# Carpinteria Valley
# Recycled Water Facilities Plan
# Final Report

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State Water Resources Control Board; Carpinteria Valley Water District Recycled Water Facilities Plan;
Water Recycling Funding Program Project No. 3318-010

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## List of Abbreviations

| | |
|---|---|
| AACE | American Association of Cost Estimating |
| AF | Acre-foot |
| AFY | Acre-feet per year |
| AO | Advanced oxidation |
| AOP | Advanced oxidation process |
| AWT | Advanced water treatment |
| Basin Plan | Central Coastal Basin |
| BNR | Biological nitrogen removal |
| CCI | Construction cost index |
| CCT | Chlorine contact tank |
| CCWA | Central Coast Water Authority |
| CEC | Constituents of emerging concern |
| CEQA | California Environmental Quality Act |
| CIMIS | California Irrigation Management Information System |
| $Cl_2$ | Free chlorine |
| COMB | Cachuma Operation and Maintenance Board |
| CSD | Carpinteria Sanitary District |
| CT | Modal contact time |
| CVWD, District | Carpinteria Valley Water District |
| CWC | California Water Code |
| DBO | Design/build/operate |
| DDW | SWRCB Division of Drinking Water |
| District | Carpinteria Valley Water District |
| ENR | Engineering News Record |
| Facilities Plan | Recycled Water Facilities Plan |
| gpm | Gallons per minute |
| GWR | Groundwater recharge |
| H&SC | Health and Safety Code |
| $H_2O_2$ | Hydrogen peroxide |
| hp | Horsepower |
| kgal | 1,000 gallons |

| | |
|---|---|
| kWh | Kilowatt-hour |
| MF | Microfiltration |
| mgd | Million gallons per day |
| mL | Milliliters |
| MOU | Memorandum of Understanding |
| MPN | Most probable number |
| NDN | Nitrification-Denitrification |
| $NH_4^+$ | Ammonium |
| $NO_2$ | Nitrite |
| $NO_3^-$ | Nitrate |
| NPDES | National Pollutant Discharge Elimination System |
| NTU | Nephelometric Turbidity Units |
| O&M | Operations and maintenance |
| $O_3$ | Ozone |
| OH | Hydroxyl radicals |
| RO | Reverse osmosis |
| RRT | Response retention time |
| RWC | Recycled water contribution |
| RWQCB | Regional Water Quality Control Board |
| SAT | Soil aquifer treatment |
| SCC | South Coast Conduit |
| SRF | State Revolving Fund |
| SWP | State Water Project |
| SWRCB | State Water Resources Control Board |
| TOC | Total organic carbon |
| UV | Ultraviolet light |
| WRFP | Water Recycling Funding Program |
| WWTP | Wastewater treatment plant |

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## Executive Summary

The Carpinteria Valley Water District (CVWD, District) has partnered with the Carpinteria Sanitary District (CSD) and the City of Carpinteria to develop a recycled water facilities plan for CVWD's service area. The purpose of this plan is to identify a cost-effective recycled water program and lay out steps to implement the program. This plan was partially funded by a grant from the State Water Resources Control Board (SWRCB) Water Recycling Funding Program. The completion of this document and acceptance by SWRCB will make CVWD and CSD eligible to seek construction grants and low interest loans.

This executive summary presents the following topics that are described in more detail in the subsequent chapters of the facilities plan: existing water supply portfolio; recycled water market assessment; recycled water treatment alternatives; project alternatives; alternatives comparison; preferred project; comparison with alternative supplies; project implementation plan; and conclusions.

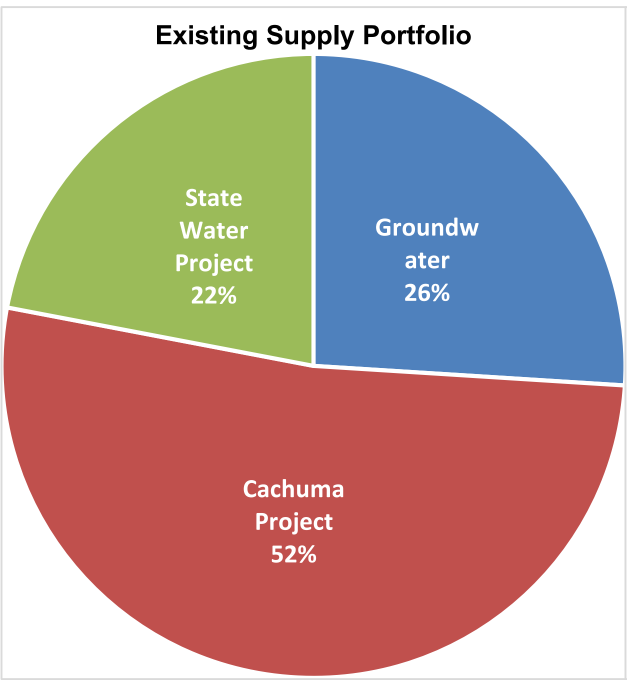
### Existing Water Supply Portfolio

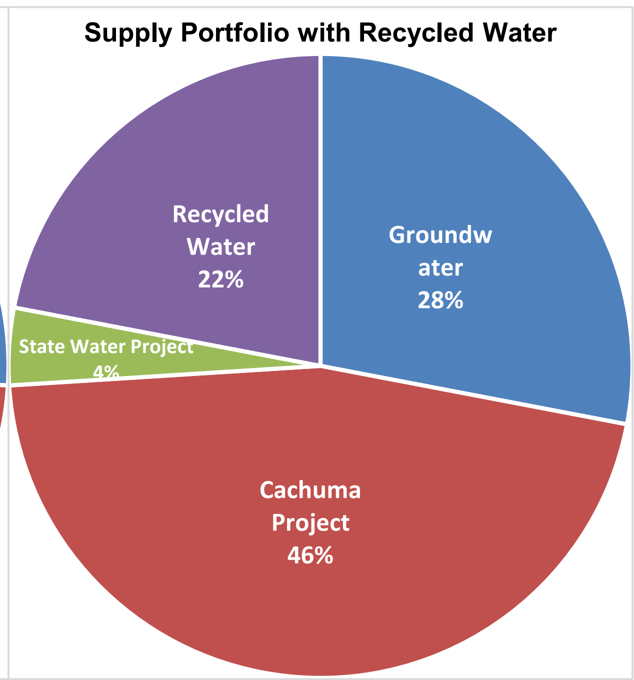
The District relies on three main sources of water supply:

- Groundwater from the Carpinteria Groundwater Basin;
- Surface water from Lake Cachuma that originates in the Santa Ynez watershed;
- Imported water from the State Water Project delivered to Lake Cachuma.

As shown below, imported water comprises roughly three quarters of existing supplies. In addition, the surface water allocation from the Cachuma Project is anticipated to decrease in the future due to sedimentation in the lake, mandatory releases for fish species, and downstream water rights. Similarly, State Water Project water availability varies from year to year, depending on precipitation, regulatory restrictions, legislative restrictions, and operational conditions.

Development of 1,100 acre-feet per year (AFY) of recycled water would nearly double the local portion of the District's supply portfolio, as shown below. Developing recycled water would reduce dependence on imported water supplies, improve water supply reliability, and increase local control of supplies.



## Recycled Water Market Assessment

Three distinct markets were evaluated for non-potable water use by CVWD:

1. Municipal Irrigation
2. Agricultural Irrigation
3. Groundwater Recharge

Each market was found to be viable but each has a large range of potential demands, as shown in the following table. The combined agricultural demand categories significantly exceed available supply, especially when considering the seasonal nature of demand. Potential indirect potable reuse demand also exceeds available supply, which is approximately 1,100 AFY; so it was assumed that a project of this nature could utilize 100% of available supply.

| End Use Type | Existing Supply | Estimated Recycled Water Demand | Estimated Recycled Water Put to Beneficial Use |
|---|---|---|---|
| Municipal Irrigation | Potable Water | 150 AFY | 150 AFY |
| Agricultural Irrigation, Existing Potable Use | Potable Water | 1,500 AFY | 725 AFY |
| Agricultural Irrigation, Existing Groundwater Use | Groundwater | 1,900 AFY | 725 AFY |
| Groundwater Recharge | Not Applicable | 100% of Available Supply | 1,100 AFY |

Regarding recycled water quality, tertiary treated effluent should be acceptable for municipal irrigation uses; but some customers may prefer lower total dissolved solids (TDS) levels. Agricultural irrigation uses would likely require chloride concentrations to be reduced such that they are comparable to the existing potable water supply (i.e., approximately 100 mg/L). Groundwater recharge (GWR) uses would also likely require chloride concentrations to be reduced to at least 100 mg/L to meet groundwater basin water quality objectives. A summary of selected constituents in existing potable water quality, local grower water quality targets, and Carpinteria Groundwater Basin objectives compared with three levels of recycled water quality are shown in the following table.

| Constituent | CVWD Potable Water | Local Grower Targets | Groundwater Basin Objectives | Recycled Water | | |
|---|---|---|---|---|---|---|
| | | | | Alt 1. Tertiary | 2. Partial RO | 3. AWT |
| TDS | 650 | < 640 | 650 | 1,360 | 340 | 40 |
| Sodium | 48 | < 90 | 100 | 281 | 70 | 10 |
| Chloride | 22.5 | < 100 | 100 | 390 | 100 | 10 |
| Boron | 0.3 | < 0.5 | -- | 0.5 | 0.4 | 0.3 |

Note: Refer to the following section for discussion of treatment alternatives.

## Recycled Water Treatment Alternatives

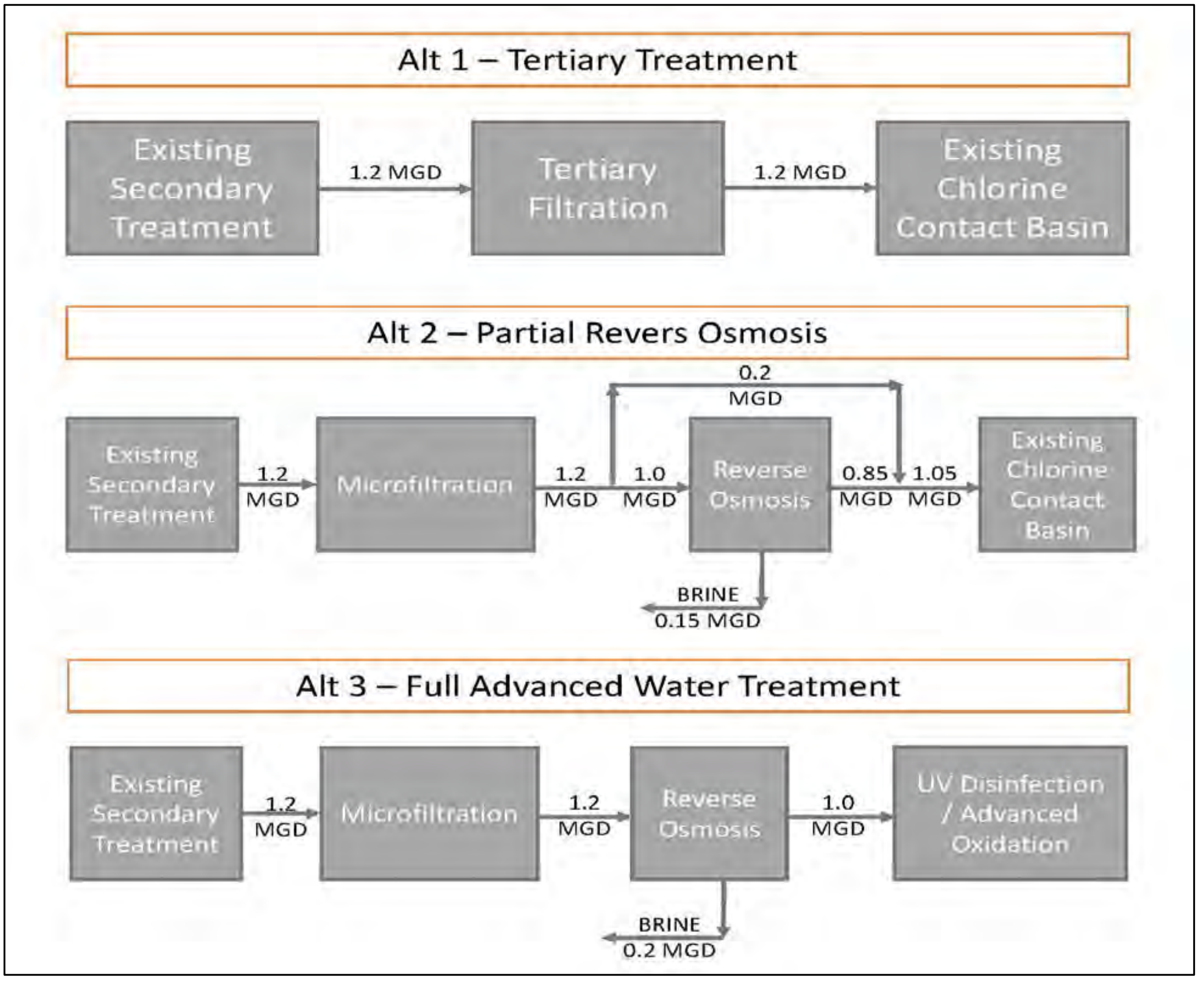
The Carpinteria Wastewater Treatment Plant (WWTP), owned and operated by CSD, is the only potential recycled water source in the service area. The current influent flow rate averages approximately 1.2 million gallons per day (MGD), and buildout flows are estimated at 1.5 MGD. The treatment plant provides secondary treatment and disinfection of collected wastewater prior to dechlorination and discharge into the

Pacific Ocean via a dedicated outfall pipe. Filtration processes would be necessary at the Carpinteria WWTP to produce recycled water that meets Title 22 criteria; and advanced water treatment would be necessary to provide higher water quality needed for some potential end uses. Adequate space at the facility is available to implement a recycled water project that could potentially scale up to provide additional treatment for the full volume of secondary effluent produced.

Based on required water quality and applicable regulations for potential end uses, three types of recycled water treatment alternatives were considered in this analysis:

1. **Tertiary:** 1.2 MGD tertiary filtration and disinfection to meet Title 22 requirements to serve municipal irrigation customers.
2. **Partial Reverse Osmosis (RO):** 1.2 MGD of microfiltration (MF) and 1.0 MGD of RO (influent flow) with a 0.2 MGD tertiary bypass stream to reduce TDS and chloride to acceptable concentrations for agricultural irrigation. The two treatment streams would be blended prior to disinfection and result in an average production of 1.05 MGD after accounting for brine losses and RO down time.
3. **Advanced Water Treatment (AWT):** 1.2 MGD (influent flow) of MF/RO/advanced oxidation process (AOP), also referred to as AWT, to be used for groundwater recharge. Average AWT production of 1.0 mgd is estimated after accounting for brine losses and RO down time.

The three alternatives are schematically shown in the following figure.



## Recycled Water Project Alternatives

Ten alternatives were developed as summarized in the following table, as well as a no project alternative, to serve the three primary markets plus a hybrid:

1. Municipal Irrigation (Tertiary Treatment)
2. Agricultural Irrigation (Partial RO)
3. Groundwater Recharge (Partial RO or AWT)
4. Agricultural Irrigation & GWR (Partial RO)

| ID | Alternative | Level of Treatment | Project Yield (AFY) |
|---|---|---|---|
| 1A | Municipal, Fill Station | Tertiary Only | 10 |
| 1B | Municipal, Large Landscape | Tertiary Only | 53 |
| 2A | Agricultural, Potable Use Offset | Partial RO | 725 |
| 2B | Agricultural, Total Use Offset | Partial RO | 725 |
| 3A | GWR, Surface Spreading | Partial RO | 1,170 |
| 3B | GWR, Surface Spreading | Advanced Water Treatment | 1,100 |
| 3C | GWR, Inland Injection | Advanced Water Treatment | 1,100 |
| 3D | GWR, Seawater Intrusion Barrier | Advanced Water Treatment | 1,100 |
| 4A | Alt 2A (Ag, Potable) & Alt 3A | Partial RO | 1,170: Ag (585) & GWR (585) |
| 4B | Alt 2B (Ag, Total Use) & Alt 3A | Partial RO | 1,170: Ag (585) & GWR (585) |

**Alternative 1 (Municipal Irrigation; Tertiary Treatment Only)** options were developed to determine if any feasible projects could be developed with limited investment in treatment. Two tertiary only options were considered. A public fill station (Alt 1A) was considered to represent the minimum initial investment to start a recycled water program. The second option (Alt 1B) focused on public landscape irrigation restricted to parks and schools.

**Alternative 2 (Agricultural Irrigation; Partial RO Treatment)** options were developed to offset some of the largest individual water customers in the area. Since agricultural irrigation is supplied by two primary water sources – CVWD potable water and groundwater – with two distinct supply costs, two agricultural options were developed that focus on potable water offset (Alt 2A) and total water (groundwater and potable) offset (Alt 2B). Municipal Irrigation customers located along pipeline alignments were included in the alternative.

**Alternative 3 (Groundwater Recharge; Partial RO or AWT)** options were developed to utilize the groundwater basin already managed by CVWD and to maximize beneficial reuse of available recycled water. Four options were considered, and three included AWT primarily to avoid the need for diluent water in recharge operations. Alt 3A and 3B entail surface spreading in areas overlying the basin's unconfined zone, Alt 3C entails injecting water inland, and Alt 3D entails injecting water along the coastline in an area with concerns about seawater intrusion. Alt 3A requires recharge of diluent water at the same location as the recycled water recharge.

**Alternative 4** expands the Alt 2 (Agricultural Irrigation) options, which have a large seasonal demand variation. This alternative maximizes beneficial reuse of available recycled water by recharging the groundwater basin when agricultural irrigation demands are lower than available supply, similar to Alt 3A. Partial RO is assumed for agricultural irrigation as is surface spreading (the only recharge method that can use partial RO). Use of partial RO water requires diluent water.

## Recycled Water Alternatives Cost Comparison

Capital and operation and maintenance estimates for each alternative are presented in the following table.

| | Capital ($M) | Annualized Capital ($M) | Annual O&M ($M) | Total Annual ($M) | Project Yield (AFY) | Unit Cost ($/AF) |
|---|---|---|---|---|---|---|
| 1A | $1.0 | $0.05 | $0.03 | $0.08 | 10 | $ 7,800 |
| 1B | $4.1 | $0.18 | $0.07 | $0.25 | 53 | $ 4,660 |
| 2A | $28.3 | $1.26 | $0.53 | $1.79 | 725 | $ 2,470 |
| 2B | $19.7 | $0.88 | $0.44 | $1.32 | 725 | $ 1,820 |
| 3A | $21.4 | $0.96 | $1.12 | $2.07 | 1,170 | $ 1,770 |
| 3B | $20.2 | $0.90 | $0.97 | $1.87 | 1,100 | $ 1,700 |
| 3C | $21.1 | $0.94 | $1.08 | $2.02 | 1,100 | $ 1,840 |
| 3D | $24.7 | $1.10 | $1.10 | $2.20 | 1,100 | $ 2,000 |
| 4A | $31.3 | $1.40 | $0.94 | $2.34 | 1,170 | $ 2,000 |
| 4B | $26.0 | $1.16 | $0.92 | $2.08 | 1,170 | $ 1,780 |

The following conclusions were made when comparing all alternatives:

- **Alt 1 (Municipal Irrigation)** options should not be pursued based on unit costs unless a relatively small new water supply need is identified. It should be noted that potential Alt 1 customers expressed support for converting to recycled water.
- **Alt 2A (Agricultural Irrigation, Potable Offset)** is more expensive than Alt 2B (Agricultural Irrigation, Groundwater Offset) as well as Alt 3 and Alt 4 options. However, potential Alt 2 customers expressed support for converting to recycled water. A portion of the capital cost is driven by amount of RO required to reduce TDS and chloride concentrations. Alternatives should be reconsidered if subsequent wastewater quality analysis supports reduced treatment needs.
- **Alt 2B (Agricultural Irrigation, Groundwater Offset)** is challenging due to the difficulty of identifying sufficient customers that currently rely mostly on groundwater who would be willing to convert to recycled water. Pricing, water quality, and system operation needs will need to be addressed. Agricultural groundwater pumpers were not a focus of customer outreach in this study. Also, the water supply benefit will be dependent upon actual recycled water used by customers and will require a framework to enable CVWD to pump offset groundwater. Similar to Alt 2A, subsequent wastewater quality analysis could support reduced treatment needs.
- **Alt 3 (Groundwater Recharge)** options have similar costs to Alt 2B while providing a larger and more versatile water supply benefit. Recharge can occur year-round while Alt 2B is limited by seasonal irrigation demand. The key issue for Alt 3 options is the establishment of an institutional and legal framework for a groundwater basin management structure, which would be interrelated with development of a Groundwater Sustainability Agency. In addition, groundwater modeling is required to confirm that project concepts can meet GWR regulations, particularly underground travel time requirements.
- **Alt 3B (GWR, Surface Spreading, Full AWT)** has the lowest unit cost of the Alt 3 options, partially because it avoids the need for diluent water (in Alt 3A) and doesn’t include expensive injection wells (Alt 3C and 3D). However, the need for diluent water in other Alt 3 options could

be reduced if total organic carbon concentrations are shown to be lower than assumed. It should be noted that land acquisition for recharge basins could be difficult.

- **Alt 3C (GWR, Injection, Full AWT)** allows for the most flexibility in recharge location relative to existing potable wells, which should provide the easiest approach to meeting underground retention time requirements.

## Preferred Project

Overall, groundwater recharge is the preferred project based on competitive costs, maximized water supply benefits, and lower operational complexity compared with an agricultural irrigation system. Alt 3B has the lowest unit cost but feasible implementation may be limited by available sites to construct recharge basins, the ability to meet travel time requirements to potable wells (defined by the GWR regulations), and the ability to confirm whether the District would eventually recapture all recharged water. Alternatively, injection wells (Alt 3C) allow flexibility to place wells in the area of lowest groundwater elevations as well as in an area that is proximate to District wells (but with limited other potable wells in the vicinity), and therefore have a high level of confidence to recapture the water in the future.

In summary, Alt 3B has lower costs but higher risk of not being able to be successfully implemented while Alt 3C has higher costs with a higher likelihood of successful implementation. A hydrogeological investigation must be conducted to evaluate and confirm the assumptions made in the report so that a final preferred alternative can be selected. Therefore, at this time two alternatives, **Alt 3B (GWR, Surface Spreading, Full AWT)** and **Alt 3C (GWR, Injection, Full AWT),** are recommended as the preferred project approach.

A key step to implementation is identifying potential feasible surface spreading and injection sites based on the following considerations:

- Public or potentially available private lands
- Proximity to existing potable wells and travel time estimates to proximate wells
- Percolation rate and injection rate estimates considering long-term recharge operations

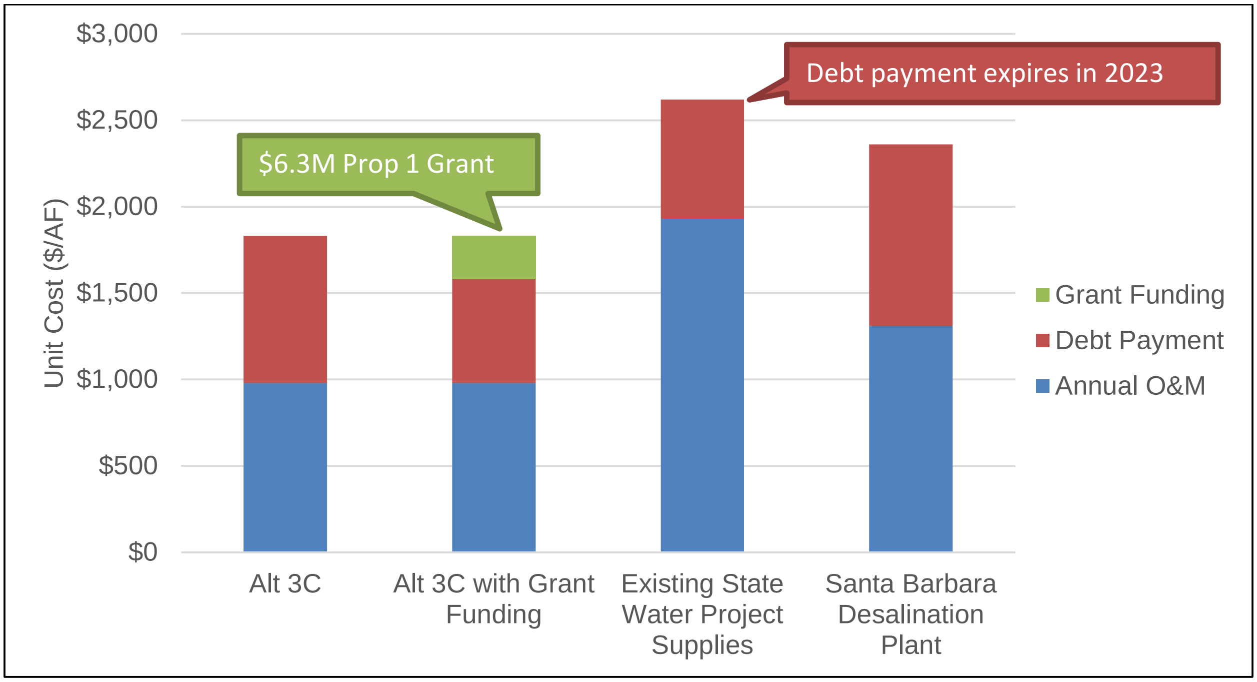
Following the results of this assessment, a recharge method and location should be selected. Then implementation of the selected project can proceed.

## Comparison with Alternative Supplies

CVWD plans to meet most, if not all, future water demands through increased conservation and is exploring recycled water options as a strategy for meeting existing demands due to increasing unreliability of its surface water supplies and the related potential for water shortages in drought years. If a recycled water project is not implemented, CVWD has limited opportunities to expand existing water supplies:

- Groundwater: Increased pumping likely would cause sustained basin overdraft conditions
- Cachuma Project: The project is fully subscribed and yield has been decreasing due to reservoir siltation and increased requirements for environmental releases. Additional yield from the project is not a viable option.
- State Water Project: High variability, high water rights acquisition costs, and projected delivery cost increases make further rights acquisition beyond existing rights undesirable.

As shown in the following figure, the preferred recycled water project has a lower unit cost than the existing cost of State Water Project water. Although the No Project alternatives would avoid potential short-term environmental impacts, such as traffic impacts from construction activities and noise impacts from operation of equipment and vehicles, CVWD still would have potential water shortages in drought years. Other long-term benefits associated with implementing the recycled water project include reduced dependence on surface water supplies, improved water supply reliability, increased local control of supplies, improved groundwater basin management, and increased climate change resiliency.




In addition to existing supplies, a potential new water supply is participation in the expansion of the proposed re-commissioned Santa Barbara Desalination Plant. Participation by CVWD would likely entail an exchange of Cachuma Project water for expanding the desalination plant, rather than direct delivery of the desalinated water. It should be made clear that CVWD is not pursuing this alternative, but the option provides a reasonable cost comparison with production of recycled water locally.

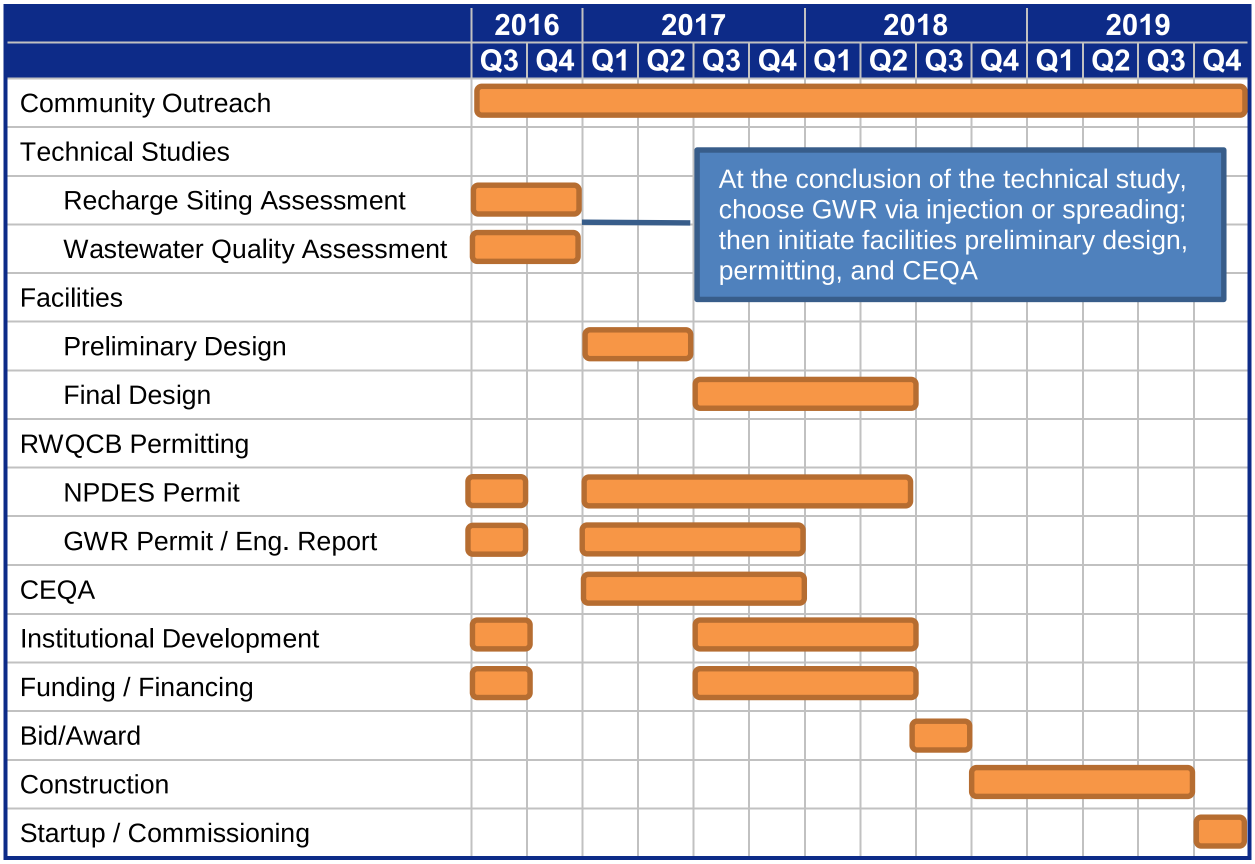
## Project Implementation Plan

Additional technical studies, environmental review, public outreach and regulatory discussion are needed to refine the preferred recycled water projects concepts and verify economics. The overall implementation plan for the preferred project is shown on the following page. In summary, all the preliminary studies required to further refine the project need to be completed in order to: 1) prepare the Engineering Report for the SWRCB Division of Drinking Water (DDW); 2) initiate environmental documentation; and 3) refine project cost estimates. The environmental documentation should be done in parallel with the Engineering Report.

From a project funding and financing perspective, California Environmental Quality Act (CEQA) certification is the critical path for gaining preliminary approval for grant funding and low-interest loans from the SWRCB. From a project start-up perspective, the Engineering Report approval is the critical path for acquiring a recycled water permit from the Regional Water Quality Control Board (RWQCB), which is needed prior to start of operations. CEQA certification is also needed before the RWQCB can issue the tentative permit.

Design of the infrastructure improvements would continue after completion of the relevant preliminary studies in coordination with CEQA and permitting efforts. Applications for funding and stakeholder/public outreach efforts would occur over the lifetime of the project. If pilot testing of treatment processes is conducted, it should be done in coordination with public outreach and design efforts.

Full implementation of the project is anticipated to take approximately 3.5 years. It should be noted, however, that the schedule for achieving DDW/RWQCB approval would depend on DDW/RWQCB staff work load and the number of issues requiring resolution.



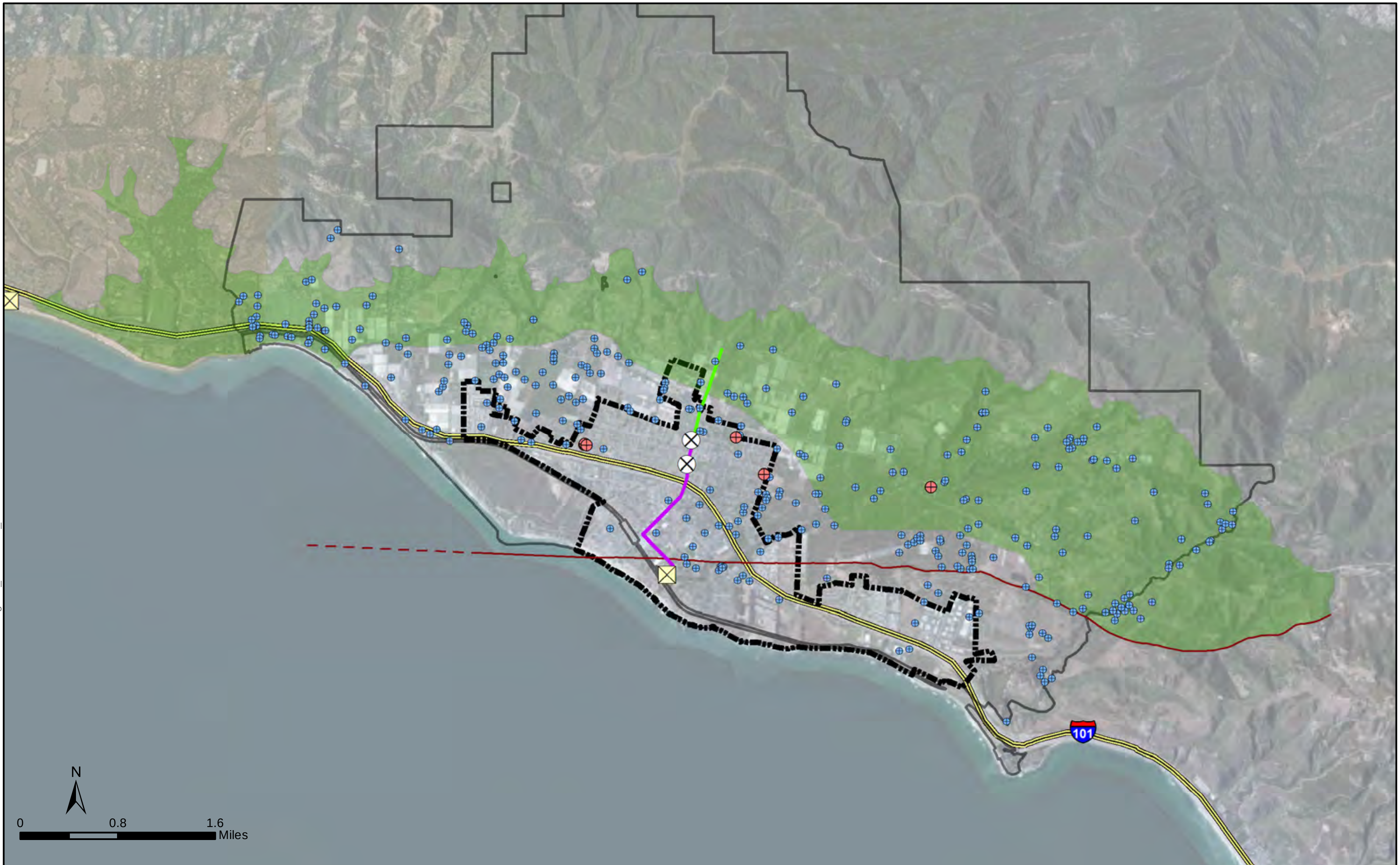

## Conclusions

The facilities plan considered use of recycled water for landscape irrigation, agricultural irrigation, and groundwater recharge. Groundwater recharge with full advanced water treatment was selected as the preferred use of recycled water based on:

- Maximizing available water for reuse (versus seasonal use with irrigation)
- Allows use of new water supply at its highest and best use (potable use)
- Leverages existing facilities – primarily the groundwater basin and District wells
- Provides ability to store supplies on a multi-year basis to be used in years with low surface water deliveries
- Provides ancillary groundwater basin benefits, such as higher groundwater levels and lower risk of seawater intrusion, and supports groundwater sustainability
- Full AWT is only incrementally more expensive than the 80 percent RO option, which is the minimum treatment needed to meet minimum water quality requirements for agricultural irrigation or groundwater recharge
- Full AWT avoids the need for diluent water for recharge, which can be expensive and unreliable

By implementing a groundwater recharge with recycled water project, the District can reduce its dependence on surface water – which has high variability and increasing costs – with a locally controlled and drought proof water supply that increases the District's climate change resiliency.

A key step to implementation is identifying potential feasible surface spreading and injection sites. Following the results of this assessment, a recharge method and location should be selected. Then implementation of the selected project can proceed.

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**Alternative Pipelines**

- Alternatives 3B + 3C
- Alternative 3B only

**Other Features**

- Carpinteria WWTP
- CVWD Boundary
- Rincon Fault Thrust Line

- Unconfined Area
- Injection Wells
- CVWD Wells
- Private Wells

**Recommended Project: Groundwater Recharge**

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# Chapter 1 Introduction

The Carpinteria Valley Water District (CVWD, District) has partnered with the Carpinteria Sanitary District (CSD) and the City of Carpinteria to develop a recycled water facilities plan (Facilities Plan) for the District's service area. The three entities have signed a Memorandum of Understanding (MOU) to share the costs of the proposed Facilities Plan. Developing recycled water use opportunities could have significant benefits to CSD, CVWD, and the broader Carpinteria Valley area by further enhancing water supply reliability and creating beneficial uses of wastewater. However, implementing these new opportunities will require a feasibility analysis of alternatives, facilities planning, and discussion with potential customers as well as the CVWD and CSD.

The purpose of this Facilities Plan is to identify a cost-effective recycled water program and lay out steps to implement the program. This Facilities Plan was partially funded by a grant from the State Water Resources Control Board (SWRCB) Water Recycling Funding Program (WRFP). The completion of this document and acceptance by SWRCB will make CVWD and CSD eligible to seek construction grants and low interest loans.

## 1.1 Background

The District's service area comprises approximately 11,098 acres (17.3 square miles) along the south coast of the County of Santa Barbara easterly from the Toro Canyon area to the Ventura County line. The District provides domestic water service to a population of approximately 15,700, and provides agricultural water supply to approximately 3,200 acres of irrigated crops (CVWD, 2011).

The District relies on three main sources of water supply

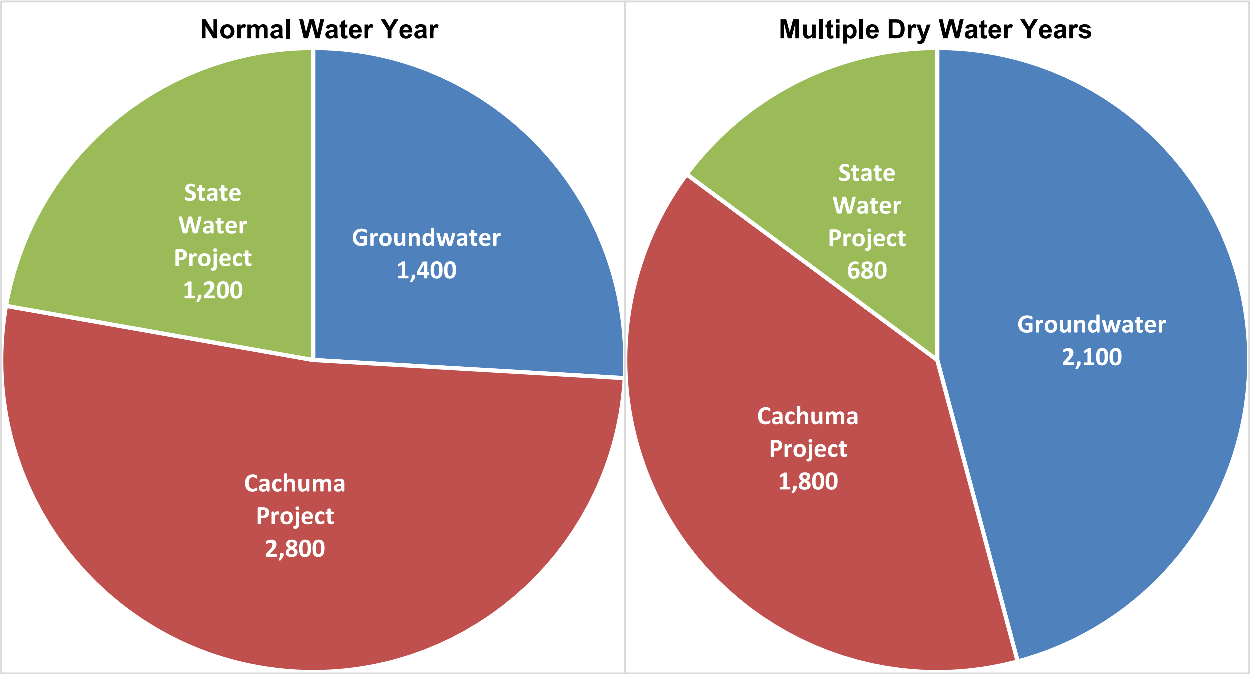
- Groundwater from the Carpinteria Groundwater Basin
- Surface water from Lake Cachuma in the Santa Ynez watershed
- Imported water from the State Water Project (SWP) delivered to Lake Cachuma.

As shown in **Figure 1-1**, the District's surface water supply profile can be highly variable. In addition, reliable yield from the surface water supplies has decreased over time and likely will continue to decrease in the future due to other competing interests and factors. In response to these conditions and slight demand increases anticipated from population growth, the District is interested in developing alternative water resources, including recycled water facilities, to help reliably and cost effectively meet its water supply needs.

Developing recycled water use in the District's service area would:

1. **Reduce Dependence on Surface Water Supplies:** Imported water from the Cachuma Project and SWP represents approximately 74 percent of supplies. Recycled water use within and adjacent to the District will help reduce dependence on these sources.
2. **Improve Water Supply Reliability:** Recycled water supply is generally not affected by hydrologic conditions; therefore, it provides additional dry year reliability.
3. **Preserve Potable Water Supplies:** Using recycled water to serve non-potable demands, such as irrigation demands, will preserve high-quality drinking water supplies for potable needs.

**Figure 1-1: CVWD Water Supply Profiles (AFY)**




Source: District Staff

## 1.2 Report Organization

This Facilities Plan consists of five chapters and is organized as follows:

- **Chapter 1 – Introduction:** This section describes the need for developing the use of recycled water for the District and an overview of the Plan.
- **Chapter 2 – Project Setting:** This section characterizes the District, including climate, hydrologic features, land use, water supply and use, wastewater treatment and disposal, and existing recycled water facilities.
- **Chapter 3 – Market Assessment:** This section identifies potential non-potable water users within the District, providing estimates of recycled water demand.
- **Chapter 4 – Recycled Water Treatment Options:** This section defines treatment alternatives to provide sufficient water quality for the market segments identified in Chapter 3.
- **Chapter 5 – Project Alternatives Analysis:** This section discusses the methodology for developing and evaluating various recycled water project alternatives. It defines design criteria and assumptions and provides a detailed description of each project alternative, including a “No Project Alternative.”
- **Chapter 6 – Recommended Project:** This section describes the recommended facilities, including operational strategy, cost, implementation plan and construction financing plan.

# Chapter 2 Project Setting

This section provides a characterization of the study area, water supply and use, and wastewater treatment and disposal.

## 2.1 Study Area Characteristics

### 2.1.1 Study Area Description

The study area, as shown on **Figure 2-1**, consists of the District's service area. The District is located on the coast of California, 80 miles north of Los Angeles and 12 miles southeast of Santa Barbara. The District's service area encompasses an area extending along the south coast of the County of Santa Barbara easterly from the Toro Canyon area to the Ventura County line. The District is located in a Mediterranean climate, characterized by dry summers with mild temperatures and cool winters with light to moderate quantities of precipitation. Annual rainfall for the area is approximately 19.2 inches (Santa Barbara County Rainfall Station 208).

The District overlies the Carpinteria Groundwater Basin, which is bounded on the north by consolidated rocks of the Santa Ynez Mountains, on the south and southwest by the Pacific Ocean, and on the west by contact with the consolidated rocks of Toro Canyon. Natural groundwater recharge in the area occurs from direct infiltration of precipitation, streambed percolation, irrigation return flow, and to a limited extent, underflow (CVWD, 2015).

There are five major streams in the Carpinteria Groundwater Basin including Carpinteria, Gobernador, Santa Monica, Arroyo Parida, and Rincon Creeks. Additional drainages include Toro and Franklin Creeks. Streambed percolation is assumed to occur only where the stream overlies the basin's unconfined area. Once the streamflow reaches the confined area, the amount of deep percolation to the main groundwater system is assumed to be insignificant. Rainfall is the primary source of inflow/recharge to the Carpinteria Groundwater Basin, whether it falls directly on the basin and percolates vertically downward through the basin sediments or falls on the adjacent watershed areas and flows into the Carpinteria Groundwater Basin via the surface or subsurface (CVWD, 2012).

### 2.1.2 Land Use

Existing land use within the District's boundaries is shown in **Figure 2-2**. Land use within the District's service area includes agriculture, residential, and commercial properties. Within the City boundaries, land use is primarily residential or commercial with some industrial and manufacturing. A majority of the agricultural land lies outside the City limits. Agricultural crops include avocados, lemons, fruit trees, field crops, and nursery operations, as summarized in **Table 2-1**. The City of Carpinteria regulates land use within the City, while the County of Santa Barbara controls the unincorporated area of the District.

**Table 2-1: Agricultural Crops in the District (2014)**

| Irrigation Method | Acres |
|---|---|
| Avocados | 1,799 |
| Lemons | 201 |
| Nursery (open) | 330 |
| Nursery (covered) | 359 |
| Field crops | 193 |
| Fruit trees | 166 |
| Other (<5%) | 188 |
| **Total** | **3,236** |

Source: 2014 crop type estimates provided by CVWD

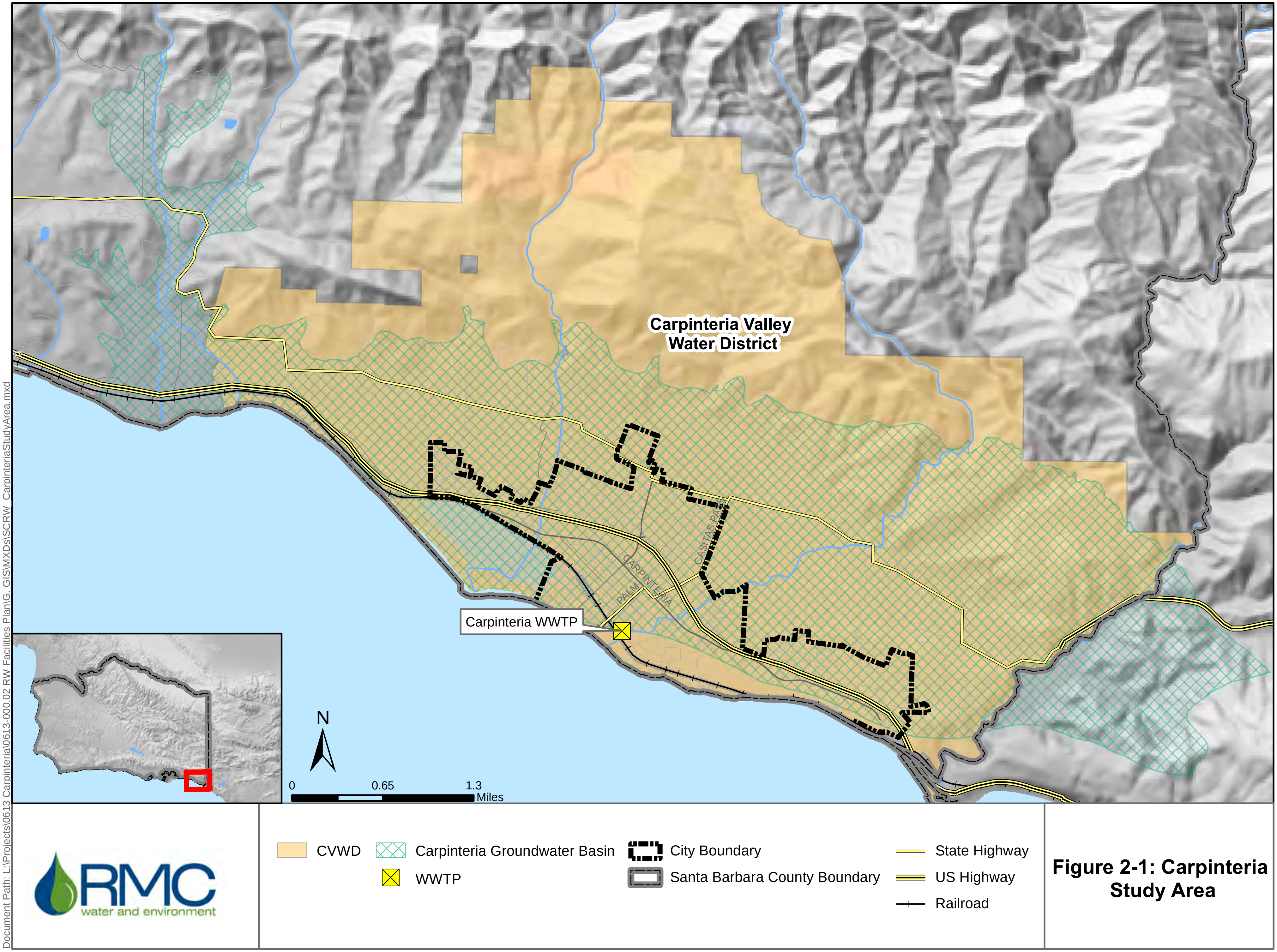



**Figure 2-1: Carpinteria Study Area**

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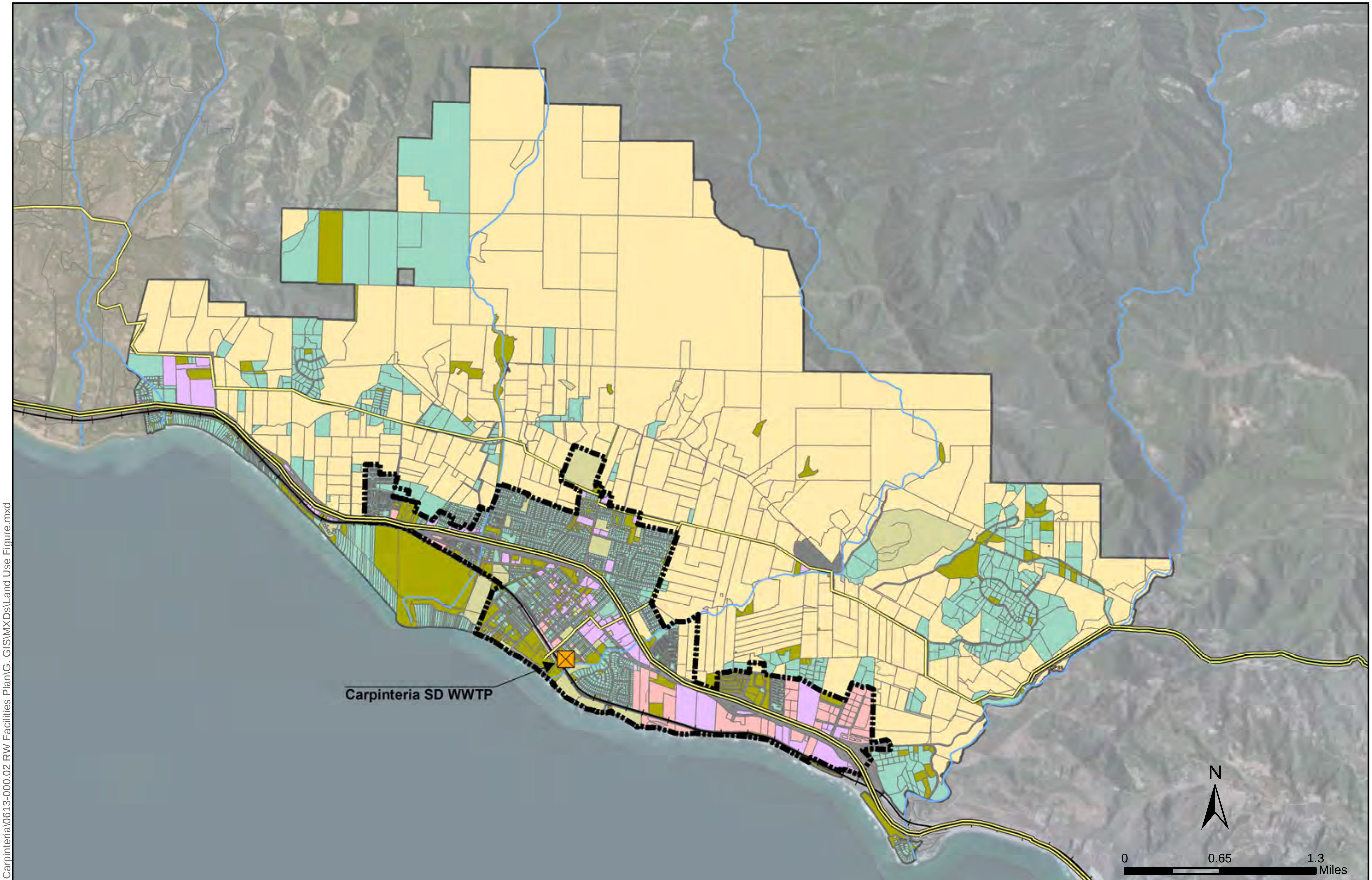


Land Use

| | | | |
|---|---|---|---|
| Agriculture | Industrial | Public | City Boundary |
| Commercial | Null | Residential | |

RMC water and environment

**Figure 2-2: Study Area Land Use**

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### 2.1.3 Population Projections

Currently, water service is provided to a population within the District's service area of approximately 15,700 and a total of 4,400 service connections. **Table 2-2** provides a summary of population projections for the District.

**Table 2-2: Historical and Projected District Population**

| 2010 | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 |
|---|---|---|---|---|---|---|
| 15,494 | 15,675 | 15,858 | 16,102 | 16,348 | 16,597 | 16,734 |

Source: District Staff.

## 2.2 Water Supply and Use

### 2.2.1 Potable Water Supply Characteristics and Facilities

The District serves water to over 3,500 single family and multi-family residential accounts; 500 commercial, industrial, institutional, and other accounts; and over 400 agricultural accounts.

The District relies on three main sources of water supply, as summarized in **Table 2-3**:

- Groundwater from the Carpinteria Groundwater Basin
- Surface water from Lake Cachuma in the Santa Ynez watershed
- Imported water from the SWP delivered to Lake Cachuma.

**Table 2-3: Water Supply in Normal Years (2015 – 2035)**

| Supply | AFY | Notes |
|---|---|---|
| Groundwater | 1,500 | The current long-term sustainable groundwater yield is approximately 4,000 AFY. Private pumping represents approximately 2,500 AFY. |
| Cachuma Project | 2,250 | Based on maximum allocation of 2,813 AFY in 2010-2014; maximum allocation anticipated to decrease to 2,250 AFY for period 2015-2035; assumes 100 percent delivery of maximum available allocation. |
| SWP | 1,200 | Based on maximum allocation of 2,000 AFY (excluding 200 AFY drought buffer program); assumes 60 percent delivery (DWR, 2010, Table 6.20). |
| **Total** | **5,150** | |

Source: District Staff

#### Groundwater

The District overlies the Carpinteria Groundwater Basin, a relatively large groundwater aquifer. The total volume of groundwater in Carpinteria Groundwater Basin Storage Unit No. 1 (the largest unit) is approximately 575,000 AF, and the estimated usable groundwater storage volume is 40,000 AF (CVWD, 2014). The basin extends from beyond the Ventura County line on the east, to Toro Canyon on the west. Groundwater rights in the Carpinteria Groundwater Basin have not been adjudicated. Under the authority of State Assembly Bill 3030, the District adopted a Groundwater Management Plan in order to establish its role as groundwater manager for the Carpinteria Groundwater Basin.

Groundwater quality in the Carpinteria Groundwater Basin is suitable for most uses and is predominantly characterized by calcium bicarbonate, with varying amounts of sodium (DWR, 2004). In general, water quality is reported as stable, with no trends toward impairment. Chloride concentrations have remained relatively steady for the past several years (CVWD, 2015). However, historical data show elevated nitrate concentrations in the western portion of the basin (DWR, 2004).

Groundwater pumping in the basin occurs both from the District production wells and from about 100 private wells. The District operates five municipal wells with a combined capacity to produce approximately 3.98 million gallons per day (MGD). Pumping for the District has averaged approximately 1,500 AFY since 1984, while private pumping has averaged 2,200 AFY over the same period. The current long-term sustainable groundwater yield is approximately 4,000 AFY. Private pumping projections represent approximately 2,500 AFY and the balance of 1,500 AFY is planned for CVWD. Also CVWD participates in the Irvine Ranch Water District groundwater bank in the Central Valley, the Strand Ranch Integrated Water Banking Project, whereby CVWD can utilize a 2 for 1 exchange option to store SWP water.

#### Cachuma Project

The primary features of the Cachuma Project are Lake Cachuma, Bradbury Dam, Tecolote Tunnel, the South Coast Conduit (SCC) and related distribution systems. Water diverted from Lake Cachuma passes through the Tecolote Tunnel, which brings water through the Santa Ynez Mountains to the SCC. The Tecolote Tunnel, SCC, and the regulating reservoir facilities are operated by the Cachuma Operation and Maintenance Board (COMB). The District has a contractual agreement with COMB for delivery of its Cachuma Project water. Surface water stored in Lake Cachuma is treated at the Cater Water Treatment Plant, which is owned and operated by the City of Santa Barbara, before being conveyed to the District.

The District purchased an annual average of 3,100 AFY from the Cachuma Project over the period of 2001 to 2010 (CVWD, 2011). The District's surface water allocation from the Cachuma Project is currently 2,813 AFY but is anticipated to decrease to 2,250 AFY due to sedimentation in the lake, releases for fish species, and downstream water rights.

#### State Water Project

The District contracts with the Central Coast Water Authority (CCWA) for its SWP allocation of 2,000 AFY plus a 200 AFY drought buffer. The District's SWP water is stored in Lake Cachuma and is accessed in a similar manner as Cachuma Project water. Availability of SWP water varies from year to year, depending on precipitation, regulatory restrictions, legislative restrictions, and operational conditions. It is especially unreliable during dry years and multiple dry-year periods.

### 2.2.2 Water Use Trends

District customers include single and multi-family, commercial, industrial, institutional, and agricultural. The majority of growth in the number of connections through 2035 will be in the residential sector. **Table 2-4** presents an estimate of water demand through 2035.

**Table 2-4: CVWD Demand Projections (AFY)**

| 2010 | 2015 | 2020 | 2025 | 2030 | 2035 |
|---|---|---|---|---|---|
| 3,718 | 4,268 | 4,212 | 4,268 | 4,325 | 4,382 |

Source: CVWD, 2011
Note: Does not include potential reduction of demand of 10 percent for period 2015-2035 utilizing water conservation Demand Management Measures.

### 2.2.3 Potable Water Rates

Potable water rates (2015/16) for the District are summarized in **Table 2-5**. In addition to the water rates, the District applies several service charges, including Fire, Basic, SWP, Capital Improvement Program, and Drought (temporary) charges.

**Table 2-5: 2015-2016 Water Rates ($/AF)**

| Current Water Rates ($/AF) | | | |
|---|---|---|---|
| | Basic | Pressure Zone I[1] | Pressure Zone II[2] |
| Residential, Commercial, Industrial, and Public Authority: | | | |
| Base[3] | $1,481 | $1,594 | $1,673 |
| Mid-Level[4] | $1,982 | $2,095 | $2,174 |
| Peak[5] | $2,831 | $2,945 | $3,023 |
| Agricultural/Irrigation: | | | |
| Tier 1[6] | $836 | $950 | $1,028 |
| Tier 2[7] | $980 | $1,093 | $1,172 |
| Tier 3[8] | $1,089 | $1,202 | $1,281 |
| Residential Equivalency Fee: | | $24.66 per residence per month | |

Notes:

1. Pressure Zone I = Connections served by Gobernador Reservoir
2. Pressure Zone II = Connections served by Shepard Mesa Tank
3. Base = 5 year December to March water consumption by account/dwelling unit; 6 HCF minimum.
4. Mid-Level = 20 percent of Base tier allocation
5. Peak = All consumption in excess of Base and Mid-Level combined
6. Tier 1 = 100 percent of 5-year average monthly consumption or pre-defined water need based on land use
7. Tier 2 = 20 percent of Tier 1
8. Tier 3 = All consumption in excess of Tier 1 and Tier 2 combined

The District has recently commenced a water rate study that could impact future rate structures.

## 2.3 Wastewater Collection and Treatment

Wastewater collection and treatment for the City of Carpinteria is provided by CSD. The Carpinteria Wastewater Treatment Plant (WWTP), owned and operated by CSD, is the only potential recycled water source in the service area. The treatment plant has a secondary capacity of 2.5 MGD, the current influent flow rate averages approximately 1.2 MGD, and buildout flows are estimated as 1.5 MGD (CSD, 2015). The treatment plant provides secondary treatment and disinfection of collected wastewater prior to dechlorination and discharge into the Pacific Ocean via a dedicated outfall pipe. The treatment process consists of primary clarification, aeration, secondary clarification, and chlorine disinfection. Sodium bisulfite is used to dechlorinate effluent prior to discharge into the Pacific Ocean. Collected sludge is processed utilizing an aerobic digester and belt thickeners prior to disposal.

Filtration processes would be necessary at the Carpinteria WWTP to produce recycled water that meets Title 22 criteria; and advanced water treatment would be necessary to provide higher water quality needed for some potential end uses. Adequate space at the facility is available to implement a recycled water project that could potentially scale up to provide additional treatment for the full volume of secondary effluent produced.

# Chapter 3 Regulatory, Permitting, and Legal Requirements

This chapter identifies the regulatory, permitting, and legal requirements for implementing non-potable water reuse projects and potable water reuse projects. The chapter is organized into the following sections:

- SWRCB Division of Drinking Water (DDW) regulations
- SWRCB policies
- RWQCB requirements
- Permitting water reuse projects

The use of recycled water (potable and non-potable) is regulated under the Clean Water Act when applicable (for example, when a project involves discharge to a Water of the U.S.), the Safe Drinking Water Act, and several State laws, regulations, and policies, with different responsibilities assigned to the SWRCB, the SWRCRB DDW, and the nine RWQCBs.

The California Water Code (CWC) and Health and Safety Code contain California's statutes that regulate the use of water and the protection of water quality, public health, water recycling, and water rights. The key statutes that are relevant to water recycling include:

- Water rights
- Recycled water definitions for potable and non-potable reuse
- Authority for adopting state policies to protect water quality and develop regulations to protect drinking water
- Authority related to issuance of recycled water permits
- Authority to develop recycled water regulations

A complete compendium of applicable statutes is available on the DDW website.

## 3.1 DDW Regulations

Applicable DDW recycled water regulations are presented in the following sections:

- Non-potable reuse regulations
- Groundwater recharge regulations
- Surface water augmentation regulations

### 3.1.1 Non-Potable Reuse Regulations

The California SWRCB DDW sets forth water recycling criteria, including water quality standards, treatment process requirements, operational requirements, and treatment reliability requirements as part of the California Code of Regulations Title 22, Division 4, Chapter 3, Article 7 (Title 22). According to Title 22, recycled water used for surface irrigation of food crops, including all edible root crops, where recycled water comes into contact with the edible portion of the crop must be disinfected tertiary recycled water. Recycled water used for irrigation of food crops where the edible portion does not come in contact with the recycled water must be at least disinfected secondary-2.2 recycled water, meaning 2.2 is the most probable number (MPN) of coliform bacteria per 100 milliliters (mL). Recycled water used for pasture for animals producing milk for human consumption must be at least disinfected secondary-23 recycled water, meaning 23 MPN coliform bacteria per 100 mL. Recycled water meeting Title 22 disinfected tertiary treated requirements for unrestricted reuse can be used for the greatest variety of uses. To be conservative, Title 22 disinfected tertiary recycled water quality standards are discussed herein. The requirements for Title 22 disinfected tertiary recycled water are as follows:

- Wastewater must be oxidized (i.e., the equivalent of primary and secondary treatment)

- Filtration: the treated wastewater must be filtered so that the turbidity of the filtered wastewater does not exceed 0.2 NTU more than 5 percent of the time within a 24-hour period and 0.5 NTU at any time.
- Disinfection: a disinfection process combined with filtration that has been demonstrated to 99.999% removal or inactivation of plaque-forming units of F-specific bacteriophage MS-2, or polio virus in wastewater. If chlorine is used, a residual/contact time value of not less than 450 milligram-minutes per liter with a contact time of at least 90 minutes based on peak dry weather design flow is required.
- Total coliform concentrations must not exceed a 7-day median concentration of 2.2 MPN per 100 milliliters; not more than one sample greater than 23 MPN per 100 milliliters in any 30-day period; and no sample shall exceed 240 MPN per 100 milliliters.

In addition to establishing recycled water quality standards, Title 22 specifies the reliability and redundancy for each recycled water treatment process and use operation. Title 22 (Articles 9 and 10) specifies that the facilities must be designed to provide operational flexibility. Multiple treatment units capable of producing the required quality must be provided in the event that one unit is not in operation. In lieu of multiple units, alternative treatment processes, storage or disposal provisions may be provided for redundancy.

**Table 3-1** includes a list of potential recycled water uses allowed by Title 22 for disinfected tertiary recycled water. This Facilities Plan focuses on municipal use, agriculture use, and groundwater recharge (GWR). In addition to meeting minimum water quality requirements for DDW public health protection, some crops are sensitive to specific constituents that requires additional treatment. Also, GWR regulations requires a higher level of treatment for GWR via well injection while GWR via surface spreading has less restrictive requirements with higher levels of treatment. Refer to Section 3.1.2 for further information.

**Table 3-1: Title 22 Allowed Uses for Disinfected Tertiary Recycled Water[1]**

| **Municipal Uses** |
|---|
| Parks and playgrounds |
| School yards |
| Residential landscaping |
| Golf courses |
| Cemeteries |
| Freeway landscaping |
| **Industrial & Commercial Uses** |
| Industrial or commercial cooling |
| Industrial boiler feedwater |
| Flushing toilets and urinals |
| **Agricultural Uses** |
| Food crops where recycled water contacts the edible portion of the crop, including all root crops |
| Ornamental nursery stock and sod farms |
| Fodder and fiber crops and pasture for animals, including pasture for milk animals for human consumption |
| **Indirect Potable Use** |
| Groundwater recharge via surface spreading[2] |

Notes:

1. This table does not represent an all-inclusive list of recycled water uses. See California Recycled Water-Related Regulations[1] and Statutes.[2]
2. GWR regulations include multiple requirements for project approval. GWR via well injection requires a higher level of treatment than disinfected tertiary. Refer to Section 3.1.2 for further information.

### 3.1.2 Groundwater Recharge Regulations

The CWC defines groundwater recharge as 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. Since 1976, the California Department of Public Health (CDPH) issued numerous draft versions of more detailed GWR regulations that served as guidance for the seven permitted GWR projects in California. Final GWR regulations were adopted and went into effect June 18, 2014. The GWR Regulations are organized by type of project:

- Surface application (surface spreading); and
- Subsurface application (injection or vadose zone wells)

The regulations address the following key project requirements:

- Source control
- Emergency response plan
- Pathogen control
- Nitrogen control
- Regulated chemicals control
- Initial recycled water contribution (RWC)
- Increased RWC
- Advanced treatment criteria
- Application of advanced treatment.
- Soil aquifer treatment (SAT) performance (surface application)
- Response retention time (RRT)

For planning purposes, the key GWR requirements applicable to the Carpinteria setting are:

- Minimum treatment
- Recycled water contribution
- Underground retention time

**Minimum Treatment**

The minimum treatment requirements are substantively different depending on the type of application. For surface spreading, the minimum treatment is disinfected tertiary recycled water and nitrogen removal that produces a total nitrogen concentration less than 10 mg/L. For injection, the minimum treatment is reverse osmosis (RO) and advanced oxidation (AO) applied to the full volume of water recharged – a treatment combination referred to as “advanced water treatment (AWT)”.

**Recycled Water Contribution**

The RWC is defined as the portion recycled water applied at the GWR project after accounting for credited dilution water [Recycled Water / (Recycled Water + Diluent Water)]. The RWC is calculated initially after 30 months of project operations and as a rolling average over 120 months thereafter. It is determined as a function of total organic carbon (TOC) concentration in the recycled water. For surface spreading projects,

[1] www.swrcb.ca.gov/drinking_water/certlic/drinkingwater/documents/lawbook/RWregulations_20150716.pdf
[2] www.swrcb.ca.gov/drinking_water/certlic/drinkingwater/documents/lawbook/RWstatutes2014-05-01a.pdf

an initial RWC of 20% (or 4:1) is applied unless an alternative RWC is approved based on additional treatment prior to recharge or through SAT[3]. Application of AWT to all effluent would ultimately eliminate the need for any dilution water while application of RO to a portion of the effluent could decrease the dilution requirement by removing more TOC. Also, monitoring of TOC removal can be used to demonstrate SAT proficiency and can allow for increased maximum RWC. RWC scenarios are summarized in **Table 3-2**.

**Table 3-2: Recycled Water Contribution / Diluent Water Requirements**

| GWR Method | Surface Spreading | | Well Injection | |
|---|---|---|---|---|
| Treatment Level | Initial RWC | Ultimate RWC | Initial RWC | Ultimate RWC |
| Tertiary Only | 20% (1) | 20% to 50% (1) | N/A | N/A |
| Partial RO | 20% to 50%(1) | 50% to 75% (1) | N/A | N/A |
| AWT | 50% | 100% | 50% | 100% |

RWC = Recycled Water Contribution = Portion that recycled water makes up of total recharge

1. Initial RWC is dependent on TOC concentration in recycled water and ultimate RWC is dependent on TOC concentration after soil aquifer treatment. The process to justify an increase of the RWC over time is outlined in the GWR regulations and would be included in the GWR permit.

**Retention Time**

The regulations include two requirements that relate to retention time: Pathogen Control and RRT. For pathogen control for surface spreading projects, the recycled water must meet Title 22 disinfected tertiary effluent requirements. The treatment system must achieve a 12-log enteric virus reduction, 10- log Giardia cyst reduction, and 10-log Cryptosporidium oocyst reduction using at least 3 treatment barriers. For each pathogen, a separate treatment process can only be credited up to a 6-log reduction and at least 3 processes must each achieve no less than a 1.0-log reduction. Retention time credit is allowed for virus (only) of 1-log/month.

RRT is the time recycled water must be retained underground to identify any treatment failure and implement actions so that inadequately treated recycled water does not enter a potable water system, including the time to provide an alternative water supply or treatment. The minimum RRT is 2 months, and it must be justified by the project sponsor(s). For planning purposes, RRT is assumed to be 6 months.

The largest of the retention times required (Pathogen Control or RRT) is used to establish the zone within which drinking water wells cannot be constructed (this effectively establishes a boundary between potable and non-potable use of the groundwater basin).

For planning purposes, the regulations allow use of groundwater modeling to estimate residence times for project facility siting. A project sponsor must validate retention time using an added or intrinsic tracer within the first three months of operation.

## 3.2 State Water Resources Control Board Policies

Two types of policies have particular importance with respect to all recycled water projects for protection of water quality and human health:

[3] SAT describes the natural attenuation of contaminants as water travels through the vadose zone and then underground. Removal mechanisms include photolysis (by the sun while in the recharge basin), biodegradation, and adsorption onto soil particles. SAT is effective at removing viruses, bacteria, TOC, nutrients, and contaminants of concern (CECs) to various degrees. Removal is site specific and column studies must be conducted to obtain accurate estimates of potential performance.

- Anti-degradation Policies
- Recycled Water Policy

In addition, the California Toxics Rule (CTR) and the SWRCB Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California (SIP) may apply to GWR projects that involve a discharge to a water of the U.S. The CTR and SIP would not apply to a project if the receiving surface water is not deemed to be a Water of the U.S. in the applicable RWQCB Water Quality Control Plan (Basin Plan).

### 3.2.1 Anti-degradation Policies

California's anti-degradation policies are found in Resolution 68-16, Policy with Respect to Maintaining Higher Quality Waters in California and Resolution 88-63, Sources of Drinking Water Policy. These resolutions are binding on all State agencies. They apply to both surface water and groundwater, protect both existing and potential uses, and are incorporated into RWQCB Basin Plans.

### 3.2.2 Recycled Water Policy

The Recycled Water Policy was adopted by the SWRCB in 2009. It was subsequently amended in January 22, 2013, with regard to monitoring constituents of emerging concern (CECs) for groundwater recharge projects based on recommendations of an expert panel. The panel did not recommend CEC monitoring for landscape irrigation projects using recycled water. The Policy was a critical step in creating uniformity in how RWQCBs were individually interpreting and implementing Resolution 68-16 for water recycling projects. The critical provisions in the Policy related to landscape irrigation and GWR projects include:

- Development of SNMPs
- Requirements for landscape irrigation projects
- RWQCB GWR requirements
- Anti-degradation and assimilative capacity
- CECs

The Recycled Water Policy requires the development of SNMPs 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 (including estimates for GWR and landscape irrigation projects that use recycled water), 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 as well as 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 whether salts, nutrients, and other CECs (as identified in the SNMPs) are consistent with applicable water quality objectives.

#### Landscape Irrigation Project Requirements

The Recycled Water Policy establishes requirements for control of incidental runoff of recycled water from irrigation areas, such as unintended minimal overspray from sprinklers. These requirements include the implementation of an operations and maintenance plan, proper design and aim of sprinklers, discontinuation of irrigation during precipitation events, and management of storage ponds to prevent overflow.

#### RWQCB Groundwater Requirements

The Recycled Water Policy does not limit the authority of a RWQCB to include more stringent requirements for GWR projects to protect designated beneficial uses of groundwater, provided that any proposed limitations for the protection of public health may only be imposed following consultation with DDW. In addition, the Recycled Water Policy does not limit the authority of a RWQCB to impose additional requirements for a proposed GWR 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.

#### Anti-degradation and Assimilative Capacity

Assimilative capacity is typically defined as the difference between the ambient groundwater concentration and the concomitant groundwater quality objective. In accordance with the Recycled Water Policy, two assimilative capacity thresholds were established for GWR projects in light of the type of assimilative capacity that must be conducted. A GWR project that uses 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) must conduct an anti-degradation analysis verifying the use of the assimilative capacity. In the event that a project or multiple projects utilize more than the designated fractions of assimilative capacity (e.g., 10% or 20%), the project proponent must conduct a RWQCB-deemed acceptable anti-degradation analysis. Some SNMPs use these assimilative capacity values as thresholds for evaluating impacts of salt and nutrient loadings and implementation measures.

A landscape irrigation project that meets the Recycled Water Policy streamlining criteria, and which is also within a groundwater basin with an approved SNMP, may be approved by a RWQCB without further anti-degradation analysis if the project is consistent with the SNMP. A landscape irrigation project that meets the streamlining criteria, which is within a groundwater basin preparing an SNMP, may be approved by a RWQCB by demonstrating using a salt/nutrient mass balance or equivalent analysis that the project uses less than 10% of the available assimilative capacity or less than 20% of the available assimilative capacity for multiple projects.

#### CECs

As part of the Recycled Water Policy, a Science Advisory Panel was formed to identify a list of CECs for monitoring in recycled water used for GWR and landscape irrigation. The Panel recommended monitoring selected health-based and treatment performance indicator CECs and surrogates for GWR projects. The Panel concluded that CEC monitoring was unnecessary for landscape irrigation. The GWR monitoring recommendations were directed at surface spreading using tertiary recycled water and injection projects using advanced water treatment.

The Recycled Water Policy was amended in 2013 to include the CEC monitoring program. The Amendment provides the final list of specific CECs and monitoring frequencies for GWR projects and procedures for both evaluating the data and responding to the results. These requirements will be incorporated into the permits for existing GWR projects and will be included as requirements for all future projects. As part of the final GWR Regulations, additional CEC requirements and monitoring locations must be met in addition to the Recycled Water Policy requirements. The next update of CEC monitoring by a SWRCB expert panel will occur in 2016.

### 3.2.3 California Toxics Rule and SIP

In 2000, the U.S. Environmental Protection Agency (USEPA) adopted the CTR that included aquatic life criteria for 23 priority pollutants and human health criteria for 57 priority pollutants. There are two types of human health criteria: (1) criteria based on consumption of water and organisms, and (2) criteria based on consumption of organisms only.

In the same year, the SWRCB adopted implementation procedures for the CTR through the SIP. The SIP was amended in 2005. The CTR criteria and SIP are applicable to discharges of wastewater (and recycled water) to all inland surface waters and enclosed bays and estuaries of California with some exceptions, such as cases where site specific water quality objectives have been adopted in Basin Plans.

The SIP includes procedures to determine which priority pollutants need effluent limitations; methods to calculate water quality-based effluent limitations; and policies regarding mixing zones, metals translators, monitoring, pollution prevention, reporting levels for determining compliance with effluent limitations, and whole effluent toxicity control. Using the SIP, permit limits are established for those CTR constituents that have the reasonable potential to cause or contribute to an excursion above any applicable criteria including consideration of a mixing zone if authorized by a RWQCB. The SIP also allows the SWRCB to grant an exception to complying with priority pollutant criteria in situations wherein site-specific conditions in individual water bodies or watersheds differ sufficiently from statewide conditions, wherein the exception will not compromise protection of beneficial uses, and wherein the public interest will be served.

## 3.3 Central Coast RWQCB Requirements

The Central Coast RWQCB is responsible for regulating recycled water discharges to surface water and groundwater, which are subject to State water quality regulations and statutes. For a surface water discharge, the RWQCB issues a National Pollutant Discharge Elimination System (NPDES) permit that would include provisions to implement applicable the CTR, State water quality control policies and plans, including water quality objectives and implementation policies established in the Basin Plan. NPDES permits must consider wasteload allocations in approved Total Maximum Daily Loads developed for surface waters that do meet water quality standards. For a discharge to land, the RWQCB would issue Waste Discharge Requirements (WDRs) that would include provision to implement applicable State water quality control policies and plans and water quality objectives and implementation policies established in the Basin Plan.

### 3.3.1 Basin Plan

The Basin Plan designates beneficial uses for surface water and groundwater and establishes surface water and groundwater quality objectives to project those uses. Identified uses of surface water bodies by hydrologic unit are presented in Table 2-1 of the Central Coast Basin Plan. Groundwater throughout the Central Coast basins is deemed suitable for municipal, agricultural, and industrial use.

#### Groundwater Requirements

The Central Coast RWQCB provides local implementation of SWRCB policies and regulations and develops and implements the 2011 Water Quality Control Plan for the Central Coastal Basin (Basin Plan) to protect surface water and groundwater quality and beneficial uses. The Basin Plan identifies groundwater objectives for the Carpinteria Groundwater Basin that are intended to serve as a water quality baseline for evaluating water quality management in the basin. The median values for groundwater objectives are shown in **Table 3-3**.

**Table 3-3: Carpinteria Groundwater Basin Median Groundwater Objectives (mg/L)**

| TDS | Chloride | Sulfate | Boron | Sodium | Nitrogen |
|---|---|---|---|---|---|
| 650 | 100 | 150 | 0.2 | 100 | 7 (as N) |

Source: Water Quality Control Plan for the Central Coast Basin (Central Coast RWQCB, 2011), Table 3-8
Note: Objectives shown are median values based on data averages; objectives are based on preservation of existing quality or water quality enhancement believed attainable following control of point sources.

A GWR project will need to consider the assimilative capacity of the groundwater basin for specific constituents to conform to State Anti-degradation Policy (Resolution 68-16) and SWRCB Recycled Water Policy (2009). In addition, a Salt and Nutrient Management Plan will be required.

#### Surface Water Requirements

The Basin Plan also designates beneficial uses and water quality objectives for surface waters. Surface water discharges that recharge groundwater are assigned a GWR beneficial use and the Basin Plan groundwater quality objectives also apply. Discharges to surface water must be of sufficient water quality to not impact groundwater quality beneficial use(s).

The Central Coast Basin Plan does not include surface water quality objectives for Carpinteria Creek (or any other creek in the study area) but Carpinteria Creek is designated as MUN. In addition to NPDES requirements, GWR permit requirements (discussed in the previous section), such as groundwater quality objectives, must be met as well

## 3.4 Permitting Recycled Water Projects

### 3.4.1 SWRCB General Permit

On June 3, 2014, the SWRCB adopted Order WQ 2014-0090-DWQ General Waste Discharge Requirements for Recycled Water (General Permit). This permit supersedes the 2009 SWRCB General WDR for Landscape Irrigation Uses of Recycled Water. The General Order provides statewide authorization of all of Title 22 uses of recycled water by Producers, Distributors, and Users except GWR and is intended to streamline project permitting. To obtain coverage under the General Order, an applicant must have an approved Engineering Report and submit a Notice of Intent to the RWQCB within its jurisdiction. Producers, Distributors, or Users of recycled water covered under existing permits may elect to continue or expand coverage under the existing permits or apply for coverage under the General Order.

### 3.4.2 Individual Non-Potable Reuse Project Permits

The DDW, as part of the SWRCB, has the statutory authority to issue WDRs and WRRs. Under the current permitting framework where the RWQCB issues the permit, for WDRs or WRRs, project sponsors are required to submit an Engineering Report to DDW and RWQCB, as well as a Report of Waste Discharge to the RWQCB. In issuing the permit, the RWQCB is required to consult with DDW. Any reclamation requirements included in a permit must conform to Title 22. The RWQCBs have the option of issuing a Master Reclamation Permit in lieu of individual WRRs for a project involving multiple uses. The Master Permit can be issued to a recycled water supplier or distributor, or both.

### 3.4.3 Groundwater Recharge Projects

The process for project approval and permitting of GWR projects is similar to individual non-potable reuse project permits; however, the Engineering Report prepared for DDW has a more prominent role in review and approval of the project. The RWQCB would issue the permit based on requirements consistent with the GWR Regulations, Basin Plans, SNMPs, and State policies. The type of permit (WDR and/or WRR) issued depends on how and where the recycled water is "discharged".

### 3.4.4 Surface Water Discharge Regulations

The discharge of a waste to a body of water in the U.S., such as Carpinteria Creek, is regulated under the Clean Water Act and California Water Code and subject to an NPDES permit for discharge into an inland surface water based on:

- All applicable water quality standards (beneficial uses, water quality objectives to protect the uses, and anti-degradation policies) in the Central Coast Basin Plan,
- Water quality criteria in the (CTR for protection of aquatic life and human health, and
- Implementation measures for the CTR in the SIP.

In addition, surface water discharges have a higher risk of stricter treatment requirements in the future. There is also a risk of increased monitoring for new constituents, which can be expensive. Some possible limits, such as for disinfection byproducts based on CTR criteria, could require additional treatment beyond AWT and would further increase the costs of projects.

# Chapter 4 Market Assessment

## 4.1 Methodology

The goals of the recycled water market assessment are to identify near- and long-term uses of recycled water within the District's service area. The market assessment included a detailed examination within the service area of potential users and demands, supply availability, and implementation challenges. The methodology used for the market assessment is described below.

- Identify potential users
- Determine potential recycled water demands
- Evaluate recycled water quality relative to potential types of use
- Review availability of recycled water supply relative to timing of demands
- Meet with the largest potential recycled water customers to gauge interest and concerns

### 4.1.1 Water Quality

Chapter 5 discusses three recycled water treatment alternatives. To support the water quality evaluation portion of the market assessment in this chapter, projected recycled water quality associated with each alternative is summarized in **Table 4-1**. Refer to Chapter 5 for a discussion of the basis of the projections.

**Table 4-1: Projected Effluent Quality (mg/L)**

| Level of Treatment | Boron | Calcium | Chloride | Nitrate | Sodium | TDS |
|---|---|---|---|---|---|---|
| Secondary[1] | 0.5 | 123 | 390 | 23 (as N) | 281 | 1360 |
| 1. Tertiary | 0.5 | 123 | 390 | 23 (as N) | 281 | 1360 |
| 2. Partial RO[2] | 0.4 | 65 | 100 | 6 (as N) | 70 | 340 |
| 3. AWT | 0.3 | 5 | 10 | < 1 (as N) | 10 | < 100 |

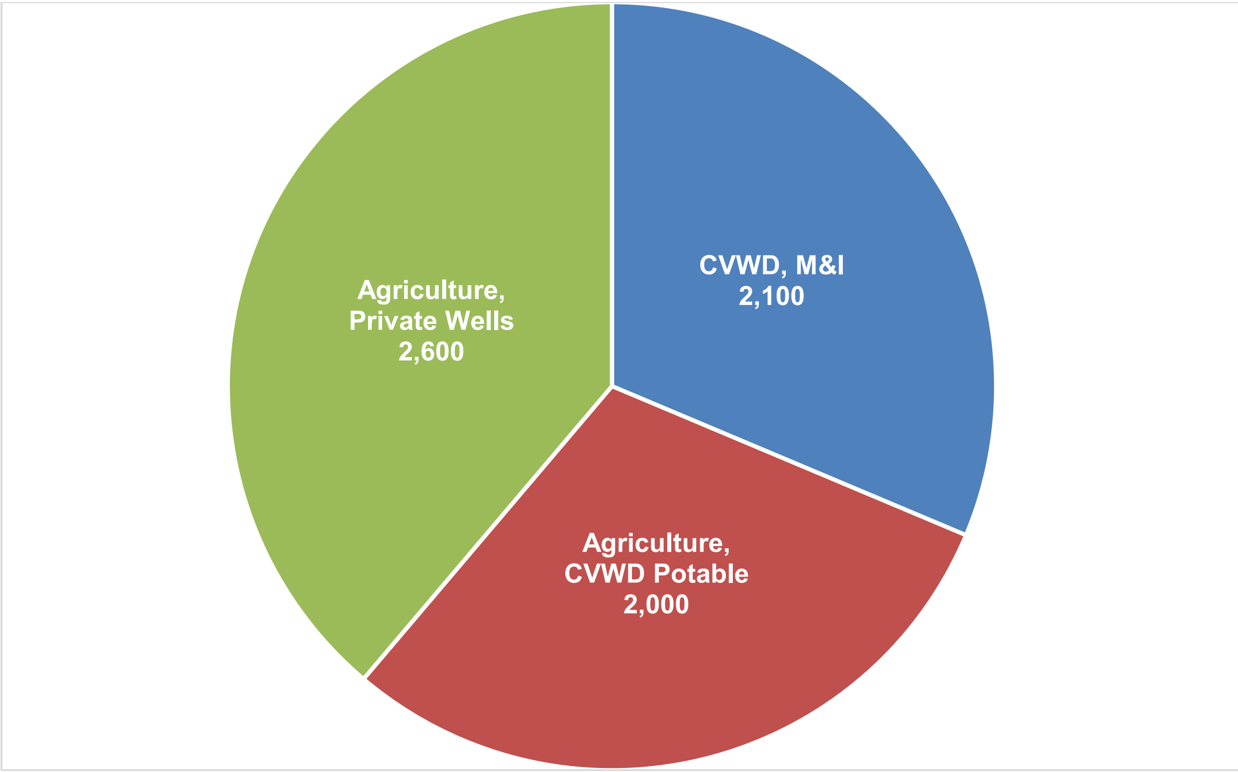
Notes:

1. Source: CSD, 4/22/15 sample. Additional sampling is planned to better define effluent quality.
2. Assumes 80% of effluent is treated by RO.

## 4.2 Municipal Demands

CVWD provides potable water for municipal and agricultural uses with a combination of surface water (Cachuma Project and SWP) and groundwater from Carpinteria Groundwater Basin. Approximately 125 private wells provide groundwater from Carpinteria Groundwater Basin for agricultural irrigation. In addition, many agricultural sites with private wells use potable water from CVWD for irrigation. **Figure 4-1** presents the division of types of water use between CVWD and private wells. The market assessment separates use of CVWD potable water and private groundwater since the cost for each water supply is different and, as a result, the likely acceptable rate for recycled water offsetting these demands would be different.

**Figure 4-1: Summary of Study Area Water Use (AFY)**




### 4.2.1 CVWD Public Fill Station

Numerous water recycling facilities have installed fill stations to provide public access to recycled water produced at the plant for non-potable uses, such as landscape irrigation and dust-control. California requires that recycled water for residential irrigation be disinfected tertiary treated water under Title 22.

Average use during the irrigation season (April to October) was approximately 1 gallons per day per resident (based on total population) according to a review of fill station use in 2014 and 2015 by multiple agencies in Northern California. This results in an estimate of 15,000 gallons per day for CVWD for a seven-month irrigation period, which is roughly equivalent to 10 AFY. However, sustained use by the public is hard to estimate if drought restrictions, pricing, and awareness change in the future.

Additional treatment beyond Title 22 is not required for public fill stations; however, elevated concentrations of chloride, sodium, and TDS in the recycled water may limit the types of plants that can accept the water if recycled water is the primary irrigation source.

### 4.2.2 CVWD Municipal

Municipal recycled water demands within the District represent a range of potential uses and users. Most of the potential recycled water customers need landscape irrigation at parks and schools. Based on a review of 2014 water use records for non-residential accounts, 11 customers with potable demands greater than 5 AFY, for a total of 101 AFY of potable water demand, were identified as potential recycled water customers . Of all potential recycled water customers, 36 were determined to have demands greater than 1 AFY, for a total potential non-potable demand of 151 AFY that was calculated by applying the factors in **Table 4-2**. These potential customers are listed in **Table 4-3** and are shown in **Figure 4-2**. The complete list of potential customers is located in **Appendix A**. It should be noted that customers with dedicated irrigation meters are assigned a conversion factor of 1.0.

**Table 4-2: Non-Potable Water Demand Conversion Factors**

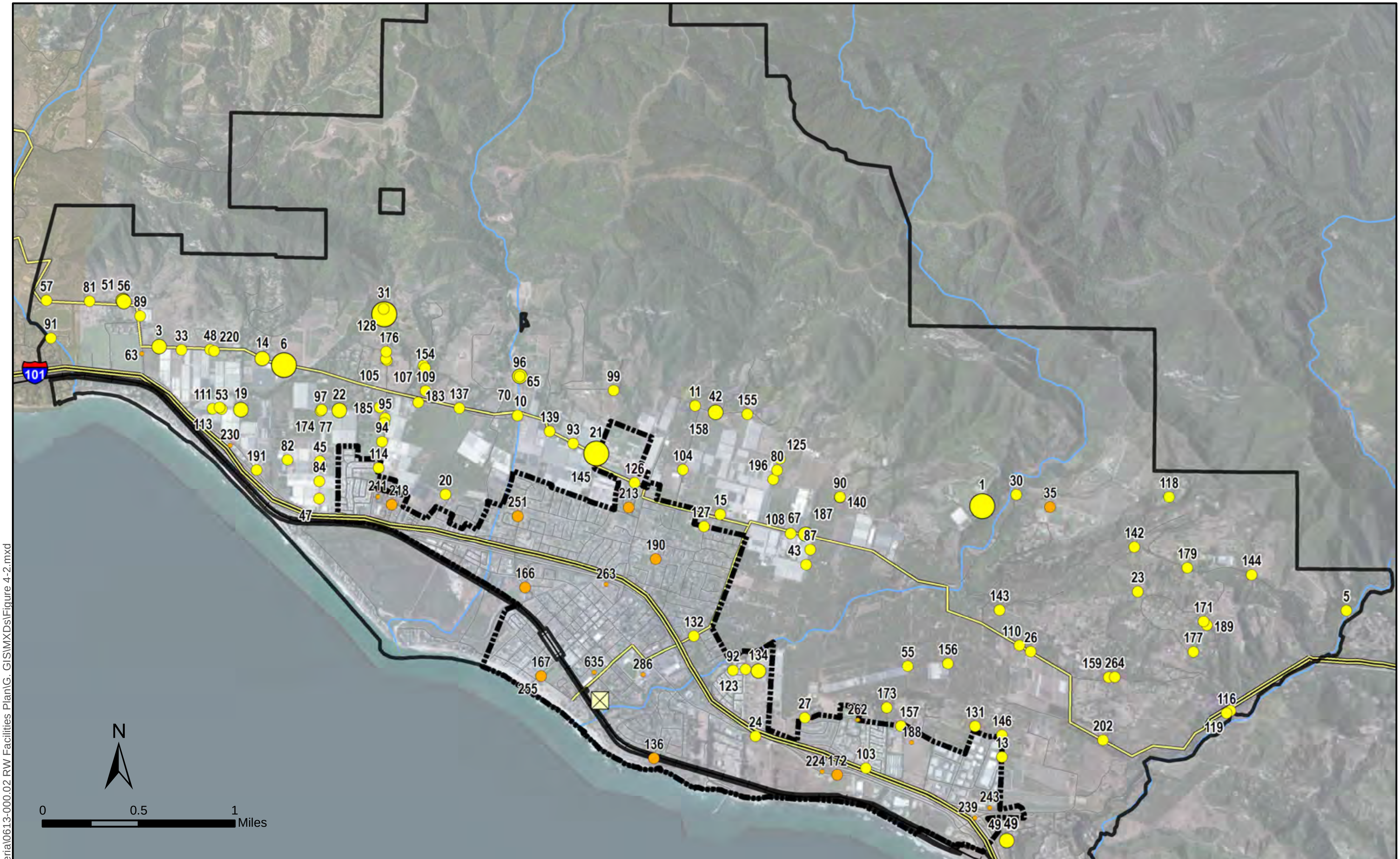
| Type of Use | Potable to Non-Potable Demand Factor | Notes |
|---|---|---|
| Irrigation | 1.0 | Indicates a dedicated irrigation meter |
| Agriculture | 1.0 | Assumes non-potable use of potable water for agricultural customers |
| Park | 0.9 | Accounts for minor potable uses at parks, such as drinking water fountains and bathrooms. |
| School | 0.5 | Assumes 50% of total use is estimated to be for outdoor irrigation |
| Commercial | 0.1 | Assumes 10% of total use is estimated to be for outdoor irrigation |
| Multi-Residential | 0.0 | Irrigation demands are assumed to be served by a dedicated irrigation meter |

Note: Single family residential customers were not considered for non-potable use.

**Table 4-3: Potential Municipal Irrigation Customers (>5 AFY)**

| ID | Name | 2009 – 2014 Potable Demand (AFY) [1] | Non-Potable Conversion Factor [2] | Estimated Recycled Water Demand (AFY) |
|---|---|---|---|---|
| 145 | Carpinteria High School | 15 | 1.0 | 15 |
| 35 | Cate School | 82 | See Note 3 | 15 |
| 136 | Carpinteria State Beach (East Side) | 14 | 1.0 | 14 |
| 172 | Viola Bluffs Baseball Field | 13 | 0.9 | 11 |
| 166 | Aliso Elementary School | 7 | 1.0 | 7 |
| 190 | Carpinteria Family School | 7 | 1.0 | 7 |
| 213 | HOA | 7 | 1.0 | 7 |
| 167 | Tomol Park | 6 | 1.0 | 6 |
| 218 | HOA | 6 | 1.0 | 6 |
| 251 | HOA | 6 | 1.0 | 6 |
| | **> 5 AFY Subtotal** | **163** | | **94** |
| | Other Customers > 1 AFY (26) | 128 | | 57 |
| | **Total** | **291** | | **151** |

Notes:
1. Based on average annual potable water use from 2009 to 2014 from CVWD meter records.
2. A conversion factor of 1.0 was applied to potable demands from dedicated irrigation meters.
3. Cate School estimate is based on discussions with school representatives. The school already reuses all wastewater produced at the site for irrigation of fields with an onsite recycled water plant. Remaining potential recycled water demand represents fields currently irrigated with potable water.




## RW Demand (AFY)

- 2 < x < 5*
- 5 < x < 25
- 25 < x < 45
- Greater than 45

## Customer Type

- Agriculture
- Municipal

## Other Features

- Carpinteria WWTP
- City Boundary
- CVWD Boundary

*Only Municipal demands shown in this range

RMC water and environment

**Figure 4-2: Potential Recycled Water Customers, Municipal and Agriculture (CVWD Potable)**

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## Customer Meetings

The project team met with representatives from City Parks and Recreation and Carpinteria Unified School District. Both groups were familiar with the use of recycled water in neighboring communities (Santa Barbara and Goleta) for similar types of customers and expressed support for the use of recycled water at their facilities.

### 4.2.3 Municipal Irrigation Implementation Considerations

Landscape irrigation projects that offset existing municipal water use offer a direct water supply benefit by replacing potable water use with non-potable water.

The cost effectiveness of a project is dependent on actual recycled water use. Some potential customers ultimately do not connect to the system, and actual irrigation demands for those that do connect are often lower by the time deliveries begin. This can be due to conservation measures, delays to or cancellation of planned site expansions, future changes in site uses, and/or partial conversions due to retrofit complications.

Other factors that influence connecting a potential landscape irrigation customer are:

- Recycled water quality
- Conversion requirements
- Recycled water pricing

Each are discussed in this section.

## Water Quality

Tertiary effluent provides suitable water quality for irrigation of most plants and turfgrasses with the exception of those species that are sensitive to salinity. General irrigation water quality guidelines and projected CSD tertiary effluent quality characteristics are presented in **Table 4-4**. Recycled water from Treatment Alternative 1 (Tertiary Filtration) falls within the range of "slight to moderate" degrees of restriction while Treatment Alternative 2 (Partial RO) is at or below concentrations for unrestricted use (i.e., "none"). Most plants and turfgrasses can tolerate mineral water quality in the "slight to moderate" range. The actual sensitivity is dependent on the type of turfgrass being irrigated as well as soil type, drainage, climate, and irrigation method.

**Table 4-4: Turfgrass Irrigation Water Quality Guidelines for Salinity (mg/L)**

| | Treatment Alternative | | Degree of Restriction of Use | | |
|---|---|---|---|---|---|
| Constituent | 1. Tertiary Only | 2. Partial RO | None | Slight to Moderate | Severe |
| TDS[1] | 1,360 | 340 | < 450 | 450 - 2,000 | > 2,000 |
| Sodium[2] | 281 | 70 | < 70 | > 70 | |
| Chloride[2] | 390 | 100 | < 100 | > 100 | |

Source: USEPA, 2012

1. Salinity can build up in the root zone, causing water absorption inhibition and other problems.
2. Sodium and chloride may be absorbed through the leaves of sensitive flora, causing leaf burn.

## Customer Conversions

The cost to convert (also referred to as "retrofit") existing sites to recycled water has a high variance, depending on the age and complexity of the existing irrigation system as well as the availability of adequate records and/or staff knowledge of the onsite irrigation and potable water piping configuration. Most existing irrigation customers have separate meters for potable use and irrigation. The simplest conversion entails bringing the new recycled water supply to the existing irrigation meter. Older sites may have improperly connected potable water features, such as drinking fountains or bathrooms, to the irrigation system or may not have a separate irrigation meter. These sites must consider the costs to separate the non-potable (irrigation) systems and potable systems, potentially including the installation of new potable lines to drinking fountains or bathrooms. Also, recycled water irrigation systems must avoid spray contact with eating areas and drinking fountains, which may require re-routing of underground irrigation pipes.

When determining the cost to convert, agencies must consider a site's service needs, including water quality, delivery pressure, interface with irrigation system components (e.g., tanks, pumps, etc.), and reliability. The cost of facilities to provide appropriate recycled water service must be included in project costs, except possibly in cases where a mandatory recycled water use ordinance is in effect.

**New Development**

It should be noted that installation of recycled water systems during construction of new developments (i.e., "dual plumbing") avoids many of the initial conversion costs discussed above by integrating recycled water infrastructure into design and construction. Reuse in new developments typically occurs in common areas, such as medians, greenbelts, and parks. The developer typically bears the cost of constructing these systems. Many municipalities have ordinances that require installation of recycled water systems for new developments if they are located within a specified zone with respect to the recycled water system.

#### Recycled Water Pricing

California Water Code 13580.7 limits recycled water rates to the estimated reasonable cost of providing the service. Recycled water rates are commonly established at values lower than potable water rates to promote customer acceptance. The Water Reuse Rates and Charges, Survey Results (AWWA, 2008) showed that most rates range from 50 percent to 100 percent of potable water rates, with a median rate of approximately 80 percent. The discount acknowledges cost to convert onsite systems, as well as a lower level of service in terms of pressure and/or water quality. The survey findings exclude situations where the purpose of reuse is wastewater disposal, since these situations typically involve free water or very low rates.

## 4.3 Agricultural Demands

### 4.3.1 CVWD Agricultural Irrigation (CVWD Potable Water Use)

Based on 2009 to 2014 water use records, 102 agricultural customers have potable demands greater than 5 AFY for a total of 1,560 AFY of potable water demand. Of these customers, 19 have potential recycled water demands greater than 25 AFY and a total potential demand of 578 AFY, as shown in **Table 4-5.** All potential agricultural customers with demands greater than 5 AFY are shown in Figure 4-2 and are listed in Appendix A.

**Table 4-5: Potential CVWD Agricultural Irrigation Customers (> 25 AFY)**

| ID | Type of Crop [1] | Estimated Recycled Water Demand (AFY) [2] |
|---|---|---|
| 6 | Field Crops / Mixed Crops | 69 |
| 1 | Avocado | 63 |
| 21 | Avocado | 53 |
| 31 | Avocado | 49 |
| 14 | Nursery | 35 |
| 3 | Avocado | 34 |
| 19 | Avocado | 33 |
| 42 | Avocado | 29 |
| 49 | Other | 28 |
| 56 | Turfgrass | 28 |
| 22 | Nursery | 28 |
| 51 | Avocado | 27 |
| 67 | Other | 26 |
| 70 | Other | 26 |
| 134 | Other | 25 |
| 24 | Golf / Field Crops | 25 |
| | **> 25 AFY Subtotal** | **578** |
| | Other customers > 5 AFY (86) | 982 |
| | **Total** | **1,560** |

Note:

1. Categorized based on the predominant crop type associated with the customer meter. Crop type categories were developed by CVWD in 2014 as part of groundwater management efforts. Crop type categories are: avocado, nursery, field crops, horse facilities, or other based on CVWD aerial surveys.
2. Based on CVWD average annual potable water use meter records from 2009 to 2014.

## Customer Meetings

Early in the process, an agricultural reuse workshop was organized by the District to introduce the study objectives and gain feedback from potential recycled water customers. Support for reuse was generally expressed and successful use of recycled water was verified by a grower with operations in other areas in California. The largest concerns expressed were about the cost and quality of recycled water. Water quality concerns were proposed to be addressed, in part, by producing recycled water with TDS concentrations similar to CVWD potable water TDS concentrations. The cost of recycled water was proposed to be set at a “slight discount” compared to potable water rates, but details would be pending the alternatives analysis to be conducted as part of this study.

Following the workshop, the District reached out to all of their largest agricultural customers to evaluate the potential recycled water demands, gauge interest in recycled water, answer questions about recycled water, and identify potential service issues. Some information was collected over the phone and several in-person meetings were held. In general, there was extensive support for recycled water if provided at an acceptable cost and quality. Many growers identified the value in securing a reliable, long-term supply.

### 4.3.2 Total Agricultural Irrigation (Potable and Groundwater Use)

Agricultural irrigation water is supplied both from the CVWD potable water system and private groundwater wells. For potable system customers, use of recycled water creates a new water supply by offsetting existing potable water use. For groundwater pumpers, use of recycled water offsets groundwater pumping by the agricultural customer that could then be used by CVWD pumping for potable water.

Since agricultural customers in the CVWD service area can use both potable water and groundwater, it is constructive to estimate the total potential demands for these customers that could be provided by recycled water. This will represent a larger total potential demand than the potable demands alone.

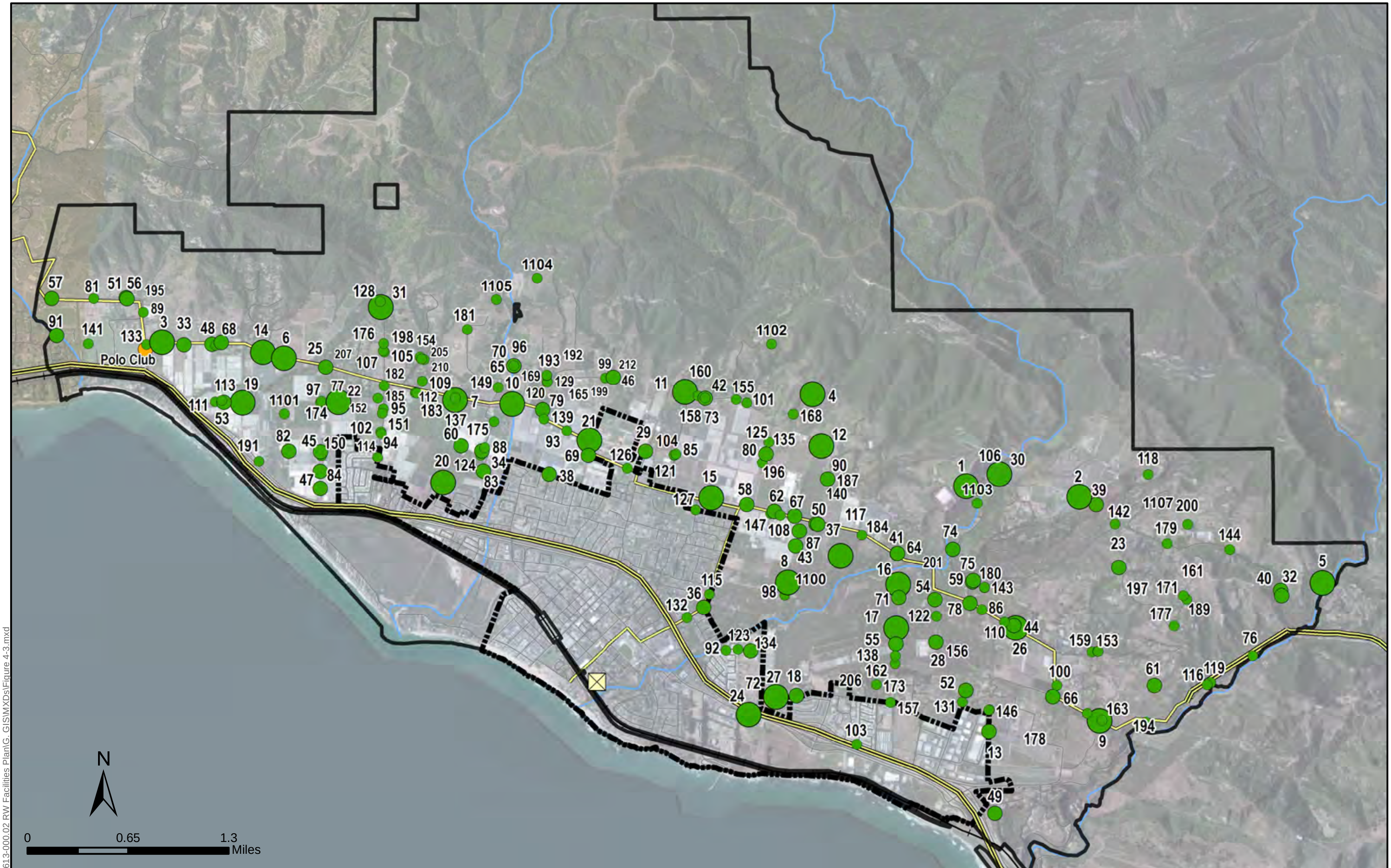
CVWD estimates groundwater pumping from private wells as part of its groundwater basin management responsibilities and documents efforts in annual groundwater reports. Pumping is estimated based on unit water use values for various crop types that are derived from CVWD metered use; the unit values are then applied to areas that are based on land use imagery. Based on these estimates, 125 private wells are estimated to pump approximately 2,600 AFY for agricultural irrigation within the District's service area. Of these agricultural sites, 61 sites have total water use (calculated as potable records plus groundwater estimates) greater than 25 AFY, representing a total of 2,738 AFY. Agricultural parcels identified with existing groundwater demands greater than 50 AFY are listed in **Table 4-6**. Agricultural customers with total estimated water use (both potable and groundwater) greater than 5 AFY are shown in **Figure 4-3** and are listed in Appendix A.

**Table 4-6: Potential Agricultural Irrigation Sites, Total Estimated Demand (> 50 AFY)**

| ID | Type of Crop [1] | Potable Demand (AFY) [2] | Estimated Groundwater Demand (AFY) [3] | Total Estimated Demand (AFY) [4] |
|---|---|---|---|---|
| 1 | Avocado | 63 | 92 | 155 |
| 2 | Avocado | 1 | 126 | 127 |
| 3 | Avocado | 34 | 53 | 88 |
| 5 | Avocado | 11 | 62 | 73 |
| 6 | Field Crops / Mixed Crops | 69 | 0 | 69 |
| 4 | Avocado | 4 | 64 | 68 |
| 14 | Nursery | 35 | 33 | 68 |
| 11 | Avocado | 14 | 49 | 63 |
| 10 | Nursery | 23 | 40 | 62 |
| 8 | Avocado | 1 | 58 | 59 |
| 7 | Avocado | 0 | 58 | 59 |
| 9 | Avocado | 4 | 53 | 57 |
| 15 | Nursery | 6 | 51 | 57 |
| 12 | Avocado | 3 | 52 | 55 |
| 21 | Avocado | 53 | 0 | 53 |
| 22 | Nursery | 28 | 24 | 52 |
| 18 | Nursery | 3 | 49 | 51 |
| 16 | Avocado | 1 | 51 | 51 |
| 17 | Avocado | 1 | 51 | 51 |
| 24 | Golf / Field Crops | 25 | 25 | 50 |
| 20 | Nursery | 9 | 41 | 50 |
| | **> 50 AFY Subtotal** | **385** | **1,032** | **1,417** |
| | Other customers > 25 AFY (40) | 445 | 873 | 1,318 |
| | **Total** | **830** | **1,905** | **2,835** |

Notes:

1. Categorized based on the predominant crop type associated with the customer meter. Crop type is for 2014 and was developed by CVWD as part of groundwater management efforts. Crop types are: avocado, nursery, field crops, horse facilities, or other based on CVWD aerial surveys.
2. Based on average annual potable water use from 2009 to 2014 from CVWD meter records.
3. The difference between total estimated demand (see Note 4) and potable demand (see Note 2).
4. Based on CVWD total (potable and groundwater) water demand estimates for each customer for 2014.




**RW Demand (AFY)**

5 < x < 25

25 < x < 45

Greater than 45

**Customer Type**

Agriculture - Total Demand*

**Other Features**

CVWD Boundary

City Boundary

Carpinteria WWTP

*Total Demand includes estimated groundwater use.

**Figure 4-3: Agricultural Sites, Total Demand (Potable & Groundwater)**

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### 4.3.3 Agricultural Irrigation Implementation Considerations

Agricultural irrigation water is supplied both from CVWD potable water system and private groundwater wells. For potable system customers, use of recycled water creates a new water supply by offsetting existing potable water use. For groundwater pumpers, use of recycled water offsets groundwater pumping by the agricultural customer that could then be used by CVWD pumping for potable water. Achieving either benefit is dependent on connecting agricultural irrigation customers, which is contingent upon their willingness to use recycled water. Their willingness generally depends on a combination of:

- Delivered water quality
- Price of recycled water
- Irrigation system operations
- Market acceptance of food irrigated with recycled water

In addition, the recycled water provider must be able to realize a water supply benefit. Each of these topics is discussed further in this section.

#### Delivered Water Quality

Recycled water may meet minimum water quality requirements for DDW public health protection, but some crops are sensitive to specific constituents. Four common categories of water quality-related issues are (Ayers and Wescot, 1985):

- Salinity: Salts in soil or water reduce water availability to the crop to such an extent that yield is affected.
- Water Infiltration Rate: Relatively high sodium or low calcium content of soil or water reduces the rate at which irrigation water enters soil to such an extent that sufficient water cannot be infiltrated to supply the crop adequately.
- Specific Ion Toxicity: Certain ions (sodium, chloride, boron) from soil or water accumulate in sensitive crops and cause crop damage and/or reduce yields.
- Miscellaneous: Excessive nutrients can reduce yield or quality. Unsightly deposits on fruit or foliage reduce marketability. Excessive corrosion of equipment increases maintenance and repair costs.

**Table 4-7** characterizes three degrees of restriction (“none”, “slight to moderate” and “severe”) for use of recycled water based on various water quality constituents (although specific requirements vary depending on the type of plant). The table also provides a comparison to expected product water quality from Carpinteria WWTP Treatment Alternative 1 (Tertiary) and Alternative 2 (Partial RO).

**Table 4-7: Irrigation Water Quality Comparison (mg/L)**

| Constituent | Degree of Restriction on Use [1] None | Degree of Restriction on Use [1] Slight to Moderate | Degree of Restriction on Use [1] Severe | CVWD Potable Water[2] | Local Grower[3] Minimum Requirements | Recycled Water[4] Alt 1: Tertiary | Recycled Water[4] Alt 2: Partial RO |
|---|---|---|---|---|---|---|---|
| Salinity | | | | | | | |
| TDS | < 450 | 450 - 2,000 | > 2,000 | 650 | < 640 | 1,360 | 340 |
| Specific Ion Toxicity | | | | | | | |
| Sodium[5] | < 70 | > 70 | | 48 | < 90 | 281 | 70 |
| Chloride[5] | < 100 | > 100 | | 22.5 | < 100 | 390 | 100 |
| Boron | < 0.7 | 0.7 - 3.0 | > 3.0 | 0.3 | < 0.5 | 0.5 | 0.4 |
| Miscellaneous Effects | | | | | | | |
| Total Nitrogen (as nitrogen)[6] | < 5 | 5 - 30 | > 30 | 2 | N/A[(7)] | 23 | 6 |

Notes:
1. Adapted from Metcalf and Eddy, 2007.
2. CVWD 2013 Annual Water Quality Report. Assumes 75% imported water and 25% groundwater.
3. Based on feedback from growers from the agricultural recycled water workshop on April 15, 2015.
4. See Table 5-1.
5. Values apply to most tree crops and woody ornamentals that are sensitive to sodium and chloride. With overhead sprinkler irrigation and low humidity (< 30%), sodium or chloride levels greater than 70 or 100 mg/L, respectively, have resulted in excessive leaf adsorption and crop damage to sensitive crops.
6. Total nitrogen should include nitrate-nitrogen, ammonia-nitrogen, and organic-nitrogen. Although forms of nitrogen in wastewater vary, the irrigated plant responds to the total nitrogen.
7. Growers expressed concern over the impact of recycled water on their nitrogen reporting rather than for impacts on crop viability.

The Treatment Alternative 1 (Tertiary) TDS concentration of 1,360 mg/L is too high for use on salt sensitive crops, such as avocados and flowers. It is roughly twice the concentration of TDS in CVWD potable water (650 mg/L). Treatment Alternative 2 (Partial RO) is recommended for agricultural irrigation based on the ability to meet local grower minimum requirements of 640 mg/L TDS and 10 mg/L chloride.

For comparison with projected Treatment Alternative 2 (Partial RO) water quality, water quality for other California recycled water agricultural projects is shown in TABLE.

**Table 4-8: Recycled Water Quality – Existing Agricultural Reuse Projects (mg/L)**

| Constituent | Existing Projects: MRWPCA Tertiary Effluent[1] | PVMWA Blended Supply[2] | PVMWA Water Quality Goals[3] | IRWD Tertiary Effluent[4] | Oxnard AWPF Effluent[5] | Santa Rosa Tertiary Effluent[6] | Alt 2: Partial RO[7] |
|---|---|---|---|---|---|---|---|
| TDS | 807 | 607 | 500 | 820 | 230 | 450 | 340 |
| Sodium[5] | 172 | 94 | -- | 149 | 47 | 82 | 70 |
| Chloride[5] | 262 | 103 | 140 | 150 | 70 | 64 | 100 |
| Boron | N/A | N/A | N/A | 0.3 | 0.5 | 0.4 | 0.4 |
| Nitrogen (as N) | 9.5 | 5.4 | 10 | 11.9 | 5 | 11 | 6 |

Source: Cannon, 2014

Notes:
1. Recycled water is blended with groundwater and surface water in portions of the distribution system. Recycled water represents approximately 2/3 of the supply.
2. Average of 440 samples collected from the distribution system since March, 2009. Tertiary effluent is blended with groundwater to reduce TDS. Recycled water represents approximately 2/3 of the supply.
3. Source: PVMWA Revised Basin Management Plan
4. Source: Irvine Ranch Water District (IRWD) Michelson Water Recycling Plant effluent water quality average from June 2013 to May 2014
5. Projected recycled water quality for Oxnard Advanced Water Purification Facility (AWPF) based on water quality testing between June and September 2012 and adjusted for aged membranes.
6. Average of samples taken from January 2000 through December 2011.
7. Refer to Table 5-1.

### Water Quality Management Options

Salinity (TDS, chloride, sodium) levels in wastewater are primarily influenced by the potable water supply sources, human excretion, types of waste discharges, water conservation practices, and the use of water softeners. An alternative to treatment involves taking proactive steps to reduce salinity inputs to wastewater that can be managed, such as restricting water softener operation (e.g., requiring use of exchangeable canisters that can be discharged at an ocean outfall rather than discharged to the sewer).

Continued analysis of CSD effluent is recommended to obtain a better sample size to estimate existing effluent water quality for irrigation constituents of concern (TDS, sodium, chloride, boron) as well as to investigate the potential wastewater sources of sodium and chloride.

## Recycled Water Pricing

Most municipal water supplies, particularly new supplies, are more expensive than pumping groundwater. As a result, potential agricultural customers may have limited incentive to participate in a recycled water project if the cost of recycled water is higher than the cost of their existing supply. The cost of groundwater supply generally includes amortized replacement costs of the well equipment and operational and maintenance (O&M) costs. To address this disparity, recycled water that is intended to offset the use of groundwater should be priced with rates that reflect the cost of the groundwater supply. In addition, a slight rate reduction may be needed to incentivize agricultural users to convert.

In this scenario, the recycled water would be sold at an apparent loss. However, this does not consider the larger water resources portfolio. From the District’s perspective, the recycled water project would be making a new municipal water supply available – groundwater not pumped by agriculture in exchange for recycled water – so the project cost is essentially the cost to acquire this new groundwater. From this perspective, the cost of the recycled water project should be compared with other potential new municipal water supplies, such as additional imported water from the SWP, just as a typical landscape irrigation recycled water project is evaluated. The evaluation considers costs as well as other factors such as reliability and drought resistance.

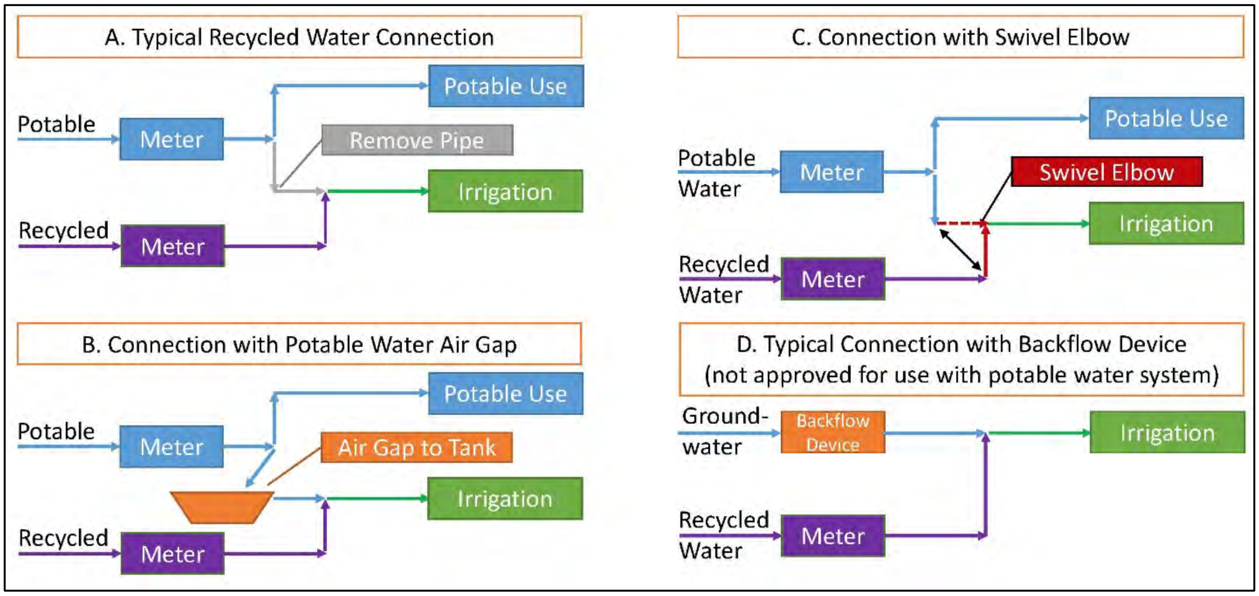
## Customer Connections

Typical recycled water service connections that serve existing potable customers remove any potential connection between the potable system and non-potable system, as shown in **Figure 4-4**, Item A. Some customers require a higher level of water supply reliability, such as industrial customers, or require the flexibility of using a supply other than recycled water if recycled water is not available. The most common approach to provide the secondary supply while maintaining potable system separation is the use of a tank that receives potable water via an air gap, as shown in Item B.

Customers with an air gap tank typically have the facilities in place as part of normal operations since installation of the tank and booster pump would entail high costs for use as an emergency supply. In some situations, a swivel elbow, as shown in Item C, can be used instead of an air gap tank; however, their approved use is limited and may require District system operators to use the swivel elbow instead of the customer. A swivel elbow is assumed to be the preferred approach for potential agricultural irrigation customers that irrigate with potable water. Further discussions should occur with the State Department of Public Health to confirm this approach.

Customers that do not irrigate with potable water and instead rely on groundwater typically require a backflow device between the recycled water source and the groundwater well. It should be noted that these devices are typically required on groundwater wells used for agricultural irrigation due to the common practice of chemigation, which is introducing chemicals into the irrigation system as a method to apply fertilizer, pesticides, etc.

**Figure 4-4: Example Customer Connection Schematics**




## System Design

The primary consideration for recycled water system design is the time of water use. Agricultural customers can theoretically receive recycled water at any time, but operational experience from other agricultural reuse projects indicates that customers prefer to receive water during the day for multiple reasons. These reasons include planned staff presence and the ability to observe any issues with irrigation. Based on this knowledge, recycled water delivery to agricultural customers is assumed to occur over a 12-hour duration during the day and forms the basis for sizing distribution system facilities.

Facilities could be smaller if deliveries could occur over a 24-hour duration. Recycled water could be delivered to a water supply pond or directly into the local irrigation system. Spreading deliveries over 24 hours instead of 12 hours allows for smaller storage volumes, pumps, and pipes, thus reducing project costs. This option depends on the availability of space for onsite storage and/or the willingness of growers to use water during the night.

## Market Acceptance

Market acceptance is dependent on perceived and real public health risks. Several agricultural reuse projects in California demonstrate the market acceptance of crops irrigated with recycled water.

Monterey Regional Water Pollution Control Agency (MRWPCA) has sold 18 mgd of tertiary effluent for irrigation of food crops in the Monterey Peninsula for the past 15 years. The major crops grown are artichokes, broccoli, celery, strawberries, and lettuce. In addition, the Pajaro Valley Water Management Agency has sold 5 mgd of tertiary effluent for irrigation of food crops in the Watsonville area (just north of the Monterey area) for the past five years. The major crops grown are strawberries and vegetable row crops. The Irvine Ranch Water District (in Orange County, California) has successfully used tertiary treated recycled water for food crop irrigation since the late 1960s, with strawberries being a prime example.

## 4.4 Groundwater Recharge

Recharge of the Carpinteria Groundwater Basin is another potential use for recycled water to increase the amount of groundwater available for pumping and increase groundwater levels. Recharge could be accomplished by either surface spreading or direct injection. The minimum level of treatment varies depending on the type of recharge; and the volume of diluent water required varies depending on the level of treatment, as described in Section 3.1.2. Minimum treatment requirements are summarized as follows:

- GWR via surface spreading within a dedicated recharge basin requires disinfected tertiary filtration combined with a minimum percentage of diluent water (i.e., storm water or imported water). The addition of RO reduces the minimum diluent water volume. In addition, groundwater quality objectives must be met or addressed through an anti-degradation analysis. Application of full AWT to all effluent could remove the need for dilution water for surface spreading projects.
- GWR via surface spreading in an existing surface water, such as a creek, has the same requirements as a dedicated recharge basin as well as the requirement to meet surface water quality objectives for the water body.
- GWR via direct injection using dedicated injection wells requires full AWT.

### 4.4.1 GWR Options

The most recent modeling study of Carpinteria Groundwater Basin (Pueblo, 2012) estimated an operational yield of 3,600 to 4,200 AFY, and long-term groundwater pumping estimates are within this range. For the purposes of the RWFP, it is assumed that all available effluent could be recharged and recovered; however, this assumption must be confirmed with subsequent groundwater modeling. Assuming 1.2 mgd of available effluent for feed, partial RO treatment produces approximately 1.05 mgd (1,170 AFY) of recycled water and full AWT produces approximately 1.0 mgd (1,100 AFY).

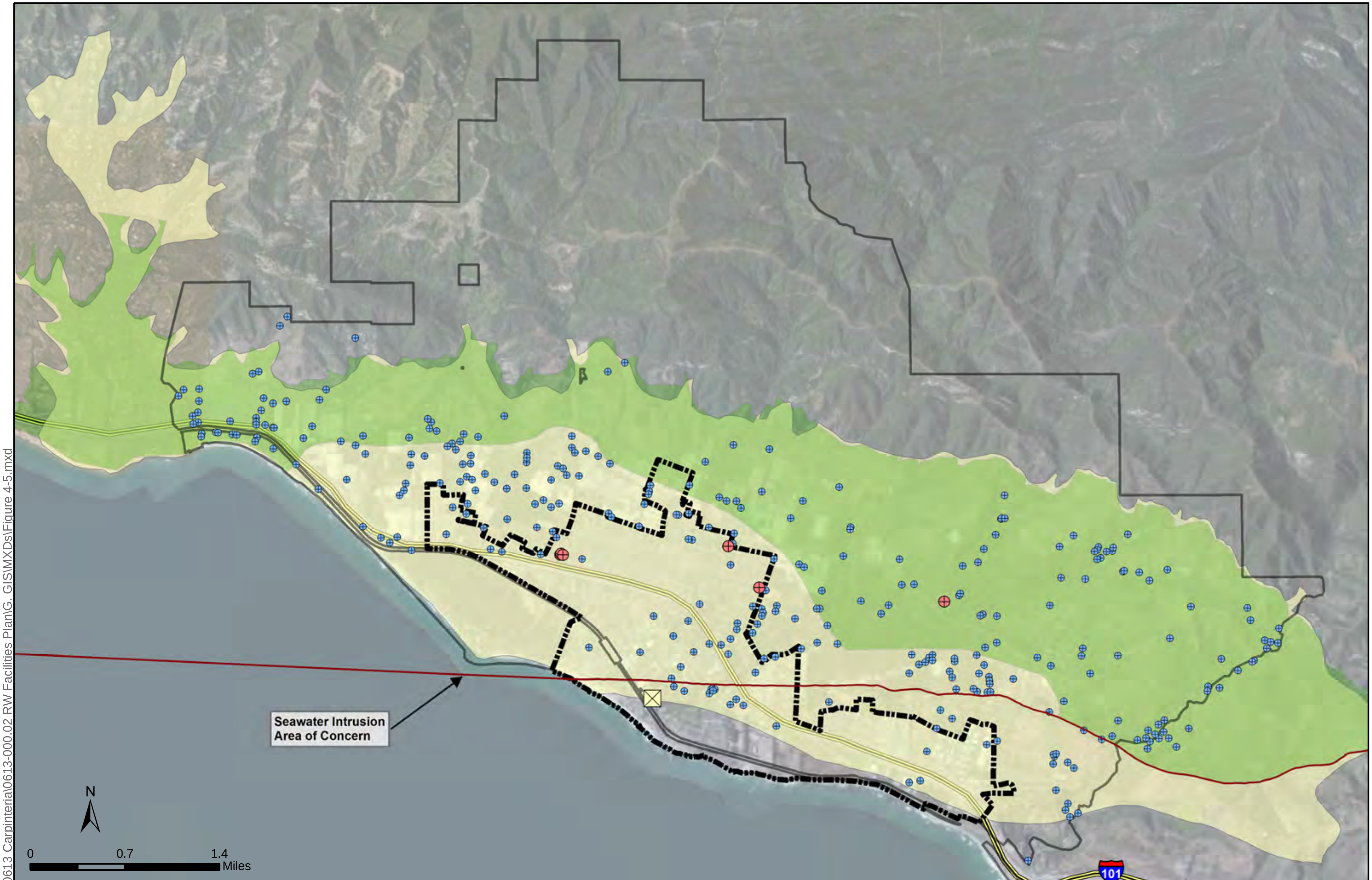
Both GWR methods (spreading and injection) are considered. Surface spreading is limited to the unconfined area of the groundwater basin, as shown in **Figure 4-5**, while injection is much less limited in terms of location.

#### Recharge via Surface Spreading

Three surface spreading locations are discussed: 1) dedicated recharge basins; 2) Carpinteria Creek; and 3) seasonal recharge on active agricultural land.

**Dedicated Recharge Basins**

Assuming full AWT, 1.0 mgd (3.0 AF per day) is available for recharge year-round at a percolation rate of 6 inches per day; therefore, approximately 6.0 acres of recharge basins are required, which translates to approximately 7.2 acres of total land needed when accounting for berms and maintenance access. No capacity is included for diluent water based on the assumption that the use of AWT product water for recharge via surface spreading will allow for 100% recycled water contribution soon after a reasonable period of project startup. Some diluent water may need to be applied during the initial years of operation.




**Features**

- CVWD Wells
- Private Wells
- Carpinteria WWTP
- Rincon Fault Thrust Line
- Unconfined Area
- Carpinteria Groundwater Basin
- City Boundary
- CVWD Boundary

RMC water and environment

**Figure 4-5: Potential Groundwater Recharge Areas**

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Assuming partial RO treatment, 1.05 mgd (3.2 AF per day) is available for recharge year-round at a percolation rate of 6 inches per day; therefore, approximately 6.4 acres of recharge basins are required, which translates to approximately 7.7 acres of total land needed when accounting for berms and maintenance access. In addition, an equal volume of recharge capacity would be needed for diluent water based on the assumption of a 1:1 ratio, which is based on the assumption of successful partial RO treatment to reduce TOC concentrations. Note that the actual ratio will depend on measured post-treatment TOC concentrations along with demonstrated soil aquifer treatment credits received. In total, approximately 15.4 acres of land would be needed to recharge 1.05 mgd of recycled water and 1.05 mgd of diluent water. For this project, diluent water is assumed to be treated surplus Cachuma water, which is assumed to be available in wet years.

Finally, available land for recharge basin development is severely limited in the area overlying the unconfined zone. As a result, land for recharge basins would likely need to be purchased.

**Carpinteria Creek**

Discharge to Carpinteria Creek was considered as a GWR via surface spreading option based on the concept of the creek bed serving as recharge basins and the benefit of natural storm water providing dilution water credits; however, the option was not evaluated in detail due to:

- Limited understanding of creek bed recharge capacity in the unconfined zone of the groundwater basin without the construction of a temporary dam
- Limited understanding of the verifiable ability to capture storm flows, which is necessary to claim diluent water credit
- Inability to recharge recycled water during storm flows, since recycled water discharged to the creek would be carried to the ocean during storms and would not provide a water supply benefit
- Potential increased treatment requirements from future surface water regulations

Further consideration of this approach entails modeling of discharges to the creek to validate the volume of water that could be beneficially recharged and determine if approximately 1.0 to 1.1 mgd of recycled water could be reliably recharged year-round.

**Seasonal Recharge on Agricultural Lands**

An alternative approach to permanent recharge basins is to recharge via intentional flooding of selected agricultural fields for the purposes of groundwater recharge. During fallow or dormant periods, existing agricultural land could be recharged by constructing low berms (less than 2 ft) around existing fields and discharging recycled water within the berms. This approach requires cooperation from farmers in the percolation area that are willing to forgo a winter crop or to flood fields with permanent crops that are tolerant to winter saturation. These farmers would likely receive some compensation for their participation.

Ideal crops for this purpose would be annual species with saturation tolerance and low nitrogen demand. Perennial crops with standing water tolerance and low nitrogen demand meet the profile; however, the financial risk associated with crop loss could exceed the potential benefits of water savings. Therefore, annual crops are more promising, such as field crops. Approximately 180 acres of field crops are estimated to exist overlying the groundwater basin.

The seasonal nature of this option, where recharge occurs during the winter season, coordinates well with agricultural irrigation demands that occur during the summer season. Treatment for agricultural irrigation assumes partial RO, which results in approximately 1.1 mgd (3.3 AF per day) being available for recharge. Based on the use of partial RO recycled water, an equal volume of diluent water would be required to be recharged in the same location as the recycled water.

Total agricultural land of 40 acres would be needed based on:

- 3.3 AF per day of recycled water and 3.3 AF per day of CVWD potable water as diluent
- Percolation rate of 6 inches per day (0.5 ft per day)
- Recharge of all recycled water and potable water over five winter months
- Recharge activities only occur on individual parcels within a site during two months of the five month period (assuming two months of fallowed land)
- 20% additional land for berms and maintenance access.
- 40 acres = [(3.3 + 3.3 AF/day) / 0.5 ft/day * 5 months/2 months * 1.2 factor]

Dedicated recharge basins are assumed for the purposes of this study; however, seasonal recharge on agricultural lands should continue to be discussed with potential agricultural customers to gauge interest.

### Recharge via Groundwater Injection

Two approaches for injection are taken: 1) mid-basin; 2) seawater intrusion barrier. Injection could occur at most locations in the basin as long as storage capacity is available. This project assumes injection would occur in the area with the lowest groundwater levels, which is generally between Hwy 101 and Foothill Rd in the vicinity of Linden Rd.

In addition, injection can take the form of a seawater intrusion barrier near the interface between the ocean and groundwater to create a hydraulic barrier. The most recent Groundwater Basin Report (Fugro, 2014) identified the potential for seawater intrusion at the west end of the City of Carpinteria where the Rincon Creek Thrust Fault line and recommended further investigation. If seawater intrusion is occurring in the area, threatening groundwater supplies, then a seawater intrusion barrier using recycled water would be an effective means of mitigation.

Injection requires full AWT, which can produce an estimated 1.0 mgd (1,100 AFY; 700 gallons per minute [gpm]) of product water from available effluent. For mid-basin injection, two wells each with approximately 450 gpm of capacity are assumed. The capacity is based on an existing CVWD injection well. Establishing a total capacity that exceeds needed capacity provides operational flexibility.

A range of injection well scenarios for a seawater intrusion barrier were developed to maintain protective water levels along the 15,000 feet of coastline coinciding with the confined area boundary within Storage Unit No. 1 (Pueblo Water Resources, 2015). The scenarios ranged from 2 wells with injection rates of 275 gpm (550 gpm combined) to 16 wells with injection rates of 35 gpm (560 gpm total) to create a hydraulic barrier. For purposes of this analysis, four wells with injection rates of 175 gpm (700 gpm total) were assumed.

## 4.4.2 Groundwater Recharge Implementation Considerations

### Water Supply Benefit

GWR creates a new water supply benefit by physically introducing new water into the groundwater with the intent of pumping a similar volume of groundwater in the future. Recharge within the Carpinteria Groundwater Basin, which is currently un-adjudicated, will require CVWD legal counsel involvement to develop a program to ensure CVWD is able to recover the full volume of water recharged.

Formation of a groundwater sustainability agency (GSA) under the recent Sustainable Groundwater Management Act (SGMA) legislation should facilitate the ability to account for and recover recharged water. CVWD is currently taking the initial steps to form a GSA recognized by DWR.

### Public Acceptance

Public acceptance of GWR projects has increased over the past decade based on successful projects such as the OCWD Groundwater Replenishment Project. Any GWR project will require a public outreach effort. The WateReuse Research Foundation has an interactive website to help communities plan and introduce potable reuse projects. The additional costs associated public outreach efforts will result in a higher planning cost estimate.

## 4.5 Recycled Water Supply versus Demand

The Carpinteria WWTP currently discharges 1.2 MGD of secondary treated effluent to the ocean and could produce between 1.0 MGD (1,100 AFY) and 1.2 MGD (1,340 AFY) of recycled water supply after treatment upgrades, as summarized in **Table 4-9**. Potential agricultural irrigation and groundwater recharge uses of recycled water, which were identified in the previous section, exceed the available supply.

**Table 4-9: Recycled Water Supply Estimate by Treatment Option**

| Treatment Options | Recycled Water Quantity | |
|---|---|---|
| 1. Tertiary Treatment Only | 1.2 MGD | 1,340 AFY |
| 2. Partial RO Treatment | 1.05 MGD | 1,170 AFY |
| 3. Full Advanced Water Treatment | 1.0 MGD | 1,100 AFY |

In addition, the seasonal nature of irrigation demand limits the amount of recycled water that can be used throughout the year. **Figure 4-6** shows monthly irrigation demand peaking factors (versus average annual demand) for orchards / field crops and greenhouses based on CVWD monthly use records for 2009 through 2014. As seen in the figure, orchards / field crops have a peaking factor of 2.0 while greenhouses have a peaking factor of 1.4. The average of the two monthly peaking factors is applied for agricultural irrigation alternatives and is also shown in Figure 4-6. Monthly agricultural irrigation recycled water use is shown in **Figure 4-7. Figure 4-8** indicates that groundwater recharge results in year-round beneficial use of the recycled water.

**Figure 4-6: Seasonal Irrigation Peaking Factor (vs. Average Demand)**

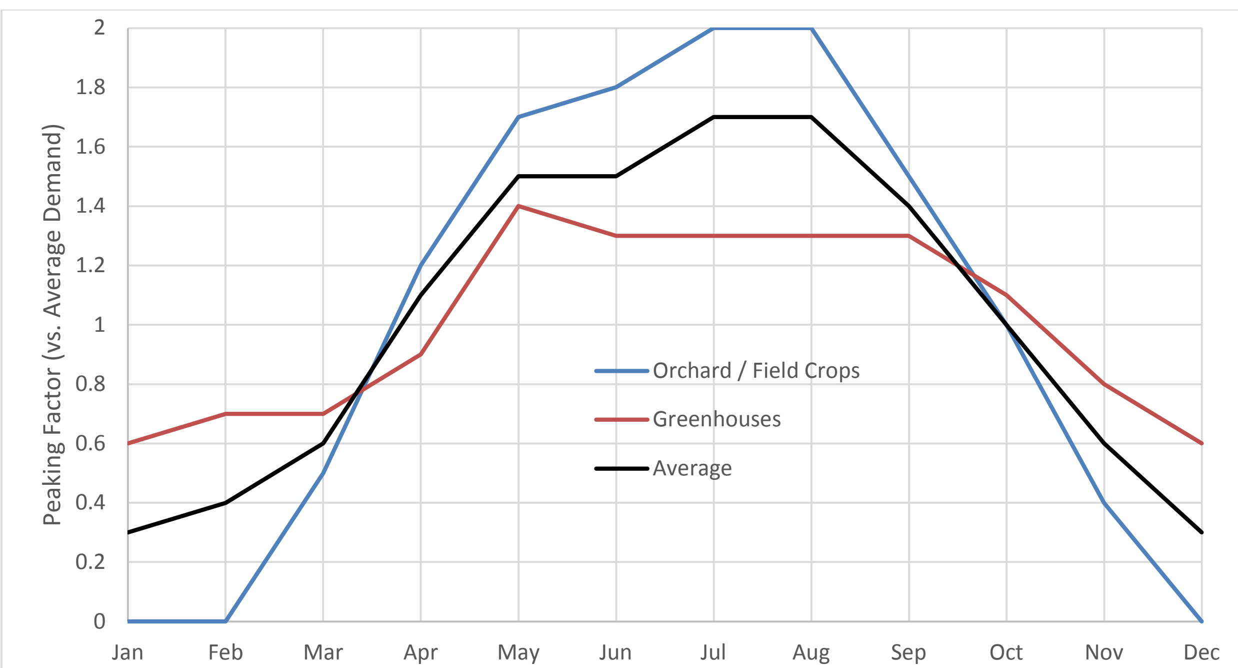


**Figure 4-7: Seasonal Agricultural Irrigation Demand, Potable Water Use Offset**

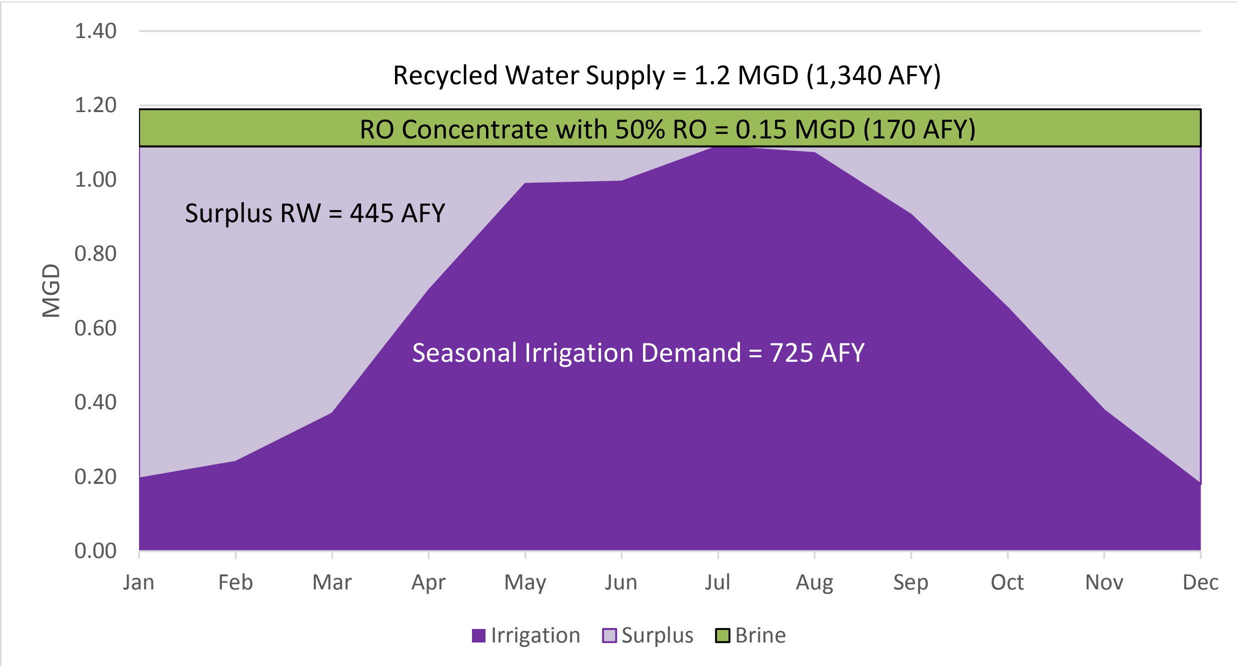
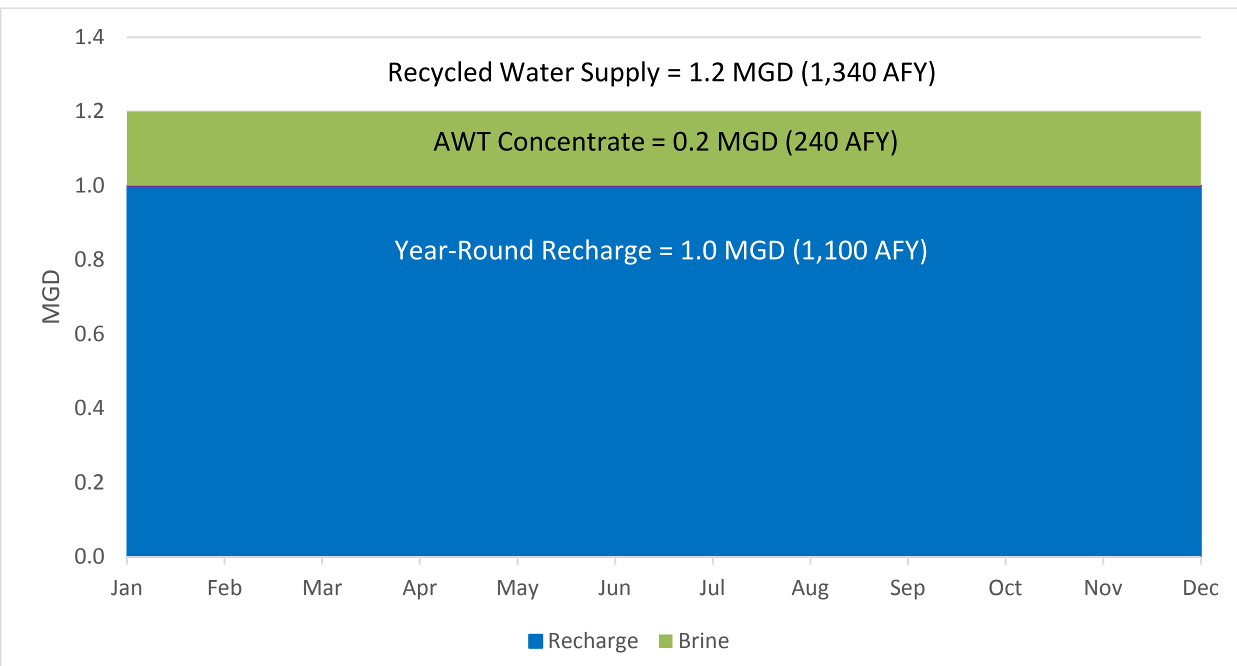



**Figure 4-8: Seasonal Groundwater Recharge Demand**




## 4.6 Market Assessment Summary

Three distinct markets were evaluated for non-potable water use by CVWD:

4. Municipal Irrigation
5. Agricultural Irrigation
6. Groundwater Recharge

Each market was found to be viable but each has a large range of potential demands with municipal irrigation customers limited to approximately 150 AFY, potable agricultural customers up to approximately 1,600 AFY, and total agricultural customers up to 1,900 AFY. The agricultural demand categories significantly exceed available supply, especially when considering the seasonal nature of demand. Potential groundwater recharge demand also exceeds available supply; so it was assumed that a project of this nature could utilize 100% of available supply. These findings are summarized in **Table 4-10**.

**Table 4-10: Summary of Recycled Water Customer Database**

| Use Type | Number of Customers | Estimated Recycled Water Demand | Estimated Recycled Water Supply | Estimated Recycled Water Put to Beneficial Use |
|---|---|---|---|---|
| Municipal Irrigation | | | | |
| Public Fill Station | | 10 AFY | 0.01 MGD | 10 AFY |
| Municipal Irrigation | 36 (> 1 AFY) | 151 AFY | 1.2 MGD (1,340 AFY) | 150 AFY |
| Agricultural Irrigation | | | | |
| Existing Potable Use | 102 (> 5 AFY) | 1,560 AFY | Partial RO: 1.05 MGD (1,170 AFY) | 725 AFY (limited by seasonal demand) |
| Existing Groundwater Use | 54 (> 25 AFY) | 1,905 AFY | | |
| Total Water Use | 61 (> 25 AFY) | 2,738 AFY | | |
| Groundwater Recharge | | | | |
| Surface Spreading | 1 | 100% of Available Supply | 100% AWT: 1.0 MGD (1,100 AFY) | 1,100 AFY |
| Seawater Intrusion Barrier | 1 | | | |
| Inland Injection | 1 | | | |

Regarding recycled water quality, tertiary treated effluent should be acceptable for municipal irrigation uses; but some customers may prefer lower TDS levels. Agricultural irrigation uses would likely require chloride concentrations to be reduced such that they are comparable to the existing potable water supply (i.e., approximately 100 mg/L). Groundwater recharge uses would also likely require chloride concentrations to be reduced to at least 100 mg/L to meet groundwater basin water quality objectives. Groundwater recharge via injection wells requires full advanced water treatment.

Overall, peak season recycled water supplies are limited and part of the alternatives evaluation in the following chapter will consider this when developing and evaluating potential projects.

# Chapter 5 Recycled Water Treatment Alternatives

The Carpinteria WWTP, owned and operated by CSD, is the only potential recycled water source in the service area. The plant has a secondary treatment capacity of 2.5 MGD, with a historical influent flow rate averaging approximately 1.4 MGD. In 2014, the average flow rate was approximately 1.2 MGD and buildout flows are estimated at 1.5 MGD. The treatment process consists of screening, grit removal, primary sedimentation, aeration, secondary clarification, and chlorine disinfection. Sodium bisulfite is used to de-chlorinate effluent prior to discharge into the Pacific Ocean. Collected sludge is processed utilizing aerobic digesters, a screw press, and a belt filter press prior to disposal at a composting facility.

The Carpinteria WWTP currently does not produce recycled water. All effluent from the WWTP is currently discharged into the Pacific Ocean in approximately 25 feet of water through a 1,000-foot dedicated outfall pipe. **Figure 5-1** shows an aerial view of the WWTP site.

**Figure 5-1: Aerial View of Existing WWTP Site**


## 5.1 Introduction of Alternatives

Chapter 4 (Market Assessment) identified five potential uses of recycled water in the study area:

- Public fill station
- Landscape irrigation
- Agricultural irrigation
- Groundwater recharge via surface spreading
- Groundwater recharge via well injection

Based on required water quality and applicable regulations for potential end uses, three types of recycled water treatment alternatives were considered in this analysis:

4. **Tertiary:** 1.2 MGD tertiary filtration and disinfection to meet Title 22 requirements to serve municipal irrigation customers.
5. **Partial Reverse Osmosis (RO):** 1.2 MGD of microfiltration (MF) and 1.0 MGD of RO (influent flow) with a 0.2 MGD tertiary filtration bypass stream to reduce TDS and chloride to acceptable concentrations for agricultural irrigation. The two treatment streams would be blended prior to disinfection and result in an average production of 1.05 MGD after accounting for brine losses and RO downtime.
6. **Advanced Water Treatment (AWT):** 1.2 MGD (influent flow) of MF/RO/advanced oxidation process (AOP), also referred to as AWT, to be used for groundwater recharge. Average AWT production of 1.0 mgd is estimated after accounting for brine losses and RO downtime.

**Table 5-1** below summarizes the treatment requirements for each type of reuse, and **Table 5-2** summarizes the treatment technologies and associated flow capacities for each alternative.

**Table 5-1: Treatment Requirements for Each Type of Reuse**

| Type of Reuse / Type of Treatment(1) | Public Fill Station | Landscape Irrigation | Agricultural Irrigation | Recharge, Surface Spreading(2) | Recharge, Injection |
|---|---|---|---|---|---|
| 0. Secondary (Existing) | | | | | |
| 1. Tertiary Filtration Only | √ | √ | √ (3) | √ (3) | |
| 2. Partial RO | √ | √ | √ | √ | |
| 3. AWT | √ | √ | √ | √ | √ |

Note:
1. All treatment options include disinfection.
2. Surface water dilution requirements for surface spreading vary depending on the level of treatment and associated TOC concentration. Tertiary filtered effluent typically requires a 4:1 dilution (4 parts surface water to 1 part recycled water). Partial RO dilution requirements range from 3:1 to 1:1 depending on the effluent TOC concentration. AWT may not require any dilution.
3. Agricultural irrigation and groundwater via surface spreading is approved for recycled water with tertiary filtration; however, projected water quality (see Section 4.1.1) is unacceptable for salt sensitive crops, such as avocadoes and flowers, and for groundwater basin water quality objectives.

**Table 5-2: Treatment Technologies and Flow Capacities (MGD) for each Alternative**

| Treatment Alternative | Secondary Treatment | Tertiary Filtration | Micro-filtration | Reverse Osmosis | Chlorine Disinfection | UV/AOP |
|---|---|---|---|---|---|---|
| 1. Tertiary Only | 2.5 | 1.2 | -- | -- | 1.2 | -- |
| 2. Partial RO | 2.5 | -- | 1.2 | 1.0 | 1.05 | -- |
| 3. AWT | 2.5 | -- | 1.2 | 1.2 | -- | 1.0 |

Note: Existing secondary treatment capacity is 2.5 MGD. Total existing flow is 1.2 mgd so treatment is limited to 1.2 MGD. UV/AOP is slightly smaller than RO after accounting for RO brine losses.

Recycled water is required to have process redundancy, alarms, and emergency storage or disposal for reliability. The three alternatives include automated diversion to the ocean outfall in the event that the water does not meet Title 22 standards. Automation will be accomplished through the use of on-line analyzers and automated valves.

### 5.1.1 Projected Recycled Water Quality

Three treatment options were defined in Section 4.1. Projected effluent water quality for irrigation constituents of concern for the three treatment options are summarized in **Table 5-3** to support the water quality discussion in Section 4.1.

**Table 5-3: Projected Effluent Quality for Irrigation Constituents of Concern (mg/L)**

| Treatment Alternative | Boron | Calcium | Chloride | Nitrate | Sodium | TDS |
|---|---|---|---|---|---|---|
| Secondary[1] | 0.5 | 123 | 390 | 23 (as N) | 281 | 1360 |
| 1. Tertiary | 0.5 | 123 | 390 | 23 (as N) | 281 | 1360 |
| 2. Partial RO[2] | 0.4 | 65 | 100 | 6 (as N) | 70 | 340 |
| 3. AWT | 0.3 | 5 | 10 | < 1 (as N) | 10 | 40 |

Notes:

1. Source: CSD, 4/22/15 sample. Additional sampling is planned to better define effluent quality.
2. Assumes 80% of effluent is treated by RO.

## 5.2 Treatment Technologies

The ensuing subsections provide an overview of the various treatment techniques that are applicable for the types of reuse contemplated by CVWD.

### 5.2.1 Tertiary Filtration

Tertiary filtration further reduces suspended solids and turbidity from secondary levels. Several types of filter technologies are available including: mono and dual media filter beds, rotating disk cloth filters, and continuous backwash upflow sand filters. For the purposes of this study, rotating disk filters and continuous backwash filters were evaluated because they have smaller footprints, are approved for Title 22 recycled water treatment, and are typically more economical than filter beds at the proposed flow rates.

The rotating disk filter uses a pile cloth as the filter media attached to a vertically oriented disk. The units have a low hydraulic profile and have approximately 18-inches of headloss across the units at peak design flow. They are also capable of maintaining performance during times of high solids loading rates and high hydraulic loading rates and are capable of keeping low backwash rates. In general, disk filters are recognized for low operating costs and ease of operation and maintenance compared to other filter systems.

The continuous-backwash upflow filter is a deep bed, granular media filter. It is cleaned by an internal airlift washing system that does not require backwash pumps or storage tanks and consequently has low energy consumption. The deep media bed allows it to handle high levels of suspended solids.

Because of the need for an intermediate pump station with the upflow filter and the associated costs, the low headloss rotating disk filters are used in the cost estimates and for cost comparisons. A concrete pad with a roof over the equipment has been included in the cost estimate along with a small polymer dosing system, which is normally not needed to meet effluent requirements. Mixed liquor recycle pumps have also been included in the cost estimate to aid with nitrification as discussed below. The filters perform better with nitrified secondary effluent.

### 5.2.2 Chlorine Disinfection

Title 22 requires a disinfection process that provides either of the following criteria: 1) a chlorine contact time value of at least 450 milligram-minutes per liter with a modal contact time (CT) of at least 90 minutes at peak dry weather design flow, or 2) a process that will inactivate 5-log of plaque forming units of F-specific bacteriophage MS2, or polio virus. At 1.2 MGD, the existing chlorine contact tank provides approximately 96 minutes of contact time.

An effluent pump station is proposed adjacent to the chlorine contact tank (CCT). This pump station wet well will provide additional CT and storage for flow equalization. The station will deliver the reuse water to the distribution network.

### 5.2.3 Microfiltration

MF is included in Alternatives 2 and 3. Low-pressure membranes (MF or ultrafiltration (UF)) serve as a pretreatment for RO. The performance and costs, as well as operating and energy requirements have become similar for MF and UF. Both can remove bacteria, viruses, and protozoa. Filtration efficiencies will vary with membrane type and feed water quality.

The MF units will require an upstream storage tank to provide flow equalization during backwash and cleaning and also to provide a more consistent flow through the membranes during nighttime and diurnal fluctuations. Typically, there will be a backwash cycle every 30 minutes, a chlorine and acid wash every 48 hours, and a full clean-in-place every 30 days. It has been assumed that the membrane feed pumps will pump out of the equalization tank, so additional intermediate pumps have not been included in the cost estimates.

### 5.2.4 Reverse Osmosis

Alternatives 2 and 3 include RO for different reasons, respectively: 1) reduction of chlorine to below 100 mg/L and blended so that the recycled water can be used to irrigate sensitive agricultural crops, and 2) as a treatment step within advanced water treatment (AWT; see next section) so that the water can be used for GWR via injection or potentially for GWR via spreading with little or no dilution requirements.

A pretreatment step to RO is necessary to remove colloids and particulates that would damage the RO elements. Membrane pretreatment is the industry standard for water reuse with MF. MF removes suspended solids and most bacteria, with RO and AOP also contributing to bacterial removal.

RO provides a barrier to a wide range of contaminants including salts, bulk organics (as indicated by total organic carbon), and CECs, such as pharmaceuticals, endocrine disruptors, ingredients in personal care products, pesticides, and others. RO is also a highly effective microbial and viral barrier; however, imperfections in the membranes and potential for leaks around the seals and connectors can cause breakthrough of microorganisms, particularly viruses. Thus, as a precaution, disinfection following RO treatment is required if non-disinfected water is used as the feed source, which would be the case for this project.

### 5.2.5 Advanced Water Treatment

AWT is a well-proven treatment technique for potable reuse projects and consists of RO to remove TDS and organics (TOC and CECs), disinfection with ultraviolet light (UV) and an advanced oxidation process (AOP) to destroy recalcitrant CECs. Pretreatment with MF is typical. Finally, RO product water will likely need to be stabilized depending on the water chemistry and pipeline materials used to transmit advanced treated recycled water to end uses. For example, a combination of decarbonation and lime addition is used at the Orange County Water District's Groundwater Replenishment System for stabilization purposes.

### 5.2.6 Advanced Oxidation Processes

Several potential oxidation/disinfection technologies exist for use as part of AWT for potable reuse, and may be categorized as (1) UV light exposure with free chlorine ($UV/Cl_2$) or hydrogen peroxide addition

($UV/H_2O_2$) and (2) ozone ($O_3$) combined with hydrogen peroxide ($O_3/H_2O_2$). Since chlorine is currently used at the treatment facility, $UV/Cl_2$ is the AOP treatment of choice for this project.

Oxidation using $UV/Cl_2$ consists of free chlorine addition followed by UV exposure within a closed vessel reactor. When aqueous chlorine solutions are exposed to UV, hydroxyl radicals (OH) are produced, which are highly and non-selectively reactive and are responsible for oxidation.

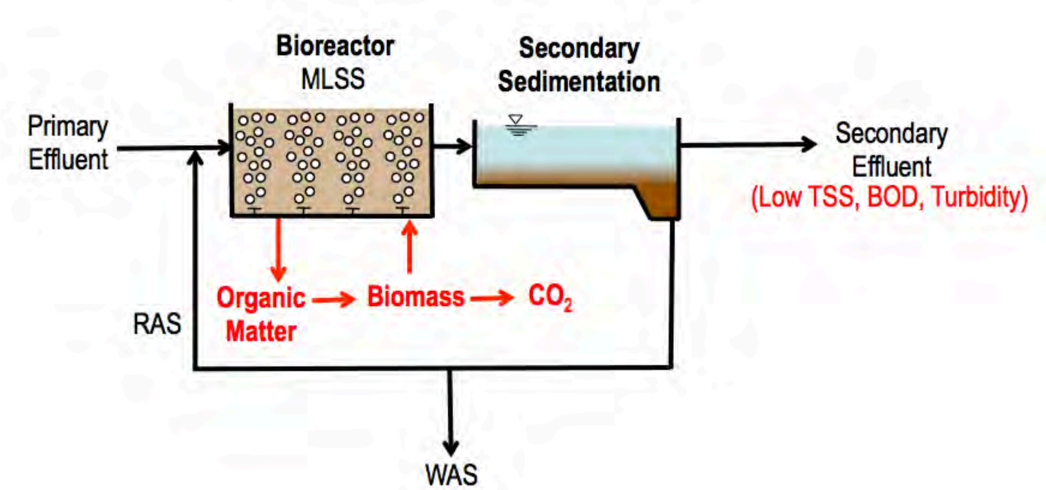
Microbial disinfection requirements are met by UV, with typical doses on the order of 100 $mJ/cm^2$. Oxidation requirements are met with the addition of free chlorine upstream of the UV reactor, which is then photolyzed into hydroxyl radicals that are responsible for the degradation or attenuation of hazardous organic compounds.

### 5.2.7 Nitrification-Denitrification

Total nitrogen concentrations less than 10 mg/L (as N) are required for groundwater recharge projects. Carpinteria WWTP currently provides treatment that reduces ammonia concentrations to 1 mg/L and results in nitrate concentrations of 23 mg/L (as N). Reverse osmosis achieves approximately 90 percent removal of nitrogen, so approximately 70 percent of the total effluent would need to pass through RO to achieve the 10 mg/L limit, unless denitrification is implemented.

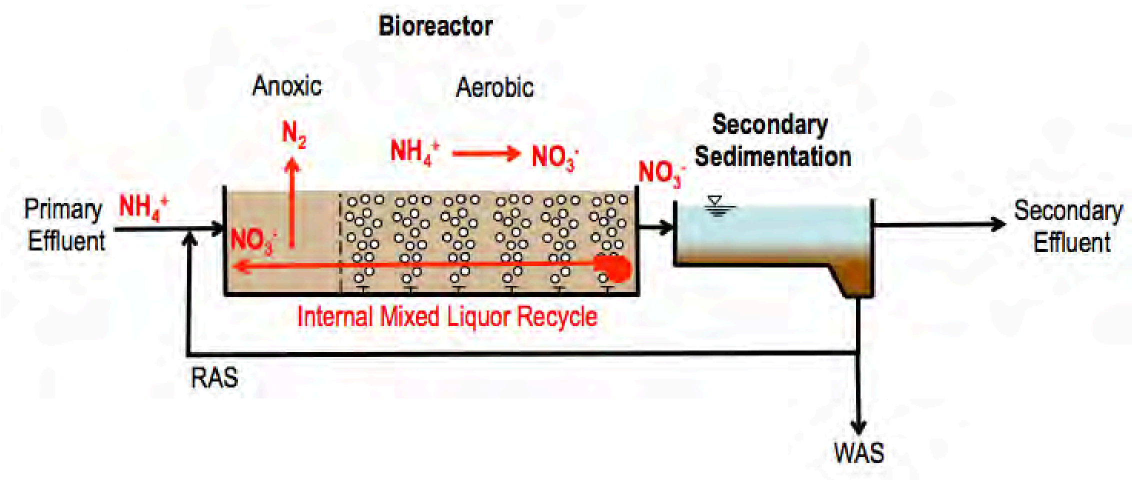
A schematic of the secondary treatment process is shown in **Figure 5-2**. Because this process does not remove nitrogen from the system, total nitrogen levels in the secondary effluent will be approximately that of the influent ammonia. The red text in Figure 5-2 highlights the process to remove TSS and BOD but not nitrogen.

**Figure 5-2: Existing CSD Secondary Treatment Configuration**




Nitrogen removal can be achieved through a two-step NDN secondary biological nitrogen removal (BNR) process (**Figure 5-3**). The first step of BNR is nitrification, which is the oxidation of ammonium ($NH_4^+$) into nitrite ($NO_2$), then to nitrate ($NO_3^-$). Nitrification is accomplished by maintaining a high solids retention time (i.e., sludge age) to encourage the growth and proliferation of autotrophic nitrifying bacteria. The second step is denitrification, which is the process of reducing the nitrate to nitrogen gas. Denitrification is accomplished by providing an anoxic zone upstream of the aerobic zone and recycling mixed liquor (to provide nitrate) from the end of the reactor to the head of the anoxic zone. The conditions in the anoxic selector promote the growth of heterotrophic denitrifying bacteria. These denitrifying bacteria consume organic matter present in the influent wastewater and utilize the oxygen from nitrate, which releases nitrogen gas. A properly functioning NDN process can maintain total nitrogen levels less than 10 mg/L (as N). The red text in Figure 5-3 highlights the NDN process to remove nitrogen.

**Figure 5-3: Nitrification-Denitrification Secondary Treatment Configuration**




## 5.3 Description of Treatment Alternatives

As outlined previously, three types of recycled water treatment alternatives were considered in this analysis based on potential recycled water end uses:

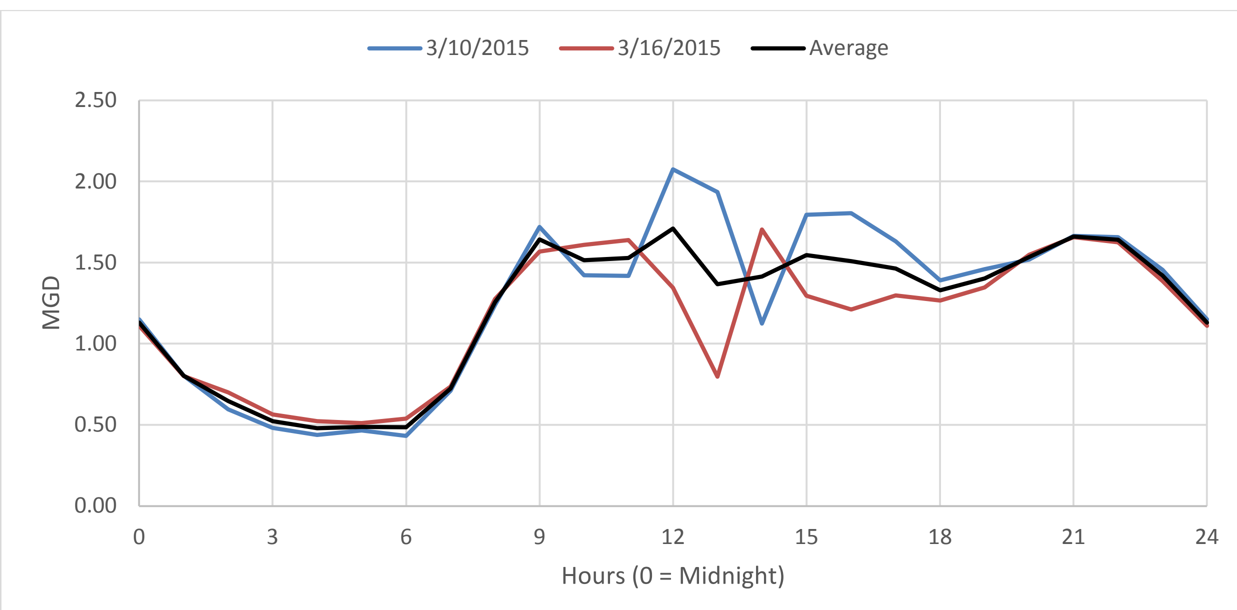
1. Tertiary Only (for Municipal Irrigation)
2. Partial Reverse Osmosis (for Agricultural Irrigation or Groundwater Recharge)
3. Full Advanced Treatment (for Groundwater Recharge)

Each alternative is described in this section followed by a preliminary facilities layout and a cost estimate.

### 5.3.1 Equalization Storage

Equalization storage is included in each alternative to mitigate the influent diurnal variation. Based on the variation shown in **Figure 5-4**, approximately 0.2 MG of storage is assumed. The storage could be placed either upstream or downstream of secondary treatment.

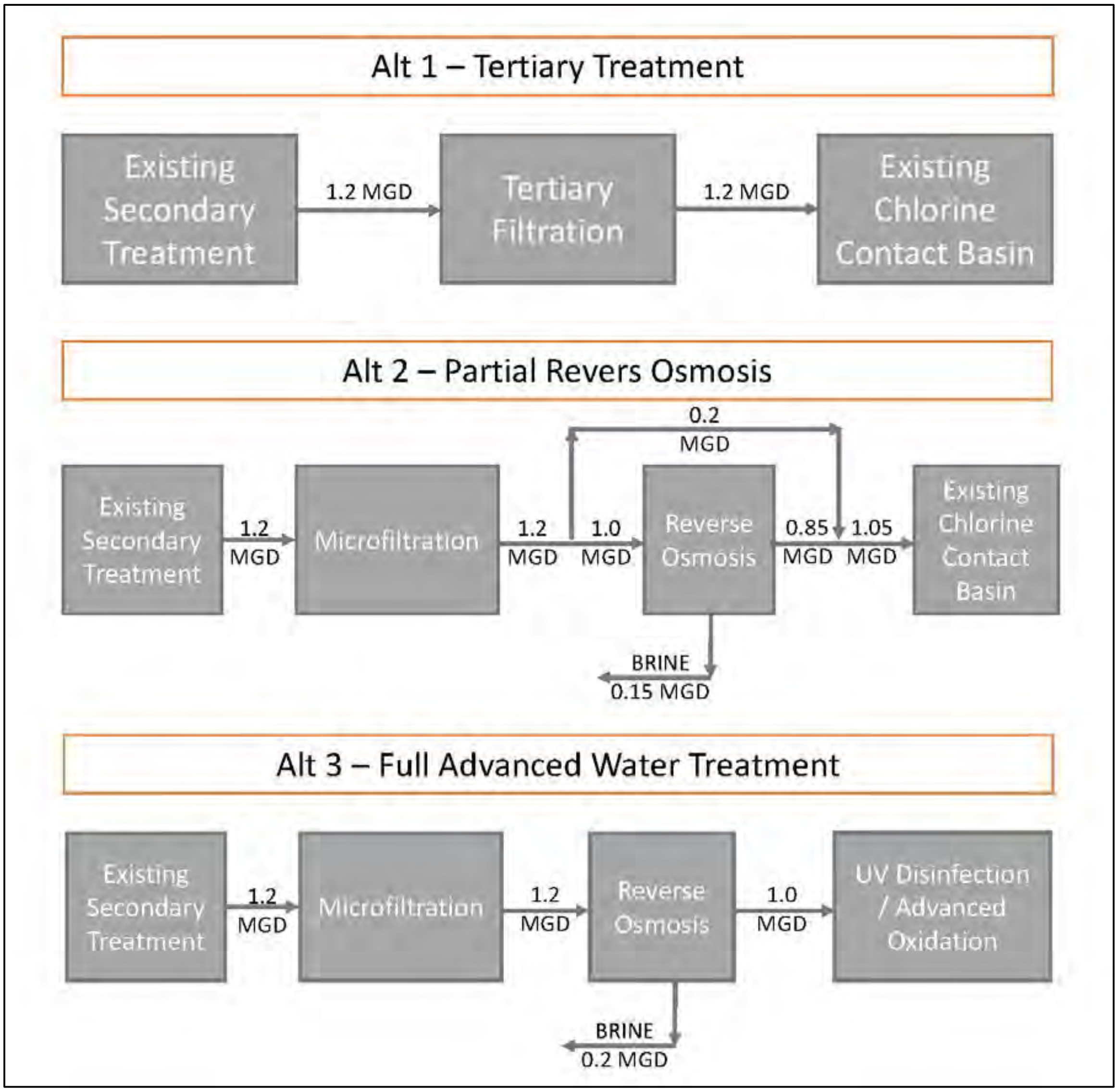
**Figure 5-4: CSD WWTP Influent Diurnal Flows**



### 5.3.2 Alternative Descriptions

Three alternatives are schematically shown in **Figure 5-5** and described following the figure.

**Figure 5-5: Treatment Alternatives Schematics**




## Alternative 1 - Tertiary Treatment

This alternative evaluated treating the existing secondary effluent to Title 22 levels through tertiary treatment. The two primary criteria for tertiary treatment are: 1) low suspended solids and turbidity, and 2) sufficient disinfection to minimize health risks. These criteria are achieved through filtration and an increased level of disinfection.

This alternative assumes that effluent can flow by gravity from the aeration basin, through the disk filters, to the CCT, and to the recycled water effluent pump station. This alternative includes use of the existing CCT.

### Alternative 2 – Partial Reverse Osmosis

Alternative 2 evaluated removing TDS and chloride from approximately 80% of the existing secondary flow by implementing MF for all flow (1.2 MGD) and a partial-RO design capacity of 1.0 MGD. The RO process will produce approximately 0.85 MGD of product water and 0.15 MGD of brine for disposal. The RO permeate and MF permeate that bypassed RO would be blended to achieve a chloride concentration below 100 mg/L, followed by chlorine disinfection. The chloride concentration target is based on grower feedback on maximum desired levels for agricultural irrigation (see Table 4-7) and on the groundwater quality objective for chloride in the Carpinteria Groundwater Basin (see Table 3-3). The existing CCT will be used for disinfection. A concrete pad with a roof over the MF and RO equipment has been included in the equipment costs.

For groundwater recharge applications, total nitrogen must be reduced below 10 mg/L. Treatment of 80 percent of flow with RO would reduce total nitrogen below 10 mg/L in the blended flow, so the addition of a denitrification process is not necessary.

### Alternative 3 – Advanced Water Treatment

Alternative 3 evaluates treating all of the secondary flow with MF/RO/AOP (referred to as AWT) with a design capacity of 1.2 MGD. Approximately 1.0 MGD of effluent would be produced along with approximately 0.2 MGD of brine. Since chlorine is currently used at the treatment facility, UV/$Cl_2$ is the AOP treatment of choice for this project. Product water will discharge to the wet well of the recycled water pump station.

For groundwater recharge applications, total nitrogen must be reduced below 10 mg/L. AWT reliably produces water with total nitrogen below 5 mg/L, so the addition of a denitrification process is not necessary.

## 5.3.3 Cost Estimates

Since this project is in the early stages of planning, cost estimates were developed without preliminary or final design. Guidelines for an Estimate Class Level 5 as defined by the American Association of Cost Estimating (AACE) were used for the estimates.

Concrete pads with roof canopies have been included in the equipment costs for the disk filters and membranes. Equipment estimates applied a 15% contractor mark-up and 40% installation cost to the equipment costs. Electrical and instrumentation and controls (I&C) were estimated at 20% of equipment costs, yard piping was estimated at 10% of equipment costs, and miscellaneous work and cleanup was estimated at 5% of equipment costs. The effluent pump station is excluded from the treatment alternative cost but is included in the cost of each project alternative in Chapter 6.

The summary of costs for each alternative is shown in **Table 5-4**. Detailed cost estimates and potential facilities layouts are included in Appendix B.

**Table 5-4: Summary of Treatment Alternatives Cost Estimates**

| Treatment | Capital Cost | Annualized Capital Cost | O&M Cost | Total Annual Cost | Yield | Unit Cost |
|---|---|---|---|---|---|---|
| 1. Tertiary Only | $3.5 M | $0.2 M | $0.1 M | $0.3 M | 1,340 AFY | $190/AF |
| 2. Partial RO | $8.5 M | $0.4 M | $0.5 M | $0.9 M | 1,170 AFY | $750/AF |
| 3. AWT | $12.2 M | $0.5 M | $0.8 M | $1.3 M | 1,100 AFY | $1,200/AF |

Note: Detailed cost estimates and potential facilities layouts are included in Appendix B.

### 5.3.4 NPDES Permit Impacts of Treatment Alternatives

CSD currently operates under NPDES Permit Nos. CA0047364 and R3-2011-003 for discharge through the ocean outfall. The original order became effective on March 25, 2011 and expires on March 25, 2016. The permit contains both technology-based and water quality-based requirements.

To conservatively estimate effluent the impacts of a recycled water program on permit limits, Alternative 3 is analyzed. This alternative represents a "high loading" scenario because 100% of the waste stream would be treated with RO, therefore adding the highest amount of brine. The calculations assume that the AWT process (including RO) has an 83% recovery rate (i.e., ratio of product water to feed water) and that brine has constituent concentrations approximately 6 times that of the secondary effluent. Alternative 3 provides AWT facilities to treat 1.2 mgd of influent capacity and yields 1.0 mgd of product water and 0.2 mgd of brine.

Table 5-5 and Table 5-6 provide a summary of the constituents with effluent limits as dictated by the NPDES permit, typical concentration values for those constituents in the current effluent (from 2013-2015 data), assumed values for non-detect (ND) values (100% of the detection limit), and projected values for a future scenario where Alternative 3 is implemented and the brine concentrate becomes the only flow stream through the ocean outfall.

Values of potential concern are shown in red in the two tables. A similar analysis was conducted for the Protection of Human Health constituents listed in the NPDES permit. No values of concern were identified and those constituents are not listed here.

For the conventional pollutants, it should be noted that the effluent concentration limits dictated by the NPDES permits are typically based on daily loadings (in pounds per day). The loadings would not significantly change when using RO treatment so it may be possible to recalculate the effluent concentrations and adjust the NPDES water quality-based limits based on the reduced effluent flow rates (and increased concentrations) that would be experienced with the implementation of RO.

For total chlorine residual, it is reasonable to assume that chlorine application procedures would change as a result of implementing AWT.

**Table 5-5: NPDES Conventional Pollutants, Projected Effluent Quality**

| Constituent | Units | Current Effluent Water Quality[1] | | Multi-plier[2] | Projected Effluent Water Quality (to ocean outfall) | | NPDES Limits[3] | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Avg. | High | | Avg. | High | Avg. Monthly | Avg. Weekly | Max. Daily |
| Biochemical Oxygen Demand | mg/L | 5.65 | 7.33 | 6.0 | 33.9 | 44.0 | 30 | 45 | 90 |
| Total Suspended Solids | mg/L | 5.36 | 6.67 | 6.0 | 32.2 | 40.0 | 30 | 45 | 90 |
| Oil and Grease | mg/L | 3.29 | 4.1 | 6.0 | 19.7 | 24.6 | 25 | 40 | 75 |
| Total Coliform | MPN/ 100mL | 2.78 | 4.67 | 6.0 | 16.7 | 28.0 | N/A | 23 | 2300 |

Notes:
1. Based on effluent water quality data provided by CSD for 2013 – 2015.
2. Based on assumed AWT influent capacity of 1.2 MGD and yield of 1.0 MGD of product water.
3. CSD WWTP NPDES permit.

**Table 5-6: NPDES Toxic Pollutants, Projected Effluent Quality**

| Constituent | Units | Current Effluent Water Quality[1] | | Detection Limit[2] | Multiplier[3] | Projected Effluent Water Quality (to ocean outfall) | | NPDES Limits[4] | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Avg | High | | | Avg | High | 6-month median | Daily Max. | Inst. Max |
| Arsenic | µg/L | 0.95 | | | 6.0 | 5.7 | | 470 | 2700 | 7200 |
| Cadmium | µg/L | 0.058 | | | 6.0 | 0.3 | | 94 | 380 | 940 |
| Chromium, Hexavalent | µg/L | 0.251 | | | 6.0 | 1.5 | | 190 | 750 | 1900 |
| Lead | µg/L | 0.6815 | | | 6.0 | 4.1 | | 190 | 750 | 1900 |
| Selenium | µg/L | 1.74 | | | 6.0 | 10.4 | | 1400 | 5600 | 14000 |
| Silver | µg/L | 0.1105 | | | 6.0 | 0.7 | | 51 | 250 | 640 |
| Total Chlorine Residual | µg/L | 44.36 | 89.67 | | 6.0 | 266.2 | 538 | 190 | 750 | 5600 |
| Endosulfan[5] | µg/L | ND | | 0.00051 | 6.0 | 0.0031 | | 0.85 | 1.7 | 2.5 |
| Endrin[6] | µg/L | ND | | 0.00084 | 6.0 | 0.0050 | | 0.19 | 0.38 | 0.56 |
| HCH[7] | µg/L | ND | | 0.00031 | 6.0 | 0.0019 | | 0.38 | 0.75 | 1.1 |

ND Non-detect

Notes:

1. Based on effluent water quality data provided by CSD for 2013 – 2015.
2. Conservatively assumes a value of 100% of the detection limit for the purposes of this analysis.
3. Based on assumed AWT influent capacity of 1.2 MGD and yield of 1.0 MGD of product water.
4. CSD WWTP NPDES permit.
5. Assumes highest detection limit of the three forms of endosulfan (0.51 ng/L Endosulfan II) http://www.caslab.com/Pesticide-Testing/.
6. Assumes detection limit for Endrin http://www.caslab.com/Pesticide-Testing/.
7. Assumes highest detection limit of the four forms of HCH (0.31 ng/L for beta-BHC) http://www.caslab.com/Pesticide-Testing/.

# Chapter 6 Project Alternatives Analysis

This chapter presents the development and analysis of recycled water alternatives for the District plus a no project alternative. Each alternative is defined as the combination of the treatment, storage, pumping, and distribution options necessary to serve targeted users located within the District.

The development of alternatives involved defining the following components for each alternative:

- **Service Area**: Where would recycled water be used? Recycled water would be used within the District service area.
- **Treatment**: Where would recycled water be produced? Recycled water would be produced at the Carpinteria WWTP.
- **Pumping**: Where would pump stations be required to deliver recycled water to customers at minimum pressure? Hydraulic analysis will determine optimal locations for transmission pipelines and booster pump stations under each alternative. At a minimum, a new pump station at Carpinteria WWTP would need to be constructed.
- **Storage**: How much recycled water would need to be stored and where? The need for operational storage will be evaluated as part of the hydraulic analysis in tandem with the pumping evaluation.
- **Distribution**: How would recycled water be distributed to the users? Pipelines would generally be installed in major corridors (roadways or along property boundaries) in public right-of-way, when available. Alignments will be developed based on locations of users, existing utilities, costs and impacts to the public during construction.

The following approach was adopted to meet the objectives described above:

1. Develop conceptual alternatives (including preliminary pipeline sizing, pipeline alignment, pumping requirements and storage requirements).
2. Develop conceptual level cost estimates for each alternative.
3. Obtain input from District staff to refine alternatives.
4. Evaluate the advantages and disadvantages of each conceptual alternative.
5. Recommend an alternative based on evaluation criteria (such as cost effectiveness, capital requirements, recycled water use and implementation flexibility).

## 6.1 Alternatives Development

This section details the development of various recycled water use alternatives to serve municipal, agricultural and groundwater recharge uses. First, customers were identified for each alternative based on serving large demands (> 25 AFY) and then medium customers (> 5 AFY) along an alignment to serve the large demands. Then, facilities for each alternative were defined. For all alternatives, a hydraulic analysis using InfoWater modeling software was performed to determine the pipelines, pump stations and storage facilities needed to serve the identified customers. The hydraulic criteria shown in Table 4-1 were used as a basis for the model.

**Table 6-1: Hydraulic Design Criteria for Model Development**

| Item | Criteria |
|---|---|
| Min Delivery Pressure | 60 psi - without on-site storage<br>20 psi - with on-site storage (assumed to have booster pumps) |
| Pipe Material | Up to 12" diameter: PVC, C900 Class 150 |
| Max System Pressure | 140 psi for PVC pipe |
| Allowable Velocity Range | 2 to 8 feet per second |
| Hazen-Williams Coefficient for Head Loss Calculation | 130 for PVC pipe |
| Irrigation System Pressure | Elevation 350 ft msl (based on existing CVWD potable water pressure zone along Foothill Rd) |
| **Customer Time of Use** | |
| Agriculture | 12 Hours: 7 am to 7 pm |
| Municipal | 8 Hours: 10 pm to 6 am |
| With On-Site Storage | 24 Hours |

### Storage

Due to variable demand patterns throughout the day, InfoWater software was used for the hydraulic model analysis to determine the storage requirements, pipeline sizes, and pump station needs to optimize recycled water distribution. The Carpinteria WWTP will incorporate secondary effluent equalization so that tertiary effluent flow will be constant throughout the day and approximately equal the average daily wastewater influent flow. The hydraulic modeling demonstrated that some alternatives would require operational storage at defined locations within the distribution system. The storage facilities associated with each alternative are discussed in the next section with each alternative.

## 6.2 Alternatives Descriptions

Ten alternatives were developed as summarized in **Table 6-2**, as well as a no project alternative, to serve the three primary markets plus a hybrid:

1. Municipal Irrigation (Tertiary Treatment Only)
2. Agricultural Irrigation (Partial RO)
3. Groundwater Recharge (Partial RO or AWT)
4. Agricultural Irrigation & GWR (Partial RO)

**Table 6-2: Summary of Alternatives**

| ID | Alternative | Level of Treatment | Project Yield (AFY) |
|---|---|---|---|
| 1A | Municipal, Fill Station | Tertiary Only | 10 |
| 1B | Municipal, Large Landscape | Tertiary Only | 53 |
| 2A | Agricultural, Potable Use Offset | Partial RO | 725 |
| 2B | Agricultural, Total Use Offset | Partial RO | 725 |
| 3A | GWR, Surface Spreading | Partial RO | 1,170 |
| 3B | GWR, Surface Spreading | Advanced Water Treatment | 1,100 |
| 3C | GWR, Inland Injection | Advanced Water Treatment | 1,100 |
| 3D | GWR, Seawater Intrusion Barrier | Advanced Water Treatment | 1,100 |
| 4A | Alt 2A (Ag, Potable) & Alt 3A | Partial RO | 1,170: Ag (585) & GWR (585) |
| 4B | Alt 2B (Ag, Total Use) & Alt 3A | Partial RO | 1,170: Ag (585) & GWR (585) |

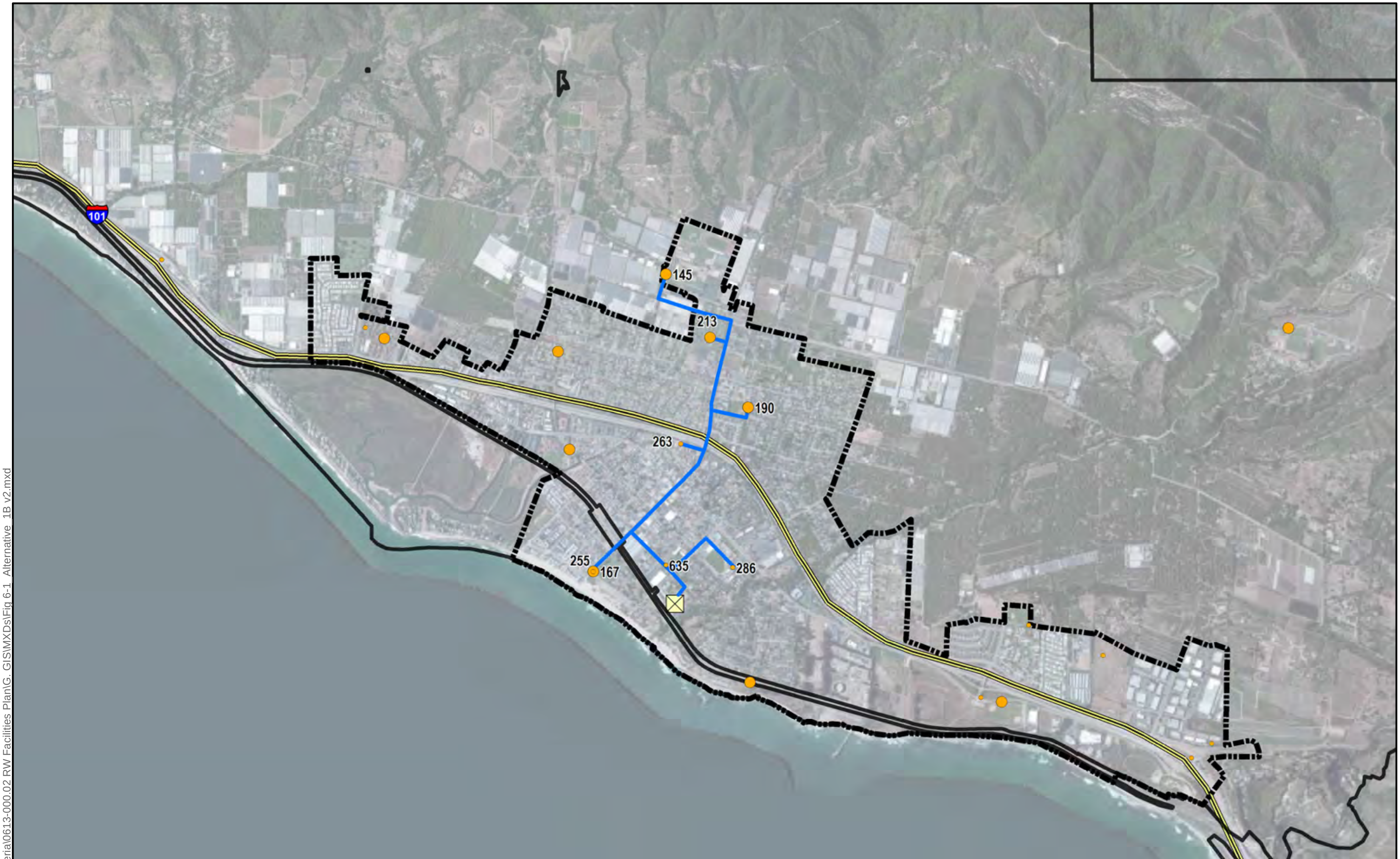
**Alternative 1 (Municipal Irrigation; Tertiary Treatment Only)** options were developed to determine if any feasible projects could be developed with limited investment in treatment. Two tertiary only options were considered. A public fill station (Alt 1A) was considered to represent the minimum initial investment to start a recycled water program. The second option (Alt 1B) focused on public landscape irrigation restricted to parks and schools.

**Alternative 2 (Agricultural Irrigation; Partial RO Treatment)** options were developed to offset some of the largest individual water customers in the area. Since agricultural irrigation is supplied by two primary water sources – CVWD potable water and groundwater – with two distinct supply costs, two agricultural options were developed that focus on potable water offset (Alt 2A) and total water (groundwater and potable) offset (Alt 2B). Municipal Irrigation customers located along pipeline alignments were included in the alternative.

**Alternative 3 (Groundwater Recharge; Partial RO or AWT)** options were developed to utilize the groundwater basin already managed by CVWD and to maximize beneficial reuse of available recycled water. Four options were considered, and three included AWT primarily to avoid the need for diluent water in recharge operations. Alt 3A and 3B entail surface spreading in areas overlying the basin's unconfined zone, Alt 3C entails injecting water inland, and Alt 3D entails injecting water along the coastline in an area with concerns about seawater intrusion. Alt 3A requires recharge of diluent water at the same location as the recycled water recharge.

**Alternative 4** expands the Alt 2 (Agricultural Irrigation) options, which have a large seasonal demand variation. This alternative maximizes beneficial reuse of available recycled water by recharging the groundwater basin when agricultural irrigation demands are lower than available supply, similar to Alt 3A. Partial RO is assumed for agricultural irrigation as is surface spreading (the only recharge method that can use partial RO). Use of partial RO water requires diluent water.

Figures for each of the alternatives are shown on the following pages followed by more detailed descriptions of each alternative.




**RW Demand (AFY)**

1 < x < 5

5 < x < 25

**Other Features**

Alternative 1B Pipeline

Carpinteria WWTP

CVWD Boundary

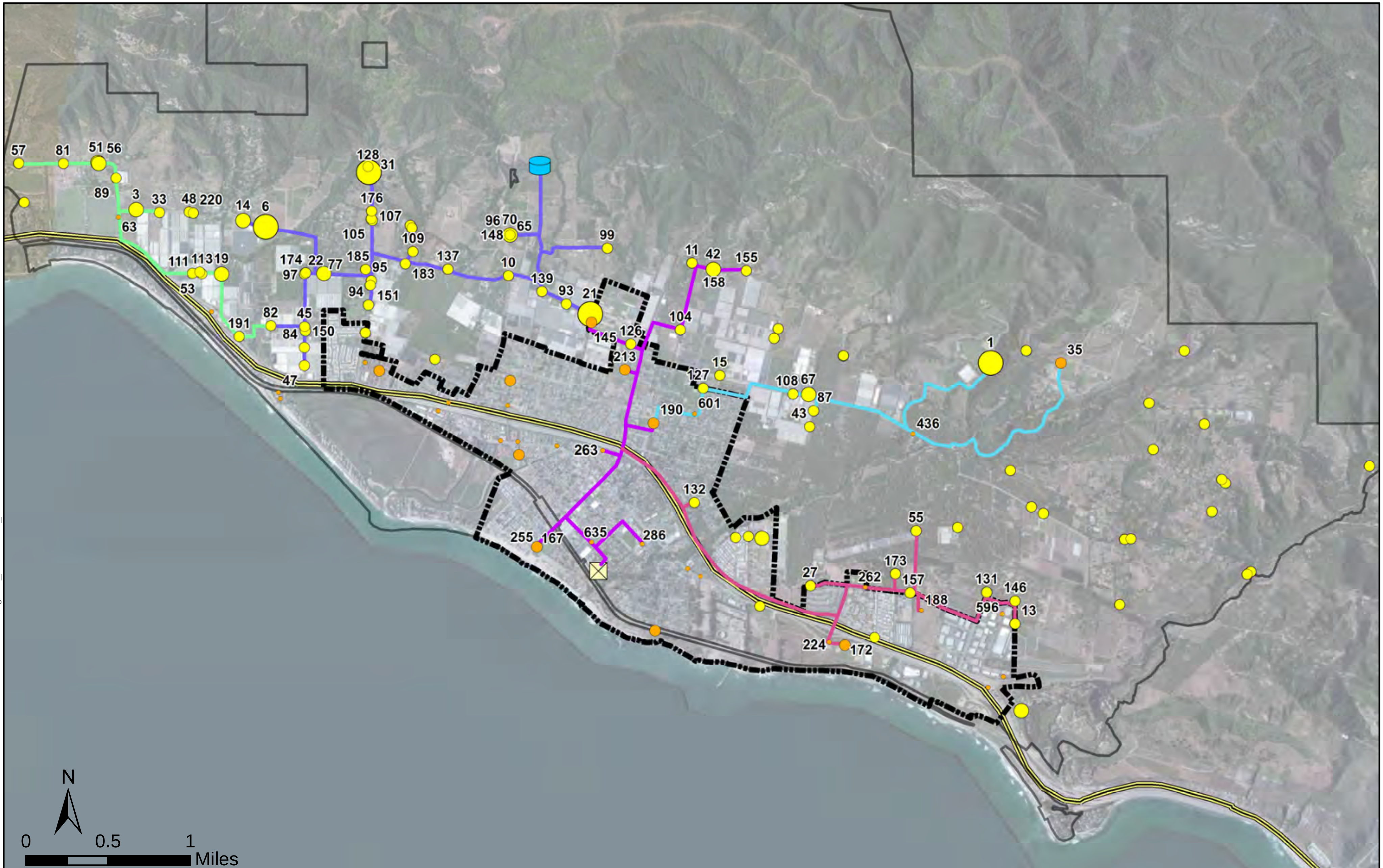
City Boundary

N

0 0.45 0.9 Miles

water and environment

**Figure 6-1: Alternative 1B - Municipal Irrigation**




**RW Demand (AFY)**
- 2 < x < 5*
- 5 < x < 25
- 25 < x < 45
- Greater than 45

**Customer Type**
- Agriculture - Potable Demand
- Municipal

**Alt 2A Phases**
- A
- B
- C
- D
- E

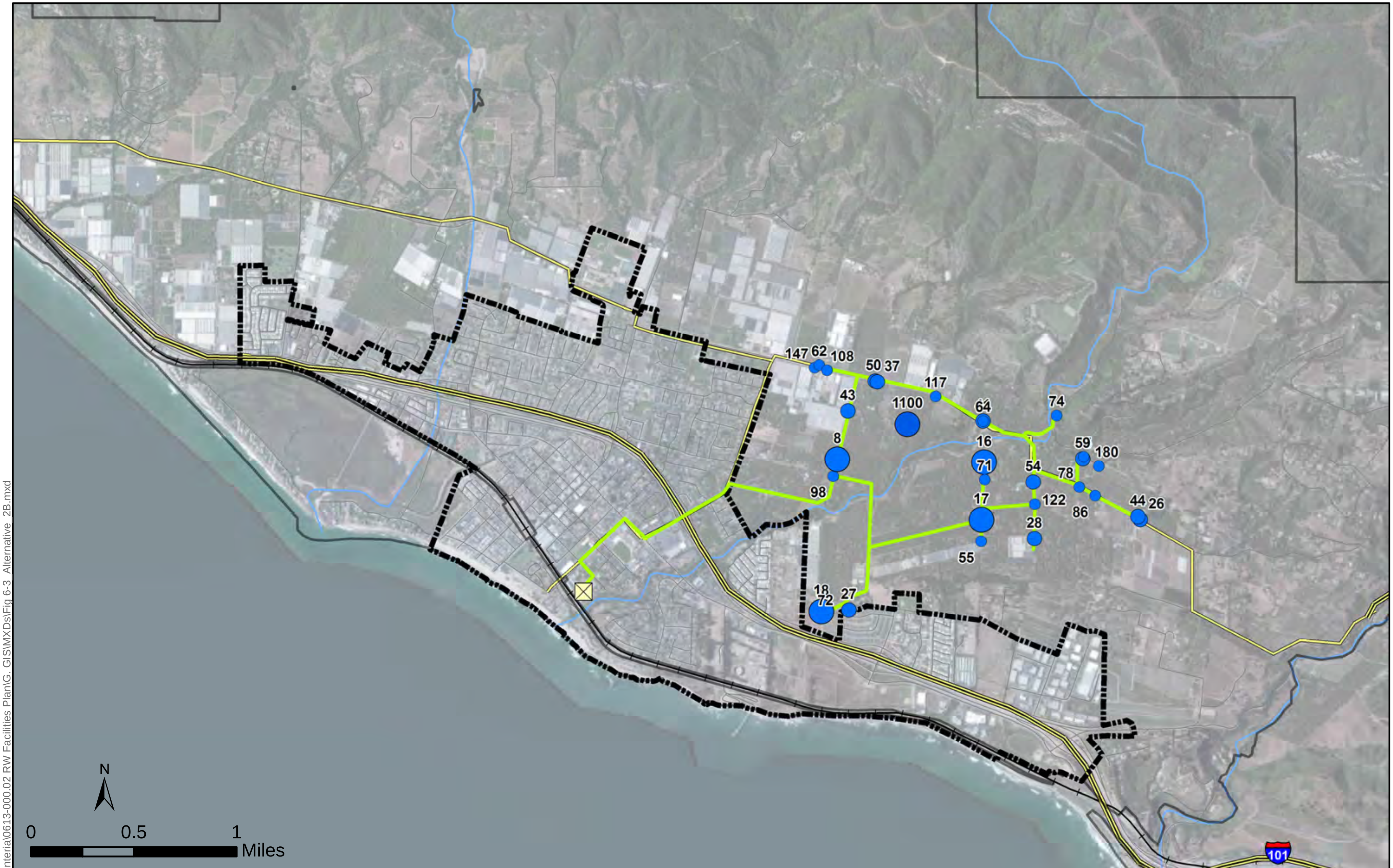
**Other Features**
- Carpinteria WWTP
- Tank
- CVWD Boundary
- City Boundary

*Only Municipal demands shown in this range

RMC water and environment

**Figure 6-2: Alternative 2A - Agricultural Irrigation Potable Offset**

Document Path: L:\Projects\0613 Carpinteria\0613-000.02 RW Facilities Plan\G. GIS\MXDs\Fig 6-2_Alternative_2A.mxd




Groundwater (AFY)
- 5 < x < 25
- 25 < x < 45
- Greater than 45

Other Features
- Alternative 2B Pipeline
- Carpinteria WWTP
- CVWD Boundary
- City Boundary

RMC water and environment

**Figure 6-3: Alternative 2B - Agricultural Irrigation, Groundwater Offset**

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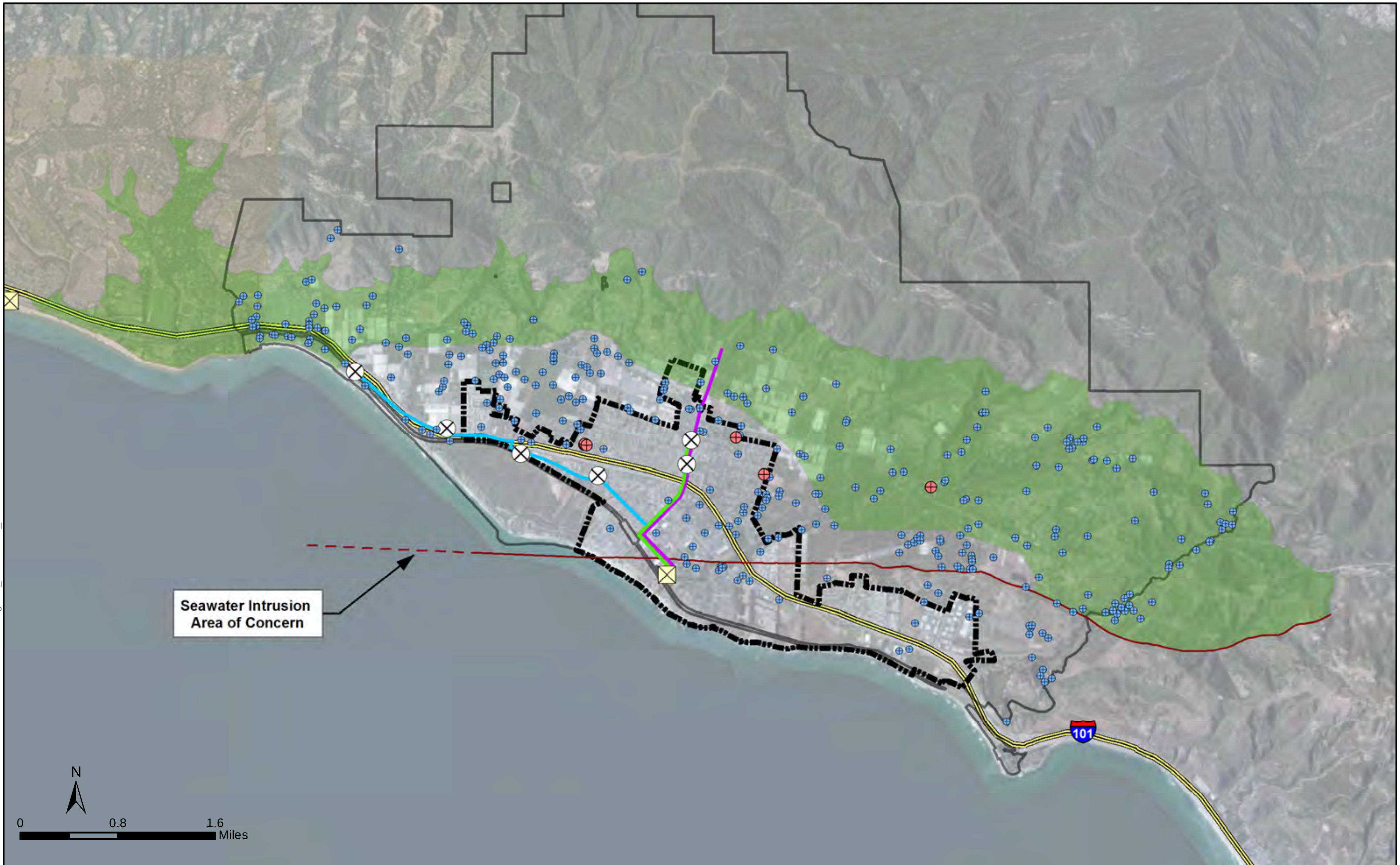


RMC water and environment

**Alternative Pipelines**

- Alternative 3A + 3B
- Alternative 3C
- Alternative 3D

**Other Features**

- Carpinteria WWTP
- CVWD Boundary
- Rincon Fault Thrust Line
- Unconfined Area
- Injection Wells
- CVWD Wells
- Private Wells

**Figure 6-4: Alternative 3 - Groundwater Recharge**

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### 6.2.1 Alt 1A: Municipal Irrigation, Fill Station (Tertiary Only)

Alternative 1A entails construction of a fill station on CSD's property to provide recycled water for internal use by CSD for sewer cleaning, to provide recycled water to rate-payers to supplement landscape irrigation demands, and for dust-control needs specifically for contractors. The alternative includes:

- 0.01 MGD of tertiary filtration and disinfection
- Small pump (5 horsepower [hp])
- Small storage tank (10,000 gallons)
- On-site piping (200 LF)

It is anticipated the fill station will initially offset approximately 10 AFY of potable water use based on use of other fill stations across California in 2014. However, sustained use is difficult to estimate if drought restrictions, pricing, and awareness change in the future.

### 6.2.2 Alt 1B: Municipal Irrigation, Landscape Irrigation (Tertiary Only)

Alternative 1B entails construction of a "purple pipe" distribution system to the largest municipal landscape irrigation customers, including: Carpinteria State Beach, El Carro Park, Carpinteria High School, Carpinteria Middle School, and Main Elementary School. Total estimated demand is 53 AFY. The alternative includes:

- 0.1 MGD of tertiary filtration and disinfection
- Small pump (10 hp)
- 6-inch piping (2.3 miles)
- Crossings: Highway 101 crossing within bridge casing to be installed as part of Caltrans' Linden Ave Interchange Project; Railroad crossing at Linden Ave

Other landscape irrigation demands located adjacent to the alignment, particularly along Linden Ave, could be included in the alternative, especially considering public outreach and water conservation awareness.

### 6.2.3 Alt 2A: Agricultural Irrigation, Potable Offset (Partial RO)

Alternative 2A builds upon Alt 1B through extension of a "purple pipe" distribution system to the largest agricultural irrigation customers based on their use of potable water provided by CVWD. Five phases were defined to serve over 1,500 AFY of demand; however, available supply limits recycled water service to approximately 725 AFY[4], so the phases were evaluated to identify the most cost effective approach as shown in **Table 6-3**. All customers associated with each phase are listed in Appendix A.

**Table 6-3: Summary of Alternative 2A Phases for Evaluation**

| | Capital ($M) | Annualized Capital ($M) | Annual O&M ($M) | Total Annual ($M) | Phase Yield (AFY) | Unit Cost ($/AF) |
|---|---|---|---|---|---|---|
| A | $6.3 | $0.3 | $0.2 | $0.5 | 185 | $2,500 |
| B | $11.7 | $0.5 | $0.5 | $1.0 | 537 | $2,000 |
| C | $5.8 | $0.3 | $0.3 | $0.5 | 266 | $1,900 |
| D | $11.2 | $0.5 | $0.1 | $0.6 | 123 | $5,000 |
| E | $6.8 | $0.3 | $0.2 | $0.5 | 227 | $2,300 |

Note: Refer to Figure 6-2 for phase designations. Phases B, D, and E build off of Phase A. Phase C builds off of Phases A and B.

[4] Refer to Section 3.3 for discussion of seasonal variation in irrigation demands.

Phases A, B, and C include approximately 988 AFY of demand. Approximately 75% of the demand must connect to the system to maximize supplies available (725 AFY), which is reasonable since not all potential customers will elect to connect to the system and the cost of some laterals may not justify connecting the demands. Connecting the large, anchor customers is essential for a successful project. All customers associated with this alternative are listed in Appendix A.

The alternative includes:

- 1.2 MGD of MF and 1.0 MGD of RO to reduce chloride to approximately 100 mg/L and 1.05 mgd disinfection capacity
- Distribution pump station (100 hp)
- 6-inch to 12-inch piping (10.0 miles)
- 0.6 MG storage tank
- Crossings: Highway 101 crossing within bridge casing to be installed as part of Caltrans' Linden Ave Interchange Project; Railroad crossing at Linden Ave; Drainage channel at Foothill Rd

The system is proposed to be operated with an elevated storage tank such that the distribution system pump station at the WWTP can pump at a relatively constant rate over 24 hours. The tank would fill at night when demands are low (since agricultural customers are assumed to primarily operate during the day) and drain during the day to meet customer demands combined with supplies from the pump station. Refer to **Appendix C** for a summary of system hydraulics under maximum day demand conditions.

Implementation of this alternative relies on the anchor agricultural customers committing to use recycled water considering the price and quality of the water. Therefore, if this alternative is preferred, continued outreach to the agricultural customers is essential along with continued monitoring of CSD effluent quality.

### 6.2.4 Alt 2B: Agricultural Irrigation, Groundwater Offset (Partial RO)

Alternative 2B considers recycled water service to agricultural irrigation customers that primarily use groundwater since the locations are closer to the CSD WWTP and, as a result, require less conveyance infrastructure. The alternative captures some of the largest agricultural irrigation customers based on their groundwater use (compared with potable use in Alt 2A).

Approximately 1,050 AFY of potential demand was identified northeast of the CSD WWTP and in the vicinity of Carpinteria Creek. Approximately 70% of the demand must connect to the system to maximize supplies available (725 AFY), which is reasonable since not all potential customers will elect to connect to the system and the cost of some laterals may not justify connecting the demands. Connecting the large, anchor customers is essential for a successful project. All customers associated with this alternative are listed in Appendix A.

The alternative includes:

- 1.2 MGD of MF and 1.0 MGD of RO to reduce chloride to approximately 100 mg/L and 1.05 mgd disinfection capacity
- Distribution pump station (210 hp)
- 6-inch to 12-inch piping (5.7 miles)
- Crossings: Highway 101 crossing within bridge casing to be installed as part of Caltrans' Casitas Pass Rd Interchange Project; Carpinteria Creek crossing channel at Foothill Rd

This alternative does not have an elevated storage tank like Alt 2A due to the lack of suitable elevated areas in the vicinity of the system. As a result, the pump station must meet peak demands without the help of a storage tank, thus the pump station is larger than in Alt 2A (220 hp vs. 100 hp). Also, meeting customer demands as they occur without the benefit a hydraulic buffer that a tank creates could result in more complicated operations and require additional surge relief. Management of customer timing and volume of recycled water use can help to mitigate operational issues. Refer to **Appendix C** for a summary of system hydraulics under maximum day demand conditions.

As with Alt 2A, implementation of this alternative relies on the anchor agricultural customers committing to use recycled water considering the price and quality of the water. Therefore, if this alternative is preferred, continued outreach to the agricultural customers is essential along with continued monitoring of CSD effluent quality.

### 6.2.5 Alt 3A: Groundwater Recharge, Surface Spreading (Partial RO)

Alternative 3A proposes to recharge all available effluent after partial RO treatment (1.05 MGD; 1,170 AFY) via surface spreading in recharge basins overlying the unconfined area of the Carpinteria Groundwater Basin. The alternative includes:

- 1.2 MGD of MF and 1.0 MGD of RO to reduce chloride to approximately 100 mg/L and 1.0 mgd disinfection capacity
- Distribution pump station (80 hp)
- 12-inch piping (1.7 miles)
- 15.4 acres of recharge basins
- Crossings: Highway 101 crossing within bridge casing to be installed as part of Caltrans' Linden Ave Interchange Project

The exact location of potential recharge basins was not evaluated as part of this study since private property would likely need to be purchased. The pipeline alignment in Figure 6-4 was used as a basis to develop the cost estimate, which will help to determine whether to further pursue this alternative. In addition, further hydrogeological investigation would be needed in the proposed recharge area to confirm that the recycled water percolates at an acceptable rate. A percolation rate of 6 inches per day for 1,170 AFY of recycled water and 1,170 AFY of potable water (diluent) was used to estimate the need for 15.4 acres of basins. For the purposes of this analysis a 50/50 blend (50% recycled water and 50% diluent water) is assumed.

### 6.2.6 Alt 3B: Groundwater Recharge, Surface Spreading (AWT)

Alternative 3B proposes to recharge all available effluent after AWT (1.0 MGD; 1,100 AFY) via surface spreading in recharge basins overlying the unconfined area of the Carpinteria Groundwater Basin. The alternative includes:

- 1.2 MGD of AWT influent capacity and 1.0 mgd disinfection capacity
- Distribution pump station (80 hp)
- 12-inch piping (1.7 miles)
- 7.2 acres of recharge basins
- Crossings: Highway 101 crossing within bridge casing to be installed as part of Caltrans' Linden Ave Interchange Project

The exact location of potential recharge basins was not evaluated as part of this study since private property would likely need to be purchased. The pipeline alignment in Figure 6-4 was used as a basis to develop the cost estimate, which will help to determine whether to further pursue this alternative. In addition, further hydrogeological investigation would be needed in the proposed recharge area to confirm that the recycled water percolates at an acceptable rate. A percolation rate of 6 inches per day for 1,100 AFY of recycled water was used to estimate the need for 7.2 acres of basins.

### 6.2.7 Alt 3C: Groundwater Recharge, Inland Injection (AWT)

Alternative 3C proposes to recharge all available effluent after AWT (1.0 MGD; 1,100 AFY; 700 GPM) via injection wells in an inland portion of the Carpinteria Groundwater Basin. The alternative includes:

- 1.2 MGD of AWT influent capacity and 1.0 mgd disinfection capacity
- Distribution pump station (80 hp)
- 12-inch piping (1.1 miles)
- 2 x 450 GPM injection wells
- Crossings: Highway 101 crossing within bridge casing to be installed as part of Caltrans' Linden Ave Interchange Project

As with Alt 3A, the exact location of potential injection wells was not evaluated as part of this study and further hydrogeological investigation would be needed in the proposed recharge area to confirm that the basin can accept recycled water. The pipeline alignment in **Figure 6-4** was used as a basis to develop the cost estimate, which will help to determine whether to further pursue this alternative.

### 6.2.8 Alt 3D: Groundwater Recharge, Seawater Intrusion Barrier (AWT)

Alternative 3D proposes to recharge approximately 1,100 AFY via injection wells along the coastline in an area of concern for seawater intrusion. The alternative includes:

- 1.2 MGD of AWT influent capacity and 1.0 mgd disinfection capacity
- Distribution pump station (80 hp)
- 12-inch piping (2.7 miles)
- 4 x 140 GPM injection wells
- Crossings: Highway 101 trenchless crossing west of Santa Ynez Avenue overpass; Drainage channel at $7^{th}$ St

The general location of the four injection wells is along Carpinteria Ave and Via Real in the vicinity of the Padaro Ln based on input from Pueblo Water Resources (via CVWD). Further hydrogeological investigation is needed to confirm feasibility of the alternative.

In addition, this alternative includes a major trenchless crossing of Highway 101 and represents a large expenditure ($1.1M). Further investigation of trenchless crossing options and associated costs are recommended.

### 6.2.9 Alt 4A: Alt 2A & Alt 3A (Partial RO)

Alternative 4A proposes to combine Alternative 2A (Agricultural Irrigation, Potable Offset) with Alternative 3A (GWR, Surface Spreading) to improve the viability of an agricultural irrigation project by beneficially reusing surplus recycled water via groundwater recharge. The flexibility of delivery to agriculture or recharge of this alternative allows for a more cost effective agricultural irrigation system by allowing for more selective customer connections; this would limit the system's extent since any surplus water could go to recharge. This alternative proposes partial RO treatment compared with full AWT for Alt 3, which results in the need for diluent water. For the purposes of this analysis a 50/50 blend (50% recycled water and 50% diluent water) is assumed. The alternative includes:

- 1.2 MGD of MF and 1.0 MGD of RO to reduce chloride to approximately 100 mg/L and 1.05 mgd disinfection capacity
- Distribution pump station (100 hp)
- 6-inch to 12-inch piping (7.7 miles)
- 0.6 MG storage tank
- 7.7 acres of recharge basins (assuming roughly half of the recycled water is recharged)
- Potable water system turnout by the recharge basins

- Crossings: Highway 101 crossing within bridge casing to be installed as part of Caltrans' Linden Ave Interchange Project; Railroad crossing at Linden Ave; Drainage channel at Foothill Rd

As with Alt 2A, the system is proposed to be operated with an elevated storage tank such that the distribution system pump station at the WWTP can pump at a relatively constant rate over 24 hours. Implementation relies on the anchor agricultural customers committing to use recycled water considering the price and quality of the water. Therefore, if this alternative is preferred, continued outreach to the agricultural customers is essential along with continued monitoring of CSD effluent quality.

As with Alt 3A, the exact location of potential recharge basins was not evaluated as part of this study since private property would likely need to be purchased.

### 6.2.10 Alt 4B: Alt 2B & Alt 3A (Partial RO)

Alternative 4B is similar to Alt 4A but proposes to incorporated Alternative 2B (Agricultural Irrigation, Total Use Offset) instead of Alt 2A. The purpose of considering Alt 2B is to evaluate whether inclusion of groundwater pumpers, that require less distribution system to serve, can improve project cost effectiveness

The alternative includes:

- 1.2 MGD of MF and 1.0 MGD of RO to reduce chloride to approximately 100 mg/L and 1.05 mgd disinfection capacity
- Distribution pump station (210 hp)
- 6-inch to 12-inch piping (5.7 miles)
- Crossings: Highway 101 crossing within bridge casing to be installed as part of Caltrans' Casitas Pass Rd Interchange Project; Carpinteria Creek crossing channel at Foothill Rd
- 7.7 acres of recharge basins (assuming roughly half of the recycled water is recharged)
- Potable water system turnout by the recharge basins
- Crossings: Highway 101 crossing within bridge casing to be installed as part of Caltrans' Linden Ave Interchange Project; Railroad crossing at Linden Ave; Drainage channel at Foothill Rd

As with Alt 2B, the system does not have an elevated storage tank due to the lack of elevated areas in the vicinity of the system. Unlike Alt 2B, the recharge basins may be able to provide some surge relief. Implementation relies on the anchor agricultural customers committing to use recycled water considering the price and quality of the water. Therefore, if this alternative is preferred, continued outreach to the agricultural customers is essential along with continued monitoring of CSD effluent quality.

As with Alt 3A, the exact location of potential recharge basins was not evaluated as part of this study since private property would likely need to be purchased.

## 6.3 Summary of Alternatives

Ten alternatives were defined in the previous section. **Table 6-4** and **Table 6-5** summarize facility and customer information for each alternative.

**Table 6-4: Summary of Alternatives Facilities**

| | Yield (AFY) | Level of Treatment | RW Pump Station (HP) | Distribution System (Miles) | Storage Tank (MG) | Recharge Facilities |
|---|---|---|---|---|---|---|
| 1A | 10 | Tertiary | 5 | 0.04 | 0.01 | |
| 1B | 36 | Tertiary | 10 | 2.3 | -- | |
| 2A | 725 | Partial RO | 100 | 10 | 0.6 | |
| 2B | 725 | Partial RO | 210 | 5.7 | -- | |
| 3A | 1,170 | Partial RO | 50 | 1.7 | -- | 15.4 Acres of Recharge Basins |
| 3B | 1,100 | AWT | 50 | 1.7 | -- | 7.2 Acres of Recharge Basins |
| 3C | 1,100 | AWT | 50 | 1.1 | -- | 2 x 450 GPM Injection Wells |
| 3D | 1,100 | AWT | 50 | 2.7 | -- | 4 x 175 GPM Injection Wells |
| 4A | 1,170 | Partial RO | 100 | 7.7 | 0.6 | 7.7 Acres of Recharge Basins |
| 4B | 1,170 | Partial RO | 210 | 5.7 | -- | 7.7 Acres of Recharge Basins |

**Table 6-5: Summary of Alternatives Customers**

| | Alternative | No. of Municipal Customers | Municipal RW Demand (AFY) | No. of Agricultural Customers | Agricultural RW Demand (AFY) | GWR (AFY) | Total RW Use (AFY) |
|---|---|---|---|---|---|---|---|
| 1A | Municipal, Public Fill Station | N/A | 10 | 0 | 0 | | 10 |
| 1B | Municipal, Large Landscape | 8 | 53 | 0 | 0 | | **53** |
| 2A | Agricultural, Potable Offset | 8 | 53 | 45 | 988 | | **725*** |
| 2B | Agricultural, GW Offset | | | 31 | 1,047 | | **725*** |
| 3A | GWR, Surface Spreading, Partial RO | | | | | 1,170 | **1,170** |
| 3B | GWR, Surface Spreading, AWT | | | | | 1,100 | **1,100** |
| 3C | GWR, Inland Injection | | | | | 1,100 | **1,100** |
| 3B | GWR, Seawater Barrier | | | | | 1,100 | **1,100** |
| 4A | Alt 2A & Alt 3A | 6 | 36 | 30 | 585 | 585 | 1,170 |
| 4B | Alt 2B & Alt 3A | 0 | 0 | 25 | 585 | 585 | **1,170** |

Note: *Total recycled water use for Alt 2A and 2B is limited by available supply rather than the total demand of potential customers. It is assumed that of the total potential agricultural demand, enough customers will connect for a total of 725 AFY of demand.

# 6.4 Cost Estimates

## 6.4.1 Cost Estimating Basis

### Cost Estimate Classification

The Association for Advancement of Cost Estimating International's (AACE) cost estimate classification system includes five classes of project cost estimates. Cost estimates in the RWFP fall within Class 4 estimates, which have an expected accuracy of +50% to -30%. Per AACE (2011): "Class 4 estimates are generally prepared based on limited information and subsequently have fairly wide accuracy ranges. They are typically used for project screening, determination of feasibility, concept evaluation, and preliminary budget approval. Typically, engineering is from 1% to 15% complete and would comprise at a minimum the following: plant capacity, block schematics, indicated layout, process flow diagrams for main process systems, and preliminary engineered process and utility equipment lists."

### Project Unit Costs

Unit costs of the various alternatives will be compared using the equivalent annual cost method. The unit cost is calculated with this method by adding the annual payment for borrowed capital costs to the annual O&M cost and dividing by the annual project yield. This method provides a simple comparison between alternatives in the study. The factors described below are used to calculate the unit cost with the annual payment method.

The economic factors used to analyze the estimated costs for each of the project alternatives are:

- **Cost Basis:** Engineering News Record's (ENR) Construction Cost Index (CCI) for California is used as the common cost basis. The costs in this report reflect the ENR 20 Cities Average CCI for August 2015 of 10,039. The CCI for cost estimates from previous reports was used to escalate those estimates to the CCI applied for this report.
- **Project Financing:** Interest Rate & Payback Period: 3% over 30 years. Based on State Revolving Fund (SRF) loans which have a lower rate and potentially shorter payback period.

### Total Capital Cost Factors

Construction contingency and implementation factors are added to the raw construction costs derived from the unit costs in the previous section.

Construction contingencies are defined as unknown or unforeseen costs. In general, higher contingencies should be applied to projects of high risk or with significant unknown or uncertain conditions. Such unknown and risk conditions for construction cost estimates could include project scope, level of project definition, occurrence of groundwater and associated dewatering uncertainties, unknown soil conditions, unknown utility conflicts, etc. **A 25% contingency will be applied to construction cost estimates based on Class 4 estimates.**

Implementation factors are included to try to capture the entire capital costs associated with the implementation of the project in addition to construction costs. While these costs can vary greatly from project to project and from component to component, it is most common to assume a standard factor applied to the estimated construction costs across all projects and project types when analyzing alternatives and project options. Implementation factors are used to account for the following activities:

- Planning, environmental documentation, and permits
- Engineering services (pre-construction)
- Engineering services during construction
- Construction management and inspection
- Legal and administrative services

For this study, two percentage values of the estimated project construction costs are used to account for these additional services, depending on the type of project. **Landscape and agricultural irrigation projects use a 25% factor, while potable reuse projects use a 35% factor.** The increased factor for potable reuse projects is due to the higher number of studies required for a successful project and the extended implementation timeline from project conception to start-up.

### 6.4.2 Alternatives Cost Estimates

#### Construction and O&M Cost Basis

The following tables present the construction and O&M costs for recycled water system facilities.

**Table 6-6: Unit Costs**

| Facilities | Construction Cost[1] | Notes | O&M Cost |
|---|---|---|---|
| Electricity | -- | | $0.13/kWh |
| **WWTP Treatment Facilities** | | | |
| Tertiary Only | $1.86 / gal capacity | Refer to Table 5-4 | $0.25 / kgal |
| Partial RO | $5.21 / gal capacity | Refer to Table 5-4 | $1.32 / kgal |
| AWT | $6.51 / gal capacity | Refer to Table 5-4 | $2.12 / kgal |
| **Distribution System Facilities** | | | |
| Product Water Pump Station[2] | $6,500 / hp | Based on Peak Flow | 5% of capital cost |
| Pipelines | See Notes ($/LF) | 6” ($150), 8” ($160), 12” ($180), 16” ($200) | 1% of capital cost |
| System Storage | $1.5 / gal | | 5% of capital cost |
| **Customer / Recharge Facilities** | | | |
| Municipal Customer Retrofit | $15,000/ea | Represents average of multiple customers | |
| Agricultural Customer Retrofit | $30,000/ea | Represents average of agricultural customers | |
| Recharge Basins | $15,000/ac | | $5,000/ac |
| Land Purchase | $300,000/ac | For agricultural land | -- |
| Monitoring Wells | $100,000/ea | | 5% of capital cost |
| 8-inch Injection Wells | $0.5 M/ea | | 5% of capital cost |
| 16-inch Injection Wells | $1.5 M/ea | | 5% of capital cost |
| Groundwater Pumping | | | $50 / AF |

Notes:
1. Contingencies and factors presented in the previous section are added to the unit construction costs.
2. Pump station sized based on 75% pump / motor efficiency.

#### Alternatives Cost Estimates

Based on the cost basis assumptions described in the previous section, capital, O&M, and unit cost estimates were developed for each alternative. The estimates are summarized in **Table 6-7** and detailed estimates are included in Appendix D. **Table 6-8** breaks down capital and O&M costs by treatment and distribution and, as expected, Alt 3A/B/C had higher treatment costs due to AWT while Alt 2A/B and 4A/B had the highest capital costs for distribution. **Figure 6-5** breaks down the unit cost between treatment and distribution.

**Table 6-7: Summary of Cost Estimates**

| | Capital ($M) | Annualized Capital ($M) | Annual O&M ($M) | Total Annual ($M) | Project Yield (AFY) | Unit Cost ($/AF) |
|---|---|---|---|---|---|---|
| 1A | $1.0 | $0.05 | $0.03 | $0.08 | 10 | $ 7,800 |
| 1B | $4.1 | $0.18 | $0.07 | $0.25 | 53 | $ 4,660 |
| 2A | $28.3 | $1.26 | $0.53 | $1.79 | 725 | $ 2,470 |
| 2B | $19.7 | $0.88 | $0.44 | $1.32 | 725 | $ 1,820 |
| 3A | $21.4 | $0.96 | $1.12 | $2.07 | 1,170 | $ 1,770 |
| 3B | $20.2 | $0.90 | $0.97 | $1.87 | 1,100 | $ 1,700 |
| 3C | $21.1 | $0.94 | $1.08 | $2.02 | 1,100 | $ 1,840 |
| 3D | $24.7 | $1.10 | $1.10 | $2.20 | 1,100 | $ 2,000 |
| 4A | $31.3 | $1.40 | $0.94 | $2.34 | 1,170 | $ 2,000 |
| 4B | $26.0 | $1.16 | $0.92 | $2.08 | 1,170 | $ 1,780 |

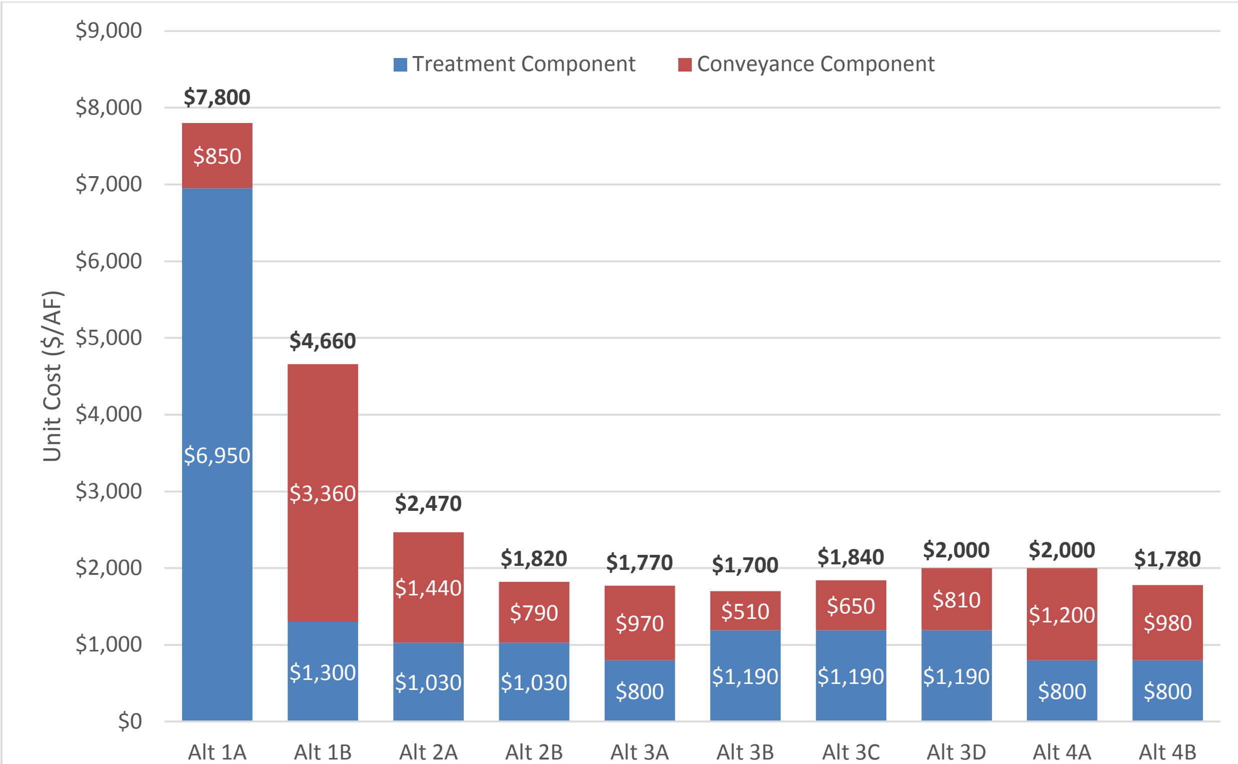
Note: Refer to Appendix D for detailed cost estimates

**Table 6-8: Summary of Cost Estimates, Treatment vs. Distribution Components**

| | Treatment Capital ($M) | Distribution Capital ($M) | Total Capital ($M) | Treatment O&M ($M) | Distribution O&M ($M) | Total O&M ($M) |
|---|---|---|---|---|---|---|
| 1A | $0.9 | $0.15 | **$1.0** | $0.030 | $0.002 | **$0.032** |
| 1B | $0.9 | $3.2 | **$4.1** | $0.03 | $0.04 | **$0.07** |
| 2A | $9.8 | $18.5 | **$28.3** | $0.3 | $0.2 | **$0.5** |
| 2B | $9.8 | $9.9 | **$19.7** | $0.3 | $0.1 | **$0.4** |
| 3A | $9.8 | $11.6 | **$21.4** | $0.5 | $0.6 | **$1.1** |
| 3B | $12.2 | $8.0 | **$20.2** | $0.8 | $0.2 | **$1.0** |
| 3C | $12.2 | $8.9 | **$21.1** | $0.8 | $0.3 | **$1.1** |
| 3D | $12.2 | $12.5 | **$24.7** | $0.8 | $0.3 | **$1.1** |
| 4A | $9.8 | $21.5 | **$31.3** | $0.5 | $0.4 | **$0.9** |
| 4B | $9.8 | $16.2 | **$26.0** | $0.5 | $0.4 | **$0.9** |

Note: Refer to Appendix D for detailed cost estimates

**Figure 6-5: Unit Cost Estimates**




### 6.4.3 Proposition 1 Construction Grant Funding

The Water Quality, Supply, and Infrastructure Improvement Act of 2014 (Proposition 1) included $625 million for grant and low interest financing for water recycling projects to be administered by the SWRCB through the existing Water Recycling Funding Program (WRFP). The WRFP provides funding for the planning, design, and construction of water recycling projects that offset or augment state fresh water supplies (this Facilities Plan is funded by a planning grant). New WRFP Guidelines were finalized in June 2015 that established the requirements to obtain WRFP funding. Recycled water projects may receive grant funds in the amount of up to 35% of actual eligible construction costs incurred up to a maximum of $15 million, including construction allowances. Eligible construction costs include construction management, contingencies, and engineering services during construction.

**Figure 6-6** shows the estimated capital cost reduction from a Proposition 1 construction grant and **Figure 6-7** shows resultant reduced unit cost estimate.

**Figure 6-6: Capital Cost Estimates with Prop 1 Construction Grant Funding (35% of Total)**

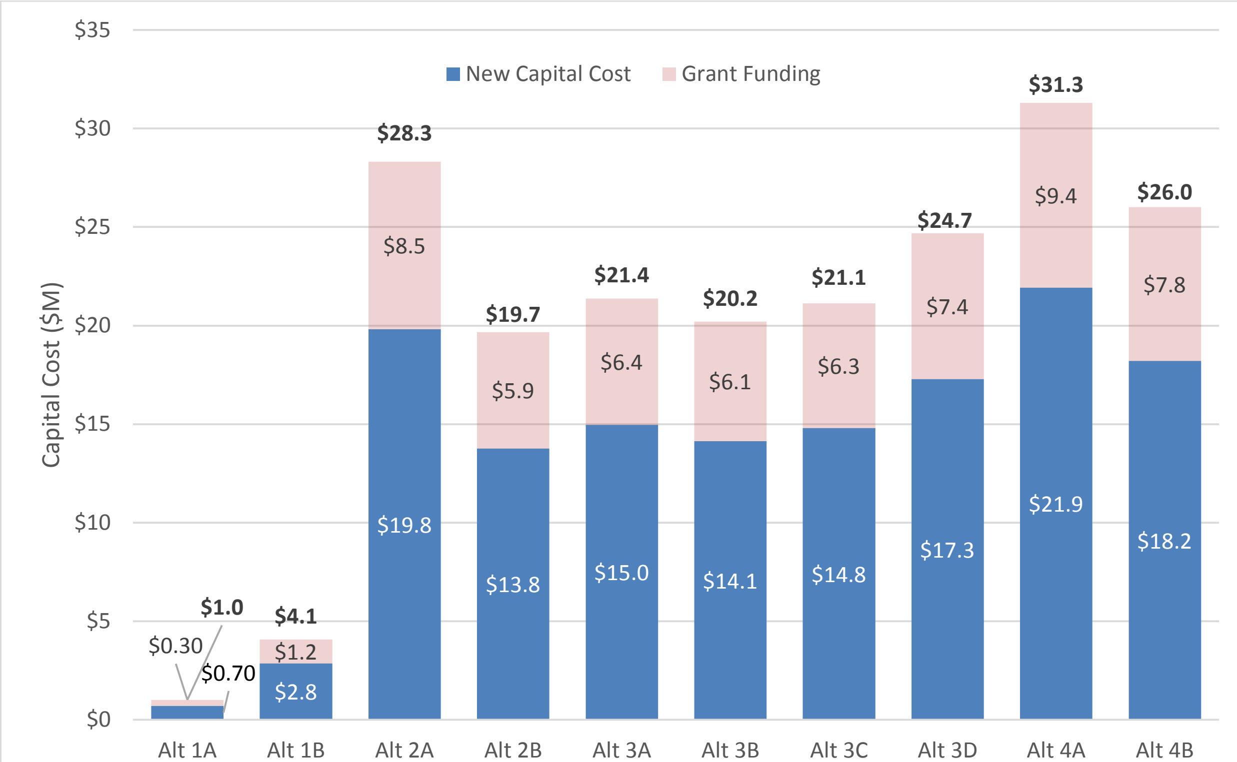
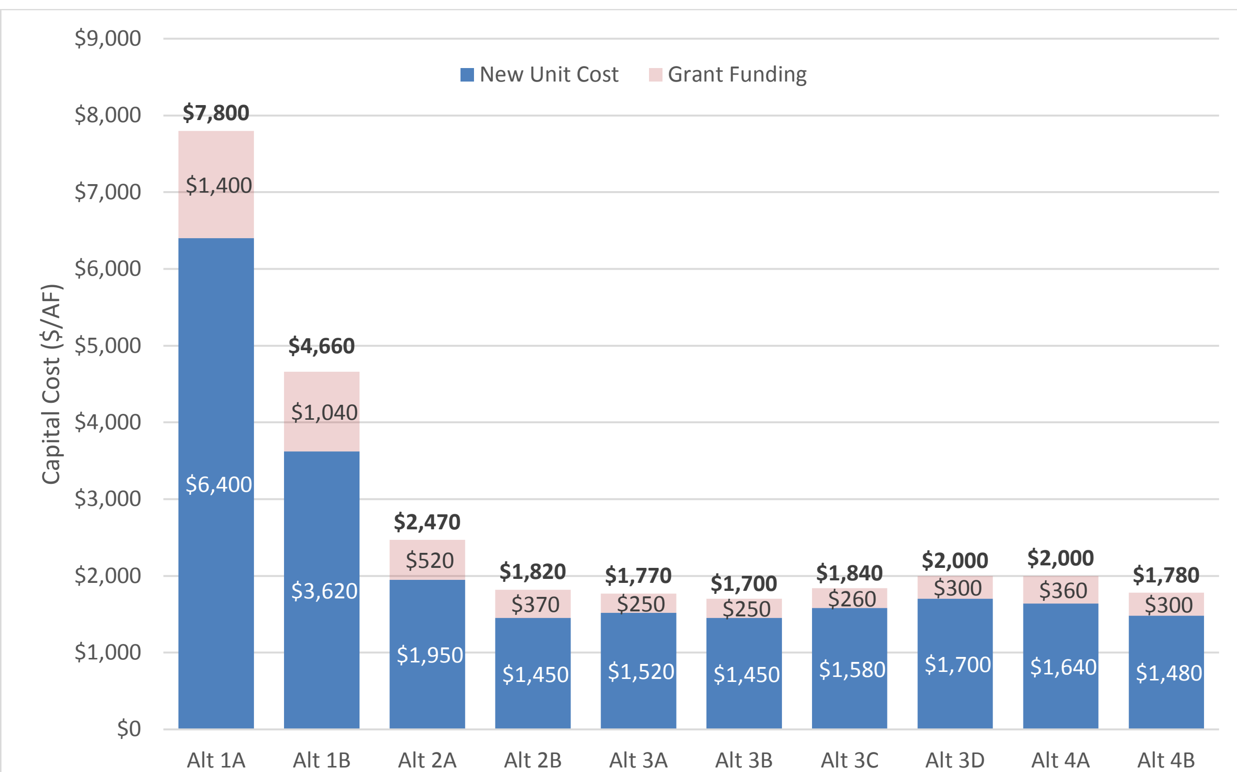



**Table 6-7: Unit Cost Estimates with Prop 1 Construction Grant Funding**



## 6.5 Alternatives Evaluation

The ten alternatives defined in the previous sections cover the three primary markets:

1. Municipal Irrigation (Tertiary Treatment Only)
2. Agricultural Irrigation (Partial RO)
3. Groundwater Recharge (Partial RO or AWT)
4. Hybrid of Agricultural Irrigation and Groundwater Recharge (Partial RO)

### 6.5.1 Unit Cost Comparison

Comparing cost estimates, as shown in **Table 6-9**, Alt 1A and 1B have the highest unit costs followed by Alt 2A and the remaining alternatives have relatively similar unit costs with the level of cost estimating accuracy used in this report. However, each alternative has several non-monetary characteristics to consider, including the mechanism to achieve a water supply benefit. Each alternative will create potable water by either freeing up the existing use of potable water (Alt 1A/1B/2A) or making new water available for pumping from the groundwater basin (Alt 2B and Alt 3 series).

**Table 6-9: Comparison of Unit Costs**

| | Description | Alternative Unit Cost with Grant | Water Supply Benefit Mechanism |
|---|---|---|---|
| 1A | Municipal, Public Fill Station | $6,400 | Potable water offset |
| 1B | Municipal, Large Landscape | $3,620 | Potable water offset |
| 2A | Agricultural, Potable Offset | $1,950 | Potable water offset |
| 2B | Agricultural, Groundwater Offset | $1,450 | Groundwater pumping offset |
| 3A | GWR, Surface Spreading (Partial RO) | $1,520 | Groundwater recharge |
| 3B | GWR, Surface Spreading (AWT) | $1,450 | Groundwater recharge |
| 3C | GWR, Inland Injection | $1,580 | Groundwater recharge |
| 3D | GWR, Seawater Barrier | $1,700 | Groundwater recharge |
| 4A | Alt 2A & Alt 3A | $1,640 | Combination of recharge and pumping offset |
| 4B | Alt 2B & Alt 3A | $1,480 | |

### 6.5.2 Other Considerations

#### Environmental Impacts

All public projects in California must comply with the California Environmental Quality Act (CEQA) unless a project is determined to be exempt. The recommended project would comply with CEQA by completing an environmental impact analysis and defining mitigation measures to address any significant impacts, as described in Section 7.4.6.

When comparing alternatives, there are few differences in potential environmental impacts since most if not all facilities included in each of the alternatives will be constructed in disturbed or impervious areas based on the existing alternative concepts. Also, sensitive areas will be avoided to the greatest extent possible. For example,

- Treatment facilities and recycled water pump station within the existing Carpinteria WWTP footprint.

- Pipelines will be located in public right of way to the greatest extent possible and also likely within paved roads. The agricultural irrigation alternatives (2A, 2B, 4A, 4B) may include pipeline alignments within agricultural land, which is disturbed land.
- Spreading basins in Alternatives 3A, 3B, 4A, and 4B are proposed to be located in available agricultural land due to the lack of open space. The basin footprint could include undisturbed land but existing concepts do not include such land.
- Similarly, but to a much smaller extent, injection well sites in Alternatives 3C and 3D will be located within the City in available areas that are likely to be disturbed or impervious.

Therefore, overall, potential environmental impacts do not significantly differentiate the alternatives.

#### Climate Change

A topic of growing concern for water planners and managers is climate change and the potential impacts it could have on California's future water supplies. Climate change models have predicted that potential effects from climatic changes include: increased temperature, reduction in Sierra Nevada snowpack depth, early snow melt and a rise in sea level.

All of the recycled water options improve the District's climate change resilience by increasing reliance on local supplies with a lower embedded energy than State Water Project supplies and desalination and a supply that is not impacted by changes to temperature, precipitation, and snowpack. The alternatives with higher yield provide a larger environmental protection benefit.

#### State Planning Priorities

California Government Code Section 65041.1 define the State's "planning priorities, which are intended to promote equity, strengthen the economy, protect the environment, and promote public health and safety in the state, including in urban, suburban, and rural communities" and are:

(a) To promote infill development and equity

(b) To protect environmental and agricultural resources

(c) To encourage efficient development patterns

All of the alternatives protect the environment by reducing the use of imported water and reducing ocean discharges. The alternatives with higher yield provide a larger environmental protection benefit. In addition, the agricultural reuse and groundwater recharge alternatives help to protect agricultural resources by providing a long-term, locally controlled, and drought resistant water supply.

### 6.5.3 Market Comparison

#### Municipal Irrigation (Alt 1) Options

The municipal irrigation (Alt 1) options have the highest unit costs but allow for relatively low investment and a relatively low yield. The scale of the investment and yield could be attractive if only 40 AFY of new water supply is desired, compared with 600 AFY to 1,200 AFY from the other alternatives. However, Alt 1 would not work as a first phase towards implementing the other alternatives since the small (0.1 MGD) tertiary filtration package plant assumed could not be scaled up to a 1.2 MGD capacity cost effectively.

Municipal irrigation projects offer a direct water supply benefit by replacing potable water use with non-potable water and the volume of the benefit will be driven by the number of customers ultimately connected.

#### Agricultural Irrigation (Alt 2) Options

The agricultural irrigation (Alt 2) options deliver a similar volume of water but Alt 2B is less expensive than Alt 2A due to a smaller distribution system that is required for offsetting groundwater use demands, which are located in a more concentrated area than potable use demands. A large cost component for both alternatives is for RO treatment of 80 percent of the recycled water to reduce chloride and TDS concentrations to acceptable levels for local crops.

Implementation of a cost effective agricultural irrigation alternative will require willing participation by potential customers, which requires extensive customer outreach regarding recycled water quality, recycled water system operations, conversion requirements and recycled water pricing. For example, potable water customers would be required to disconnect their irrigation systems from the potable system when using recycled water and would have to conduct irrigation operations within a managed timeframe

Alt 2A receives a direct water supply benefit by replacing potable water use with non-potable water. Alt 2B receives a water supply benefit by offsetting groundwater pumping with recycled water and enabling CVWD to pump the offset groundwater. Receiving the groundwater offset benefit requires a legal framework and would be supported by the formation of a Groundwater Sustainability Agency under SGMA.

It should be noted that additional wastewater quality testing is recommended as part of the project implementation plan to be better define existing effluent quality and treatment costs could be reduced

#### Groundwater Recharge (Alt 3) Options

The groundwater recharge (Alt 3) options demonstrate four methods to reliably replenish the groundwater basin and provide groundwater sustainability and management benefits. Of the four options, Alt 3B (Surface Spreading, Full AWT) has the lowest unit cost. In comparison, the slightly lower treatment cost for Alt 3A (Surface Spreading, Partial RO) is more than offset by the need to pump and recharge potable water to provide diluent water. Alt 3C and 3D have slightly higher capital costs than Alt 3B based on injection well costs slightly exceeding the cost to purchase and develop surface spreading basins. Overall, the costs are roughly similar considering the level of cost estimating accuracy for this report.

Defining differentiators between the Alt 3 options will require further investigation into: 1) travel time to the nearest potable wells for all options; 2) the availability and price for land for recharge basins for Alt 3A and 3B; and 3) the need for a seawater intrusion barrier for Alt 3D. Next steps for these items are discussed in Chapter 7.

Most importantly, an institutional and legal framework for a groundwater basin management structure must be in place for CVWD to ensure recovery of recharged water. This framework will be developed during development of a Groundwater Sustainability Agency for the basin under SGMA. The framework could also provide an additional source of funding for all or a portion of the project.

#### Hybrid (Alt 4) Options

The Hybrid (Alt 4) options combined Alt 2 options with Alt 3A to gain water supply benefits from surplus recycled water through recharge. Alt 4A (Alt 2A & Alt 3A) resulted in slightly lower unit costs than Alt 2A. On the other hand, Alt 4B (Alt 2B & Alt 3A) resulted in similar unit costs as Alt 2B but slightly lower unit cost than Alt 3A.

### 6.5.4 Alternatives Comparison

The following conclusions were made when comparing all alternatives:

- **Alt 1 (Municipal Irrigation)** options should not be pursued based on unit costs unless a relatively small new water supply need is identified. It should be noted that potential Alt 1 customers expressed support for converting to recycled water.
- **Alt 2A (Agricultural Irrigation, Potable Offset)** is more expensive than Alt 2B (Agricultural Irrigation, Groundwater Offset) as well as Alt 3 and Alt 4 options. However, potential Alt 2 customers expressed support for converting to recycled water. A portion of the capital cost is

driven by amount of RO required to reduce TDS and chloride concentrations. Alternatives should be reconsidered if subsequent wastewater quality analysis supports reduced treatment needs.

- **Alt 2B (Agricultural Irrigation, Groundwater Offset)** is challenging due to the difficulty of identifying sufficient customers that currently rely mostly on groundwater who would be willing to convert to recycled water. Pricing, water quality, and system operation needs will need to be addressed. Agricultural groundwater pumpers were not a focus of customer outreach in this study. Also, the water supply benefit will be dependent upon actual recycled water used by customers and will require a framework to enable CVWD to pump offset groundwater. Similar to Alt 2A, subsequent wastewater quality analysis could support reduced treatment needs.
- **Alt 3 (Groundwater Recharge)** options have similar costs to Alt 2B while providing a larger and more versatile water supply benefit. Recharge can occur year-round while Alt 2B is limited by seasonal irrigation demand. The key issue for Alt 3 options is the establishment of an institutional and legal framework for a groundwater basin management structure, which would be interrelated with development of a Groundwater Sustainability Agency. In addition, groundwater modeling is required to confirm that project concepts can meet GWR regulations, particularly underground travel time requirements.
- **Alt 3B (GWR, Surface Spreading, Full AWT)** has the lowest unit cost of the Alt 3 options, partially because it avoids the need for diluent water (in Alt 3A) and doesn't include expensive injection wells (Alt 3C and 3D). However, the need for diluent water in other Alt 3 options could be reduced if TOC concentrations are shown to be lower than assumed. It should be noted that land acquisition for recharge basins could be difficult.
- **Alt 3C (GWR, Injection, Full AWT)** allows for the most flexibility in recharge location relative to existing potable wells, which should provide the easiest approach to meeting underground retention time requirements.

## Preferred Project

Overall, groundwater recharge is the preferred project based on competitive costs, maximized water supply benefits, and lower operational complexity compared with an agricultural irrigation system. Alt 3B has the lowest unit cost but feasible implementation may be limited by available sites to construct recharge basins, the ability to meet travel time requirements to potable wells (defined by the GWR regulations), and the ability to confirm whether the District would eventually recapture all recharged water. Alternatively, injection wells (Alt 3C) allow flexibility to place wells in the area of lowest groundwater elevations as well as in an area that is proximate to District wells (but with limited other potable wells in the vicinity), and therefore have a high level of confidence to recapture the water in the future.

In summary, Alt 3B has lower costs but higher risk of not being able to be successfully implemented while Alt 3C has higher costs with a higher likelihood of successful implementation. A hydrogeological investigation must be conducted to evaluate and confirm the assumptions made in the report so that a final preferred alternative can be selected. Therefore, at this time two alternatives, **Alt 3B (GWR, Surface Spreading, Full AWT)** and **Alt 3C (GWR, Injection, Full AWT),** are recommended as the preferred project approach.

A key step to implementation is identifying potential feasible surface spreading and injection sites based on the following considerations:

- Public or potentially available private lands
- Proximity to existing potable wells and travel time estimates to proximate wells
- Percolation rate and injection rate estimates considering long-term recharge operations

Following the results of this assessment, a recharge method and location should be selected. Then implementation of the selected project can proceed.

# Chapter 7 Recommended Project

This chapter describes the Recommended Recycled Water Project (Recommended Project), including descriptions of project facilities, cost estimates, and an implementation plan (including construction financing plan).

## 7.1 Project Description

The Recommended Project, as shown in **Figure 7-1**, entails advanced water treatment (UF/RO/AOP) of effluent from the CSD WWTP for recharge of the Carpinteria Groundwater Basin. The method of recharge will either be surface spreading or direct injection; the preferred method will be determined as the first step in project implementation via recommended groundwater basin and recharge siting studies. **Table 7-1** summarizes the recommended facilities and associated planning-level design criteria.

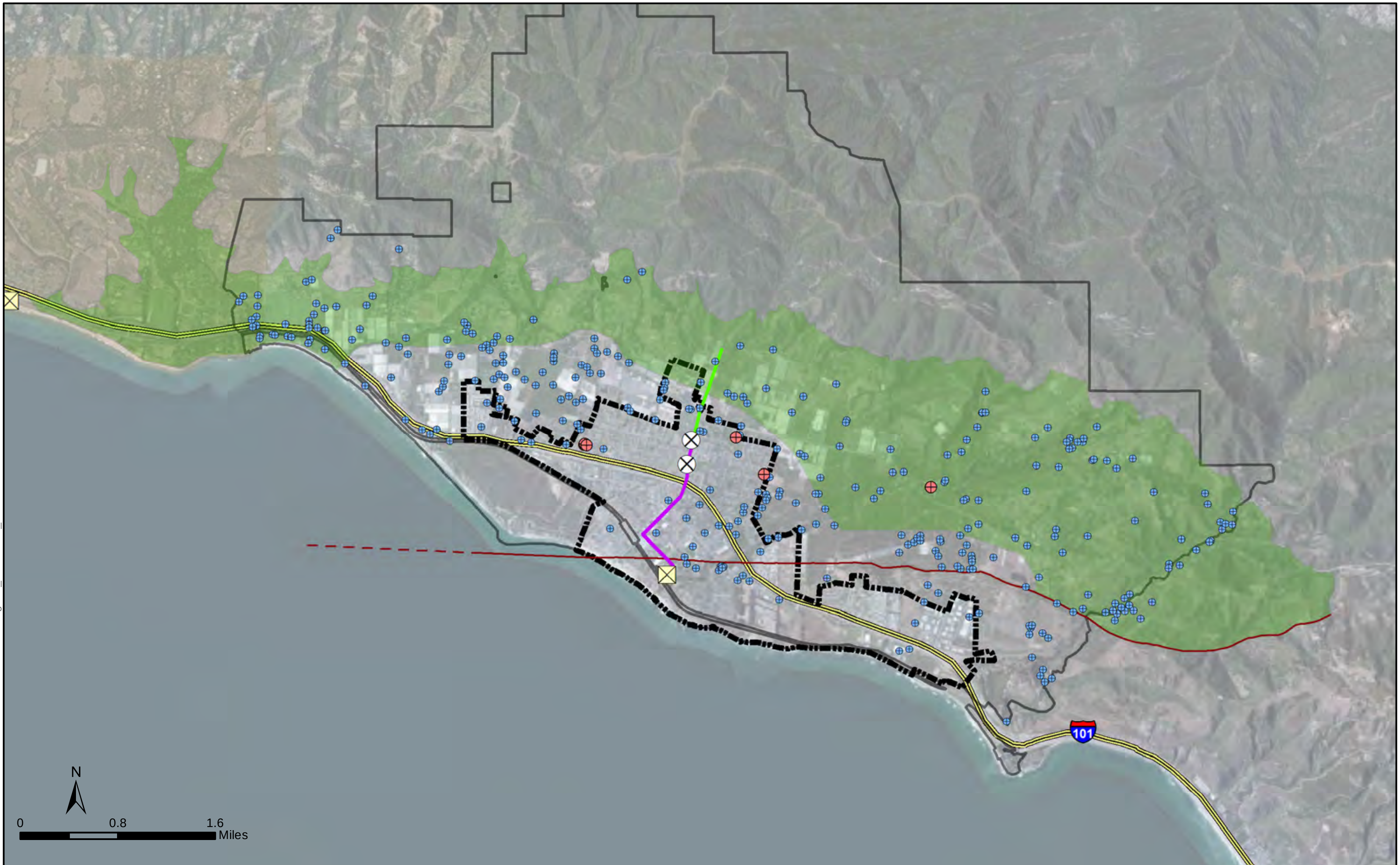
**Table 7-1: Recommended Project Facilities**

| Item | Alt 3B: GWR via Surface Spreading | Alt 3C: GWR via Direct Injection |
|---|---|---|
| Treatment | AWT (UF/RO/AOP)<br>1.2 MGD Capacity<br>1.0 MGD Product Yield (1,100 AFY) | |
| Conveyance | 12-in Pipe, 9,000 LF | 12-in Pipe, 6,000 LF<br>8-in Pipe, 1,000 LF |
| Major Crossings | Hwy 101: Use planned pipe casing to be installed as part of Caltrans' Linden Ave / Casitas Pass Road Interchange Improvement Project | |
| Pump Station | 100 HP, Q = 800 GPM, TDH = 300 ft<br>2 Pumps: 1 Duty, 1 Standby | |
| Recharge Method | 7.2 Acres of Recharge Basins<br>Percolation Rate of 6 Inches per Day | 2 x 16-in Injection Wells<br>450 GPM Capacity |
| Groundwater Wells | Existing District Wells | |
| Monitoring Wells | 3 New Wells | |

The implementation plan (Section 7.4) will lay out the tasks necessary to implement the project. A key next step is identifying potential surface spreading and injection sites based on the following considerations:

- Availability of public or potentially private lands
- Proximity to existing potable wells and travel time estimates to proximate wells
- Percolation rate and injection rate estimates considering long-term recharge operations

Following this evaluation, the type of GWR project and associated facilities will be chosen such that permitting, environmental documentation, funding applications, and facilities design can be initiated. The ultimate recharge site will impact the location and length of conveyance facilities. Also, the recharge efficiency of the recharge basins and injection wells will impact the area required for recharge and the number or size of injection wells.

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RMC water and environment

**Alternative Pipelines**

- Alternatives 3B + 3C
- Alternative 3B only

**Other Features**

- Carpinteria WWTP
- CVWD Boundary
- Rincon Fault Thrust Line

- Unconfined Area
- Injection Wells
- CVWD Wells
- Private Wells

**Figure 7-1: Recommended Project - Groundwater Recharge**

## 7.2 Project Cost

**Table 7-2** and **Table 7-3** summarize the estimated capital cost and O&M cost, respectively, for the Recommended Project. See Appendix D for detailed cost information.

**Table 7-2: Recommended Project - Capital Costs**

| Item | Alt 3B: GWR via Surface Spreading | Alt 3C: GWR via Direct Injection |
|---|---|---|
| Treatment | $7.8 M | $7.8 M |
| Conveyance | $1.6 M | $1.2 M |
| Pump Station | $0.5 M | $0.5 M |
| Recharge Basins or Injection Wells | $0.4 M | $2.8 M |
| Monitoring Wells | $0.3 M | $0.3 M |
| **Construction Subtotal** | **$10.7 M** | **$12.3 M** |
| Construction Contingency (25%) | $2.7 M | $3.1 M |
| **Construction Total** | **$13.4 M** | **$15.4 M** |
| Implementation Costs (35%) | $4.7 M | $5.5 M |
| Land Purchase | $2.2 M | $0.2 M |
| **Total Capital Costs** | **$20.2 M** | **$21.1 M** |

**Table 7-3: Recommended Project - O&M Costs**

| Item | Alt 3B: GWR via Surface Spreading | Alt 3C: GWR via Direct Injection |
|---|---|---|
| Treatment | $0.76 M | $0.76 M |
| Conveyance | $0.01 M | $0.01 M |
| Pump Station | $0.09 M | $0.09 M |
| Recharge Basins | $0.04 M | -- |
| Injection / Monitoring Wells | $0.02 M | $0.16 M |
| Groundwater Pumping | $0.05 M | $0.05 M |
| **Total O&M Costs** | **$0.97 M** | **$1.07 M** |

## 7.3 Comparison with Supply Alternatives

CVWD plans to meet most, if not all, future water demands through increased conservation and is exploring recycled water options as a strategy for meeting existing demands due to increasing unreliability of its surface water supplies and the related potential for water shortages in drought years. If a recycled water project is not implemented, CVWD has limited opportunities to expand existing water supplies:

- Groundwater: Increased pumping likely would cause sustained basin overdraft conditions

- Cachuma Project: The project is fully subscribed and yield has been decreasing due to reservoir siltation and increased requirements for environmental releases. Additional yield from the project is not a viable option.
- State Water Project: The District has existing rights; however, high variability, high water rights acquisition costs, and projected delivery cost increases make further rights acquisition undesirable.

As shown in Table 7-4, the preferred recycled water project has a lower unit cost than the existing cost of State Water Project water. Although the No Project alternatives would avoid potential short-term environmental impacts, such as traffic impacts from construction activities and noise impacts from operation of equipment and vehicles, CVWD still would have potential water shortages in drought years. Other long-term benefits associated with implementing the recycled water project include reduced dependence on surface water supplies, improved water supply reliability, increased local control of supplies, improved groundwater basin management, and increased climate change resiliency.

In addition to existing supplies, a potential new water supply is participation in the expansion of the proposed re-commissioned Santa Barbara Desalination Plant. In July 2015 the Santa Barbara City Council issued a contract to reactivate and operate the Charles E. Meyer Desalination Plant. The City Council awarded IDE Americas, Inc. a design/build/operate contract to re-commission the desalination plant. The plant is scheduled to be in service by September 2016, and will produce 3,125 AFY of potable water. Table 7-4 presents estimated costs for the initial plant size in comparison with Alt 3C (GWR via direct injection).

Participation by CVWD would likely entail an exchange of Cachuma Project water for expanding the desalination plant, rather than direct delivery of the desalinated water. The District could theoretically fund an expansion of the plant beyond the initial planned size of 3,125 AFY in exchange for additional Cachuma Project water. This could be a relatively straightforward exchange since the District already receives their Cachuma water from Santa Barbara's water treatment plant. It should be made clear that CVWD is not pursuing this alternative, but the option provides a reasonable cost comparison with production of recycled water locally, as shown in the sections that follow.

**Table 7-4: Summary of Alternatives Cost Estimates**

| Item | Alt 3C | Existing State Water Project Costs[1] | Santa Barbara Desalination[2] |
|---|---|---|---|
| Yield | 1,100 AFY | 1,450 AFY | 3,125 AFY |
| Capital Cost | $21,100,000 | -- | $55,000,000 |
| Capital Cost with Grant[3] | $14,800,000 | -- | N/A |
| Capital Financing | 2.0% over 30 Years (SRF Loan estimate) | -- | 1.7% over 20 Years (SRF Loan Terms) |
| Capital Payment | $660,000 | $1,100,000 | $3,270,000 |
| Annual O&M Cost | $1,070,000 | $2,800,000 | $4,100,000 |
| Total Annual Cost | $1,730,000 | $3,900,000 | $7,370,000 |
| **Rounded Unit Cost** | **$1,600 / AF** | **$2,700 / AF until 2022[(4)]**<br>**$1,900 / AF after 2022[(4)]** | **$2,400 / AF** |

Notes:
1. Source: CCWA State Water Cost Ten-Year Projections for CVWD for FY 2015/2016 through 2024/2025.
2. Source: www.santabarbaraca.gov/gov/depts/pw/resources/system/sources/desalination.asp
3. Refer to Section 7.5 for further explanation.
4. Final debt payment is in FY 2021/2022. Unit cost is only based on annual O&M cost after FY 21/22.

## 7.4 Project Implementation Plan

Additional technical studies, environmental review, public outreach and regulatory discussion are needed to refine the Recommended Projects concepts and verify economics. The recommended activities would address the following:

- Stakeholder/Public Outreach
- Groundwater Recharge Assessment
- Wastewater Quality Assessment
- Regulatory Activities
- Environmental Documentation
- Engineering, Design, and Construction
- Funding and Financing

The following sections presents a summary of the activities under each category for implementation of the Recommended Project. First, an overall implementation schedule is presented.

### 7.4.1 Implementation Schedule

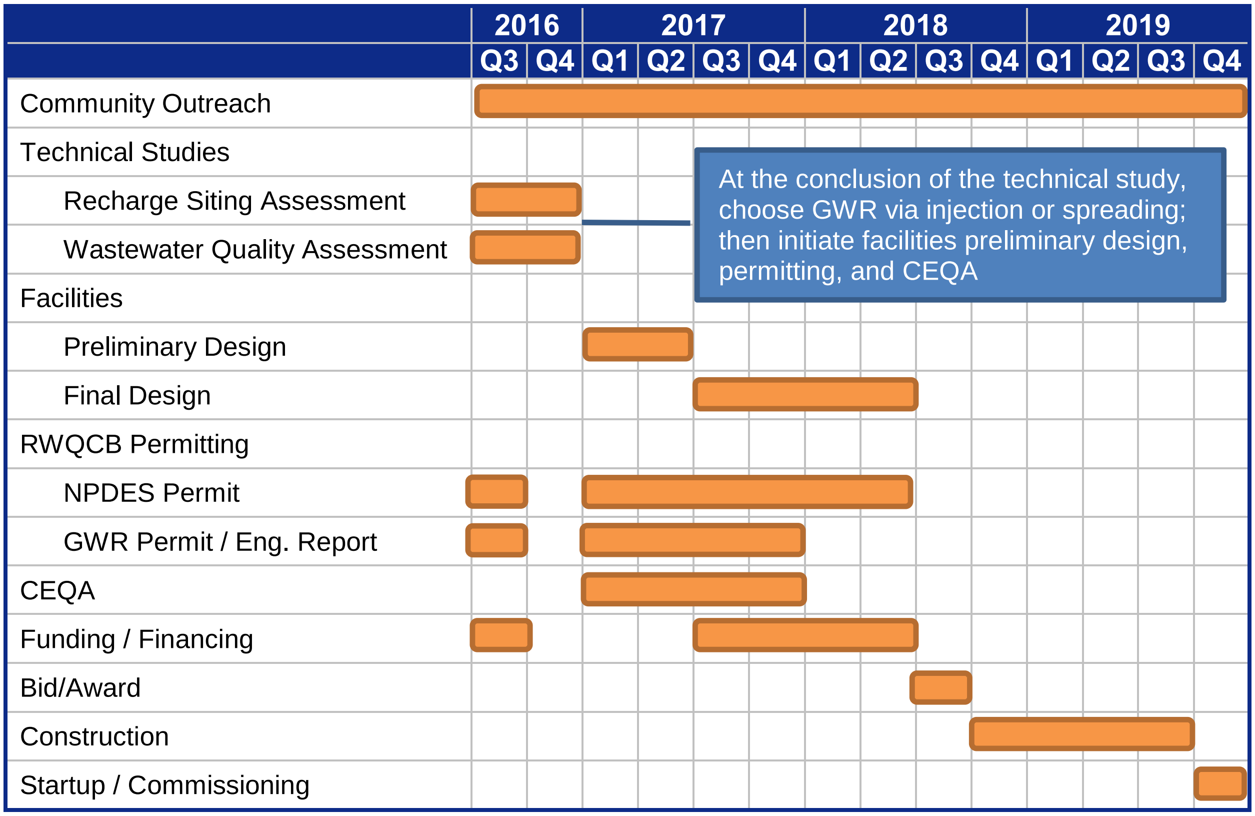
The overall implementation plan for the Recommended Project is shown on **Figure 7-2**. In summary, all the preliminary studies required to further refine the project need to be completed in order to: 1) prepare the Engineering Report for DDW; 2) initiate environmental documentation; and 3) refine project cost estimates. The environmental documentation should be done in parallel with the Engineering Report.

From a project funding and financing perspective, CEQA certification is the critical path for gaining preliminary approval for grant funding and low-interest loans from the SWRCB. From a project start-up perspective, the Engineering Report approval is the critical path for acquiring a recycled water permit from the RWQCB, which is needed prior to start of operations. CEQA certification is also needed before the RWQCB can issue the tentative permit.

Design of the infrastructure improvements would continue after completion of the relevant preliminary studies in coordination with CEQA and permitting efforts. Applications for funding and stakeholder/public outreach efforts would occur over the lifetime of the project. If pilot testing of treatment processes is conducted, it should be done in coordination with public outreach and design efforts

Full implementation of the project is anticipated to take approximately 3.5 years. It should be noted, however, that the schedule for achieving DDW/RWQCB approval would depend on DDW/RWQCB staff work load and the number of issues requiring resolution.

**Figure 7-2: Implementation Schedule for the Carpinteria Groundwater Recharge Project**




### 7.4.2 Stakeholder/Public Outreach

Because the public has often been reluctant to accept potable reuse as a safe, feasible solution, a public information program is an essential element of the project. A public information program includes both outreach and participation, which serve different functions. Outreach is a way of disseminating or collecting information to educate the public; participation implies a means for stakeholders to actively engage in and influence a plan.

Successful IPR projects have a number of characteristics in common:

- They are designed to improve water quality;
- They augment water supplies or prevent seawater intrusion versus being designed to dispose of wastewater;
- They maintain a historical water quality database and conduct research to support success;
- They are managed by agencies with established experience and that have gained the confidence of regulatory authorities.

Thus a program for the project should be initiated early in the planning process and be incorporated into an existing community relations program to reinforce the purpose and need for the project. CVWD should engage with a public outreach consultant to develop an outreach program that is appropriate for Carpinteria. Elements of an outreach program for the project may include:

- **Planning Workshops**: To identify communication goals and objectives for the project, project challenges and opportunities, and key messages and audiences.

- **Purpose and Need Statement**: Review the reason for examining potable reuse and ensure that the purpose and need for the project are clearly and consistently stated. This could be the basis for key messages, informational materials, presentations and all other project communications.
- **Survey:** Conduct a baseline public opinion survey so that perceptions, awareness and knowledge about the District's water supply needs and sources, recycled water and potable reuse can be measured at the very start of the project. Key messages could also be tested to determine if they help respondents understand the project more clearly.
- **Communication Plan**: Develop a strategic communication plan that includes: a situation analysis; project challenges and opportunities; the communication goal and objectives; strategies or a list of how the goals and objectives would be accomplished; and outreach tactics or activities that are the communication tools for carrying out the strategies and meeting the goals or objectives.
- **Informational Materials:** Develop a fact sheet and frequently asked questions document that can be posted on the project or District website and printed for distribution at appropriate locations, including the District offices and at community presentations or events.
- **Website:** Evaluate the need for a separate project website or a page on the District's existing website. Post all information about the potable reuse project on the website.
- **Community Advisory Group**: Consider establishing a community advisory group to work with staff and the project team on an identified task related to the project. This task could be for the community advisory group to review the communication strategies and provide input on additional ways to expand outreach about the project in the service area.

### 7.4.3 Recharge Siting Assessment

#### Preliminary Screening

A preliminary screening of potential surface spreading and injection sites should be conducted to select areas to be included in groundwater modeling. The effort will require selection of the most suitable factors having influence on recharge potential. It is assumed that these factors will likely include vegetation, soils, geology, topography (slopes), flood hazards, environmental impacts, proximity to existing production wells, ownership, and acquisition costs.

A field program could be developed to evaluate recharge potential at the preferred sites. The field program may include exploratory borehole drilling, surface geophysical survey, infiltration rate testing, and/or installation of piezometers.

In addition, an environmental constraints analysis could be performed to identify any fatal flaws or potential major mitigation requirements that might be associated with any of the sites.

- Soils, Geology, Slope Analysis and Groundwater Resources
- Biological Sensitive Lands and Wetlands
- Prehistoric and Historic Sites, Cultural Resources
- Biological Resources
- Hazardous Materials

#### Refined Groundwater Modeling

The model must be sufficiently developed to answer the following four key questions:

- What is the available storage capacity of the Groundwater Basin?
- What are the anticipated travel times of recycled water in the groundwater basin at selected locations, relative to existing production wells?

- What is the ambient groundwater quality?
- Where are potential recharge locations?

The District currently has a calibrated MODFLOW groundwater flow model of the Carpinteria Groundwater Basin. While this model will be used in evaluating potential GWR projects, data contained in the model should be verified by field testing, including soil borings, test wells, installation of piezometers, and subsurface geophysical investigations at the proposed injection well and spreading basin locations.

#### Baseline Groundwater Quality Monitoring

Per the Title 22 Criteria, groundwater quality monitoring would be needed to collect enough data to determine the background water quality in the basin prior to groundwater recharge project startup. Available background water quality data would be collected and presented in the draft Engineering Report.

### 7.4.4 Wastewater Quality Analysis

#### Collection System Source Control Plan Augmentation

The District will be required to conduct an assessment of the fate of DDW specified contaminants through the wastewater and recycled water treatment systems. The constituents are those considered of importance based on industrial discharges to the wastewater system and the source control program inventory of contaminants. These contaminants may include pharmaceuticals, endocrine disruptors, and other wastewater indicator chemicals as specified by DDW based on the review of the Engineering Report. In addition, CSD's existing source control program should be reviewed and augmented as necessary to satisfy the Title 22 Criteria.

A first step in this assessment is analyzing existing effluent for the suite of DDW constituents of concern for GWR permitting.

#### CSD WWTP Secondary Effluent Monitoring and Operation Analysis

CSD WWTP current operational procedures should be reviewed to determine their suitability to support the project. Operational improvement and optimization opportunities should be identified to increase the reliability of the secondary treatment per the Title 22 Criteria. However, the WWTP was recently rehabilitated so limited opportunities for improvement are expected.

#### NPDES Assessment

A preliminary review of existing NPDES permit limits was conducted and the numerical limits were compared with projected effluent quality assuming all available effluent undergoes full advanced treatment. This assumed configuration would generate a concentrated RO brine for disposal that has a similar mass of constituents (compared to current discharges) but with much higher concentrations. The next step in the assessment is review of the California Ocean Plan for potential constituents not currently in the existing NPDES permit, review of other California projects in similar scenarios, and meeting with the Central Coast RWQCB.

#### Salinity Monitoring

The District currently has salinity loadings that are introduced to the wastewater collection system from various sources. A preliminary effluent wastewater quality analysis indicated a TDS concentration of over 1,500 mg/L, which would cause issues for some of the proposed end uses in the expanded recycled water system. Salinity monitoring is a priority due to the treatment cost and operational impacts of effluent with high salinity. As a step toward greater understanding, there are refinements that could be made to the existing water quality monitoring program to better characterize salinity impacts.

The objectives of the salinity monitoring plan are: (1) gain a more thorough assessment of salinity entering and leaving the WWTP; and (2) increase understanding of salinity loadings to the WWTP effluent from the following potential sources:

- Source water
- Residential addition
- Commercial addition
- Industrial addition
- Infiltration and inflow (I&I)
- Wastewater treatment process addition

The first objective may be met by increasing the amount of monitoring performed on influent and effluent flows at the WWTP for TDS, boron, chloride, nitrate, and sodium. This will provide an understanding of TDS concentrations that enter the plant and how they vary on a weekly basis; and it will provide an understanding of the TDS loading contributed by chemical processes within the plant itself.

After improved characterization, the following measures may be considered to more thoroughly characterize salinity in the collection system.

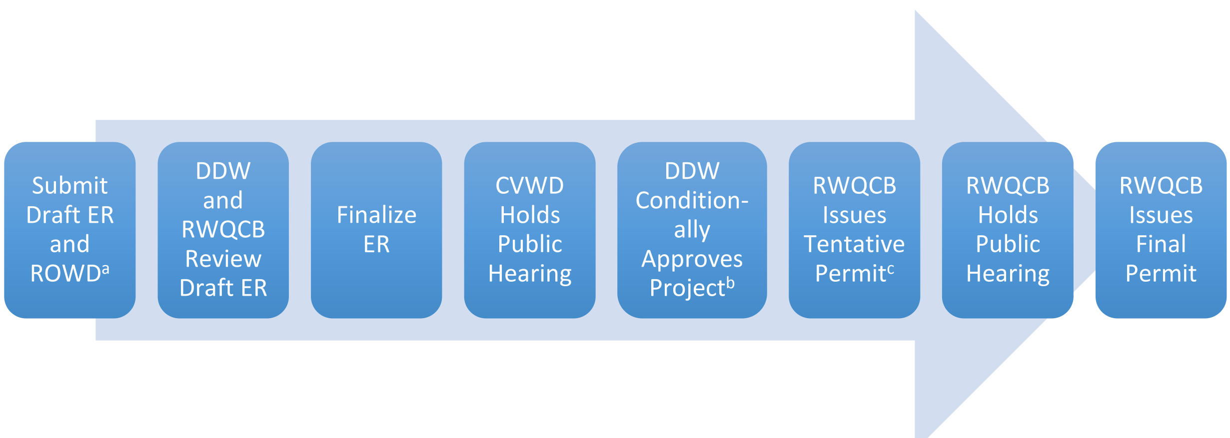
1. Establish a longer-term salinity monitoring plan
2. Regularly monitor source water TDS and consult with the wholesale provider on available TDS data to establish patterns of TDS loading.
3. Monitor industry as part of the source control program
4. Conduct I&I sampling in areas where seawater or brackish water I&I is suspected due to proximity to the ocean.

These measures can be considered after initial sampling results have been obtained and analyzed; a more comprehensive salinity monitoring program can be developed at that time.

### 7.4.5 GWR Permit

Details of the regulatory strategy for the project alternative must be defined. Regulatory oversight of the project is carried out by the DDW and the Central Coast RWQCB. The general responsibilities of each agency through the regulatory approval process are illustrated in **Figure 7-3**.

**Figure 7-3: Regulatory Approval Process**




a. ER – Engineering Report; ROWD – Report of Waste Discharge.
b. The conditional approval may include conditions recommended by DDW for the RWQCB to include in the permit.
c. The CEQA documentation must be certified before the tentative permit is released for public comment.

## Engineering Report

As part of the DDW approval process, the District must submit a draft Engineering Report to DDW and RWQCB. The purpose of the engineering report is to describe how the project would comply with the Title 22 Criteria, the Basin Plan, and SWRCB Plans and Policies. The report would include the following types of information:

- The purpose and goals of the project
- The project participants
- The applicable rules and regulations
- The project facilities
- The industrial pretreatment/source control program
- The chemical quality of the source water (CSD WWTP raw wastewater)
- How compliance with the Title 22 Criteria pathogen control requirements would be achieved
- The proposed response retention time
- The quality of the recycled water and a comparison to Title 22 Criteria
- The proposed initial and maximum recycled water contributions
- A description of the groundwater basin and productions wells
- The results of groundwater modeling showing the travel time to the closest productions wells
- Maps showing the zone of controlled well construction
- An assessment of the project on contaminant plumes and dissolution of naturally occurring contaminants
- An anti-degradation assessment per the Recycled Water Policy
- The proposed monitoring program
- Compliance with the Basin Plan

All the supporting technical studies should be completed in order to prepare the draft Engineering Report. The development of the draft Engineering Report is anticipated to take approximately six months with an additional six months to finalize the report (e.g., addressing DDW and RWQCB comments and revising the text). The actual time necessary for finalizing the report may be shorter or longer depending on the availability of DDW to review the draft report and resolution of regulatory comments on the draft report.

## Public Hearing

Once the report is finalized, the District would schedule a public hearing to receive comments on the project. DDW would attend the hearing. Following the public hearing, depending on the comments received, DDW would send a letter to the RWQCB that conditionally approves the project and recommends that the RWQCB issue a tentative permit. The approval letter may contain conditions that must be implemented (and included in the permit) prior to operation of the project. The time necessary to receive the conditional approval letter is a function of the length of time needed to organize the hearing, DDW availability to participate in the hearing and approve materials to be presented at the hearing, and the time for DDW to issue the approval letter. This overall process is estimated to take about three months.

## RWQCB Permit – Water Recycling Requirements (WRR)

A ROWD for the proposed recycled water recharge is submitted to the RWQCB to initiate the RWQCB permitting process. The ROWD must identify proposed treatment, discharge facilities and operations, and characterize potential impacts on water quality. The ROWD is typically submitted along with the draft Engineering Report.

After DDW has issued its conditional approval letter and after the project's CEQA document is certified, the RWQCB would issue a tentative WDR/WRR. It is also possible to request that the District be given the opportunity to review a pre-public draft of the permit to resolve any significant issues in advance of the public review period. In accordance with the SWRCB Recycled Water Policy, a GWR project that submits a ROWD should be permitted within a year from receipt of DDW conditional approval. Therefore, it would be important to initiate and complete the CEQA process as soon as possible to expedite project permitting. Because the RWQCB agendas are typically full, it would be important to work with the RWQCB well in advance to schedule the tentative permit consideration. It is suggested that this be done when the ROWD is submitted along with the draft Engineering Report. Similar to the DDW review, the District would be actively involved during the review period.

#### Ongoing Regulatory Coordination.

It would be important to begin early and remain engaged with DDW and RWQCB through project permitting and implementation. The DDW process is characterized by ongoing consultation between the project proponent and DDW throughout the project planning, predesign, design, and construction phases. Consultation with the RWQCB should occur both before and after submittal of the ROWD. Pre-submittal consultation is directed toward ensuring that the ROWD is structured to adequately address all RWQCB issues and concerns. Post-submittal consultation may be directed toward addressing subsequent RWQCB questions or requests for additional information. The timing and manner of engagement (e.g., in-person meetings versus conference calls) should be coordinated with the regulators based on their schedules and availability.

#### Salt and Nutrient Management Plan

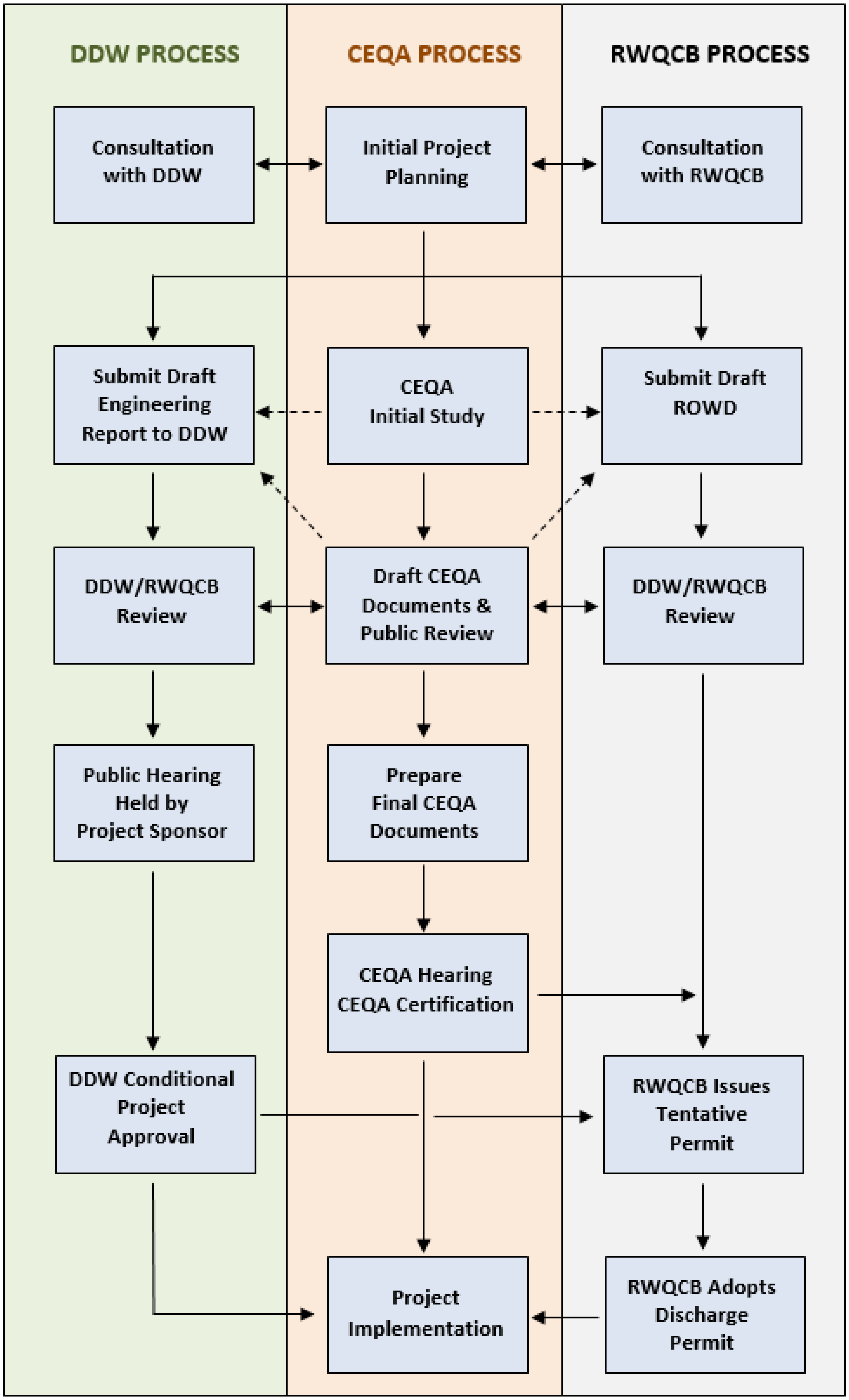
In February 2009, the SWRCB adopted the Recycled Water Policy. The policy addresses the concern for protecting the beneficial uses of groundwater basins by requiring every groundwater basin in California to adopt a Salt and Nutrient Management Plan (SNMP). The policy directs local groundwater managers to address salt and nutrient loading in basins/sub-basins through a collaborative stakeholder process. Before any recycled water projects are permitted and operated, a SNMP will have to be developed using this collaborative process.

### 7.4.6 Environmental Documentation

All public projects in California must comply with the CEQA. If a project is not exempt, CEQA provides for the preparation of an Initial Study (IS) to analyze whether the project would have a significant impact upon the environment. A Negative Declaration/Mitigated Negative Declaration could be issued if the analysis in the IS determines that the project or action, as proposed or as proposed with specific mitigation measures, would not have a significant impact upon the environment. If the analysis in the IS determines that the project or action has the potential to result in a significant impact(s) to the environment, then an Environmental Impact Report (EIR) would need to be prepared to further address such impacts. It is anticipated that the District will need to complete an EIR for the project. In addition to CEQA, a project is subject to National Environmental Policy Act (NEPA) if it is jointly carried out by a federal agency, requires a federal permit, entitlement, or authorization, requires federal funding, and/or occurs on federal land. The SWRCB SRF loan program (see the following section for further discussion) is partially funded by the U.S. Environmental Protection Agency and, as a result, requires additional environmental documentation beyond CEQA – but not as extensive as NEPA – that is referred to as "CEQA-Plus."

While the DDW, CEQA, and RWQCB processes can proceed on somewhat parallel paths, these approval processes are tied together by several critical scheduling nexus points. **Figure 7-4** presents a schematic depicting how the potential CEQA process integrates with the DDW project approval and RWQCB permitting processes. CEQA certification is required prior to RWQCB action to adopt the discharge permit. The RWQCB staff typically defers preparation of the tentative discharge permit until after full CEQA certification has been completed.

**Figure 7-4: Interaction of Environmental and Permitting Processes for Recycled Water GWR Projects**



The environmental review process for the project is anticipated to take about 12 months to complete.

### 7.4.7 Engineering, Design, and Construction Activities

The new facilities for the project were presented in Table 7-1. This section discusses the effort needed to develop and implement the capital improvement projects identified for the project, including AWT, conveyance pump stations, pipelines, injection wells or spreading basins, and monitoring wells.

#### Pre-Design Report

Detailed facilities plans would be prepared for all the new facilities identified for the project, including facilities layouts for the AWT, conveyance pump station, pipeline alignment, and injection wells or spreading basins. The plans would also include revised capital and O&M cost estimates based on vendor quotes and proposals. During pre-design, the conceptual design developed in this report would be further developed, and assumptions would be updated, validated and documented. The draft pre-design report is anticipated to take approximately six months. The conveyance pipeline alignments and injection well or recharge basin siting would be addressed in the pre-design report (i.e., the decision about the method of groundwater recharge will have been decided by this point).

**AWT Pilot Test**

Pilot testing of AWT facilities is common for potable reuse projects across California. Findings from completed pilot tests as well as from several operational AWT facilities provide extensive documentation of treatment performance and understanding of design and operational issues. Since many of the lessons learned are applicable to this project, AWT pilot testing is not considered mandatory but would nonetheless provide the following benefits:

- Supports outreach to the public through tours and media reporting
- Provides operator experience with AWT facility operations
- Demonstrates operator competency to DDW and RWQCB
- Demonstrates removal of constituents unique to Carpinteria setting (if these constituents are detected during effluent water quality testing, as described in Section 7.4.4)
- Allows testing of AWT brine for toxicity to support NPDES permit
- Supports CSD and CVWD institutional cooperation

These benefits must be weighed against the costs to conduct a pilot test. These costs can range from $500,000 to $1.5 million depending on several factors, including the duration of operations, extent of water quality testing, and extent of in-kind services from CSD and CVWD. These costs would be in addition to the estimates included in this report and would represent a roughly 5 percent cost increase overall. Most AWT pilot test efforts are part of much larger projects (100 mgd vs. 1 mgd) where the pilot costs represent less than 1 percent of total project costs. Therefore, at this time, AWT pilot testing is not recommended but should be reconsidered if one or more of the above benefits is determined to be essential to successful project implementation.

#### Final Design

Following preliminary design, design packages would be prepared for the AWT facilities. Design for the injection wells or spreading basins, monitoring wells, and conveyance pipelines could proceed independently of the AWT facility design. The AWT facilities design is expected to be completed within six to ten months. A bid package (after permitting is completed) could be prepared in two months.

#### Bidding/Contract Award, Construction, and Startup

Bidding and contract award would commence once the bid package is complete. These tasks are assumed to take three months. The bidding and contract award period is defined as starting from when the bid package is sent for advertisement to the day that the notice to proceed to the contractor is issued. Construction of the AWT facility, conveyance pipelines, and injection wells or spreading basins is anticipated to take one year. The startup period and final approvals of the AWT facility and overall project are anticipated to take three months.

### 7.4.8 Funding / Financing

A variety of funding opportunities are possible for this project, including the following:

- SWRCB Recycled Water Funding Program
- Integrated Regional Water Management (IRWM) Program Funding
- US Bureau of Reclamation (USBR) Title XVI Funding

Each of these funding opportunities is described in further detail in the following sections.

#### State Water Resources Control Board Recycled Water Funding

The SWRCB administers three types of recycled water funding: recycled water facilities planning grants, construction implementation grants and loans, and clean water state revolving fund loans. Construction grants and loans specific to recycled water programs fall under the Water Recycling Funding Program (WRFP) and follow the clean water state revolving fund policy. Once the Facilities Plan is in place, the District can focus on obtaining grants or low interest loans to cover the construction implementation costs.

**Facility Construction Grants**

The SWRCB currently administers a grants program to cover construction of recycled water facilities. Funding will come from the Proposition 1 bond passed in November 2014 that makes available $725 million for recycled water and desalination projects. At the writing of this plan, it is estimated that $100 million will go towards desalination projects administered through the Department of Water Resources and $625 million will be available through SWRCB for planning and facilities construction grants and low interest loans.

The State Board's Water Recycling Funding Program Guidelines adopted on June 16, 2015, provide a construction grant that will cover 35% of actual eligible construction costs up to $15 million, including construction allowances. Eligible costs include construction allowances which may include engineering during construction, construction management, and contingencies limited to 15% of the construction grant value. To be eligible to receive grant funds, at least a 50% local cost share match must be provided.

**Clean Water State Revolving Fund (CWSRF) Loans**

The SWRCB administers the Clean Water State Revolving Fund (CWSRF) Loan Program. This Program offers low-interest loans to eligible applicants for construction of publicly-owned facilities including wastewater treatment, local sewers, sewer interceptors, water reclamation facilities, and stormwater treatment. Funding under this Program is also available for expanded use projects, including implementation of nonpoint source projects or programs, and development and implementation of estuary comprehensive conservation and management plans.

The process for securing funds includes submitting a CWSRF application, in addition to additional water recycling project-specific application items. CWSRF loans typically have a lower interest rate than bonds, at half of the General Obligation bond (typically 2.5% to 3%, currently 2.1%) at the time of the Preliminary Funding Commitment. Loans are paid back over 20 or 30 years. Annually, the CWSRF program disburses $200 million to $300 million to agencies in California. There is no award maximum, but a maximum allocation of $50 million per year per agency exists. Repayment begins one year after construction is complete. SWRCB funds projects on a readiness-to-proceed basis. The application process can take up to 6 months; SWRCB recommends collecting required information and applying once the draft California

Environmental Quality Act (CEQA) and additional federal requirements (i.e. CEQA Plus) documents, required resolutions, and financial package are completed.

Projects may receive a combination of grant and low interest loan construction financing. The application process for construction grants and loans is the same and involves completion of an application package consisting of four separate sections to document general project information, financial security, technical project information, and environmental documentation and placement on the competitive funding list. More information about the SWRCB CWSRF Program can be found here:
http://www.waterboards.ca.gov/water_issues/programs/grants_loans/srf/srf_forms.shtml

#### Integrated Regional Water Management Program Funding

The IRWM Program, administered by DWR, provides planning and implementation grants to prepare and update IRWM Plans and to implement integrated regional water resources related projects. IRWM program funding is awarded through a competitive grants program, in which approved IRWM Regions submit application packages for funding multiple projects within their regions as a package.

DWR has initiated the process of soliciting proposals for planning grants under Proposition 1 and this will be followed by a solicitation for implementation grants. This project would be eligible for an implementation grant so the District should continue engagement with the IRWM program and monitor the grant development schedule. Additional information about the IRWM grant program can be accessed here: http://www.water.ca.gov/irwm/grants/index.cfm

#### US Bureau of Reclamation Title XVI – Grant Funding

Processed through the US Bureau of Reclamation (USBR), the Title XVI grant program is focused on identifying and investigating opportunities for water reclamation and reuse. Funding is made available for the planning, design, and construction of water recycling treatment and conveyance facilities and is structured to cover up to 25% of the total project costs (up to $20 million), with project proponents contributing 75% or more of total project costs. Proposal requirements include technical and budgetary components, as well as a completed Title XVI Feasibility Study, which must be submitted to USBR for review and approval. While compliance with the National Environmental Policy Act (NEPA) is not required during the proposal phase, it is required prior to the receipt and expenditure of Federal funds. Additionally, in order to be eligible to receive Title XVI funding, a project must be congressionally authorized.

Based on communication with USBR staff, USBR may replace the grant program with a low-interest (1 percent), 30-year loan program. Alternatively, it may create a joint-grant and loan program. The timing or certainty of these changes are currently unknown. More information is available from USBR's website here: http://www.usbr.gov/lc/socal/titlexvi.html/

### 7.4.9 Institutional Activities

#### Carpinteria Sanitary District Partnership

A strong working relationship between the wastewater and water agencies is an essential component of a successful recycled water project when the services are provided by separate agencies. The CSD produces the water that will enter the AWTF for purification and may operate the AWTF as well. Consistent, high quality WWTP effluent is important for successful AWTF operations. In addition, ongoing coordination is required between WWTP, AWTF, and recharge (injection wells or spreading basins) operations to ensure reuse is maximized with limited interruptions.

#### Groundwater Plans

Carpinteria Groundwater Basin must comply with the Sustainable Groundwater Management Act (SGMA). In fact, formation of a Groundwater Sustainability Agency (GSA) for the Carpinteria Basin, development of basin governance, and development of a Groundwater Sustainability Plan (GSP) will support GWR project implementation.

**Groundwater Sustainability Plan**

The Carpinteria Groundwater Basin is not an adjudicated groundwater basin and has been classified as a low priority groundwater basin under the SGMA. While not mandated by SGMA, the District is presently considering participating in the SGMA process. Concurrent to the Work Plan development, the District intends to work towards being the designated GSA for the Carpinteria Basin and to develop the needed basin governance and GSP. Water rights coordination would also be considered during the SGMA-related work.

**Groundwater Management Plan**

The District is in the process of updating its Groundwater Management Plan (GWMP). As part of this plan, activities would be completed to comply with the California Statewide Groundwater Elevation Monitoring program and other monitoring requirements in the Carpinteria Basin per existing groundwater regulations. The GWMP would address both the ability to control drilling in the Title 22 Criteria zone of controlled well construction, and the ability to charge a replenishment fee should new wells be drilled that would extract recharged purified water. In addition, a pumping assessment fee can be added after implementation of an IPR project since others besides the District use the Carpinteria Basin. The District will seek to update the GWMP such that it is compliant with the requirements for a GSP under SGMA.

## 7.5 Construction Financing and Revenue Plan

**Table 7-5** summarizes project funding and financing assumptions. The District intends to fund pre-construction planning tasks with available funds, construction costs with a SWRCB WRFP grant, and the balance of capital costs with a low-interest SRF loan. As shown in the table, the District must generate at least $1.7 million dollars per year in revenue and/or avoided existing costs to ensure SRF loan payback and sufficient O&M funding. The annual payment results in a unit cost for water at this feasibility level of $1,600/AF with a Proposition 1 grant and a low-interest SRF loan.

**Table 7-5: Construction Financing and Revenue Plan Basis**

| Item | | Notes |
|---|---|---|
| Construction Cost | $15,650,000 | Refer to Table 7-2 |
| Implementation Tasks | $5,480,000 | 35% of construction costs |
| **Total Capital Cost** | **$21,130,000** | |
| | | |
| Eligible Capital Cost for Prop 1 Grant Funding | $18,000,000 | Construction cost plus 15% for CM, ESDC, etc. |
| | | |
| Prop 1 Grant Amount | $6,330,000 | 35% of eligible capital costs |
| Capital Cost for SRF Financing | $14,800,000 | Remaining capital costs |
| **Total Capital Cost** | **$21,130,000** | |
| | | |
| SRF Annual Payment | $660,000 | SRF financing at 2.0% over 30 Years |
| Annual O&M | $1,070,000 | Refer to Table 7-3 |
| **Total Annual Cost** | **$1,730,000** | |
| Annual Yield | 1,100 AF | |
| **Unit Cost w/ Grant Funding** | **$1,600/AF** | |

## 7.6 Conclusions

The Carpinteria Valley Water District partnered with the Carpinteria Sanitary District, City of Carpinteria, and SWRCB to prepare a recycled water facilities plan for the Carpinteria valley to explore recycled water options due to increasing unreliability of its surface water supplies and the related potential for water shortages in drought years.

The Facilities Plan considered use of recycled water for landscape irrigation, agricultural irrigation, and groundwater recharge. Groundwater recharge with full advanced water treatment (MF/RO/AOP) was selected as the preferred use of recycled water based on:

- Maximizing available water for reuse (versus seasonal use with irrigation)
- Allows use of new water supply at its highest and best use (potable use)
- Leverages existing facilities – primarily the groundwater basin and District wells
- Provides ability to store supplies on a multi-year basis to be used in years with low surface water deliveries
- Provides ancillary groundwater basin benefits, such as higher groundwater levels and lower risk of seawater intrusion
- Full AWT is only incrementally more expensive than the 80 percent RO option, which is the minimum treatment needed to meet water quality requirements for agricultural irrigation or groundwater recharge
- Full AWT avoids the need for diluent water for recharge, which can be expensive and unreliable

By implementing a groundwater recharge with recycled water project, the District can reduce its dependence on surface water – which has high variability and increasing costs – with a locally controlled and drought proof water supply.

A key step to implementation is identifying potential feasible surface spreading and injection sites. Following the results of this assessment, a recharge method and location should be selected. Then implementation of the selected project can proceed.

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# Appendix A - Customer List and Alternative’s Customers

**Alternative 1B: Municipal Irrigation**

| ID | Root | Name | All Values in AFY | | |
|---|---|---|---|---|---|
| | | | Historical Potable Use | Potable Conversion Factor | Non-Potable Use Estimate |
| 145 | 169031 | Carpinteria High School | 22 | 100% | 22 |
| 167 | 169043 | Tomol Park | 6 | 100% | 6 |
| 190 | 169023 | Carpinteria Family School | 7 | 100% | 7 |
| 213 | 134756 | HOA | 7 | 100% | 7 |
| 255 | 169004 | Carpinteria State Beach (West Side) | 7 | 50% | 4 |
| 263 | 157741 | HOA | 3 | 100% | 3 |
| 286 | 169059 | Carpinteria Middle School | 6 | 50% | 3 |
| 635 | 169007 | Main Elementary School | 2 | 100% | 2 |
| | | | **60** | | **53** |

## Alternative 2A: Agricultural & Municipal Irrigation, Potable Use Offset

| ID | Root | Name | All Values in AFY | | | | |
|---|---|---|---|---|---|---|---|
| | | | Historical Use | | | Est. Non-Potable Use | |
| | | | Potable | Ground-water | Total | Potable Offset | Total Offset |
| **Phase A** | | | | | | | |
| 11 | 180365 | Avocado | 14 | 49 | 63 | 14 | 63 |
| 21 | 180576 | Avocado | 53 | 0 | 53 | 53 | 53 |
| 42 | 180370 | Avocado | 29 | 0 | 29 | 29 | 29 |
| 73 | 180372 | Avocado | 4 | 15 | 19 | 4 | 19 |
| 85 | 180357 | Nursery | 5 | 14 | 19 | 5 | 19 |
| 104 | 180358 | Nursery | 10 | 7 | 16 | 10 | 16 |
| 126 | 180583 | Avocado | 5 | 0 | 5 | 5 | 5 |
| 145 | 169031 | Carpinteria High School | 22 | 0 | 22 | 22 | 22 |
| 155 | 180369 | Avocado | 8 | 0 | 8 | 8 | 8 |
| 158 | 180368 | Other | 7 | 0 | 7 | 7 | 7 |
| 167 | 169043 | Tomol Park | 6 | 0 | 6 | 6 | 6 |
| 190 | 169023 | Carpinteria Family School | 7 | 0 | 7 | 7 | 7 |
| 203 | 180577 | Other | 4 | 0 | 4 | 4 | 4 |
| 255 | 169004 | Carpinteria State Beach (West Side) | 7 | 0 | 7 | 7 | 7 |
| 286 | 169059 | Carpinteria Middle School | 6 | 0 | 6 | 6 | 6 |
| 353 | 169019 | Carpinteria Community Pool | 3 | 0 | 3 | 3 | 3 |
| 536 | 169006 | California Dept/Parks | 2 | 0 | 2 | 2 | 2 |
| | | **Subtotal Phase A (AFY):** | **191** | **85** | **276** | **191** | **276** |
| **Phase B** | | | | | | | |
| 6 | 180477 | Field Crops / Mixed Crops | 69 | 0 | 69 | 69 | 69 |
| 10 | 180555 | Nursery | 23 | 40 | 62 | 23 | 62 |
| 14 | 180475 | Nursery | 35 | 33 | 68 | 35 | 68 |
| 22 | 180402 | Nursery | 28 | 24 | 52 | 28 | 52 |
| 31 | 180506 | Avocado | 49 | 0 | 49 | 49 | 49 |
| 45 | 180396 | Nursery | 15 | 16 | 32 | 15 | 32 |
| 47 | 180391 | Nursery | 10 | 22 | 32 | 10 | 32 |
| 65 | 180600 | Avocado | 17 | 14 | 31 | 17 | 31 |
| 70 | 180601 | Other | 26 | 0 | 26 | 26 | 26 |
| 77 | 180403 | Other | 17 | 0 | 17 | 17 | 17 |
| 82 | 180407 | Other | 19 | 0 | 19 | 19 | 19 |
| 84 | 180394 | Nursery | 20 | 0 | 20 | 20 | 20 |
| 93 | 180575 | Other | 17 | 0 | 17 | 17 | 17 |
| 94 | 180527 | Nursery, Cemetery | 13 | 2 | 16 | 13 | 16 |
| 95 | 180523 | Nursery | 13 | 5 | 18 | 13 | 18 |
| 97 | 180400 | Avocado | 9 | 4 | 13 | 9 | 13 |
| 99 | 180569 | Other | 15 | 0 | 15 | 15 | 15 |
| 105 | 180495 | Lemons | 8 | 9 | 17 | 8 | 17 |
| 107 | 180494 | Avocado | 13 | 0 | 13 | 13 | 13 |
| 109 | 180513 | Other | 12 | 0 | 12 | 12 | 12 |
| 128 | 180509 | Other | 13 | 0 | 13 | 13 | 13 |
| 137 | 180517 | Other | 11 | 0 | 11 | 11 | 11 |
| 139 | 180573 | Other | 17 | 0 | 17 | 17 | 17 |
| 148 | 180603 | Other | 9 | 0 | 9 | 9 | 9 |
| 150 | 180395 | Other | 10 | 0 | 10 | 10 | 10 |
| 151 | 180524 | Avocado | 5 | 0 | 5 | 5 | 5 |
| 152 | 115582 | Other | 1 | 0 | 1 | 1 | 1 |
| 165 | 180563 | Other | 5 | 0 | 5 | 5 | 5 |
| 174 | 180399 | Other | 7 | 0 | 7 | 7 | 7 |
| 176 | 180497 | Other | 9 | 0 | 9 | 9 | 9 |
| 183 | 180522 | Other | 6 | 0 | 6 | 6 | 6 |
| 185 | 180490 | Other | 7 | 0 | 7 | 7 | 7 |

| ID | Root | Name | All Values in AFY | | | | |
|---|---|---|---|---|---|---|---|
| | | | Historical Use | | | Est. Non-Potable Use | |
| | | | Potable | Ground-water | Total | Potable Offset | Total Offset |
| 192 | 180559 | Other | 3 | 0 | 3 | 3 | 3 |
| 198 | 180498 | Other | 4 | 0 | 4 | 4 | 4 |
| 199 | 180565 | Other | 3 | 0 | 3 | 3 | 3 |
| | | **Subtotal Phase B (AFY):** | **537** | **170** | **706** | **537** | **706** |
| | | **Total (Phase A and Phase B):** | **728** | **255** | **982** | **728** | **982** |
| **Phase C** | | | | | | | |
| 3 | 180450 | Avocado | 34 | 53 | 88 | 34 | 88 |
| 19 | 180413 | Avocado | 33 | 16 | 49 | 33 | 49 |
| 33 | 180455 | Nursery | 19 | 6 | 26 | 19 | 26 |
| 51 | 180439 | Avocado | 27 | 0 | 27 | 27 | 27 |
| 53 | 180417 | Nursery | 24 | 0 | 24 | 24 | 24 |
| 56 | 92401 | Turfgrass | 28 | 0 | 28 | 28 | 28 |
| 57 | 180427 | Avocado | 21 | 0 | 21 | 21 | 21 |
| 63 | 92441 | Polo Club | 11 | 22 | 33 | 11 | 33 |
| 81 | 180434 | Other | 18 | 0 | 18 | 18 | 18 |
| 89 | 180445 | Nursery | 11 | 5 | 16 | 11 | 16 |
| 111 | 180418 | Other | 11 | 0 | 11 | 11 | 11 |
| 113 | 180416 | Other | 16 | 0 | 16 | 16 | 16 |
| 191 | 180409 | Other | 9 | 0 | 9 | 9 | 9 |
| 195 | 180440 | Other | 4 | 0 | 4 | 4 | 4 |
| | | **Subtotal Phase C (AFY):** | **266** | **103** | **370** | **266** | **370** |
| **Phase D** | | | | | | | |
| 13 | 170037 | Avocado | 24 | 0 | 24 | 24 | 24 |
| 27 | 170075 | Avocado | 12 | 31 | 43 | 12 | 43 |
| 55 | 170156 | Avocado | 10 | 14 | 25 | 10 | 25 |
| 131 | 170049 | Avocado | 12 | 0 | 12 | 12 | 12 |
| 132 | 170079 | Avocado | 6 | 3 | 10 | 6 | 10 |
| 138 | 170154 | Avocado | 4 | 1 | 6 | 4 | 6 |
| 146 | 170044 | Other | 6 | 0 | 6 | 6 | 6 |
| 157 | 170064 | Other | 9 | 0 | 9 | 9 | 9 |
| 162 | 170155 | Avocado | 4 | 3 | 6 | 4 | 6 |
| 172 | 169060 | Viola Baseball Field | 13 | 0 | 13 | 13 | 13 |
| 173 | 170068 | Other | 11 | 0 | 11 | 11 | 11 |
| 188 | 157275 | HOA | 3 | 0 | 3 | 3 | 3 |
| 224 | 169028 | Caltrans | 4 | 0 | 4 | 4 | 4 |
| 262 | 169048 | Monte Vista Park | 6 | 0 | 6 | 6 | 6 |
| 325 | 157150 | HOA | 1 | 0 | 1 | 1 | 1 |
| | | **Subtotal Phase D (AFY):** | **123** | **53** | **176** | **123** | **176** |
| **Phase E** | | | | | | | |
| 1 | 170144 | Avocado | 63 | 92 | 155 | 63 | 155 |
| 35 | 92392 | Cate School | 82 | 0 | 82 | 82 | 82 |
| 41 | 170145 | Avocado | 5 | 26 | 31 | 5 | 31 |
| 58 | 170110 | Avocado | 2 | 21 | 23 | 2 | 23 |
| 67 | 170126 | Other | 26 | 0 | 26 | 26 | 26 |
| 87 | 170096 | Other | 22 | 0 | 22 | 22 | 22 |
| 108 | 170125 | Nursery | 8 | 6 | 15 | 8 | 15 |
| 127 | 170089 | Other | 15 | 0 | 15 | 15 | 15 |
| 184 | 170140 | Other | 3 | 0 | 3 | 3 | 3 |
| | | **Subtotal Phase E (AFY):** | **227** | **145** | **372** | **227** | **372** |
| | | **Grand Total (AFY):** | **1,344** | **556** | **1,900** | **1,344** | **1,900** |

**Alternative 2B: Agricultural Irrigation, Groundwater Use Offset**

| ID | Root | Name | All Values in AFY | | |
|---|---|---|---|---|---|
| | | | Potable Use | GW Use | Total Use |
| 8 | 170093 | Avocado | 1 | 58 | 59 |
| 17 | 170153 | Avocado | 1 | 51 | 51 |
| 16 | 170148 | Avocado | 1 | 51 | 51 |
| 18 | 170076 | Nursery | 3 | 49 | 51 |
| 26 | 180343 | Avocado | 7 | 41 | 49 |
| 28 | 146117 | Avocado | 1 | 39 | 40 |
| 36 | 71955 | Avocado | 0 | 34 | 34 |
| 37 | 170127 | Avocado | 1 | 32 | 32 |
| 27 | 170075 | Avocado | 12 | 31 | 43 |
| 44 | 180342 | Avocado | 2 | 29 | 31 |
| 50 | 146108 | Avocado | 0 | 28 | 28 |
| 43 | 170095 | Avocado | 5 | 27 | 32 |
| 41 | 170145 | Avocado | 5 | 26 | 31 |
| 59 | 170181 | Avocado | 0 | 26 | 26 |
| 54 | 170169 | Avocado | 1 | 25 | 26 |
| 62 | 170124 | Avocado | 3 | 24 | 27 |
| 64 | 170146 | Avocado | 3 | 23 | 26 |
| 72 | 170074 | Avocado | 0 | 21 | 21 |
| 71 | 170149 | Avocado | 0 | 21 | 21 |
| 75 | 170184 | Avocado / Cate School | 0 | 20 | 20 |
| 74 | 170159 | Avocado / Cate School | 1 | 20 | 21 |
| 78 | 180350 | Avocado | 0 | 20 | 20 |
| 86 | 180347 | Avocado | 1 | 17 | 19 |
| 98 | 170092 | Avocado | 0 | 16 | 16 |
| 55 | 170156 | Avocado | 10 | 14 | 25 |
| 115 | 170084 | Avocado | 1 | 12 | 13 |
| 117 | 170142 | Avocado | 1 | 12 | 13 |
| 122 | 170176 | Avocado | 1 | 12 | 12 |
| 147 | 170123 | Nursery | 0 | 8 | 8 |
| 108 | 170125 | Nursery | 8 | 6 | 15 |
| 180 | 170180 | Avocado | 1 | 5 | 6 |
| 1100 | - | Parcel without an account | 0 | 40 | 40 |
| | | **Total:** | **69** | **838** | **907** |

**Potential Customer List, Agricultural Customers (Total > 5 AFY)**

| ID | Root | Name | All Values in AFY | | |
|---|---|---|---|---|---|
| | | | Potable Use | GW Use | Total Use |
| 1 | 170144 | Avocado | 63 | 92 | 155 |
| 2 | 170165 | Avocado | 1 | 126 | 127 |
| 3 | 180450 | Avocado | 34 | 53 | 88 |
| 4 | 170119 | Avocado | 4 | 64 | 68 |
| 5 | 170241 | Avocado | 11 | 62 | 73 |
| 6 | 180477 | Field Crops / Mixed Crops | 69 | 0 | 69 |
| 7 | 180516 | Avocado | 0 | 58 | 59 |
| 8 | 170093 | Avocado | 1 | 58 | 59 |
| 9 | 170260 | Avocado | 4 | 53 | 57 |
| 10 | 180555 | Nursery | 23 | 40 | 62 |
| 11 | 180365 | Avocado | 14 | 49 | 63 |
| 12 | 170139 | Avocado | 3 | 52 | 55 |
| 13 | 170037 | Avocado | 24 | 0 | 24 |
| 14 | 180475 | Nursery | 35 | 33 | 68 |
| 15 | 180353 | Nursery | 6 | 51 | 57 |
| 16 | 170148 | Avocado | 1 | 51 | 51 |
| 17 | 170153 | Avocado | 1 | 51 | 51 |
| 18 | 170076 | Nursery | 3 | 49 | 51 |
| 19 | 180413 | Avocado | 33 | 16 | 49 |
| 20 | 180535 | Nursery | 9 | 41 | 50 |
| 21 | 180576 | Avocado | 53 | 0 | 53 |
| 22 | 180402 | Nursery | 28 | 24 | 52 |
| 23 | 180310 | Avocado | 10 | 25 | 35 |
| 24 | 170003 | Golf / Field Crops | 25 | 25 | 50 |
| 25 | 180476 | Avocado | 3 | 41 | 44 |
| 26 | 180343 | Avocado | 7 | 41 | 49 |
| 27 | 170075 | Avocado | 12 | 31 | 43 |
| 28 | 146117 | Avocado | 1 | 39 | 40 |
| 29 | 180586 | Avocado | 1 | 38 | 40 |
| 30 | 170161 | Avocado | 22 | 24 | 47 |
| 31 | 180506 | Avocado | 49 | 0 | 49 |
| 32 | 170243 | Avocado | 1 | 37 | 37 |
| 33 | 180455 | Nursery | 19 | 6 | 26 |
| 34 | 180545 | Avocado | 1 | 35 | 36 |
| 36 | 071955 | Avocado | 0 | 34 | 34 |
| 37 | 170127 | Avocado | 1 | 32 | 32 |
| 38 | 180590 | Avocado | 2 | 25 | 27 |
| 39 | 170163 | Avocado | 4 | 19 | 23 |
| 40 | 170239 | Avocado | 5 | 27 | 32 |
| 41 | 170145 | Avocado | 5 | 26 | 31 |
| 42 | 180370 | Avocado | 29 | 0 | 29 |
| 43 | 170095 | Avocado | 5 | 27 | 32 |
| 44 | 180342 | Avocado | 2 | 29 | 31 |
| 45 | 180396 | Nursery | 15 | 16 | 32 |
| 46 | 180570 | Avocado | 4 | 28 | 32 |
| 47 | 180391 | Nursery | 10 | 22 | 32 |
| 48 | 180456 | Nursery | 10 | 26 | 36 |
| 49 | 170024 | Other | 28 | 0 | 28 |
| 50 | 146108 | Avocado | 0 | 28 | 28 |
| 51 | 180439 | Avocado | 27 | 0 | 27 |
| 52 | 170047 | Lemons | 3 | 26 | 29 |
| 53 | 180417 | Nursery | 24 | 0 | 24 |
| 54 | 170169 | Avocado | 1 | 25 | 26 |

| ID | Root | Name | All Values in AFY | | |
|---|---|---|---|---|---|
| | | | Potable Use | GW Use | Total Use |
| 55 | 170156 | Avocado | 10 | 14 | 25 |
| 56 | 092401 | Turfgrass | 28 | 0 | 28 |
| 57 | 180427 | Avocado | 21 | 0 | 21 |
| 58 | 170110 | Avocado | 2 | 21 | 23 |
| 59 | 170181 | Avocado | 0 | 26 | 26 |
| 60 | 124091 | Avocado | 2 | 24 | 25 |
| 61 | 170283 | Avocado | 3 | 20 | 23 |
| 62 | 170124 | Avocado | 3 | 24 | 27 |
| 64 | 170146 | Avocado | 3 | 23 | 26 |
| 65 | 180600 | Avocado | 17 | 14 | 31 |
| 66 | 170261 | Avocado | 1 | 22 | 23 |
| 67 | 170126 | Other | 26 | 0 | 26 |
| 68 | 180463 | Avocado | 4 | 19 | 24 |
| 69 | 180580 | Nursery | 4 | 18 | 22 |
| 70 | 180601 | Other | 26 | 0 | 26 |
| 71 | 170149 | Avocado | 0 | 21 | 21 |
| 72 | 170074 | Avocado | 0 | 21 | 21 |
| 73 | 180372 | Avocado | 4 | 15 | 19 |
| 74 | 170159 | Avocado / Cate School | 1 | 20 | 21 |
| 75 | 170184 | Avocado / Cate School | 0 | 20 | 20 |
| 76 | 170246 | Avocado | 2 | 16 | 18 |
| 77 | 180403 | Other | 17 | 0 | 17 |
| 78 | 180350 | Avocado | 0 | 20 | 20 |
| 79 | 180556 | Avocado | 2 | 18 | 20 |
| 80 | 170116 | Nursery | 7 | 12 | 19 |
| 81 | 180434 | Other | 18 | 0 | 18 |
| 82 | 180407 | Other | 19 | 0 | 19 |
| 83 | 180541 | Nursery | 4 | 19 | 23 |
| 84 | 180394 | Nursery | 20 | 0 | 20 |
| 85 | 180357 | Nursery | 5 | 14 | 19 |
| 86 | 180347 | Avocado | 1 | 17 | 19 |
| 87 | 170096 | Other | 22 | 0 | 22 |
| 88 | 180546 | Avocado | 0 | 18 | 18 |
| 89 | 180445 | Nursery | 11 | 5 | 16 |
| 90 | 170133 | Other | 19 | 0 | 19 |
| 91 | 105156 | Horse Facilities | 20 | 1 | 21 |
| 92 | 092384 | Other | 12 | 0 | 12 |
| 93 | 180575 | Other | 17 | 0 | 17 |
| 94 | 180527 | Nursery, Cemetery | 13 | 2 | 16 |
| 95 | 180523 | Nursery | 13 | 5 | 18 |
| 96 | 180602 | Nursery | 6 | 15 | 21 |
| 97 | 180400 | Avocado | 9 | 4 | 13 |
| 98 | 170092 | Avocado | 0 | 16 | 16 |
| 99 | 180569 | Other | 15 | 0 | 15 |
| 100 | 170266 | Nursery | 3 | 6 | 9 |
| 101 | 180374 | Nursery | 3 | 13 | 15 |
| 102 | 180525 | Nursery | 2 | 14 | 15 |
| 103 | 082080 | Other | 16 | 0 | 16 |
| 104 | 180358 | Nursery | 10 | 7 | 16 |
| 105 | 180495 | Lemons | 8 | 9 | 17 |
| 106 | 170160 | Avocado | 2 | 11 | 13 |
| 107 | 180494 | Avocado | 13 | 0 | 13 |
| 108 | 170125 | Nursery | 8 | 6 | 15 |
| 109 | 180513 | Other | 12 | 0 | 12 |
| 110 | 180346 | Other | 16 | 0 | 16 |
| 111 | 180418 | Other | 11 | 0 | 11 |

| ID | Root | Name | All Values in AFY | | |
|---|---|---|---|---|---|
| | | | Potable Use | GW Use | Total Use |
| 112 | 180521 | Avocado | 2 | 13 | 15 |
| 113 | 180416 | Other | 16 | 0 | 16 |
| 114 | 180528 | Nursery | 6 | 10 | 16 |
| 115 | 170084 | Avocado | 1 | 12 | 13 |
| 116 | 170248 | Avocado | 14 | 0 | 14 |
| 117 | 170142 | Avocado | 1 | 12 | 13 |
| 118 | 170191 | Avocado | 9 | 6 | 16 |
| 119 | 170249 | Other | 10 | 0 | 10 |
| 120 | 180557 | Avocado | 2 | 11 | 12 |
| 121 | 180359 | Nursery | 3 | 10 | 13 |
| 122 | 170176 | Avocado | 1 | 12 | 12 |
| 123 | 092393 | Other | 15 | 0 | 15 |
| 124 | 180542 | Avocado | 4 | 7 | 11 |
| 125 | 170118 | Other | 5 | 0 | 5 |
| 126 | 180583 | Avocado | 5 | 0 | 5 |
| 127 | 170089 | Other | 15 | 0 | 15 |
| 128 | 180509 | Other | 13 | 0 | 13 |
| 129 | 180571 | Avocado | 0 | 11 | 11 |
| 130 | 170043 | Avocado | 2 | 9 | 11 |
| 131 | 170049 | Avocado | 12 | 0 | 12 |
| 132 | 170079 | Avocado | 6 | 3 | 10 |
| 133 | 180447 | Avocado | 1 | 10 | 11 |
| 134 | 170078 | Other | 25 | 0 | 25 |
| 135 | 170117 | Lemons | 0 | 10 | 10 |
| 137 | 180517 | Other | 11 | 0 | 11 |
| 138 | 170154 | Avocado | 4 | 1 | 6 |
| 139 | 180573 | Other | 17 | 0 | 17 |
| 140 | 170134 | Other | 13 | 0 | 13 |
| 141 | 180422 | Horse Facilities / Pasture | 0 | 6 | 7 |
| 142 | 170187 | Avocado | 8 | 2 | 10 |
| 143 | 170182 | Other | 8 | 0 | 8 |
| 144 | 170228 | Other | 5 | 0 | 5 |
| 146 | 170044 | Other | 6 | 0 | 6 |
| 147 | 170123 | Nursery | 0 | 8 | 8 |
| 148 | 180603 | Other | 9 | 0 | 9 |
| 149 | 180552 | Cherimoyas | 0 | 8 | 8 |
| 150 | 180395 | Other | 10 | 0 | 10 |
| 151 | 180524 | Avocado | 5 | 0 | 5 |
| 153 | 170274 | Cherimoyas | 0 | 8 | 8 |
| 154 | 180514 | Other | 9 | 0 | 9 |
| 155 | 180369 | Avocado | 8 | 0 | 8 |
| 156 | 170170 | Other | 10 | 0 | 10 |
| 157 | 170064 | Other | 9 | 0 | 9 |
| 158 | 180368 | Other | 7 | 0 | 7 |
| 159 | 170272 | Other | 6 | 0 | 6 |
| 160 | 180371 | Avocado | 2 | 5 | 7 |
| 162 | 170155 | Avocado | 4 | 3 | 6 |
| 163 | 170259 | Avocado | 0 | 7 | 7 |
| 164 | 170254 | Cherimoyas | 1 | 6 | 7 |
| 168 | 146106 | Avocado | 0 | 6 | 7 |
| 169 | 180547 | Avocado | 0 | 6 | 6 |
| 171 | 170288 | Other | 5 | 0 | 5 |
| 173 | 170068 | Other | 11 | 0 | 11 |
| 174 | 180399 | Other | 7 | 0 | 7 |
| 175 | 180549 | Avocado | 1 | 5 | 6 |
| 176 | 180497 | Other | 9 | 0 | 9 |

| ID | Root | Name | All Values in AFY | | |
|---|---|---|---|---|---|
| | | | Potable Use | GW Use | Total Use |
| 177 | 180329 | Other | 8 | 0 | 8 |
| 179 | 170211 | Other | 7 | 0 | 7 |
| 180 | 170180 | Avocado | 1 | 5 | 6 |
| 181 | 115599 | Avocado | 1 | 5 | 5 |
| 182 | 180488 | Avocado | 2 | 5 | 6 |
| 183 | 180522 | Other | 6 | 0 | 6 |
| 185 | 180490 | Other | 7 | 0 | 7 |
| 187 | 170135 | Other | 6 | 0 | 6 |
| 189 | 170289 | Other | 7 | 0 | 7 |
| 191 | 180409 | Other | 9 | 0 | 9 |
| 193 | 115604 | Avocado | 2 | 3 | 5 |
| 194 | 170256 | Cherimoyas | 0 | 5 | 5 |
| 196 | 170114 | Other | 8 | 0 | 8 |
| 200 | 170215 | Nursery | 4 | 1 | 6 |
| 202 | 170257 | Other | 5 | 0 | 5 |
| 205 | 180512 | Avocado | 4 | 2 | 6 |
| 210 | 180510 | Other | 7 | 0 | 7 |
| 220 | 180461 | Other | 12 | 0 | 12 |
| 264 | 170287 | Other | 5 | 0 | 5 |
| 1100 | -- | APN 001-030-030 | 0 | 40 | 40 |
| 1101 | -- | APN 005-430-048 | 0 | 19 | 19 |
| 1102 | -- | APN 155-180-085 | 0 | 14 | 14 |
| 1103 | -- | APN 001-040-002 | 0 | 10 | 10 |
| 1104 | -- | APN 155-170-066 | 0 | 9 | 9 |
| 1105 | -- | APN 155-170-060 | 0 | 6 | 6 |
| | | | **1,707** | **2,661** | **4,368** |

**Potential Customer List, Municipal Customers (Total >1 AFY)**

| ID | Root | Name | AFY | | |
|---|---|---|---|---|---|
| | | | Potable Use | Potable Conversion Factor | Non-Potable Use Estimate |
| 35 | 092392 | Cate School | 82 | N/A | 0 |
| 136 | 169018 | Carpinteria State Beach (East Side) | 14 | 100% | 14 |
| 145 | 169031 | Carpinteria High School | 22 | 100% | 22 |
| 166 | 169035 | Aliso Elementary School | 7 | 100% | 7 |
| 167 | 169043 | Tomol Park | 6 | 100% | 6 |
| 172 | 169060 | Viola Baseball Field | 13 | 90% | 11 |
| 188 | 157275 | HOA | 3 | 100% | 3 |
| 190 | 169023 | Carpinteria Family School | 7 | 100% | 7 |
| 211 | 157819 | HOA | 3 | 100% | 3 |
| 213 | 134756 | HOA | 7 | 100% | 7 |
| 218 | 157808 | HOA | 6 | 100% | 6 |
| 224 | 169028 | Caltrans | 4 | 100% | 4 |
| 230 | 169036 | Caltrans | 2 | 100% | 2 |
| 239 | 169047 | Caltrans | 2 | 100% | 2 |
| 243 | 169575 | Business Park | 4 | 100% | 4 |
| 251 | 134605 | HOA | 6 | 100% | 6 |
| 255 | 169004 | Carpinteria State Beach (West Side) | 7 | 50% | 4 |
| 262 | 169048 | Monte Vista Park | 6 | 50% | 3 |
| 263 | 157741 | HOA | 3 | 100% | 3 |
| 286 | 169059 | Carpinteria Middle School | 6 | 50% | 3 |
| 289 | 092325 | Private Business | 1 | 100% | 1 |
| 320 | 092373 | -- | 16 | 10% | 2 |
| 323 | 092367 | Hotel / Motel | 14 | 10% | 1 |
| 347 | 092550 | Hotel / Motel | 14 | 10% | 1 |
| 351 | 115460 | HOA | 1 | 100% | 1 |
| 353 | 169019 | Carpinteria Community Pool | 3 | 0% | 0 |
| 354 | 092577 | Hotel / Motel | 12 | 10% | 1 |
| 356 | 115456 | HOA | 2 | 100% | 2 |
| 368 | 157981 | HOA | 2 | 100% | 2 |
| 390 | 115700 | HOA | 1 | 100% | 1 |
| 408 | 082010 | HOA | 1 | 100% | 1 |
| 436 | 169027 | U S Forest Service | 2 | 50% | 1 |
| 481 | 082015 | Private Business | 1 | 100% | 1 |
| 536 | 169006 | California Dept/Parks | 2 | 50% | 1 |
| 596 | 169550 | Private Business | 1 | 100% | 1 |
| 601 | 169025 | City Of Carpinteria | 2 | 100% | 2 |
| | | | **297** | **-** | **138** |

# Appendix B - Treatment Alternatives Layouts and Cost Estimates


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| RMC water and environment | DESIGNED BY:<br>DRAWN BY:<br>CHECKED BY:<br>REVIEWED BY:<br>APPROVED BY: DATE | REV. NO. | DATE | BY | APPRVD | DESCRIPTION | REVIEWED BY:<br>PROJECT MANAGER DATE<br>AUTHORIZED REP. DATE | SCALE<br>AS SHOWN<br>Bar Scale shown below is one inch on original drawings. If NOT one inch on this sheet, adjust scales accordingly.<br>0" 1" | CARPENTERIA VALLEY WATER DISTRICT | Recycled Water Facilities Plan<br>ALTERNATIVE 1 - CONCEPTUAL LAYOUT<br>TERTIARY TITLE 22 TREATMENT | SHEET NO.<br>1<br>1 OF X<br>RMC PROJECT NO.<br>0613-000.02 |
|---|---|---|---|---|---|---|---|---|---|---|---|

# Carpinteria Recycled Water Facilities Plan

## Treatment Alternative 1: Tertiary Only

**Influent** 1.2 MGD
**Effluent** 1.2 MGD

| Item | Qty | Units | Unit Cost | Cost |
|---|---|---|---|---|
| Equalization Basin | 300,000 | Gal | $0.80 | $240,000 |
| Rotating Disk Cloth Filters | 1.5 | MGD | $680,000 | $1,020,000 |
| Yard Piping (10%) | 1 | LS | $126,000 | $126,000 |
| Electrical/I&C (20%) | 1 | LS | $444,000 | $444,000 |
| Miscellaneous Work and Clean-Up (5%) | 1 | LS | $291,000 | $291,000 |
| Mobilization & Demobilization (2%) | 1 | LS | $42,000 | $42,000 |
| General Conditions - Bonds/Insurance (3%) | 1 | LS | $63,000 | $63,000 |

| | | |
|---|---|---|
| **Raw Construction Subtotal** | | **$2,226,000** |
| **Raw Construction Unit Cost ($/gal capacity)** | **$1.86** | |
| Contingency Costs | 25% | $557,000 |
| **Total Construction Subtotal** | | **$2,783,000** |
| Implementation Costs | 25% | $696,000 |
| **Total Capital Costs** | | **$3,479,000** |

*Note: Equipment costs include a 15% contractor mark-up and 40% installation cost.*

| O&M | | | | |
|---|---|---|---|---|
| Power (60 Hp) | kW-Hr | 375,000 | $0.13 | $48,750 |
| Cloth Media Replacement | LS | 1 | $3,000 | $3,000 |
| Labor | Existing Staff | | | |
| Monitoring / Reporting | LS | 1 | $50,000 | $50,000 |

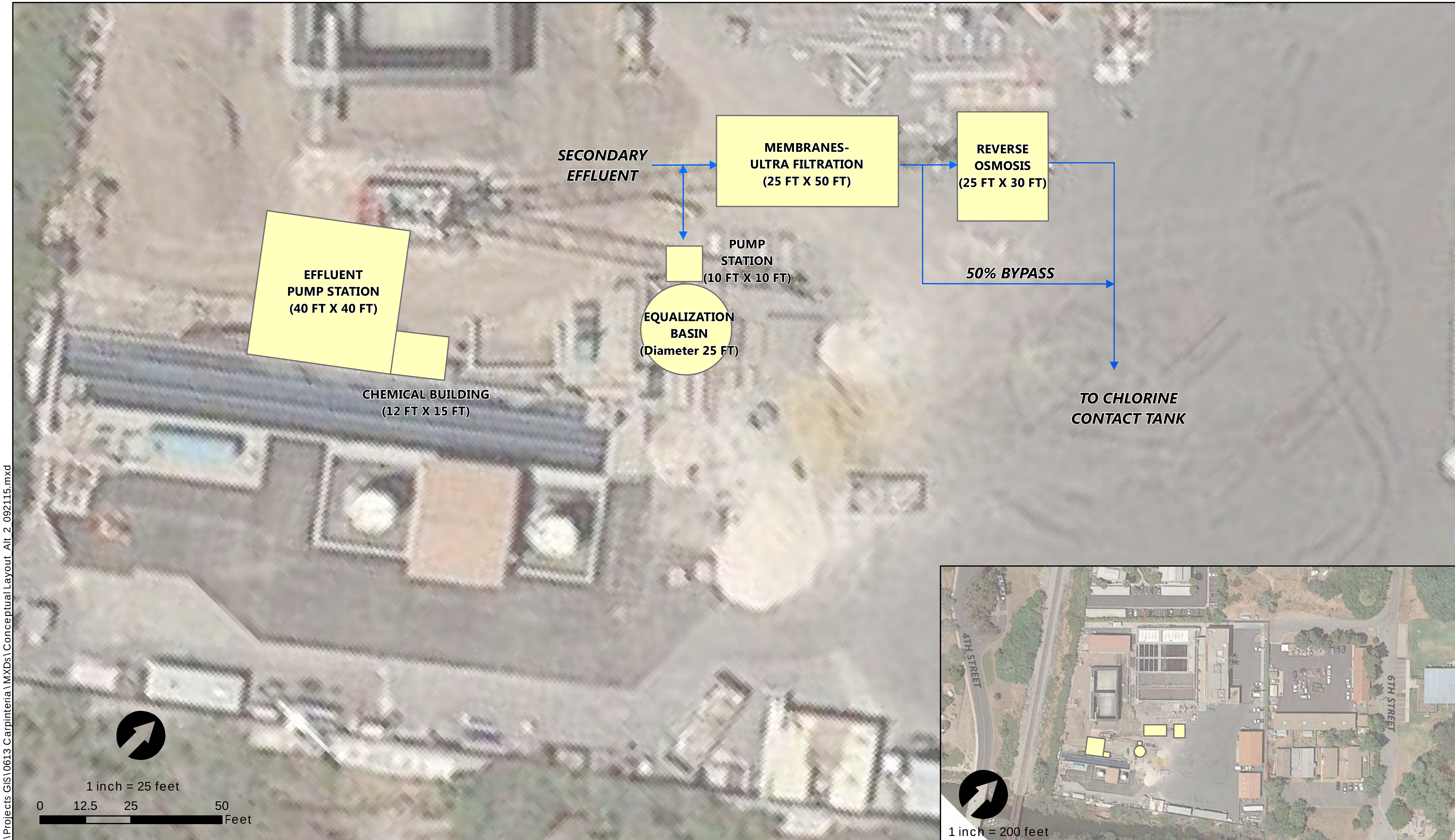
| | | |
|---|---|---|
| **Total O&M Costs ($/yr)** | | **$101,750** |
| | **$/AF Product** | **$80** |
| | **$/kgal Product** | **$0.25** |

**Annual Costs ($ / Year)**

| | | |
|---|---|---|
| Annualized Capital Costs | $ | 155,000 |
| Annual O&M Costs | $ | 101,750 |
| **Total Annualized Cost** | **$** | **256,750** |

**Unit Costs ($ / AF)**

| | | |
|---|---|---|
| Estimated Recycled Water Yield | AFY | 1,340 |
| **Estimated Unit Cost ($/AF)** | | **$190** |

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| | | |
|---|---|---|
| RMC water and environment | DESIGNED BY:<br>DRAWN BY:<br>CHECKED BY:<br>REVIEWED BY:<br>APPROVED BY: DATE | REV. NO. / DATE / BY / APPRVD / DESCRIPTION |
| REVIEWED BY:<br>PROJECT MANAGER DATE<br>AUTHORIZED REP. DATE | SCALE<br>AS SHOWN<br>Bar Scale shown below is one inch on orignial drawings. If NOT one inch on this sheet, adjust scales accordingly.<br>0" 1" | CARPENTERIA VALLEY WATER DISTRICT |
| Recycled Water Facilities Plan<br>ALTERNATIVE 2 - CONCEPTUAL LAYOUT<br>PARTIAL RO | SHEET NO.<br>1<br>1 OF X | RMC PROJECT NO.<br>0613-000.02 |

# Carpinteria Recycled Water Facilities Plan

## Treatment Alternative 2: Partial RO

| | | | |
|---|---|---|---|
| Influent | 1.2 | MGD | |
| Effluent | 1.05 | MGD | |

| Item | Qty | Units | Unit Cost | Cost |
|---|---|---|---|---|
| Equalization Basin | 300,000 | Gal | $0.80 | $240,000 |
| Microfiltration Units | 1.2 | MGD | $1,100,000 | $1,320,000 |
| Reverse Osmosis | 1.0 | MGD | $2,270,000 | $2,270,000 |
| Yard Piping (10%) | 1 | LS | $383,000 | $383,000 |
| Electrical/I&C (20%) | 1 | LS | $766,000 | $766,000 |
| Miscellaneous Work and Clean-Up (5%) | 1 | LS | $192,000 | $192,000 |
| Mobilization & Demobilization (2%) | 1 | LS | $103,000 | $103,000 |
| General Conditions - Bonds/Insurance (3%) | 1 | LS | $155,000 | $155,000 |
| **Raw Construction Subtotal** | | | | **$5,429,000** |
| **Raw Construction Unit Cost ($/gal capacity)** | | | **$4.52** | |
| Contingency Costs | | | 25% | $1,357,000 |
| **Total Construction Subtotal** | | | | **$6,786,000** |
| Implementation Costs | | | 25% | $1,697,000 |
| **Total Capital Costs** | | | | **$8,483,000** |

*Note: Equipment costs include a 15% contractor mark-up and 40% installation cost.*

| O&M | Qty | Units | Unit Cost | Cost |
|---|---|---|---|---|
| UF Chemical Usage | | | | |
| Sodium Hypochlorite | 1,000 | Gal | $6.00 | $6,000 |
| Citric Acid | 2,500 | Gal | $5.00 | $13,000 |
| Sodium Hydroxide | 200 | Gal | $4.00 | $1,000 |
| UF Feed and Backwash Pumps | 320,000 | kW-Hr | $0.13 | $42,000 |
| UF Membrane Replacement | 8 | Each | $2,700 | $22,000 |
| RO Chemical Usage | | | | $0 |
| Antiscalant (Feed) | 5,000 | lbs | $1.35 | $7,000 |
| Membrane Cleaner (CIP) | 14,000 | lbs | $3.50 | $49,000 |
| RO Feed and Transfer Pumps | 700,000 | kW-Hr | $0.13 | $91,000 |
| RO Membrane Replacement | 35 | Each | $600 | $21,000 |
| Labor | 1 | LS | $200,000 | $200,000 |
| Monitoring / Reporting | 1 | LS | $50,000 | $50,000 |
| **Total O&M Costs ($/yr)** | | | | **$502,000** |
| | | | **$/AF Product** | **$430** |
| | | | **$/kgal Product** | **$1.32** |

| Annual Costs ($ / Year) | |
|---|---|
| Annualized Capital Costs | $ 379,000 |
| Annual O&M Costs | $ 502,000 |
| **Total Annualized Cost** | **$ 881,000** |

| Unit Costs ($ / AF) | | |
|---|---|---|
| Estimated Recycled Water Yield | AFY | 1,170 |
| **Estimated Unit Cost ($/AF)** | | **$750** |


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RMC water and environment

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DRAWN BY:
CHECKED BY:
REVIEWED BY:
APPROVED BY:

| DATE | REV. NO. | DATE | BY | APPRVD | DESCRIPTION |
|---|---|---|---|---|---|

REVIEWED BY:
PROJECT MANAGER — DATE
AUTHORIZED REP. — DATE

SCALE
AS SHOWN
Bar Scale shown below is one inch on original drawings. If NOT one inch on this sheet, adjust scales accordingly.
0" 1"

CARPENTERIA VALLEY WATER DISTRICT

Recycled Water Facilities Plan
ALTERNATIVE 3 - CONCEPTUAL LAYOUT
FULL ADVANCED TREATMENT PLANT

SHEET NO.
1
1 OF X
RMC PROJECT NO.
0613-000.02

# Carpinteria Recycled Water Facilities Plan

## Treatment Alternative 3: Advanced Water Treatment

| | | |
|---|---|---|
| Influent | 1.2 | MGD |
| Effluent | 1.0 | MGD |

| Item | Qty | Units | Unit Cost | Cost |
|---|---|---|---|---|
| Equalization Basin | 300,000 | Gal | $0.80 | $240,000 |
| Microfiltration Units | 1.2 | MGD | $1,100,000 | $1,320,000 |
| Reverse Osmosis | 1.2 | MGD | $2,270,000 | $2,724,000 |
| Ultraviolet (UV) Disinfection | 1.2 | MGD | $625,000 | $750,000 |
| Advanced Oxidation | 1.2 | MGD | $200,000 | $240,000 |
| Post-Treatment | 1.2 | MGD | $200,000 | $240,000 |
| Yard Piping (10%) | 1 | LS | $551,000 | $551,000 |
| Electrical/I&C (20%) | 1 | LS | $1,103,000 | $1,103,000 |
| Miscellaneous Work and Clean-Up (5%) | 1 | LS | $276,000 | $276,000 |
| Mobilization & Demobilization (2%) | 1 | LS | $149,000 | $149,000 |
| General Conditions - Bonds/Insurance (3%) | 1 | LS | $224,000 | $224,000 |
| | **Raw Construction Subtotal** | | | **$7,817,000** |
| | **Raw Construction Unit Cost ($/gal capacity)** | | | **$6.51** |
| | Contingency Costs | | 25% | $1,954,000 |
| | **Total Construction Subtotal** | | | **$9,771,000** |
| | Implementation Costs | | 25% | $2,443,000 |
| | **Total Capital Costs** | | | **$12,214,000** |
| *Note: Equipment costs include a 15% contractor mark-up and 40% installation cost.* | | | | |
| **O&M** | | | | |
| MF Chemical Usage | | | | |
| Sodium Hypochlorite | 1,000 | Gal | $6.00 | $6,000 |
| Citric Acid | 2,500 | Gal | $5.00 | $12,500 |
| Sodium Hydroxide | 200 | Gal | $4.00 | $800 |
| MF Feed and Backwash Pumps | 320,000 | kW-Hr | $0.13 | $41,600 |
| UF Membrane Replacement | 8 | Each | $2,700 | $21,600 |
| RO Chemical Usage | | | | $0 |
| Antiscalant (Feed) | 10,000 | lbs | $1.35 | $13,500 |
| Membrane Cleaner (CIP) | 28,000 | lbs | $3.50 | $98,000 |
| RO Feed and Transfer Pumps | 840,000 | kW-Hr | $0.13 | $109,200 |
| RO Membrane Replacement | 70 | Each | $600 | $42,000 |
| UV Power Costs | 184,000 | kW-Hr | $0.13 | $24,000 |
| UV Lamp Replacement | 75 | Each | $280 | $21,000 |
| Advanced Oxidation | 1 | LS | $15,000 | $15,000 |
| Post-Treatment | 1 | LS | $15,000 | $15,000 |
| Labor | 1 | LS | $200,000 | $200,000 |
| Monitoring / Reporting | 1 | LS | $150,000 | $150,000 |
| | **Total O&M Costs ($/yr)** | | | **$770,200** |
| | | | **$/AF Product** | **$690** |
| | | | **$/kgal Product** | **$2.12** |
| **Annual Costs ($ / Year)** | | | | |
| | Annualized Capital Costs | | $ | 545,000 |
| | Annual O&M Costs | | $ | 770,200 |
| | **Total Annualized Cost** | | **$** | **1,315,200** |
| **Unit Costs ($ / AF)** | | | | |
| | Estimated Recycled Water Yield | AFY | | 1,100 |
| **Estimated Unit Cost ($/AF)** | | | | **$1,200** |

# Appendix C - Distribution System Hydraulics Figures

## Alternative 2A: Agricultural Irrigation, Potable Offset

**Figure 1: Recycled Water Pump Station, Flow (GPM), MDD**

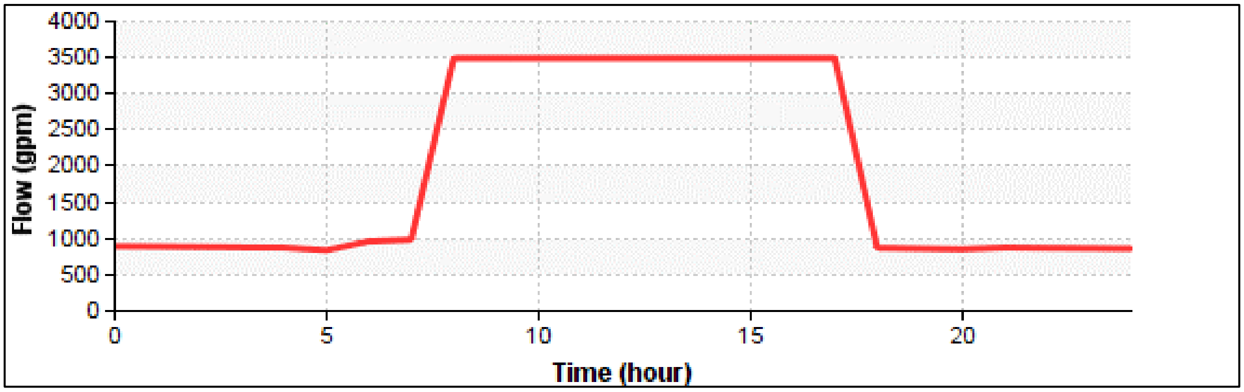



**Figure 2: Recycled Water Tank, Level (FT), MDD**

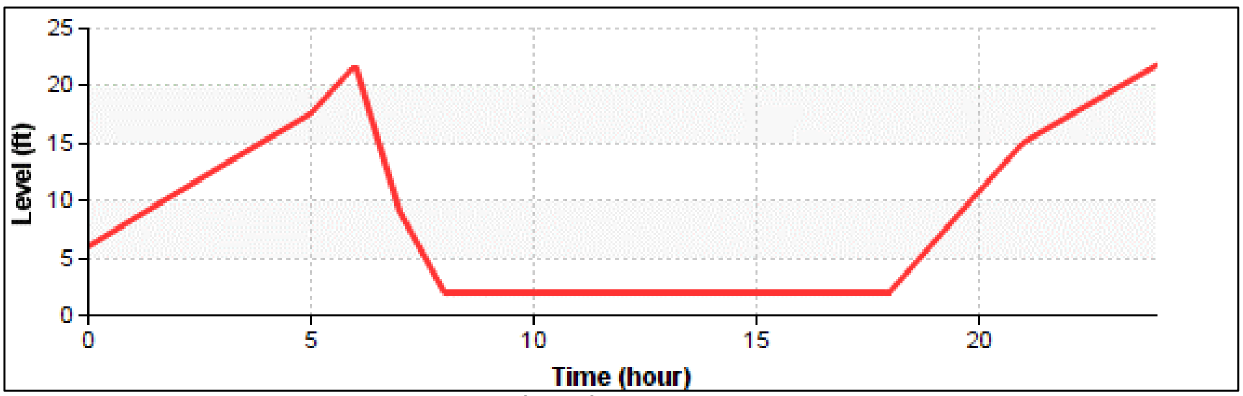
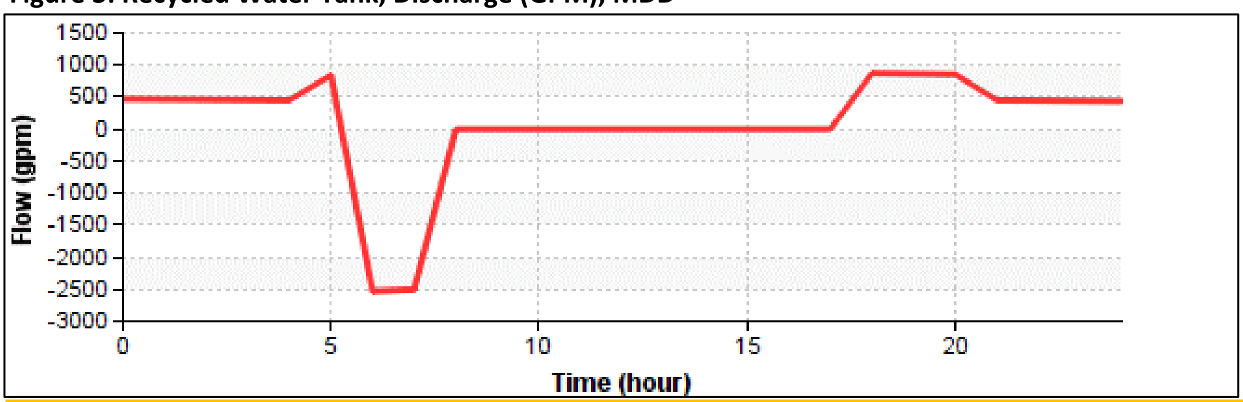
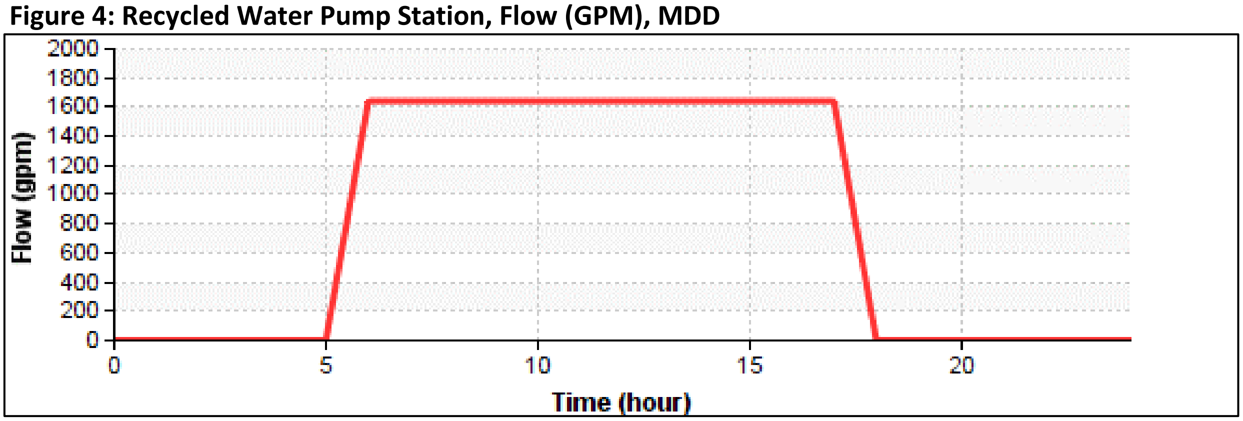



**Figure 3: Recycled Water Tank, Discharge (GPM), MDD**




## Alternative 2B: Agricultural Irrigation, Potable Offset [No Tank]

**Figure 4: Recycled Water Pump Station, Flow (GPM), MDD**

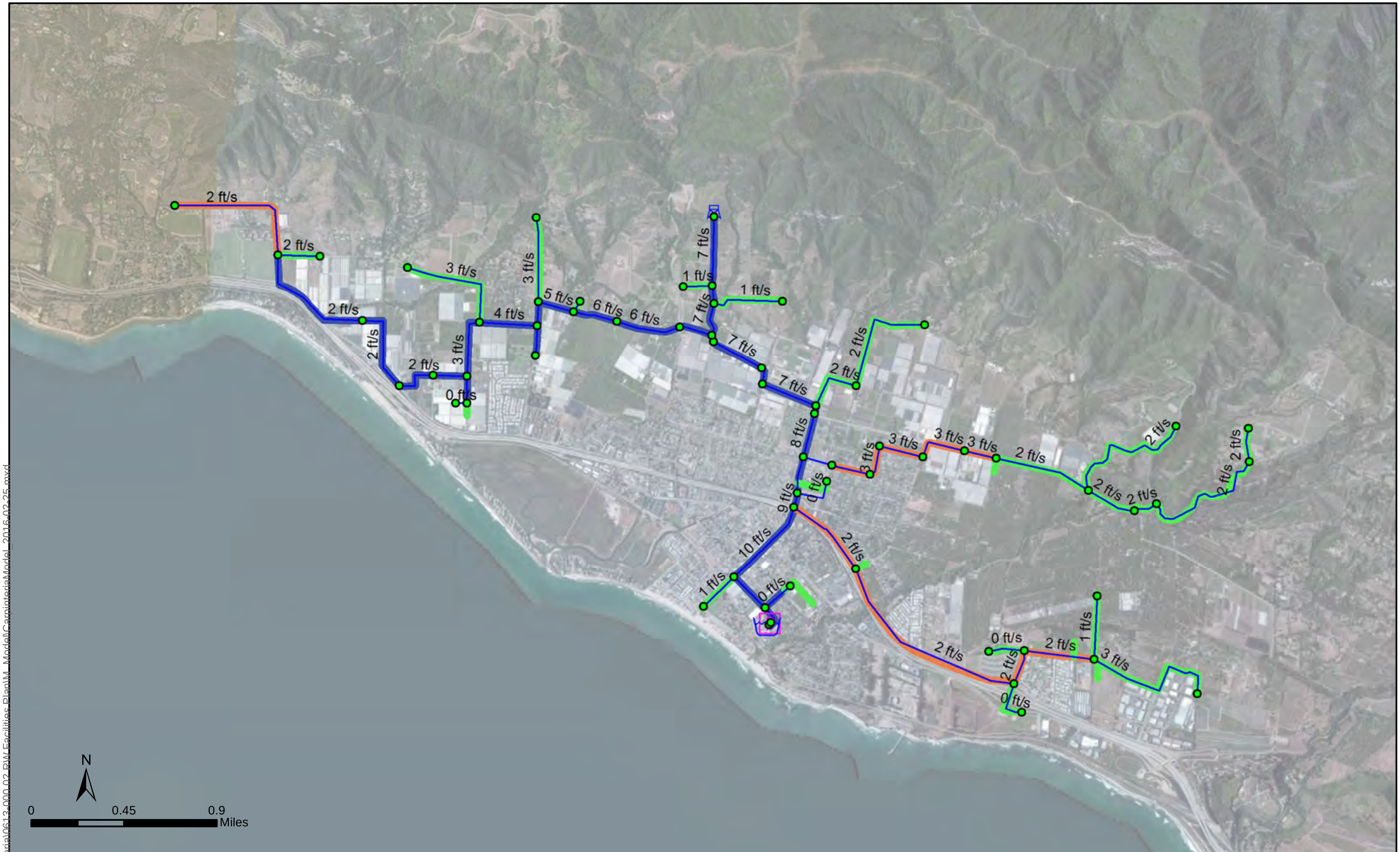



**Diameter (in)**

- 6
- 8
- 12

# Alternative 2A - Agricultural Irrigation Potable Offset

## Model Results Max Flows

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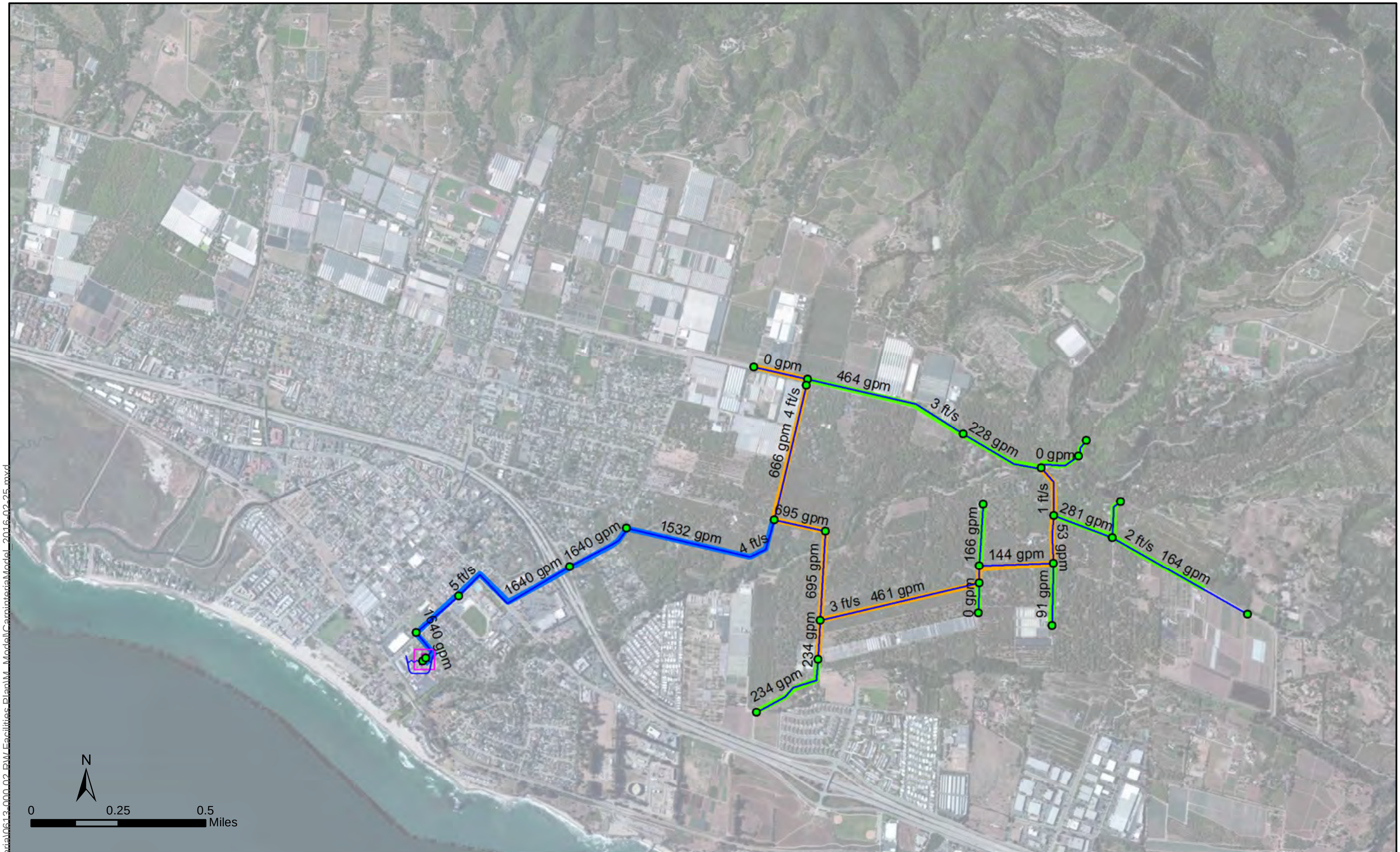
RMC water and environment

**Diameter (in)**

- 6
- 8
- 12

## Alternative 2A - Agricultural Irrigation Potable Offset

## Model Results Max Velocties

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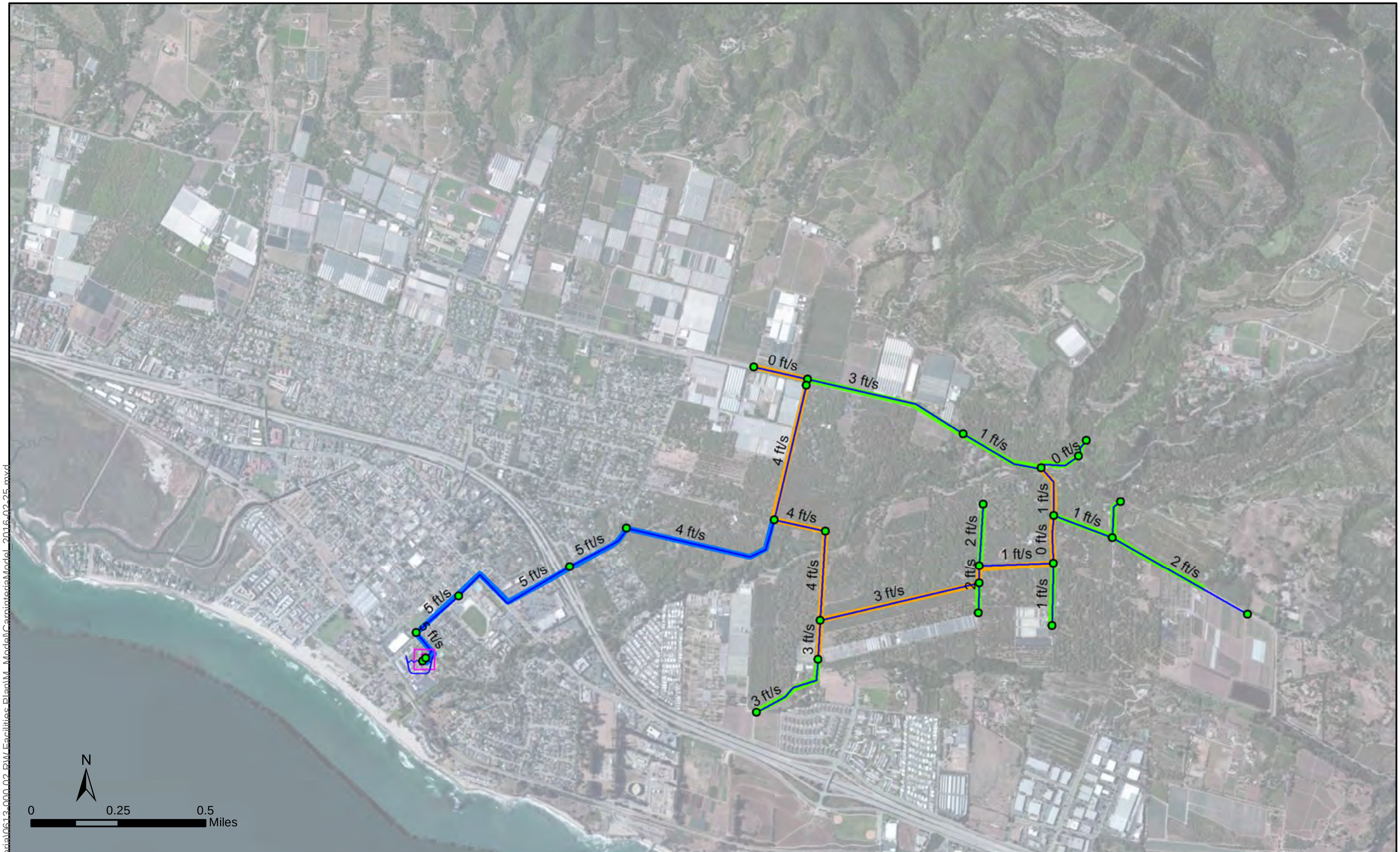
RMC water and environment

**Diameter (in)**

- 6
- 8
- 12

**Alternative 2B - Agricultural Irrigation, Groundwater Offset**

**Model Results Max Flows**




RMC water and environment

**Diameter (in)**

- 6
- 8
- 12

Alternative 2B - Agricultural Irrigation, Groundwater Offset

Model Results Max Velocities

# Appendix D - Detailed Cost Estimates

# Carpinteria Recycled Water Facilities Plan

## Summary of Alternatives

| Project | RW Demand (AFY) | Capital Costs ($M) Treatment | Capital Costs ($M) Distribution | Capital Costs ($M) Total | O&M Costs ($M) Treatment | O&M Costs ($M) Distribution | O&M Costs ($M) Total | Annualized Capital | Total Annual | $/AF |
|---|---|---|---|---|---|---|---|---|---|---|
| 1A. Municipal, Fill Station | 10 | $0.9 | $0.15 | **$1.0** | $0.030 | $0.002 | **$0.032** | $0.05 | **$0.078** | **$ 7,800** |
| 1B. Municipal, Large Landscape | 53 | $0.9 | $3.2 | **$4.1** | $0.03 | $0.04 | **$0.07** | $0.18 | **$0.25** | **$ 4,660** |
| 2A. Agricultural, Potable Offset | 725 | $9.8 | $18.5 | **$28.3** | $0.3 | $0.2 | **$0.5** | $1.3 | **$1.8** | **$ 2,470** |
| 2B. Agricultural, GW Offset | 725 | $9.8 | $9.9 | **$19.7** | $0.3 | $0.1 | **$0.4** | $0.9 | **$1.3** | **$ 1,820** |
| 3A. GWR, Surface Spreading, Partial RO | 1,170 | $9.8 | $11.6 | **$21.4** | $0.5 | $0.6 | **$1.1** | $1.0 | **$2.1** | **$ 1,770** |
| 3B. GWR, Surface Spreading, Full AWT | 1,100 | $12.2 | $8.0 | **$20.2** | $0.8 | $0.2 | **$1.0** | $0.9 | **$1.9** | **$ 1,700** |
| 3C. GWR, Inland Injection | 1,100 | $12.2 | $8.9 | **$21.1** | $0.8 | $0.3 | **$1.1** | $0.9 | **$2.0** | **$ 1,840** |
| 3D. GWR, Seawater Barrier | 1,100 | $12.2 | $12.5 | **$24.7** | $0.8 | $0.3 | **$1.1** | $1.1 | **$2.2** | **$ 2,000** |
| 4A. Alt 2A & Alt 3A | 1,170 | $9.8 | $21.5 | **$31.3** | $0.5 | $0.4 | **$0.9** | $1.4 | **$2.3** | **$ 2,000** |
| 4B. Alt 2B & Alt 3A | 1,170 | $9.8 | $16.2 | **$26.0** | $0.5 | $0.4 | **$0.9** | $1.2 | **$2.1** | **$ 1,780** |

**With Proposition 1 Grant (35%)**

| Project | RW Demand (AFY) | Capital Costs ($M) Original | Capital Costs ($M) Grant | Capital Costs ($M) New Total | O&M Costs ($M) Treatment | O&M Costs ($M) Distribution | O&M Costs ($M) Total | Annualized Capital | Total Annual | $/AF |
|---|---|---|---|---|---|---|---|---|---|---|
| 1A. Municipal, Fill Station | 10 | $1.02 | $0.31 | **$0.71** | $0.030 | $0.002 | $0.032 | $0.03 | **$0.06** | **$ 6,400** |
| 1B. Municipal, Large Landscape | 53 | $4.1 | $1.2 | **$2.8** | $0.030 | $0.035 | $0.07 | $0.13 | **$0.19** | **$ 3,620** |
| 2A. Agricultural, Potable Offset | 725 | $28.3 | $8.5 | **$19.8** | $0.3 | $0.2 | $0.5 | $0.89 | **$1.4** | **$ 1,950** |
| 2B. Agricultural, GW Offset | 725 | $19.7 | $5.9 | **$13.8** | $0.3 | $0.1 | $0.4 | $0.62 | **$1.1** | **$ 1,450** |
| 3A. GWR, Surface Spreading, Partial RO | 1,170 | $21.4 | $6.4 | **$15.0** | $0.5 | $0.6 | $1.1 | $0.67 | **$1.8** | **$ 1,520** |
| 3B. GWR, Surface Spreading, Full AWT | 1,100 | $20.2 | $6.1 | **$14.1** | $0.8 | $0.2 | $1.0 | $0.63 | **$1.6** | **$ 1,450** |
| 3C. GWR, Inland Injection | 1,100 | $21.1 | $6.3 | **$14.8** | $0.8 | $0.3 | $1.1 | $0.66 | **$1.7** | **$ 1,580** |
| 3D. GWR, Seawater Barrier | 1,100 | $24.7 | $7.4 | **$17.3** | $0.8 | $0.3 | $1.1 | $0.77 | **$1.9** | **$ 1,700** |
| 4A. Alt 2A & Alt 3A | 1,170 | $31.3 | $9.4 | **$21.9** | $0.5 | $0.4 | $0.9 | $0.98 | **$1.9** | **$ 1,640** |
| 4B. Alt 2B & Alt 3A | 1,170 | $26.0 | $7.8 | **$18.2** | $0.5 | $0.4 | $0.9 | $0.81 | **$1.7** | **$ 1,480** |

# Carpinteria Recycled Water Facilities Plan

## Unit Cost Assumptions for Capital Costs

Engineering New Record Construction Cost Index, 20-Cities Average: December 2015 = 10092

| Item | Unit Cost | Units/Notes |
|---|---|---|
| Treatment | | |
| Title 22 (Tertiary and Disinfection) - 0.1 MGD | $560,000 | LS |
| Title 22 (Tertiary and Disinfection) - 1.5 MGD | $1.86 | per gallon (capacity) |
| Partial RO (80%) | $5.21 | per gallon (capacity) |
| Advanced Water Treatment (AWT) (MF/RO/AOP) | $6.51 | per gallon (capacity) |
| Pipelines (Paved Roads) | | |
| 6-inch diameter | $150 | per LF |
| 12-inch diameter | $180 | per LF |
| 16-inch diameter | $200 | per LF |
| Pump Stations | $6,500 | HP (Based on peak flow) |
| Storage | $1.5 | per gallon |
| Recharge Basins | $50,000 | per acre |
| 8-inch Injection Well | $750,000 | per well |
| 16-inch Injection Well | $1,500,000 | per well |
| Monitoring Wells (New or Rehab) | $100,000 | per well |
| Municipal Customer Connection | $15,000 | each |
| Agricultural Customer Connection | $30,000 | each |
| Land Acquisition | $300,000 | per acre |
| **O&M Annual Costs** | | |
| Title 22 (Tertiary and Disinfection) - 0.1 MGD | $30,000 | LS |
| Title 22 (Tertiary and Disinfection) - 1.5 MGD | $0.25 | per thousand gallons |
| Partial RO (80%) | $1.32 | per thousand gallons |
| Advanced Water Treatment (AWT) (MF/RO/AOP) | $2.12 | per thousand gallons |
| Potable Water for Diluent Water | $250 | per AF |
| Conveyance | 1% | of capital costs |
| Pump Station Equipment | 5% | of capital costs |
| Pump Station Electrical | $0.13 | per kWh ($Q_{avg}$) |
| Recharge Basins | $5,000 | per acre |
| Injection Well | 5% | of capital costs |
| Groundwater Pumping | $50 | per AF |
| Storage | 5% | of capital costs |
| **Contingencies** | | |
| Contingency Construction | 25% | for raw construction costs |
| Implementation Costs for Irrigation Projects | 25% | for design, environmental, etc. |
| Implementation Costs for Groundwater Recharge Projects | 35% | for design, environmental, etc. |
| **Project Financing** | | |
| Interest Rate | 2.0% | Based on SRF |
| Payback Period | 30 | |
| Present Worth Factor (to P given A) | 22.40 | |

# Carpinteria Recycled Water Facilities Plan

## 1A. Municipal, Fill Station

| Item | Qty | Units | Unit Cost[1] | | Cost |
|---|---|---|---|---|---|
| **Capital Costs** | | | | | |
| **Treatment** | | | | | |
| Tertiary Treatment (0.1 MGD) | 1.0 | LS | $560,000 | $ | 560,000 |
| **Conveyance** | | | | | |
| 6-inch diameter | 200 | ft | $150 | $ | 30,000 |
| **Pump Stations** | | | | | |
| PS at Carpinteria WWTP | 5 | HP | $6,500 | $ | 33,000 |
| **Storage** | | | | | |
| On-Site Tank | 0.02 | MG | $1.5 | $ | 30,000 |
| | **Construction Subtotal** | | | | **$653,000** |
| | Construction Contingency | | 25% | $ | 163,000 |
| | **Construction Total** | | | | **$816,000** |
| | Implementation Costs | | 25% | $ | 204,000 |
| | **Total Capital Costs** | | | **$** | **1,020,000** |
| **O&M** | | | | | |
| **Treatment** | | | | | |
| Tertiary Treatment (0.1 MGD) | | $30,000 | LS | | $30,000 |
| **Storage** | | 5% | of capital costs | $ | 2,000 |
| | **Total O&M Costs ($/yr)** | | | **$** | **32,000** |
| **Annual Costs ($ / Year)** | | | | | |
| | Annualized Capital Costs | | | $ | 46,000 |
| | Annual O&M Costs | | | $ | 32,000 |
| | **Total Annualized Cost** | | | **$** | **78,000** |
| **Unit Costs ($ / AF)** | | | | | |
| Estimated Recycled Water Yield | | AFY | | | 10 |
| **Estimated Unit Cost ($/AF)** | | | | | **$7,800** |

# Carpinteria Recycled Water Facilities Plan

## 1B. Municipal, Large Landscape

| Item | Qty | Units | Unit Cost[1] | Cost |
|---|---|---|---|---|
| **Capital Costs** | | | | |
| **Treatment** | | | | |
| Tertiary Treatment (0.1 MGD) | 1 | LS | $560,000 | $ 560,000 |
| **Conveyance** | | | | |
| 6-inch diameter | 12,400 | ft | $150 | $ 1,860,000 |
| | | | **Pipelines Subtotal** | **$ 1,860,000** |
| **Pump Stations** | | | | |
| PS at Carpinteria WWTP | 10 | HP | $6,500 | $ 65,000 |
| **Customer Connections** | | | | |
| Municipal | 8 | | $15,000 | $ 120,000 |
| | **Construction Subtotal** | | | **$2,605,000** |
| | Construction Contingency | | 25% | $ 651,000 |
| | **Construction Total** | | | **$3,256,000** |
| | Implementation Costs | | 25% | $ 814,000 |
| | **Total Capital Costs** | | | **$ 4,070,000** |
| **O&M** | | | | |
| **Treatment** | | | | |
| Tertiary Treatment (0.1 MGD) | 1 | LS | $30,000 | $ 30,000 |
| **Conveyance** | | | 1% of capital costs | $ 19,000 |
| **Pump Stations** kWh/yr | Cost ($/yr) | | Maint. (% of cap. costs) | |
| PS at Carpinteria WWTF 29,100 | $ 3,800 | | 5% $ 4,000 | $ 8,000 |
| | **Total O&M Costs ($/yr)** | | | **$ 65,000** |
| **Annual Costs ($ / Year)** | | | | |
| | Annualized Capital Costs | | | $ 182,000 |
| | Annual O&M Costs | | | $ 65,000 |
| | **Total Annualized Cost** | | | **$ 247,000** |
| **Unit Costs ($ / AF)** | | | | |
| Estimated Recycled Water Yield | | AFY | | 53 |
| **Estimated Unit Cost ($/AF)** | | | | **$4,700** |

RMC water and environment

# Carpinteria Recycled Water Facilities Plan

## 2A. Agricultural, Potable Offset

| Item | Qty | Units | Unit Cost[1] | Cost |
|---|---|---|---|---|
| **Capital Costs** | | | | |
| **Treatment** | | | | |
| Partial RO Treatment | 1.2 | MGD | $5.21 | $ 6,254,000 |
| **Conveyance** | | | | |
| Phase A | | | | |
| 6-inch diameter | 7,700 | ft | $150 | $ 1,155,000 |
| 12-inch diameter | 9,400 | ft | $180 | $ 1,692,000 |
| Phase B | | | | |
| 6-inch diameter | 8,300 | ft | $150 | $ 1,245,000 |
| 12-inch diameter | 15,500 | ft | $180 | $ 2,790,000 |
| Phase C | | | | |
| 6-inch diameter | 1,100 | ft | $150 | $ 165,000 |
| 8-inch diameter | 3,800 | ft | $160 | $ 608,000 |
| 12-inch diameter | 6,800 | ft | $180 | $ 1,224,000 |
| | | | **Pipelines Subtotal** | **$ 8,879,000** |
| **Pump Stations** | | | | |
| PS at Carpinteria WWTP | 100 | HP | $6,500 | $ 650,000 |
| **Storage** | | | | |
| North Tank | 0.6 | MG | $1.5 | $ 900,000 |
| **Customer Connections** | | | | |
| Municipal | 6 | | $15,000 | $ 90,000 |
| Agriculture | 45 | | $30,000 | $ 1,350,000 |
| | **Construction Subtotal** | | | **$18,123,000** |
| | Construction Contingency | | 25% | $ 4,531,000 |
| | **Construction Total** | | | **$22,654,000** |
| | Implementation Costs | | 25% | $ 5,664,000 |
| | **Total Capital Costs** | | | **$ 28,318,000** |

| | | | | | |
|---|---|---|---|---|---|
| **O&M** | | | | | |
| **Treatment** | | | | | |
| Partial RO Treatment | | 236,000 | 1,000 gallons | $1.32 | $ 311,000 |
| **Conveyance** | | | | 1% of capital costs | $ 89,000 |
| **Pump Stations** | kWh/yr | Cost ($/yr) | | | |
| PS at Carpinteria WWTF | 396,800 | $ 51,600 | | 5% $ 33,000 | $ 85,000 |
| **Storage** | | | | 5% of capital costs | $ 45,000 |
| | | **Total O&M Costs ($/yr)** | | | **$ 530,000** |
| **Annual Costs ($ / Year)** | | | | | |
| | | Annualized Capital Costs | | | $ 1,264,000 |
| | | Annual O&M Costs | | | $ 530,000 |
| | | **Total Annualized Cost** | | | **$ 1,794,000** |
| **Unit Costs ($ / AF)** | | | | | |
| | Estimated Recycled Water Yield | | AFY | | 725 |
| **Estimated Unit Cost ($/AF)** | | | | | **$2,500** |

# Carpinteria Recycled Water Facilities Plan

## 2B. Agricultural, GW Offset

| Item | | Qty | Units | Unit Cost[1] | Cost |
|---|---|---|---|---|---|
| **Capital Costs** | | | | | |
| **Treatment** | | | | | |
| Partial RO Treatment | | 1.2 | MGD | $5.21 | $ 6,254,000 |
| **Conveyance** | | | | | |
| 6-inch diameter | | 10,000 | ft | $150 | $ 1,500,000 |
| 8-inch diameter | | 12,800 | ft | $160 | $ 2,048,000 |
| 12-inch diameter | | 7,400 | ft | $180 | $ 1,332,000 |
| | | | | **Pipelines Subtotal** | **$ 4,880,000** |
| **Pump Stations** | | | | | |
| PS at Carpinteria WWTP | | 80 | HP | $6,500 | $ 520,000 |
| **Customer Connections** | | | | | |
| Agriculture | | 31 | | $30,000 | $ 930,000 |
| | | **Construction Subtotal** | | | **$12,584,000** |
| | | Construction Contingency | | 25% | $ 3,146,000 |
| | | **Construction Total** | | | **$15,730,000** |
| | | Implementation Costs | | 25% | $ 3,933,000 |
| | | **Total Capital Costs** | | | **$ 19,663,000** |
| **O&M** | | | | | |
| **Treatment** | | | | | |
| Partial RO Treatment | | 236,000 | 1,000 gallons | $1.32 | $ 311,000 |
| **Conveyance** | | | | 1% of capital costs | $ 49,000 |
| **Pump Stations** | kWh/yr | Cost ($/yr) | | | |
| PS at Carpinteria WWTF | 396,800 | $ 51,600 | 5% $ | 26,000 | $ 78,000 |
| | | **Total O&M Costs ($/yr)** | | | **$ 438,000** |
| **Annual Costs ($ / Year)** | | | | | |
| | | Annualized Capital Costs | | | $ 878,000 |
| | | Annual O&M Costs | | | $ 438,000 |
| | | **Total Annualized Cost** | | | **$ 1,316,000** |
| **Unit Costs ($ / AF)** | | | | | |
| | Estimated Recycled Water Yield | | AFY | | 725 |
| **Estimated Unit Cost ($/AF)** | | | | | **$1,800** |

# Carpinteria Recycled Water Facilities Plan

## 3A. GWR, Surface Spreading, Partial RO

| Item | | Qty | Units | Unit Cost[1] | | Cost |
|---|---|---|---|---|---|---|
| **Capital Costs** | | | | | | |
| **Treatment** | | | | | | |
| Partial RO Treatment | | 1.2 | MGD | $5.21 | $ | 6,254,000 |
| | | | | | | |
| **Conveyance** | | | | | | |
| 12-inch diameter | for Recycled Water | 9,130 | ft | $180 | $ | 1,643,000 |
| 12-inch diameter | for Potable Water | 2,000 | ft | $180 | $ | 360,000 |
| | | | | **Pipelines Subtotal** | **$** | **2,003,000** |
| **Pump Stations** | | | | | | |
| PS at Carpinteria WWTP | | 85 | HP | $6,500 | $ | 553,000 |
| | | | | | | |
| **Recharge Basins** | | 15.4 | acres | $50,000 | $ | 770,000 |
| **Discharge Structure** | | 1.0 | LS | $50,000 | $ | 50,000 |
| **Monitoring Wells** | | 3.0 | LS | $100,000 | $ | 300,000 |
| | | **Construction Subtotal** | | | | **$9,930,000** |
| | | Construction Contingency | | 25% | $ | 2,483,000 |
| | | **Construction Total** | | | | **$12,413,000** |
| | | Implementation Costs | | 35% | $ | 4,345,000 |
| **Land Acquisition** | | | | | | |
| Land Acquisition for Surface Spreading | | 15.4 | acres | $300,000 | **$** | **4,620,000** |
| | | | | | | |
| | | **Total Capital Costs** | | | | **$21,378,000** |
| | | | | | | |
| **O&M** | | | | | | |
| **Treatment** | | | | | | |
| Partial RO Treatment | | 381,000 | 1,000 gallons | $1.32 | $ | 503,000 |
| **Conveyance** | | | | 1% of capital costs | $ | 20,000 |
| **Pump Stations** | kWh/yr | Cost ($/yr) | | | | |
| PS at Carpinteria WWTF | 480,232 | $ 62,400 | | 5% $ 28,000 | $ | 90,000 |
| **Diluent Water (CVWD Potable)** | | 1,170 | AFY | $250 | $ | 293,000 |
| **Groundwater Pumping** | | 2,340 | AFY | $50 | $ | 117,000 |
| **Recharge Basins** | | | | | | |
| Recharge Basin Maitenance | | 15.4 | acres | $5,000 | $ | 77,000 |
| **Wells** | | | | 5% of capital costs | $ | 15,000 |
| | | **Total O&M Costs ($/yr)** | | | **$** | **1,115,000** |
| | | | | | | |
| **Annual Costs ($ / Year)** | | | | | | |
| | | Annualized Capital Costs | | | $ | 955,000 |
| | | Annual O&M Costs | | | $ | 1,115,000 |
| | | **Total Annualized Cost** | | | **$** | **2,070,000** |
| | | | | | | |
| **Unit Costs ($ / AF)** | | | | | | |
| | Estimated Recycled Water Yield | | AFY | | | 1,170 |
| **Estimated Unit Cost ($/AF)** | | | | | | **$1,800** |

# Carpinteria Recycled Water Facilities Plan

## 3B. GWR, Surface Spreading, Full AWT

| Item | | Qty | Units | Unit Cost[1] | | Cost |
|---|---|---|---|---|---|---|
| **Capital Costs** | | | | | | |
| **Treatment** | | | | | | |
| AWT Treatment | | 1.2 | MGD | $6.51 | **$** | **7,817,000** |
| **Conveyance** | | | | | | |
| 12-inch diameter | | 9,130 | ft | $180 | $ | 1,643,000 |
| | | | | **Pipelines Subtotal** | **$** | **1,643,000** |
| **Pump Stations** | | | | | | |
| PS at Carpinteria WWTP | | 80 | HP | $6,500 | $ | 520,000 |
| **Recharge Basins** | | 7.2 | acres | $50,000 | $ | 360,000 |
| **Discharge Structure** | | 1.0 | LS | $50,000 | $ | 50,000 |
| **Monitoring Wells** | | 3.0 | LS | $100,000 | $ | 300,000 |
| | | **Construction Subtotal** | | | | **$10,690,000** |
| | | Construction Contingency | | 25% | $ | 2,673,000 |
| | | **Construction Total** | | | | **$13,363,000** |
| | | Implementation Costs | | 35% | $ | 4,677,000 |
| **Land Acquisition** | | | | | | |
| Land Acquisition for Surface Spreading | | 7.2 | acres | $300,000 | **$** | **2,160,000** |
| | | **Total Capital Costs** | | | | **$20,200,000** |
| **O&M** | | | | | | |
| **Treatment** | | | | | | |
| AWT Treatment | | 358,000 | 1,000 gallons | $2.12 | $ | 758,000 |
| **Conveyance** | | | | 1% of capital costs | $ | 16,000 |
| **Pump Stations** | kWh/yr | Cost ($/yr) | | | | |
| PS at Carpinteria WWTF | 451,500 | $ 58,700 | | 5% $ 26,000 | $ | 85,000 |
| **Groundwater Pumping** | | 1,100 | AFY | $50 | $ | 55,000 |
| **Recharge Basins** | | | | | | |
| Recharge Basin Maitenance | | 7.2 | acres | $5,000 | $ | 36,000 |
| **Wells** | | | | 5% of capital costs | $ | 15,000 |
| | | **Total O&M Costs ($/yr)** | | | **$** | **965,000** |
| **Annual Costs ($ / Year)** | | | | | | |
| | | Annualized Capital Costs | | | $ | 902,000 |
| | | Annual O&M Costs | | | $ | 965,000 |
| | | **Total Annualized Cost** | | | **$** | **1,867,000** |
| **Unit Costs ($ / AF)** | | | | | | |
| | Estimated Recycled Water Yield | | AFY | | | 1,100 |
| **Estimated Unit Cost ($/AF)** | | | | | | **$1,700** |

# Carpinteria Recycled Water Facilities Plan

## 3C. GWR, Inland Injection with Full AWT

| Item | | Qty | Units | Unit Cost[1] | Cost |
|---|---|---|---|---|---|
| **Capital Costs** | | | | | |
| **Treatment** | | | | | |
| AWT Treatment | | 1.2 | MGD | $6.51 | $ 7,817,000 |
| | | | | | |
| **Conveyance** | | | | | |
| 8-inch diameter | | 1,000 | ft | $160 | $ 160,000 |
| 12-inch diameter | | 5,700 | ft | $180 | $ 1,026,000 |
| | | | | **Pipelines Subtotal** | **$ 1,186,000** |
| **Pump Stations** | | | | | |
| PS at Carpinteria WWTP | | 80 | HP | $6,500 | $ 520,000 |
| | | | | | |
| **Injection Wells** | | | | | |
| 16-inch Injection Wells | | 2 | per well | $1,500,000 | $ 3,000,000 |
| **Monitoring Wells** | | 3.0 | LS | $100,000 | $ 300,000 |
| | | **Construction Subtotal** | | | **$12,523,000** |
| | | Construction Contingency | | 25% | $ 3,131,000 |
| | | **Construction Total** | | | **$15,654,000** |
| | | Implementation Costs | | 35% | $ 5,479,000 |
| | | **Total Capital Costs** | | | **$ 21,133,000** |
| | | | | | |
| **O&M** | | | | | |
| **Treatment** | | | | | |
| AWT Treatment | | 358,000 | 1,000 gallons | $2.12 | $ 758,000 |
| | | | | | |
| **Conveyance** | | | 1% of capital costs | | $ 12,000 |
| | | | | | |
| **Pump Stations** | kWh/yr | Cost ($/yr) | | | |
| PS at Carpinteria WWTF | 451,500 | $ 58,700 | 5% | $26,000 | $ 85,000 |
| | | | | | |
| **Wells** | | | 5% of capital costs | | $ 165,000 |
| | | | | | |
| **Groundwater Pumping** | | 1,100 | AFY | $50 | $ 55,000 |
| | | | | | |
| | | **Total O&M Costs ($/yr)** | | | **$ 1,075,000** |
| | | | | | |
| **Annual Costs ($ / Year)** | | | | | |
| | | Annualized Capital Costs | | | $ 944,000 |
| | | Annual O&M Costs | | | $ 1,075,000 |
| | | **Total Annualized Cost** | | | **$ 2,019,000** |
| | | | | | |
| **Unit Costs ($ / AF)** | | | | | |
| | Estimated Recycled Water Yield | | AFY | | 1,100 |
| **Estimated Unit Cost ($/AF)** | | | | | **$1,800** |

# Carpinteria Recycled Water Facilities Plan

## 3D. GWR, Seawater Barrier with Full AWT

| Item | | Qty | Units | Unit Cost[1] | | Cost |
|---|---|---|---|---|---|---|
| **Capital Costs** | | | | | | |
| **Treatment** | | | | | | |
| AWT Treatment | | 1.2 | MGD | $6.51 | $ | 7,817,000 |
| **Conveyance** | | | | | | |
| Hwy 101 Crossing | | 1 | LS | $700,000 | $ | 700,000 |
| 12-inch diameter | | 14,400 | ft | $180 | $ | 2,592,000 |
| | | | | **Pipelines Subtotal** | **$** | **3,292,000** |
| **Pump Stations** | | | | | | |
| PS at Carpinteria WWTP | | 80 | HP | $6,500 | $ | 520,000 |
| **Injection Wells** | | | | | | |
| 8-inch Injection Wells | | 4 | per well | $750,000 | $ | 3,000,000 |
| **Monitoring Wells** | | 3.0 | LS | $100,000 | $ | 300,000 |
| | | **Construction Subtotal** | | | | **$14,629,000** |
| | | Construction Contingency | | 25% | $ | 3,657,000 |
| | | **Construction Total** | | | | **$18,286,000** |
| | | Implementation Costs | | 35% | $ | 6,400,000 |
| | | **Total Capital Costs** | | | **$** | **24,686,000** |
| **O&M** | | | | | | |
| **Treatment** | | | | | | |
| AWT Treatment | | 358,000 | 1,000 gallons | $2.12 | $ | 758,000 |
| **Conveyance** | | | | 1% of capital costs | $ | 33,000 |
| **Pump Stations** | kWh/yr | Cost ($/yr) | | | | |
| PS at Carpinteria WWTP | 451,500 | $ 58,700 | | 5% $ 26,000 | $ | 85,000 |
| **Wells** | | | | 5% of capital costs | $ | 165,000 |
| **Groundwater Pumping** | | 1,100 | AFY | $50 | $ | 55,000 |
| | | **Total O&M Costs ($/yr)** | | | **$** | **1,096,000** |
| **Annual Costs ($ / Year)** | | | | | | |
| | | Annualized Capital Costs | | | $ | 1,102,000 |
| | | Annual O&M Costs | | | $ | 1,096,000 |
| | | **Total Annualized Cost** | | | **$** | **2,198,000** |
| **Unit Costs ($ / AF)** | | | | | | |
| | Estimated Recycled Water Yield | | AFY | | | 1,100 |
| **Estimated Unit Cost ($/AF)** | | | | | | **$2,000** |

# Carpinteria Recycled Water Facilities Plan

## 4A. Alt 2A & Alt 3A

| Item | | Qty | Units | Unit Cost[1] | | Cost |
|---|---|---|---|---|---|---|
| **Capital Costs** | | | | | | |
| **Treatment** | | | | | | |
| Partial RO Treatment | | 1.2 | MGD | $5.21 | $ | 6,254,000 |
| **Conveyance** | | | | | | |
| Ag Phase A | from Alt 2A | | | | $ | 2,847,000 |
| Ag Phase B | from Alt 2A | | | | $ | 4,035,000 |
| 12-inch diameter | for Potable Water | 2,000 | ft | $180 | $ | 360,000 |
| **Pump Stations** | | | | | | |
| PS at Carpinteria WWTP | | 210 | HP | $6,500 | $ | 1,365,000 |
| **Storage** | | | | | | |
| North Tank | | 0.6 | MG | $1.5 | $ | 900,000 |
| **Customer Connections** | | | | | | |
| Municipal | | 6 | | $15,000 | $ | 90,000 |
| Agriculture | | 30 | | $30,000 | $ | 900,000 |
| **Recharge Basins** | | 7.7 | acres | $50,000 | $ | 385,000 |
| **Discharge Structure** | | 1.0 | LS | $50,000 | $ | 50,000 |
| | | **Construction Subtotal** | | | | **$17,186,000** |
| | | Construction Contingency | | 25% | $ | 4,297,000 |
| | | **Construction Total** | | | | **$21,483,000** |
| | | Implementation Costs | | 35% | $ | 7,519,000 |
| **Land Acquisition** | | | | | | |
| Land Acquisition for Surface Spreading | | 7.7 | acres | $300,000 | **$** | **2,310,000** |
| | | **Total Capital Costs** | | | | **$31,312,000** |
| **O&M** | | | | | | |
| **Treatment** | | | | | | |
| Partial RO Treatment | | 381,000 | 1,000 gallons | $1.32 | $ | 503,000 |
| **Conveyance** | | | | 1% of capital costs | $ | 72,000 |
| **Pump Stations** | kWh/yr | Cost ($/yr) | Maint. (% of cap. costs) | | | |
| PS at Carpinteria WWTP | 424,150 | $ 55,100 | 5% | $ 69,000 | $ | 124,000 |
| Recharge Basin Maitenance | | 7.7 | acres | $5,000 | $ | 39,000 |
| Diluent Water (CVWD Potable) | | 585 | AFY | $250 | $ | 146,000 |
| Groundwater Pumping (RW & diluent) | | 1,170 | AFY | $50 | $ | 59,000 |
| | | **Total O&M Costs ($/yr)** | | | **$** | **943,000** |
| **Annual Costs ($ / Year)** | | | | | | |
| | | Annualized Capital Costs | | | $ | 1,398,000 |
| | | Annual O&M Costs | | | $ | 943,000 |
| | | **Total Annualized Cost** | | | **$** | **2,341,000** |
| **Unit Costs ($ / AF)** | | | | | | |
| | Estimated Recycled Water Yield | | AFY | | | 1,170 |
| **Estimated Unit Cost ($/AF)** | | | | | | **$2,000** |

# Carpinteria Recycled Water Facilities Plan

## 4B. Alt 2B & Alt 3A

| Item | | Qty | Units | Unit Cost[1] | | Cost |
|---|---|---|---|---|---|---|
| **Capital Costs** | | | | | | |
| **Treatment** | | | | | | |
| Partial RO Treatment | | 1.2 | MGD | $5.21 | $ | 6,254,000 |
| **Conveyance** | | | | | | |
| Alt 2B | | | | | $ | 4,880,000 |
| 12-inch diameter | for Potable Water | 2,000 | ft | $180 | $ | 360,000 |
| **Pump Stations** | | | | | | |
| PS at Carpinteria WWTP | | 210 | HP | $6,500 | $ | 1,365,000 |
| **Customer Connections** | | | | | | |
| Agriculture | | 25 | | $30,000 | $ | 750,000 |
| **Recharge Basins** | | 7.7 | acres | $50,000 | $ | 385,000 |
| **Discharge Structure** | | 1.0 | LS | $50,000 | $ | 50,000 |
| | | **Construction Subtotal** | | | | **$14,044,000** |
| | | Construction Contingency | | 25% | $ | 3,511,000 |
| | | **Construction Total** | | | | **$17,555,000** |
| | | Implementation Costs | | 35% | $ | 6,144,000 |
| **Land Acquisition** | | | | | | |
| Land Acquisition for Surface Spreading | | 7.7 | acres | $300,000 | **$** | **2,310,000** |
| | | **Total Capital Costs** | | | | **$26,009,000** |
| **O&M** | | | | | | |
| **Treatment** | | | | | | |
| Partial RO Treatment | | 381,000 | 1,000 gallons | $1.32 | $ | 503,000 |
| **Conveyance** | | | | 1% of capital costs | $ | 49,000 |
| **Pump Stations** | kWh/yr | Cost ($/yr) | | | | |
| PS at Carpinteria WWTF | 424,150 | $ 55,100 | 5% | $ 69,000 | $ | 124,000 |
| Recharge Basin Maitenance | | 7.7 | acres | $5,000 | $ | 38,500 |
| Diluent Water (CVWD Potable) | | 585 | AFY | $250 | $ | 146,250 |
| Groundwater Pumping (RW & diluent) | | 1,170 | AFY | $50 | $ | 58,500 |
| | | **Total O&M Costs ($/yr)** | | | **$** | **919,250** |
| **Annual Costs ($ / Year)** | | | | | | |
| | | Annualized Capital Costs | | | $ | 1,161,000 |
| | | Annual O&M Costs | | | $ | 919,250 |
| | | **Total Annualized Cost** | | | **$** | **2,080,250** |
| **Unit Costs ($ / AF)** | | | | | | |
| | Estimated Recycled Water Yield | | AFY | | | 1,170 |
| **Estimated Unit Cost ($/AF)** | | | | | | **$1,800** |