To make this decision, EBMUD hired Trussell Technologies (as a sub-consultant to WQTS) to provide technical expertise, to review the situation, and make a recommendation for the future ozone siting.

Trussell Technologies developed a thorough understanding of the needs and drivers for ozone for both Sobrante and Upper San Leandro WTPs through a review of historical data, reports, and design documents, as well as through site visits, interviews, and workshops with plant staff. Trussell Technologies then performed an independent evaluation of the benefits and challenges of each siting location, including the implications of the siting to the product water quality, plant capacity, operational difficulty, and cost. The evaluation was performed considering the experiences at other ozonation facilities (representing both pre-ozonation and intermediate ozonation), technical literature, and previous project experiences. Trussell Technologies and WQTS presented their findings to EBMUD along with a technical report making a final recommendation for each facility.

**Role:** *Project Engineer*

**Monterey Regional Water Pollution Control Agency**

Groundwater Recharge Project piloting

Year: 2013 – Present

To meet water supply needs in the region, the Monterey Regional Water Pollution Control Agency (MRWPCA) consulted Trussell Technologies in developing an Advanced Water Treatment (AWT) process for a Groundwater Replenishment (GWR) project and to find new, suitable source waters. Trussell Technologies devised an extensive water quality monitoring program for potential sources waters and conducted bench-scale testing to determine both the suitability of the sources for treatment and to determine the most efficacious treatment process.

After bench-scale testing, Trussell Technologies piloted specific processes of preliminary AWT treatment train, namely ozone, microfiltration, and reverse osmosis (RO), and developed a water quality sampling campaign for the pilot operation. With the operational and water quality data from the pilot, a 10% level design was developed for the whole AWT, which also included advanced oxidation (UV/AOP), and post-stabalization.

**Role:** *Project Engineer*

**City of Daly City**

Title: Tertiary Filter Capacity Evaluation and Disinfection System Predesign

Date: 2012 – present

The Daly City WTP discharges approximately 12 mgd of secondary effluent through an ocean discharge. In 2004, the plant was upgraded to enable the production of 2.7 mgd of tertiary recycled water (granular media filtration and chlorine disinfection). Demand for the recycled water quickly exceeded this rated capacity, and further upgrades to the existing facility were considered infeasible due to the confined plant footprint. Trussell Technologies is working to rerate these continuously-backwashing upflow filters (Dynasand) above the Tilte-22 limit of 5 gal/ft$^2$-min, with a goal of increasing the tertiary capacity by approximately 2 mgd tertiary. In addition, Trussell Technologies is developing a predesign of an extremely compact disinfection system capability of treating the additional water produced by the filters.

**Role:** *Project Manager*

**Kennedy-Jenks/City of Santa Cruz**

Title: Graham Hill Water Treatment Plant – Granular Media Filter Rehabilitation

Date: 2013 – present

Last upgraded in 1986, the City of Santa Cruz is in the process of rehabilitating their granular media filters, which have a rated capacity of 24 mgd. During this rehabilitation period, several improvements are being made to the to improve the filter performance (media replacement, underdrain replacement, air scour addition, trough replacement). Williams used a modeling-based approach to determine the optimal media configuration for the new filters, based on historical performance and performance goals set by the City. In addition, Williams is conducting pilot testing of various media configurations to verify the improvements and demonstrate operation at increased filtration rates.

**Role:** *Project Manager – Filter Media Expert*

**Dudek/City of Corona**

Title: Corona Tertiary Filtration Project

Year: 2011-2012

Trussell Tech was hired to provide process design for a new 4 mgd tertiary filtration system for the City of Corona Department of Water and Power. Williams was responsible for evaluating process alternatives, developing the design criteria for granular media filtration system, including: media selection, backwash design, and backwash waste treatment. Modeling of

various granular media designs were used to develop a design well-suited to the City's needs. By optimizing granular media filter design to maximize run times and treating backwash wastewater through a repurposed microfiltration system, the combined filtration process boasts a 97% recovery rate and minimizes loads on upstream process units.
**Role:** *Process Engineer*

### Santa Ana Watershed Project Authority (SAWPA)

Title: Inland Empire Brine Line Solids Formation Study
Date: 2011 – present

SAWPA manages a 73-mile pipleline that conveys 12 mgd of mixed waste from brine, domestic wastewater, commerical, and industrial dischargers. Over the past decade, formation of solids in the Brine Line have lead to more than $1M per year costs related to excess treatment and disposal charges. Trussell Technologies was hired to determined the most likely causes of the solids formation and evaluate options available for reducing the size of the problem. Trussell Technologies started with a detailed characterization of the solids present at the end of the Brine Line to determine the possible formation mechanisms. Trussell Technologies made improvements to the methods for sample collection, which corresponded with a significant reduction in the scale of the solids formation problem. The size of the problem is currently being reassessed, and Trussell Technologies is providing ongoing support and evaluation of mitigation strategies.
**Role:** *Project Manager*

### Monterey Regional Water Pollution Control Agency, City of San Jose, City of Santa Rosa, Delta Diablo Sanitation District, Los Angeles County Sanitation District

Title: Filter Loading Evaluation for Water Reuse (FLEWR) Phase II, Full-Scale Filter Study
Date: 2006 – present

Based on the findings from FLEWR Phase I (see below), the California Department of Public Health (CDPH) has allowed full-scale granular-media tertiary filtration plants to test loading rates above the Title-22 allowable limit of 5 gpm/ft$^2$. This study established a CDPH approved procedure for treatment facilities to obtain permanent exception to the Title-22 limit through demonstration of equivalent filter performance at higher loading rates. Based on this work, CDPH has rerated three granular-media tertiary facilities to a filtration rate of 7.5 gpm/ft$^2$, increasing capacity by 50% and saving more than $50M in construction costs. Williams has played a key role in this multi-plant study by designing all study protocols, analyzing all results, and preparing final reports for facilities as they complete testing.
**Role:** *Project Manager, Project Engineer, Doctoral Researcher*

### Monterey Regional Water Pollution Control Agency

Title: Filter Loading Evaluation for Water Reuse (FLEWR) Phase I, Pilot-Scale Filter Study
Date: 2003-2006

Due to an inadequate understanding of the effect loading rate has on tertiary filter performance, California's Water Recycling Criteria (Title-22) limit the maximum allowable filter loading rate to 5 gpm/ft$^2$. Because filtration is often the limiting process in terms of treatment capacity, increasing the allowable loading rate would free many California water reclamation facilities to increase their production of recycled water, without the need of costly capital additions. This pilot-study developed a better understanding of the role loading rate plays on tertiary filter performance and identified the factors necessary to achieve equivalent treatment at higher rates. As part of his doctoral research, Williams was integral to the success of this project by designing the pilot facility, overseeing pilot construction and operation, analyzing all results, and participating in discussions with the California Department of Public Health.
**Role:** *Doctoral Researcher*

### WateReuse Foundation

Title: Reclaimed Water Desalination Technologies: Establishing Nitrification Reliability Guidelines for Water Reuse
Date: 2011 – Present

This study addresses regulatory limitations on chlorine disinfection, through establishing guidelines for nitrification reliability. When the

current California Water Recycling Criteria were developed, nitrification was not considered a reliability enough process to ensure ammonia would be consistently removed from the product water. As a result, disinfection CT values for recycled water are based on the inactivation rates of less reactive chloramines. The ability of water reuse facilities to reliably nitrify has not been documented to the satisfaction of the California Department of Public Health, and nitrification reliability features in place before water reuse regulations will differentiate between chloramine and chlorine disinfection. This project involves the coordination of eight recycled water facilities to document reliability of nitrification in various secondary biological processes, evaluate various online low-range ammonia analyzers as tools for continuous monitoring, and develop a guidance document for ensuring reliable nitrification such that free-chlorine disinfection CT values can be applied to recycled water.
**Role:** *Principal Investigator*

**Vallecitos Water District**
Title: Meadowlark Operations
Year: 2009 – 2010
Vallecitos Water District owns and operates the Meadowlark Water Reclamation Facility, which is capable of treating up to 5 mgd of wastewater to produce recycled water for local customers. Historically coliform hits have been an issue at Meadowlark. Trussell Tech assisted with process modifications to reduce chemical consumption and alleviate the coliform issues. Trussell Tech diagnosed multiple issues with the chlorination, filtration, and primary treatment systems contributing to the problem. Trussell Tech was able to cut chlorine consumption by more than 50% with a new chlorine injection system, while simulateously solving the coliform exceedence problems. In addition, Trussell Technologies implemented strategies to minimize particle sloughing (shown to be the cause of turbidity spikes and particle breakthroughs), and ease coagulant dosing by maximizing aeration basin efficiency for better up stream turbidity removal.
**Role:** *Project Engineer*

**Fallbrook Public Utilities District**
Title: Tracer Study and CDPH Review
Date: 2009
Trussell Technologies was hired by Fallbrook PUD to evaluate the chlorine contact basin capacity of the Fallbrook Water Reclamation Plant, in compliance with a request from the California Department of Public Health. Trussell Tech developed a plan, executed the tracer study tests using the slug dose method, analyzed the result, and prepared a draft report summarizing the results for the District and CDPH. As a result of this study, CDPH approved a new capacity rating and chlorine equation for the Water Reclamation Plant. Williams was responsible for design the plan, executing the study, and coordinating with CDPH.
**Role:** *Project Engineer*

**San Elijo Joint Powers Authority**
Title: Recycled Water Improvement and Expansion
Date: 2008 - present
The San Elijo Water Reclamation Facility is in the process expanding their recycled water capacity and improving the water quality by adding a partial RO system to lower the product water salinity. Trussell Technologies, Inc. was hired by the Joint Powers Authority to develop a conceptual design for the RO treatment plant, evaluate the capacity of the existing recycled water system, and study the existing chlorine contact basin to determine if the actual capacity could be increased. Trussell performed a tracer study on the chlorine contact basin to determine the actual hydraulic capacity and analyzed tracer study data to prepare reports to Regional Water Quality Control Board and CDPH. As a result of this study, the chlorine contact basin was rerated to a larger capacity, such that no additional disinfection was needed in association with the MF/RO expansion.
**Role:** *Project Engineer*

**WateReuse Foundation**
Title: Reclaimed Water Desalination Technologies: A Full-Scale Performance and Cost Comparison between EDR and MF/RO
Date: 2009 - 2010
Many water reuse facilities are required to reduce the product water salinity and RO membranes have been the predominate technology used to remove salt removal in recycled water. However, because of its lower capital cost, Electrodialysis Reversal (EDR) is often proposed as an alternative to RO, but rarely actually selected (only used for reuse by two plants in US), because the actual life-cycle costs for a reuse plant are unknown. Trussell Technologies, Inc. compared the actual capital and O&M costs of EDR and RO membranes facilities used to remove salt from recycled water. The final report from this project serves as practical guide to water reuse utilities to select of the most appropriate and economical desalting technology based on the specifics of their plant.
**Role:** *Project Engineer*

**RMC/LADWP Recycled Water Master Plan**
Title: Assessment of Effects of Temperature on Recycled Water Treatment Processes
Date: 2009 – 2010
In their efforts to develop a recycled water master plan, the City of Los Angeles looked for additional reuse opportunities by evaluating tertiary treatment of high-temperature secondary water that had been used as cooling water. This high-temperature water presented unique challenges for conventional tertiary treatment. An evaluation of the impacts of temperature on all recycled water treatment processes was conducted, considering both the positive and negative effects of temperature on treatment performance, operations, maintenance, energy use, and equipment life. Williams' responsibilities included developing the technical approach, evaluating technologies, and project management.
**Role**: *Project Manager*

**RMC/LADWP Recycled Water Master Plan**
Title: Satellite Reuse Technology Assessment
Date: 2009-2010
In their efforts to develop a recycled water master plan, the City of Los Angeles looked to maximize their opportunities for reuse through satellite water treatment facilities. This project focused on evaluating all treatment technologies that had potential for use in satellite facilities, considering performance, cost, footprint, and reliability. Responsibilities included evaluating technologies, technologies selection, and partial project management.
**Role**: *Project Engineer*

**RMC - Marina Coast Municipal Water District**
Title: Desalination Plant Predesign and Permitting
Date: 2008 - 2011
After decades of unsustainable pumping of fresh groundwater supplies, the fresh groundwater supply below the Marina, CA coastline was destroyed by seawater intrusion. An RO drinking water treatment plant was being developed to desalinate this saline groundwater and supply a sustainable potable water source for the community. The production capacity of the desalination facility will be 10 mgd expandable to 14 MGD. Trussell Technologies, Inc was hired by RMC to prepare a conceptual design of the plant, and assist with the process selection, water quality goals, predesign, and the Department of Public Health permitting, including the preparation of the water quality monitoring plan.
**Role**: *Project Engineer*

**West Yost Associates – Davis-Woodland Water Supply Project Partners**
Title: Davis-Woodland Water Supply Project Pesticide White Paper
Date: 2010 – 2011
Working with the City of Davis, City of Woodland, and UC Davis to develop a regional water supply project that diverts Sacramento River Water to meet the potable water supply needs of the Davis-Woodland communities. The proposed surface water treatment plant will have the capacity to treat a proposed 53 mgd of river water. Responsibilities included developing approach to determining pesticides

of concern, reviewing water quality results, and project management.
**Role:** *Project Manager*

**West Yost Associates – Davis-Woodland Water Supply Project Partners**
Title: Davis-Woodland Water Supply Project Predesign and permitting
Date: 2009 – 2012
The City of Davis, City of Woodland, and UC Davis joined together to develop a regional water supply project that diverts Sacramento River Water to meet the potable water supply needs of the Davis-Woodland communities. A surface water treatment plant with the capacity to treat 53 mgd has been proposed treat the river water. Trussell Technologies, Inc. was hired by West Yost Associates to assist in the water supply permitting, preparing the water quality monitoring plan, lead coordination with the California Department of Public Health, and to develop a predesign for the proposed facility.
**Role:** *Project Engineer*

## Peer Reviewed Publications

**Williams, G.J.** (2015) "Establishing Nitrification Reliability Guidelines for Water Reuse." Water Reuse Research Foundation, Alexandria, VA.

**Williams, G.J.** and Trussell, R.S. (2012) "Performance and cost comparison between MF/RO and EDR membranes for reducing recycled water salinity." WateReuse Research Foundation, Washington, D.C.

Nelson, K.L, **Williams, G.,** Sheikh, B., Holden, B., Crook, J., and Cooper, R.C. (2011) "Filter Loading Evaluation for Water Reuse." WateReuse Research Foundation, Washington, D.C.

**Williams, G.J.,** Sheikh, B., Holden, R.B., Kouretas, T.J. and Nelson, K.L., (2007). The impact of increased loading rate on granular media, rapid depth filtration of wastewater. Water Research 41(19), 4535-4545.

## Select Non-Peer Reviewed Publications

**Williams, Gordon** (2013) "Unlocking the potential for low-CT tertiary disinfection: Providing reliable nitrification to ensure a free-chlorine residual." WateReuse California Annual Conference, Monterey, CA. March 17-19, 2013.

**Williams, Gordon** (2012) "Characterization of the Suspended Solids in the Inland Empire Brine Line and Approaches to Minimizing Solids Formation." 27th Annual WateReuse Symposium, Hollywood, FL. Sept 9-12, 2012.

**Williams, Gordon** (2012) "The suitability of nitrification for reliable disinfection of recycled water using free-chlorine." WateReuse California Annual Conference, Sacramento, CA. March 25-27, 2012.

de Barruel-Day Monique and **Williams, Gordon.** (2011) "Starting at One Drop Water Quality Monitoring for New Surface Water Treatment Facility." California-Nevada AWWA Annual Fall Conference, Reno, NV. October 17-20, 2011.

**Williams, Gordon**, Love, David C., Sheikh, Bahman and Nelson, Kara L. (2010) "Role of Coagulation and Particle Association in Removal of Viruses in Tertiary Granular Media Filters." WateReuse Symposium, Washington, D.C. Sept 12-15, 2010.

**Williams, Gordon** (2010) "PPCPs and Pesticides: Significance and Implications for Water Utilities." California-Nevada AWWA Annual Fall Conference, Sacramento, CA October 5-8, 2010.

**Williams, Gordon,** Rhodes Trussell, Eileen Idica, Celine Trussell, Brett Faulkner (2013) "Use of Empirical Filter Models in Water Treatment." AWWA Water Quality Technology Conference, Long Beach, CA. November 5, 2013.

***RESUMÉ***

**BAHMAN SHEIKH, PH.D., P.E.**

Water Resources and Water Recycling Specialist

*Distinguished Fellow, Center for Integrated Water Research, University of California, Santa Cruz*

http://www.bahmansheikh.com ♦ Bahman.sheikh@gmail.com

## EXPERIENCE SUMMARY

Bahman Sheikh has over 30 years of domestic and international experience in research, planning, and design of water resources projects, specializing in water conservation, reclamation, reuse, and recycling (beneficial reuse of treated wastewater). His career began as a university professor, teaching courses in water quality for various irrigation applications. Sheikh's academic career was followed by consulting, technical investigations, planning, and design of water resource facilities. Sheikh's water recycling experience includes service in the public sector with goal-setting, project planning, regulatory liaison, public outreach, and implementation of public policy programs. The focus of much of this work has been on public health and safety from the microbiological and chemical quality of water used for irrigation and other applications. He has served clients in 21 countries, including Peru, Bonaire, Mexico, South Korea, Australia, Saudi Arabia, Egypt, India, Jordan, Kuwait, UAE, Syria, Bahrain, Morocco, and Tunisia.

Bahman Sheikh has extensive experience in all aspects of water resources management, water use patterns and promotion of water use efficiency, water reclamation, recycling, and reuse, including the technical and regulatory issues, water quality, program management, alternatives analysis, feasibility studies, and planning for long-term development of water recycling in large and small communities. He conceived, planned, and conducted major long-term pilot studies of pioneering water recycling programs in Monterey County, California, and in the City of Los Angeles, demonstrating the safety of regulated use of highly treated and disinfected reclaimed water.

Bahman Sheikh is a member of the Research Advisory Board of the National Water Research Institute. He served on the Board of Directors of WateReuse Association and WateReuse Foundation. Highlights of Bahman Sheikh's specialized experience are briefly listed below:

| Domestic | International |
|---|---|
| **Denver Water—2014-Ongoing**<br>• Preparation of documentation and presentations to provide the basis for the Colorado public health and water quality assurance authorities to consider allowing more widespread uses of highly-treated recycled water, especially for irrigation of edible crops.<br><br>**Monterey Regional Water Pollution Control Agency**<br>• Currently serving on a consultant team planning a potable reuse project involving injection | **Jaipur, Pune, Faridabad, India 2012-2013**<br>• Through subcontract with DAI: Prepared customized water use survey instruments for residential, industrial and commercial sectors of the three cities and trained local interviewers who completed hundreds of individual user profiles. The statistical analysis of these audits resulted in a series of recommendations for future water efficiency strategies and policies for the three cities. Prepared water conservation and reuse elements of Municipal Water Use Ef- |

## Domestic

of highly treated recycled water into the Seaside Aquifer, as part of a multi-faceted water supply plan for the future of Monterey Peninsula.

**San Francisco Public Utilities Commission—2011-Ongoing**

- As joint-venture partner with Kennedy/Jenks Engineers, prepared master plan for development of recycled water project on the Eastside of San Francisco. Customers include dual-plumbed buildings prepared for switching to recycled water for toilet flushing, parks and landscapes switching to recycled water for irrigation, and other uses.

**City of San José, California—1997--Ongoing**

- Provides ongoing training for hundreds of newly assigned site supervisors for customers receiving recycled water from the SBWR network. Prevention of cross connection and backflow in dual-plumbed buildings and dual-use sites is a major component of this project.
- Provided expert consulting services throughout the two decades of development of the South Bay Water Recycling (SBWR) infrastructure. Customers of SBWR include dual-plumbed buildings using recycled water for toilet flushing—such as the new San Jose City Hall and the 49ers Levi's Stadium in Santa Clara.
- Created a mathematical model for projecting the economic impact of salinity increases in recycled water due to industrial brine discharges into the City sewers upon the customers of recycled water.
- Conducted site investigations in response to recycled water customers' concerns about water quality and landscape impacts.
- Reviewed and critiqued another consultant's study of impacts of recycled water on Santa Clara and Llagas Groundwater subbasins, with special emphasis on NDMA fate and transport.

**Santa Clara Valley Water District—2000--Ongoing**

- Currently, facilitating discussions among top managers in the District regarding future potential strategies for eventual implementation of potable reuse options—indirect and/or direct.
- Prepared a computational model to assess the impact of irrigation with recycled water over the unconfined aquifers in Santa Clara Valley, with special emphasis on salinity.

## International

ficiency Guidelines for three cities in India: Jaipur, Pune, and Faridabad.

**German Government Development and Export Fund (KFW)**

- 2003, through Dorsch Consult. Provided expertise for the design of a water reclamation and reuse treatment and distribution infrastructure for the Greater Gaza City, Palestinian Territory.
- 2005, through Dorsch Consult. Provided specialized engineering services for the design of an efficient irrigation system using recycled water for landscaping in hotels and government buildings on the Island of **Bonaire**, in the Netherland Antilles.

**United Nations Food and Agriculture Organization (FAO)**

- 2013, Provided Study Tour of exemplary recycled water projects in the United States for a select group of officials from the Saudi Arabia Ministry of Agriculture. The Study Tour spanned major water reuse sites in Florida, California, and Virginia.
- 2009, Served as technical advisor for use of recycled water (water reclaimed from wastewater, locally referred to as Treated Sewage Effluent, or TSE) in irrigated agriculture throughout the Kingdom by providing guidelines, leading training sessions.

**Barwon Water, Victoria, Australia**

- 2010-2013, Served as member of expert panel independently evaluating planning efforts toward an indirect potable reuse project to be implemented as part of a multi-pronged approach to future water supply security for the region.

**Australian National Environmental Protection Council Service Corporation**

- Peer reviewed draft of the Australian National Guidelines for Water Recycling

**Tunisia, Transfer of Recycled Water from Tunis to Southern Tunisia**

- 2009, Provided guidelines and case studies of similar transfers over long distances for use in irrigation, industry, and geothermal fields replenishment.
- 2007, Guided a group of Jordanian engineers in

## Domestic

- Facilitated discussions between the District and the City of San Jose (SBWR) regarding future form of collaboration between the two agencies for delivery of recycled water to their service areas. A forty-year agreement for joint development and operations resulted from the success of these negotiations.

**City of Chula Vista—2002**

- Investigated the feasibility and comparative costs and benefits of a large number of water demand management options, including residential water conservation, commercial and industrial measures to reduce demand, use of gray water for landscape irrigation, and water recycling.

**Marin Municipal Water District—2001**

- Investigated the comparative costs and benefits of alternative sources of water supply for the District including use of gray water, water recycling and desalination of seawater from the San Francisco Bay or from the Pacific Ocean.

**City of Los Angeles, California—1991-1996**

- Developed achievable goals and a master plan-for recycled water development that were adopted by the City Council. Provided interdepartmental liaison that enabled planning and ultimate implementation of several major water recycling projects in cooperation with West Basin Municipal Water District. Prepared policy analysis for control of salt discharges from residential water softeners into the municipal sewer system. Commissioned a city-wide survey of water softener use and salt purchase patterns of residents. Recommended adoption of an ordinance for prohibition of use of self-regenerating water softeners, which involve discharge of salts and wastage of water as brine is periodically discharged into the sewers during the regeneration cycles.
- Conducted a year-long graywater reuse pilot project at eight residential locations throughout the City of Los Angeles with monthly monitoring of soils, water, and vegetation for microbial, chemical and other characteristics.

**Monterey Wastewater Reclamation Study for Agriculture—1975-1986**

- Managed $7.2 million research and demonstration project on irrigation of raw-eaten vegeta-

## International

site visits to wastewater treatment plants in various parts of Tunisia, with an emphasis on beneficial uses of reclaimed water.

**Amman, Jordan (Subcontract with various USAID contractors)**

- 2008, through DAI, "Water Efficiency Recommendations for High Rise and High Density Developments" in the Greater Amman Municipality, developing best management practices (BMPs) for water reuse and conservation.
- 2005, through Chemonics, "Review of Aqaba Watger Demand and Expanded Evaluation of Water Resources."
- 2004, through ARD, Facilitated discussion workshops for members of Water Reuse Standards Committee from the Ministry of Water and Irrigation, Ministry of Health, and the Jordanian Institute for Standards and Metrology. These workshop sessions led to formulation of recommended water reuse standards for adoption by the government of Jordan.

**King Saud University, Riyadh, Saudi Arabia—2006-Date**

- Retained as Senior Advisor to Prince Khaled Chair for Water Research at the Department of Civil Engineering.
- Provides periodic workshops and seminars to graduate students and government officials on sustainable water policies and practices

**Arriyadh Development Authority (ADA)**

- 2000. Sheikh created a master plan for water, wastewater and reclaimed water for the City of Riyadh, Saudi Arabia, for the period to 2022 at which time the City's population would increase by 7,000,000 people.
- 2007. Assisted ADA in development of terms of reference (TOR) for bidding for implementation of water reclamation facilities (treatment, distribution, and retrofits) throughout the rapidly developing areas of the City of Riyadh.
- 2009. Oversaw and reviewed work products of other consultants engaged to prepare water recycling facilities plans for the City of Riyadh

**Kuwait Institute for Scientific Research**

- 2008, Prepared recommendations for updating of Kuwait's regulations and criteria for use of reclaimed water in agriculture, landscape irriga-

## Domestic

bles with recycled water, for over eleven years.

- Planned scientific design of field experiments to distinguish any impacts of use of reclaimed water on plants, soils, crop yield, crop quality, groundwater, and the environment.
- Published reports of findings and obtained the agreement of public health officials to permit use of the reclaimed water on raw-eaten food crops.
- Performed liaison and facilitation services among stakeholders, including farmers, public health officials, water supply agencies, and other environmental and citizen groups

**West/Central Basin Municipal Water Districts—1986-1988**

- Provided technical input into the Districts' extensive water reuse activities, analyzing alternatives, feasibility, economic viability, regulatory compliance, and funding of numerous projects.
- Participated in Districts' public outreach functions, promoting recycled water use
- Prepared the District's Urban Water Management Plan
- Conducted technical sessions for potential new customers of recycled water—golf courses, nurseries, parks, industries.

**WateReuse Association**

- Co-chair of the International Committee, working to expand the reach of the Association into the Middle East region.
- Completed a White Paper on Graywater for the Association Board of Directors' policy decision vis-à-vis inclusion of graywater in the Association portfolio.
- Completed a national training manual for site supervisors and users of recycled water.
- Prepared and updated summary of Title 22 "allowed uses of recycled water".
- Served as chairman of Public Education Committee.
- Collaborated in the preparation of an interactive compact disc for landscape users of recycled water for problem-solving and design of new landscaped irrigated with recycled water.
- Served on the video committee—"Water In An Endless Loop".
- Prepared popular brochure on Graywater—"Clear Facts about Gray Water".

## International

tion, industry, and groundwater recharge.

**United Stated Agency for International Development**

- 2006, through CDM and PA Consulting: Assisted local staffs in the cities of Nagpur and Hyderabad, India, to develop industrial water recycling and reuse programs, beginning with pilot treatment systems.
- 2003, through ARD: Developed a new framework for "Standards, Regulations, and Legislation for Water Reuse" in Jordan.
- 2004, through CDM: Prepared Chapter 8 of the USEPA/USAID Water Reuse Manual, describing international water reuse practices.
- 2003, through Chemonics: Reviewed Egyptian proposed rules for use of reclaimed water in agriculture.
- 2004, through PA Consulting: Reviewed a master plan for a swap of agricultural water with urban reclaimed water in the metropolitan Hyderabad, in the state of Andra Pradesh, India.

**The World Bank—2001**

- Prepared an extensive background document and proceedings and provided technical resource to a regional water reuse workshop for 10 countries of the Middle East and North Africa (MENA) in Cairo, Egypt.

**Jaffna Peninsula, Sri Lanka—1983**

- Developed end user water use information database and recommended water conservation policies and strategies in urban and agricultural areas of Jaffna Peninsula including the most cost-effective methods for reducing demand for water, especially during the low-rainfall seasons.

**Casablanca, Morocco. Use of Treated Wastewater Effluent for Irrigation of Early-Season Vegetables for the European Export Market**

- 1990, Prepared economic feasibility analysis of reclaiming wastewater from the Casablanca-Mohammediah areas for use for irrigation of vegetables in the suburban agricultural region, specifically for early-season export to the European market.

**Author of Chapter 6 in "Water Reuse for Irrigation" Edited by Valentina Lazarova and Akiça Bahri, CRC, 2005.**

| Domestic | International |
|---|---|
| **Author of "Terra Linda Demonstration Garden for Recycled Water-Irrigated Landscapes in Marin County", for Marin Municipal Water District, June 2010**<br><br>**Author of "White Paper on Graywater", a Policy Analysis for WateReuse Association Board of Directors, April 2010**<br><br>**Author of "Site Supervisor Training Manual: for Users of Reclaimed Water", September 2006**<br><br>**Principal Author of Chapter 6 on Public Education in AWWA/WEF Potable Reuse Book**<br>• Collaborated with 13 contributors to the Chapter content to provide a manual, complete with examples of cases and lessons learned from water reuse ongoing projects.<br><br>**Principal Author of Chapter 17 in "Wastewater Reclamation and Reuse"**<br>• Collaborated with three co-authors, documenting the results of the eleven-year pilot study investigating the safety of use of recycled water for irrigation of food crops in Monterey County, California. | |

## PROFESSIONAL HISTORY

1996-Date **Independent Water Resources and Reuse Consultant**, providing specialized services to public and private clients in their water reclamation projects. Major current and recent clients include USAID, The World Bank, Petroleum Institute of Mexico, Marin Municipal Water District, Metropolitan Water District of Southern California, Coachella Valley Water District, Las Virgenes Municipal Water District, Monterey Regional Water Pollution Control Agency, the City of San Jose South Bay Water Recycling Program, West/Central Basin Municipal Water Districts, Parsons Engineering Science, Harland Bartholomew, Harza Environmental Services, Bechtel International, ARD, Inc., City of Chula Vista, and Central Contra Costa Sanitary District. In addition to numerous projects in California, Bahman Sheikh serves clients with water reclamation projects in various countries, including the Netherland Antilles (Bonaire), Jordan, Kuwait, Saudi Arabia, Bahrain, Turkey, Peru, Tunisia, Morocco, and Egypt.

1994-1996 **West Basin and Central Basin Municipal Water Districts. Water Resources and Wastewater Reuse Policy Specialist.** In this capacity he advised the Districts' management on water policy issues, represented the Districts at various State forums, interfaced with regulatory agencies, environmental groups, community organizations, and the public, and worked with water customers and member utilities to solve issues and problems arising as the District expanded its water reclamation service area. Representing the Districts, Bahman Sheikh served on a number of Statewide committees working to manage the State's water resources more efficiently, e. g.:

- U.S. Bureau of Reclamation Executive Management Committee, overseeing the preparation of the "Southern California Comprehensive Water Reclamation and Reuse Study" with federal-local partnerships.
- State Potable Reuse Committee, convened by the Directors of the State Department of Water Resources and the State Department of Health Services to develop and foster regulatory and public acceptance for safe augmentation of potable water supplies with potable reclaimed water.
- Chair, Public Education Committee of WateReuse Association of California, planning and implementing public information and outreach programs on water reuse for the Association.

1989-1994 **City of Los Angeles. Executive Director, Office of Water Reclamation.** This Office was created within the Board of Public Works to bring into focus the City's basic goal of maximizing the reclamation of its wastewater resource. The City recognized the need for new water policy directions because of the increasing vulnerability of its sources of imported water supply. Bahman Sheikh was recruited to set near- and long-term water reclamation goals, bring together diverse decision-making bodies, help establish funding mechanisms, be a good-will ambassador to the public and to outside agencies, and prepare plans and strategies to achieve the City's basic goal. Policy analysis, legislative recommendations, funding and financing, interagency coordination, and interdepartmental liaison were important aspects of Bahman Sheikh's responsibilities.

Specific goals recommended by Bahman Sheikh were adopted as City goals by the Council and by the Board of Water and Power Commissioners. Based on these adopted goals, a number of water reclamation projects have been developed and are now being implemented. An important function of the Office was coordinating the water reuse activities of the major water purveyor (LADWP) and wastewater management entity (Department of Public Works) in the City, and establishing an outreach program to make the public aware of the safety and desirability of water reuse in all its forms. He designed and directed a yearlong pilot project demonstrating the safety of using gray water systems for residential landscape irrigation. The results of this pilot project were the technical basis for new regulations adopted Statewide for residential gray water use. He provided testimony at numerous local and State hearings before a variety of boards regarding reclaimed water policy.

The Office of Water Reclamation worked closely with the Mayor's Office, the City Council, and the Boards of Commissioners of Public Works and Water and Power. Examples of initiatives presented to policy makers were the gray water legalization policy and ordinances to control water softeners and to require dual plumbing in all new high-rise construction. The resultant policies caused implementation of several water reclamation projects. Bahman Sheikh represented the City of Los Angeles at numerous statewide water forums, including the following:

- Chair, Regulatory Committee of the WateReuse Association of California, working with State Department of Health Services to revise regulations governing water reuse.
- Member, Bay Delta Oversight Council (BDOC) Technical Advisory Committee on Water Supply.
- Chair, Survey Committee of the WateReuse Association of California. Prepared the 1993 estimate of Statewide water reuse potential in cooperation with the State Department of Water Resources, Metropolitan Water District of Southern California, San Diego County Water Authority, and numerous other retail and wholesale water purveyors.
- Member, California Ad-Hoc Gray Water Committee. Prepared Appendix J to the State Plumbing Code to allow individuals to use gray water in residences, under special restrictions, to protect the public health and prevent backflow into the community water supply.
- Member, DWR/DOHS-sponsored committee to develop dual plumbing standards for reclaimed water service inside high-rise buildings for toilet flushing and other non-potable water uses.
- Member, Legislative Committee of WateReuse Association of California, preparing and supporting legislation to facilitate and expand uses of reclaimed water in the State.
- Member, U.S. Bureau of Reclamation Executive Management Team for the Southern California Comprehensive Water Reclamation and Reuse Study.

1987-1989 **CH2M HILL. Civil/Environmental Engineer.** Directed and managed major water reuse projects and contributed senior review and specialized expertise to the firm's water supply and reclamation projects. Examples of his contributions include:

- **City of Ankara, Turkey:** participated in developing a master sewerage plan for the capital City of Ankara, Turkey, population 4 million, where he directed the modeling of the wastewater collection system for the entire City.
- **City of Los Angeles:** Participated in the preparation of the City's Advanced Planning Report by leading the water supply shortfall projections and analyses that resulted in recommendations for full utilization of the City's reclaimed water potential. The City's APR provides for wastewater management planning for the next 100 years and the City's needs for major wastewater and water reclamation infrastructure facilities.
- **City of Santa Rosa:** Analyzed nutrient balance in two basins proposed to receive reclaimed water for irrigation of fodder crops.
- **San Jose/Santa Clara Treatment Plant:** Analyzed opportunities for reclamation of the effluent from the plant and recommended a phased approach including irrigation of parks, industrial cooling, recharge into groundwater aquifers, and dilution of Leslie Salt Company's bittern before discharge.

1970-1987 **PARSONS Engineering-Science. Manager.** He was Project Director and oversaw the work of several project managers and engineers performing assignments on a variety of environmental engineering projects for diverse private and public sector clients. His projects are briefly highlighted below*:*

- **Areawide Water and Sewerage Master Plans:** Managed comprehensive areawide water and sewerage planning studies for mountainous, desert, and metropolitan areas of San Bernardino, Napa, and El Dorado Counties under a Farmers Home Administration planning grant program.

- **Monterey Regional Water Pollution Control Agency:** Bahman Sheikh was responsible for the conception, direction, and execution of the 11-year pilot field demonstration project for Monterey Regional Water Pollution Control Agency, investigating the feasibility of irrigating raw-eaten food crops with disinfected, tertiary-treated reclaimed water. This project, known as the Monterey Wastewater Reclamation Study for Agriculture (MWRSA), attracted worldwide interest and has been reported at many conferences and professional publications. Bahman Sheikh led MWRSA from its inception in 1976 continuously through the publication of its final report in April 1987. His effective communication of the technical intricacies of water reuse to the local farmers, local health authorities, and a score of different governmental agencies was crucial to the successful completion of the project. Large-scale irrigation with recycled water on 12,000 acres in the northern Monterey County is now routine, thanks in part to the success of MWRSA, credibility of its results, and the need for sources of additional water supply in the region.

- **Northglenn-Denver, Colorado:** Performed a water exchange study for Northglenn, Colorado, investigating use of reclaimed Denver wastewater for irrigation of sugar beets in exchange for rights to ditch waters to be diverted for municipal supply.

- **Las Palmas Ranch, Salinas, California:** Directed the evaluation of various irrigation systems, including drip irrigation, for application on a 60-acre hillside for reuse of treated municipal effluent from Las Palmas Ranch, a proposed housing development near Salinas, California.

- **Environmental Impact Studies:** Was responsible for development of Environmental Impact Reports and Statements on a variety of projects including land application of effluents and wastewater biosolids, solid waste disposal, and wastewater treatment. Bahman Sheikh performed erosion, sediment transport, irrigation, and urban runoff investigations as part of a comprehensive water quality management study of the James River Basin in Virginia.

1967-1970 **University of Shirz, Assistant Professor.** Bahman Sheikh taught technical courses in water systems design, water resources and supply management, water utility administration, irrigation, soils, hydrology and hydraulics at the University of Shiraz, College of Agriculture (in Iran). He designed and supervised construction of a hydraulics teaching and research laboratory at the field campus of the College.

## ACADEMIC ACTIVITIES

In recent years, Bahman Sheikh has taught classes—as guest lecturer and seminar presenter—in topics related to California water, at several institutions of higher learning, including:

- Department of Civil & Environmental Engineering, Woods Institute for the Environment, Stanford University
- Department of Civil Engineering University of California, Davis
- Public Policy Program at Pomona College
- School of Architecture at the University of Southern California
- Environmental Engineering Program at the University of Southern California
- Environmental Engineering at California State University at Long Beach
- Occidental College Faculty Seminar
- Extension Service of the University of California at Davis, Courses in Legal and Regulatory Water Issues
- Water Resources Short Course at UCLA for Water Officials of the Government of Thailand

## INTERNATIONAL CONSULTING:

Over the past two decades, Bahman Sheikh has completed numerous overseas missions of varying duration. Typically, he provides expert and specialized consulting services in water resource management, wastewater treatment, water reuse and related topics, to governmental agencies in countries including Mexico, Peru, South Korea, Sri Lanka, Turkey, Syria, Bahrain, Tunisia, Morocco, and most recently in India, Egypt, Jordan, Kuwait, United Arab Emirates, and Saudi Arabia. Funding agencies for these projects are the World Bank, USAID, Asia Development Bank, and the local government agencies.

## EDUCATION

1967, Ph.D., Soil Physics (Soil-Water Relations), University of California, Davis

1964, M.S., Irrigation (Water Science and Engineering), University of California, Davis

1962, Pomona College (Interdisciplinary Studies in Liberal Arts), Claremont, CA

1957, B.Sc., Agricultural Engineering, American University of Beirut, Lebanon

## AWARDS AND HONORS

Resolution of Appreciation in recognition of 27 years of service from Board of Directors, Monterey Regional Water Pollution control Agency, March 29, 2004.

Outstanding Service Award, WateReuse Association, 2002

President's Award of Appreciation, WateReuse Association, 2002

Appointed to the Board of Directors of WateReuse Research Foundation, 2001, served until 12/2007.

Appointed to the Research Advisory Board of National Water Research Institute, 1995.

Recognized by City of Los Angeles City Council for "efforts and accomplishments," 1994

Recognized by City of Los Angeles Board of Public Works for "vision and commitment," 1994
Elected to Board of Directors, WateReuse Association, 1993, served until 2002.
Integrated Resource Management Award, Water Policy Conference III, 1993
Outstanding Service Award, WateReuse Association of California, 1991

## REGISTRATION

Professional Engineer, Civil, California: C 26633

## PROFESSIONAL MEMBERSHIPS

WateReuse Association
American Water Works Association
Water Environment Federation
California Water Pollution Control Association
National Water Research Institute, Research Advisory Board

## PUBLICATIONS AND PRESENTATIONS:

"Graywater's Future Role in Integrated Water Management Planning", Scheduled for presentation at the IWA Efficient 2011 conference at Dead Sea, Jordan, March, 2011.

"Is Graywater Another Flavor of Water Reuse?", Presented at WateReuse Association Symposium 25, Washington, D. C., September 2010.

"Terra Linda Demonstration Garden for Recycled Water-Irrigated Landscapes in Marin County", prepared for Marin Municipal Water District, June 2010.

"Graywater White Paper", prepared for WateReuse Association Board of Directors, April 2010.

"Maximizing Filtration Capacity for Production of Tertiary Recycled Water", presented at WateReuse Association Symposium 24, Seattle, Washington, September 2009.

"Recycled Water—Fit for the Use", presented at WEFTEC 2008 Workshop on Water Reclamation and Reuse: The Big Picture: Reclaimed Water as a Water Resource, Chicago, Illinois, October 18, 2008.

"Future Potential for Recycled Water", presented at WateReuse Association Symposium 22, Tampa, Florida, September 2007.

"Socioeconomic Aspects of Wastewater Treatment and Water Reuse", presented at EMWater (**E**fficient **M**anagement of **W**astewater) Regional Conference in Amman, Jordan, October 2006.

"Higher Filter Loading Rates for Greater Water Reuse Capacity", presented at WEFTEC 06, Dallas, Texas, October 2006

"National Training Manual for Commercial Recycled Water Users", presented at the 21st Annual WateReuse Association Symposium, Hollywood, California, September 2006.

"A Scientific Basis for Regulating Filter Loading Rate for Production of Recycled Water in California", presented at the 21st Annual WateReuse Association Symposium, Hollywood, California, September 2006.

with Ken Tanji, "A Landscape Guide For Irrigation With Recycled Water", presented at the 21st Annual WateReuse Association Symposium, Hollywood, California, September 2006.

"Site Supervisor Training Manual: for Users of Reclaimed Water", prepared for and published by WateReuse Association, September 2006.

"U.S. and International Perspectives on Recycled Water Disinfection", presented at the 2006 California Section Annual Conference, Bridging the Gap with Recycled Water, March 12-14, 2006, San Francisco.

"Filter Loading Evaluation for Water Reuse" Presented at WateReuse Association California Section 2005 Annual Conference in San Diego on February 28, 2005.

"Institutional Requirements in California and Florida for Implementation of Water Recycling/Reclamation Projects", Presented at WateReuse Symposium XIX, Phoenix, Arizona, September 21, 2004.

"Water Reuse: International Perspectives and Rationale for Hyderabad", presented at Confederation of Indian Industry, Hyderabad, India, September 14, 2004.

"Water Recycling Projects in California: Opportunities and Challenges", presented at 2004 Annual Conference of Victorian Farmers Federation in Melbourne, Australia, July 14, 2004

"Impact of Institutional Requirements on Implementation of Water Recycling / Reclamation Projects", presented at the 2004 Water Sources Conference in Austin, Texas, January 11-14, 2004.

"Indirect Potable Reuse through Groundwater Recharge and Surface Water Augmentation: The Gold Standard of Water Recycling in California", invited keynote presentation at the National Water Recycling in Australia Conference, September 1-2, 2003, Brisbane, Australia.

"Efficacy of Pathogen Removal at Full-Scale Operational Water Reuse Facilities in Monterey, California", presentation at WateReuse Symposium XVIII, September 7-10, 2003, San Antonio, Texas.

"Rules and Regulations/Guidelines for Water Reuse" Presentation at MED-REUNET Seminar, September 25-26, 2003, Izmir, Turkey.

"Water Reclamation World-Wide: Revisions to the International Guidelines", presented to Third World Water Forum, USAID-Sponsored Session on Update of Water Reuse Guidelines, March 16, 2003, Kyoto, Japan.

"Ethical Dilemmas in the Water Cycle in the Middle East and North Africa" presented to Third World Water Forum, San Francisco Public Utilities Commission-Sponsored Session on Ethics in Water Management, March 19, 2003, Kyoto, Japan.

"Comparing and Contrasting Benefits and Costs of Water Use Efficiency Measures in Marin County and in Chula Vista", presented at CALFED Science Conference, January 2003, Sacramento, California.

"Comparing the Costs and Benefits of Water Recycling Options with Seawater Desalination and Gray Water", presented September 10, 2002, at WateReuse Association Symposium XVII, Orlando, Florida.

"Economic Impacts of Salt from Industrial and Residential Sources", presented at AWWA-WEF Joint Water Resources Conference, "Reuse, Resources, Conservation", January 2002, Las Vegas, Nevada.

"Building Water Conservation into New Homes in Chula Vista, California", presented at AWWA-WEF Joint Water Resources Conference, "Reuse, Resources, Conservation", January 2002, Las Vegas, Nevada.

"Reclaimed Water: Benefits to Society Beyond Water Resource Value In Dry Regions of the World", presented to The First International Conference on Economical and Social Uses of Water in Arab Countries, June 18-21, 2001, Beirut, Lebanon.

with Anderson, J. *et al.*, "Climbing the Ladder: A Step-by-Step Approach to International Guidelines for Water Recycling" presented at the 1st World Congress of the International Water Association (IWA), Paris, France, July 3, 2000.

"Salt in Recycled Water: Agricultural and Landscape Limitations", presented at WateReuse Workshop on Salts In the Brine Stream, held in Phoenix, Arizona, March 29, 2000.

"Riyadh, Kingdom of Saudi Arabia: A Vision of 2021: Introducing Water Reuse to A World Capital", Presented to Water Reuse 2000, Joint AWWA-WEF Specialty Conference to be held in San Antonio, Texas, January 30-February 2, 2000.

"The Importance of Reclaimed Water for Landscape Irrigation in the Arid Zone", keynote address to the First International Conference on Greenery and Environmental Beautification in Arid Zones", Sponsored by Kuwait Institute for Scientific Research, Kuwait City, November 20-24, 1999.

"Lessons From Abroad: Water Recycling Global Perspectives", presented at Symposium XIV WateReuse Association, Long Beach, California, September 15, 1999.

with NWRI writing team, "The Value of Water: Recognizing and Using the Full Potential of Your Water Supply", National Water Research Institute, Fountain Valley, California April 1999

"Sustainable Use of Water, California Success Stories", Advisory Committee Member to Pacific Institute for Studies in Development, Environment, and Security, Oakland, January 1999

"Hygienic Evaluation of Reclaimed Water Used To Irrigate Food Crops—A Case Study", Conference Proceedings, Advanced Wastewater Treatment, Recycling and Reuse, 2nd International Conference, IAWQ, Milan, Italy, September 14-16, 1998.

"Tertiary Water Food Safety Study", report to the Monterey County Water Recycling Projects' Water Quality and Operations Committee, August, 1998.

"Accounting for All the Benefits of Water Recycling" with Eric Rosenblum, Steve Kasower and Earle Hartling, Proceedings, Water Reuse '98, a joint specialty conference of WEF and AWWA in Orlando, Florida, February 1-4, 1998.

Chapter 6, Public Information Programs, in joint publication of WEF and AWWA, "Using Reclaimed Water to Augment Potable Water Resources", pp. 191-233, February 1998.

Chapter 17, Tertiary Reclaimed Water for Irrigation of Raw-Eaten Vegetables, in "Reuse of Wastewater" edited by Prof. Takashi Asano, pp. 779-825, June 1998

"Resolving Water Quality Concerns In Irrigation of Pebble Beach Golf Course Greens with Recycled Water", in Proceedings of the Water Environment Federation 70th Annual Conference (WEFTEC'97), pp. 187-194, Chicago, Illinois, October 18-22, 1997.

"International Practices In Water Reuse", in Proceedings of the Water Environment Federation 70th Annual Conference (WEFTEC'97), pp. 281-284, Chicago, Illinois, October 18-22, 1997.

with Brock McEwen of CH2MHill and Tom Richardson of Montgomery Watson, "Indirect Potable Reuse: State of the Art", presented to the Water Environment Federation Specialty Conference on Beneficial Reuse of Water and Biosolids, Marbella, Spain, April 6-9, 1997.

"An Informed Public Favors Water Recycling" presented to the Florida Section/AWWA Specialty Conference, Maitland, Florida, November 13-15, 1996.

with Eric Rosenblum, City of San Jose South Bay Water Recycling, "Environmental Influences behind Water reclamation" presented to the Florida Section/AWWA Specialty conference, Maitland, Florida, November 13-15, 1996.

"A Preview of the WEF/AWWA Guidance Manual on the Use of Reclaimed Water to Augment Potable Water Resources", presented to WEFTEC'96, Water Environment Federation 69th Annual Conference, Dallas, Texas, October 5-9, 1996.

"Global Perspectives on Water Reuse" , presented to the Pacific Northwest Pollution Control Association, Seattle, Washington, May 17, 1996.

"Obstacles of Reuse Customers and their Resolution", presented to the Pacific Northwest Pollution Control Association, Seattle, Washington, May 17, 1996.

"Outreach and Public Education for Water Reuse" presented to Water Reuse '96 a special conference co-sponsored by WEF and AWWA, San Diego, February 25, 1996.

"The Monterey Study—Agronomic Issues", presented to the California Irrigation Institute's 34th Annual Meeting, Sacramento, California, February 2, 1996.

"Uses of Recycled Water: Opportunities and Obstacles", presented to the '95 Statewide Conference of the Association of Environmental Professionals, San Jose, California, July 15, 1995.

OWR NEWS, quarterly newsletter of the City of Los Angeles Office of Water Reclamation, was published regularly from 1990 through 1994, to communicate with City decision makers and the public, expanding public awareness of water recycling through dissemination of news and general information about the safety and necessity of uses of reclaimed water.

"Future Water Recycling Potential in Southern California," presented to the American Society of Civil Engineers Annual Meeting in Denver, May 23-26, 1994.

"Status of Present and Future Water Recycling in California," presented to the Joint AWWA/WEF Water Reuse Symposium, Dallas, Texas, February 27-March 2, 1994.

with James M. Kelly and Ronald E. Young, "Emergence of Microbial Risk Assessment as a Criterion in Regulating Water Reuse in California," presented to the Joint AWWA/WEF Water Reuse Symposium, Dallas, Texas, February 27-March 2, 1994.

"The City of Los Angeles Gray Water Pilot Project," presented at CONSERV93, co-sponsored by ASCE, AWWA, and AWRA, Las Vegas, Nevada, December 12-16, 1993.

"Back to the Future: Water Reclamation," panel participant at California Water Policy III: Beyond Consensus conference, Los Angeles, October 21-22, 1993.

"Direct Potable Reuse," Moderator of Panel of Experts at California Water Policy III: Beyond Consensus conference, Los Angeles, October 21-22, 1993.

"Survey of Future Water Recycling Potential in California," presented to the WateReuse Association of California Symposium VIII, San Diego, California, October 13-15, 1993.

"Results of the City of Los Angeles Gray Water Pilot Project," presented to the AWWA Annual Conference and Exposition, San Antonio, Texas, June 6-10, 1993.

"The City of Los Angeles Gray Water Pilot Project Shows Safe Use of Gray Water Is Possible," presented to the ASCE Water Resources Planning and Management Division's 20th Anniversary Conference, Seattle, Washington, May 3-5, 1993.

"Removing Institutional Barriers to Water Reuse: A Three-Year Report Card," presented to the AWWA-WEF Joint Management Conference, Atlanta, Georgia, March 2, 1993.

"Water Reuse in Los Angeles," presented to Water Reuse Symposium, sponsored by Salt River Project, Phoenix, Arizona, November 2, 1992.

"Long-Range Planning for Water Reuse in the City of Los Angeles," in Wastewater Reclamation and Reuse, Water Science and Technology 24:9, pp. 11-17. Proceedings of International Symposium on Wastewater Reclamation and Reuse, Castell d'Aro, Costa Brava, Spain, September 24-26, 1991.

"Planning for Water Reuse to Meet the Growth Needs of the 21st Century for the City of Los Angeles," Water Pollution Control Federation Conference, October 1990, Washington, D.C.

“Monterey Wastewater Reclamation Study for Agriculture,” Research Journal, WPCF, 62:3:216-226, May-June 1990.

“Use of Wastewater Effluent for Irrigation of Raw Eaten Vegetables: A Five-Year Field Experiment Concludes It Is Feasible, Safe and Economical,” presented at Water Pollution Control Federation Annual Convention, Philadelphia, Pennsylvania, October 1987.

With R.G. Burau, “Reclaimed Water for Irrigation of Vegetables Eaten Raw,” California Agriculture 41:7 and 8, pp. 4-7, July-August 1987.

“Wastewater Effluent Reuse for Irrigation of Raw-Eaten Food Crops: A Five-Year Field Study,” presented at Water Reuse Symposium III, San Diego, California, August 1984.

“Reused Tertiary Municipal Wastewater Effluent for Irrigation of Raw-Eaten Crops: A Five-Year Study,” presented at “Water for the 21st Century: Will It Be There?”, a symposium sponsored by Southern Methodist University, Dallas, Texas, April 1984.

“Reused Tertiary Municipal Wastewater Effluent for Irrigation of Raw-Eaten Crops: A Five-Year Study,” presented to the California Water Pollution Control Association Water Reuse Seminar, Emeryville, California. February 1984.

“Treated Sewage for Crop Irrigation,” presented to the Engineering Foundation’s Conference on Environmental and Energy Engineering in the Food Processing Industry XIV, Santa Barbara, California, February 1984.

“Possibilities for Reuse of Reclaimed Wastewater for the Hashemite Kingdom of Jordan,” presented to the Jordanian Society of Engineers, Amman, Jordan, January 1984.

“Monterey Agricultural Demonstration Project — MWRSA,” presented at California Association of Reclamation Entities of Water (CAREW) Conference, Santa Barbara, California, June 1980.

“Reclaimed Wastewater for Food Crop Irrigation,” presented at National Conference on Environmental Engineering, American Society of Civil Engineers, San Francisco, California, July 1979.

“Aerosol Generation in Sprinkler Irrigation,” Proceedings, Water Reuse Symposium, American Water Works Association Research Foundation, Washington, D.C., March 1979.

“Food Crop Irrigation with Reclaimed Municipal Wastewater,” Proceedings, Water Reuse Symposium, American Water Works Association Research Foundation, Washington, D.C., March 1979.

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