Appendix D

Pure Water Monterey Groundwater Replenishment Project Water Quality Statutory and Regulatory Compliance Technical Report

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Pure Water Monterey Groundwater Replenishment Project
Water Quality Statutory and Regulatory Compliance Technical Report

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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,

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[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]

[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. <u>Anti-degradation Policies</u>

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. <u>Constituents of Emerging Concern</u>

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 90th 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:

$$\textbf{DWEL (µg/L)} = \frac{\textbf{TDI (µg/kg/day) x 70 kg}}{\textbf{2 L/day}}$$

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).

$$\textbf{Required water consumption (L/day)} = \frac{\textbf{DWEL (µg/L) x 2L/day}}{\textbf{Detected water concentration (µg/L)}}$$

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 90th 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. 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. Continue to monitor.
If MEC/MLT ratio is greater than 100	E) Resample immediately and analyze to confirm result. Continue to monitor. Contact the RWQCB and DDW to discuss additional actions. (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/.

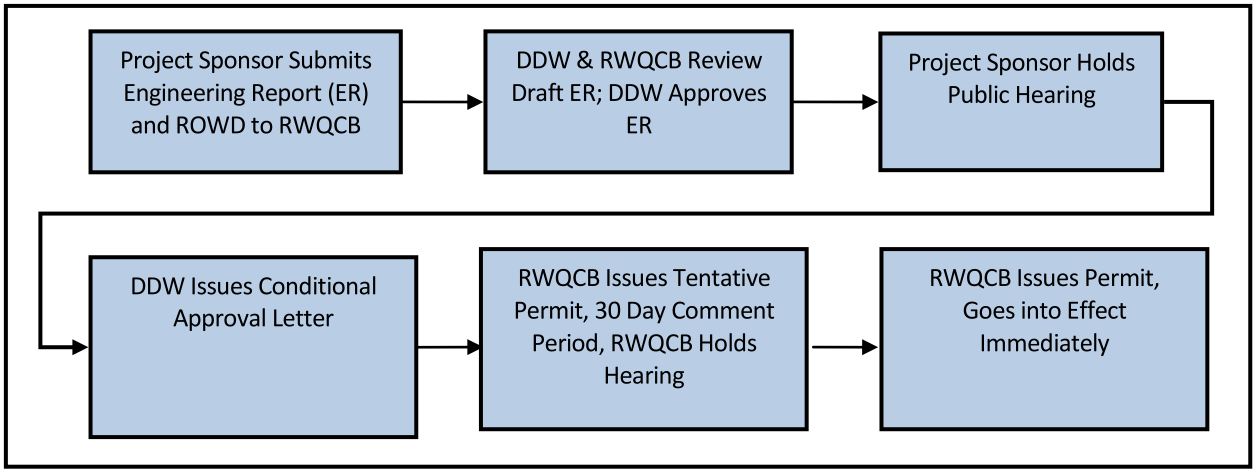

Figure 1. Current Regulatory Process for Groundwater Replenishment Projects Using Recycled Water

If DDW becomes the permitting authority for groundwater replenishment projects, the possible approval and permitting process may follow the steps shown in **Figure 2.**

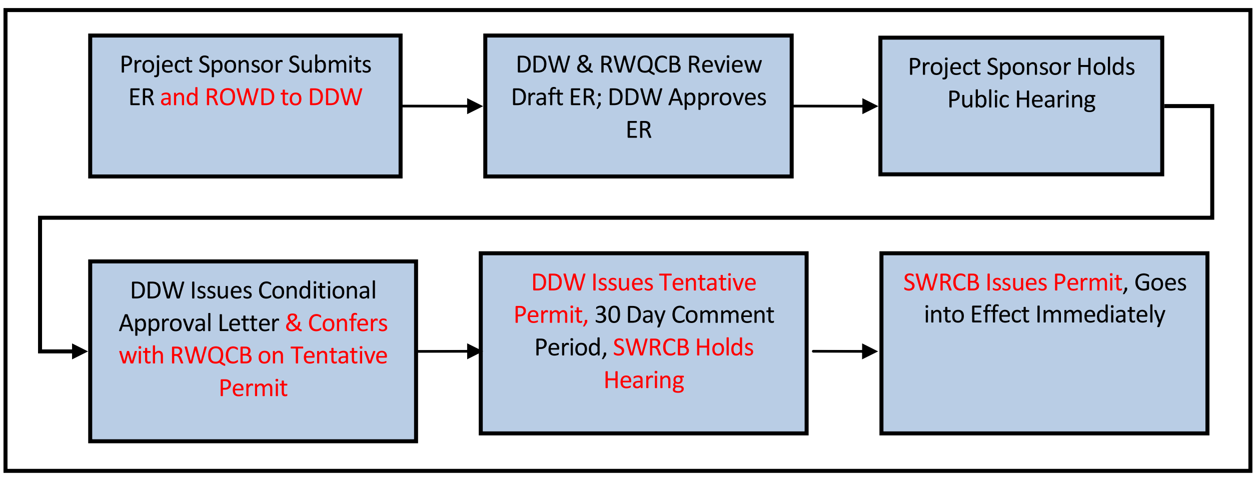

Figure 2. Potential Regulatory Process for Groundwater Replenishment Projects Using Recycled Water

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.

[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. 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. 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*). 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). 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. 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. 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. *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. 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. 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. <u>Regional Treatment Plant and New Source Waters</u>

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. <u>Advanced Water Treatment Facility</u>

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.

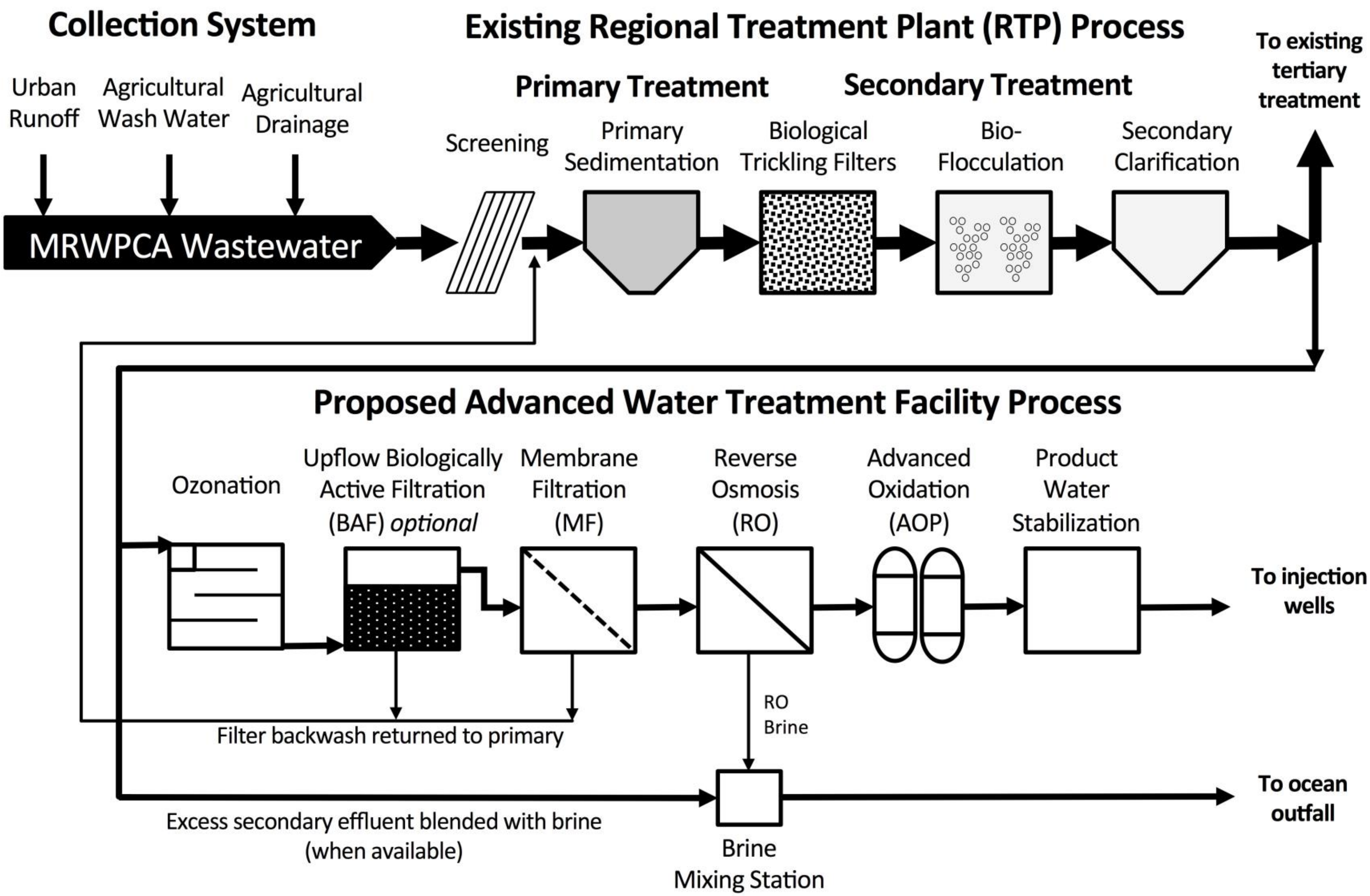

Figure 3. Simplified Flow Schematic of Regional Treatment Plant and Proposed Advanced Water Treatment Facility Processes

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. Water Quality Requirements Specified in the Groundwater Replenishment Regulations

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)	7.1×10^5 (1.9×10^5 – 1.6×10^6)	7.7×10^6 (6.2×10^5 –9.6×10^7)	4.3×10^4 (8.4×10^3 –2.0×10^6)	3.5×10^3	1.7×10^5
E. coli[d] (MPN/100 mL)	1.8×10^5 (2.9×10^4 –5.8×10^5)	<20 (<20 – 18)	2.4×10^2 (75 – 2×10^3)	<100	7.5×10^2

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 (1)[a]	12 (6)	9 (1)	3 (0)
Agricultural Wash Water	20 (5)	12 (8)	9 (2)	2 (0)
Blanco Drain	15 (2)	12 (9)	6 (0)	3 (1)
Lake El Estero	12 (0)	11 (7)	5 (0)	0
Tembladero Sough	13 (2)	9 (8)	3 (0)	1 (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 NDMA	100 µ/L 10 ηg/L	120 µg/L 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 (12-17)	295 (66-340)	3 (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 (35.7-50.5)	25.3 (19-51.1)	70.1 (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.

[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.

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[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).

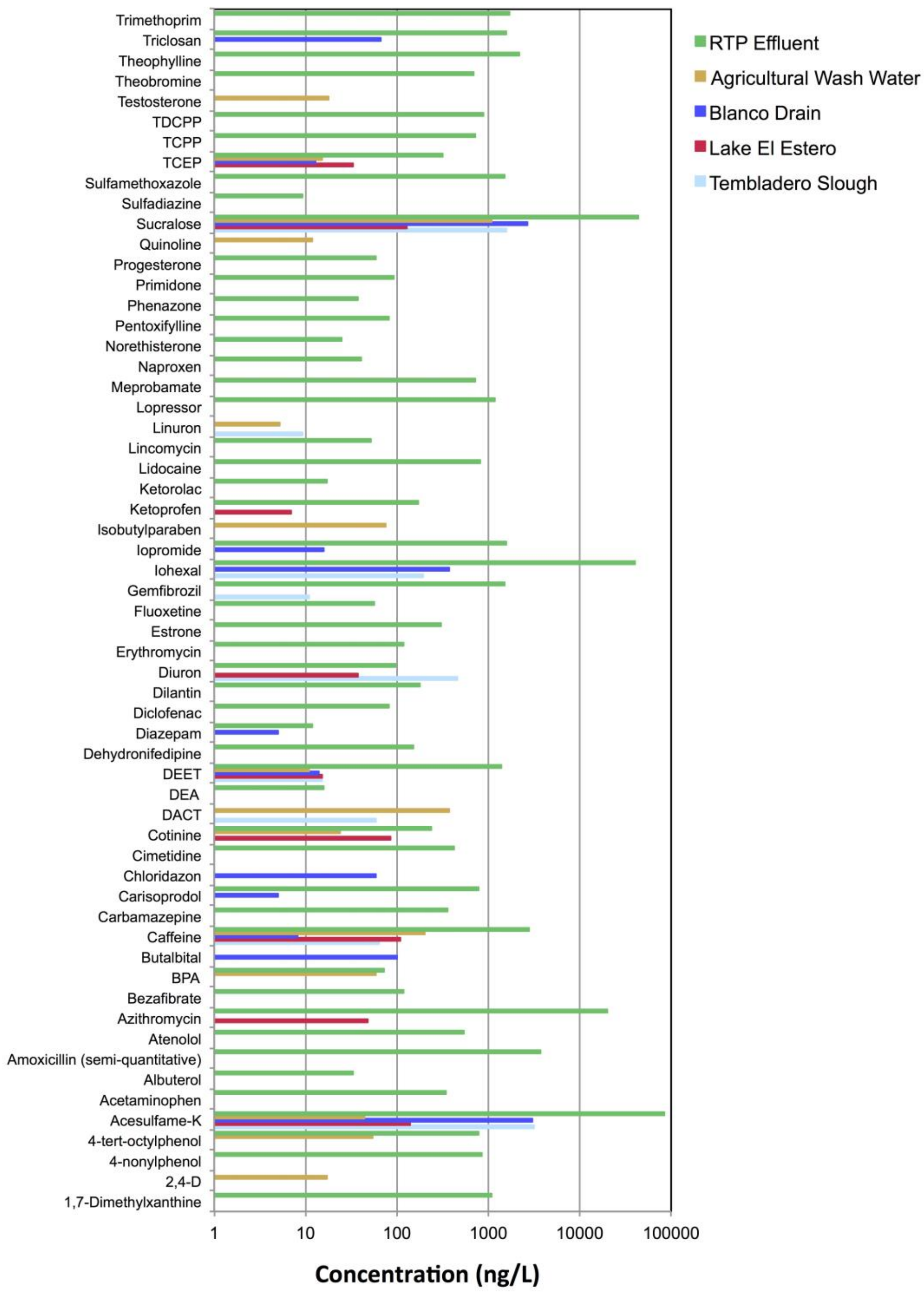

Figure 4. Constituents of Emerging Concern – Maximum Values Detected in the Various Proposed Project Source Waters

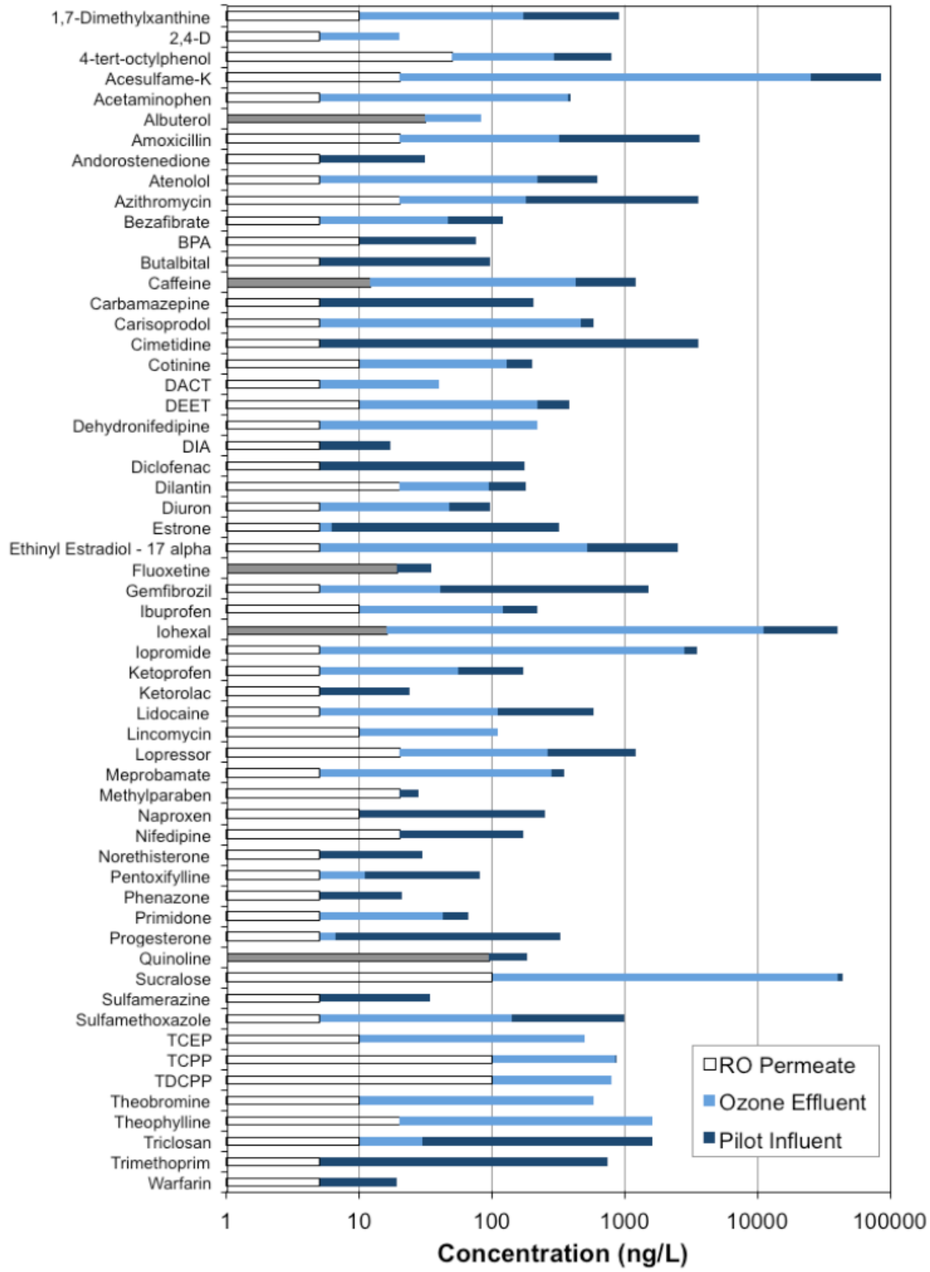

Figure 5. Constituents of Emerging Concern - Removal During Pilot Testing (Maximum Values Observed)[43]

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

[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: – 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. – Contaminant Source Investigation. MRWPCA would conduct investigations and monitoring as requested by DDW and RWQCB or based on monitoring data collected by MRWPCA. – 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. – 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. – 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 μm).

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.

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Program Internet Address: http://www.cdph.ca.gov/programs/Pages/DDWEM.aspx

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.

<u>Engineering Report, Final Design and Contingency Plan</u>

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.

<u>Operations Plan</u>

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.

<u>Response Plan</u>

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

<u>Water Quality Monitoring and Operational Reliability</u>

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
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San Luis Obispo, CA 93401

Monterey County Environmental Health Bureau
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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 (167-260)	3 / 3	356 (327-373)	4 / 4	185 (167-212)	2 / 2	363
-Bicarbonate alkalinity as HCO3	–	SM 2330B	mg/L	--	384 (338-420)	9 / 9	205 (182-310)	3 / 3	427 (399-456)	4 / 4	228 (192-259)	2 / 2	443
Ammonia as N	–	SM 4500NH3F,G	mg/L	--	32.6 (31.3-38.7)	11 / 11	5.0 (2.4-7.5)	2 / 2	*(<0.05-<0.5)*	1 / 3	*<0.05*	0 / 1	*<0.5*
Anion sum	–	SM 1030E	meq/L	--	14.49 (14.06-15.91)	9 / 9	16 (13.51-16.1)	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	1.9 (1.2-2.9)	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	186
Cation sum	–	SM 1030E	meq/L	--	14.19 (13-15.28)	9 / 9	18 (15.26-18.01)	3 / 3	28.87 (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 (260-1162)	10 / 10	48 (<5-183)	9 / 11	82	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 (160-175)	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 (2647-2929)	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	--	7.8 (5.8-10.5)	11 / 11	7.9 (3.9-8.5)	9 / 9	9.5 (6.9-13.3)	10 / 10	10.9	1 / 1	8.8
Foaming Agents (MBAS)	sMCL	SM 5540C	mg/L	0.5	0.17 (0.16-0.18)	2 / 2	0.066 (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 (0.3-0.875)	3 / 3	1.563 (0.639-3.891)	4 / 4	0.355 (0.202-0.508)	2 / 2	2.962
Langelier Index (15C)	–	SM 2330B	-	--	0.44 (0.41-0.48)	4 / 4	0.34	1 / 1	1.22 (1.07-1.8)	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 (0.039-0.061)	3 / 3	0.243 (0.06-0.449)	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	292 (70.3-352)	11 / 11	*<1*	0 / 2	255
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	69.6 (63-77.3)	8 / 8	*<0.1 (<0.1*-0.1)	1 / 2	58
Odor-Threshold	sMCL	SM 2150B	units	3	19 (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	--	7.75 (7.34-8)	12 / 12	6.95 (6.46-7.3)	10 / 10	8.1 (7.7-8.8)	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	38 (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 (38-44)	12 / 12	44 (41-48)	10 / 10	29 (26-63)	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	89 (83-161)	12 / 12	170 (163-172)	3 / 3	523 (488-630)	4 / 4	157 (127-186)	2 / 2	412
Temperature	–	Field/SM 2550B	°C	--	12.3 (8.1-25.8)	10 / 11	12.8 (7.7-18)	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	793 (771-803)	12 / 12	1282 (787-1591)	10 / 10	2003 (1822-2066)	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 (12.5-43.6)	10 / 10	<0.5 (<0.2-8.8)	4 / 11	1.2	1 / 1	<1
Total Nitrogen	–	calculation	mg/L	--	44.2 (28.8-50.5)	12 / 12	25.3 (19-51.1)	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	286 (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 (8.9-46)	3 / 3	0.38 (0.3-0.88)	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	0.26	1 / 1	0.85
Total Suspended Solids (TSS)	–	SM 2540D	mg/L	--	<5 (9-<10)	11 / 12	98 (54-140)	10 / 10	48 (18-336)	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 (0.188-0.228)	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% (59%-65%)	12 / 12	53% (33%-82%)	3 / 3	60% (56%-63%)	4 / 4	53%	1 / 1	48%
Zinc	sMCL, EPA PP	EPA 200.8	mg/L	5	<0.016 (0.016-<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 (<0.10-0.9)	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	$7.3x10^6$ ($1.9x10^3$-$1.6x10^6$)	9 / 11	$7.7x10^6$ ($6.2x10^3$-$9.8x10^7$)	2 / 3	$7.3x10^4$ ($8.4x10^3$-$2.0x10^5$)	4 / 4	$3.5x10^3$	1 / 1	$1.7x10^5$
E. coli	pMCL	SM 9223B	MPN/100mL	TT	$1.8x10^3$ ($2.9x10^1$-$5.8x10^5$)	11 / 11	$<2x10^1$ ($1.8x10^1$-$<1.0x10^2$)	1 / 3	$2.7x10^2$ ($7.5x10^1$-$2.0x10^3$)	4 / 4	$<1.0x10^2$	0 / 1	$7.5x10^2$
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	$1.8x10^2$ ($1.0x10^1$-$2.2x10^3$)	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 (0.26-2.04)	4 / 4	0.296 (0.189-0.402)	2 / 2	1.64
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	<6.4 (<4.02-<6.6)	0 / 4	<6.4 (<4.02-<6.6)	0 / 3	<8.4 (<4.02-<8.8)	0 / 4	1	1 / 1	<6.7
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 (<0.0005-0.0006)	1 / 2	<0.0005
Chromium	pMCL, EPA PP, UCMR 3	EPA 200.8	mg/L	0.05	0.0018 (0.00082-0.003)	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	0.048 (0.006-0.13)	4 / 4	0.075 (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	0.6 (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	<0.0085 (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 (<0.005-0.006)	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 - Volative 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	<0.6 (<0.6-0.85)	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 (1.9-140)	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 (<0.04-0.08)	1 / 4	0.08	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±1.27-8.32±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±1.58-18±2.45)	4 / 4	21±2.3 (17.8±2.09-26±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±3.56
Radium-226	pMCL	EPA 903.1	pCi/L	5 (Combined)	<0.906±0.364 (0.318±0.38-<0.94±0.562)	1 / 4	(<0.764±0.479-<0.827±0.487)	0 / 3	(<0.51±0.374-<0.923±0.395)	0 / 4	<0.784±0.549	0 / 1	<0.602±0.311
Radium-228	pMCL	EPA 904.0	pCi/L		(<0.62±0.365-<0.971±0.464)	0 / 4	<0.95±0.403 (<0.671±0.333-0.95±0.504)	1 / 3	(<0.609±0.265-<0.975±0.439)	0 / 4	<0.814±0.384	0 / 1	<0.991±0.452
Strontium-90	pMCL	EPA 905.0	pCi/L	8	(<0.35±0.204-<1.44±0.569)	0 / 4	(<0.545±0.29-<1.26±0.584)	0 / 3	(<0.755±0345-<1.7±0.872)	0 / 4	<0.571±0.225	0 / 1	<0.735±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 (290-350)	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 (8.8-120)	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 (2.0-18)	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	2.9 (2.6-3.3)	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 (3.4-8.8)	4 / 4	16 (13-18)	3 / 3	16 (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 (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 (<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 (<10-28)	8 / 9	<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 (<0.1-0.14)	1 / 4	<0.1	0 / 1	<0.1
Methylisothiocyanate	aNL	EPA 131	µg/L	190	<1 (<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 (0.62-0.86)	4 / 4	<0.1 (<0.1-0.16)	1 / 3	38 (38-40)	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 (0.002-0.0047)	4 / 4	0.00062 (<0.0003-0.0011)	2 / 3	<0.0003 (<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	--	**0.56 (0.52-0.86)**	4 / 4	<0.1 (<0.1-**0.16)**	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 (0.0026-0.0081)**	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 (<0.0005-**0.0042)**	3 / 4	<0.0005	0 / 3	<0.0005	0 / 4	<0.0005	0 / 1	<0.0005
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	<0.005
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	--	**6.8 (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 (<2-6.7)**	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 / 8	<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	0.95 (<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 (2.8-160)	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

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					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	--	0.58 (0.52-0.88)	4 / 4	<0.1 (<0.1-0.16)	1 / 3	38 (38-40)	4 / 4	<0.1	0 / 1	17
Glyphosate, Isopropylamine Salt	PoLI	EPA 547	ug/L	--	<5	0 / 4	<5	0 / 3	7.5 (<5-8.2)	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	60	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	--	85 (<50-780)	2 / 4	<50 (<50-53)	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	1480 (680-3000)	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	63
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 (<5-5.1)	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

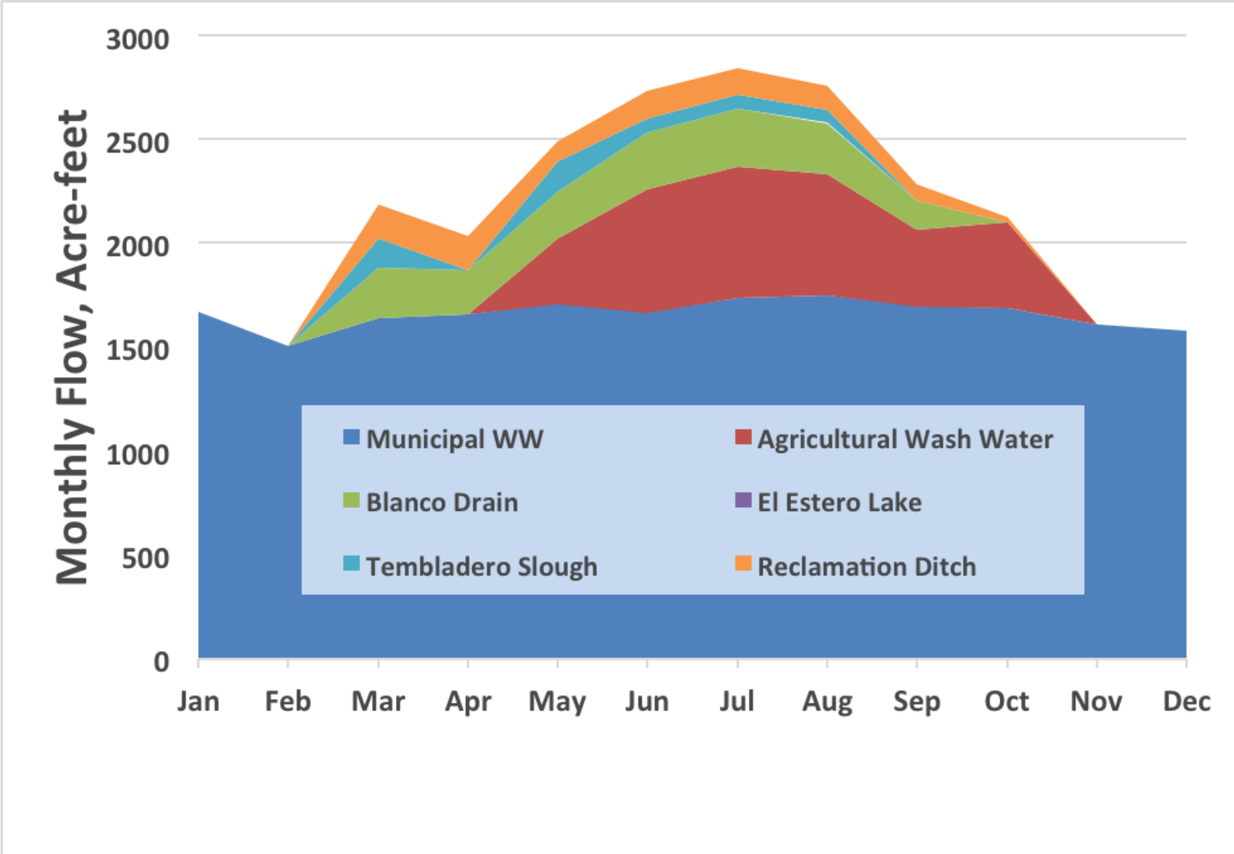
Sampling Constituent	Contaminant List	Analytical Method	Units	CDPH MCL/NL	RTP Effluent		Ag Wash Water		Blanco Drain		Lake El Estero		Tembladero Slough
					Median (Range)	Detected / Measured	Median (Range)	Detected / Measured	Median (Range)	Detected / Measured	Median (Range)	Detected / Measured	
Cimetidine	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	18 (<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	58
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	15	1 / 1	15
Dehydronifedipine	CECs	LC-MS-MS	ng/L	--	87 (82-150)	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 (<5-5)	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 (<5-98)	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 (<5-1500)	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	180
Iopromide	CECs	LC-MS-MS	ng/L	--	1400 (<5-1800)	3 / 4	<5	0 / 3	<5 (<5-18)	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	8.9	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	--	28 (<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 (<5-5.3)	1 / 3	<5	0 / 4	<5	0 / 1	8.2
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	--	48 (31-84)	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	1600
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	--	835 (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)												
		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.