LONG-TERM FACILITIES PLAN
2014 UPDATE

ORANGE COUNTY WATER DISTRICT

November 19, 2014

Miraloma Basin

TABLE OF CONTENTS

TABLES	PAGE

FIGURES

APPENDICES

EXECUTIVE SUMMARY

INTRODUCTION

The Orange County Water District (OCWD or District) is the manager of the Orange County Groundwater Basin (basin). The basin is a vital water supply source for north-central Orange County and has played a key role in meeting the water needs of the region.

OCWD works to maintain and increase the basin's yield and protect water quality. The District's managed aquifer recharge operations have played a central role in expanding the basin's yield. Most managed aquifer recharge occurs in the District's surface water recharge basins in Anaheim and Orange, however, a significant amount of recharge is also obtained from the injection barriers that protect the basin from seawater intrusion.

Water users, generally referred to as groundwater producers (Producers), benefit from access to the basin as groundwater pumped from the basin is less expensive than imported water. The entire southern California region also benefits because recharge of local water sources, such as storm flow and recycled water, represents water that does not have to be imported from outside the watershed. Due to the District's investments and basin management programs, the basin has been able to safely sustain a doubling of annual pumping over the past 45 years.

The District prepared its first Groundwater Management Plan (GWMP) in 1989 with the latest update published in 2009. The plan is scheduled to be updated again by 2015. The GWMP articulates the goals and basin management objectives that were utilized as basic assumptions in preparation of this Long-Term Facilities Plan (LTFP). The objectives guiding the District's management of the basin are to:

- Cost-effectively protect and increase the basin's sustainable yield,
- Protect and enhance groundwater quality; and,
- Increase operational efficiency.

The LTFP is a strategic planning tool which identifies potential projects that advance the District's mission. A key purpose in preparing the LTFP is to identify the most important and effective potential projects so that available resources can be focused appropriately. Preparation of the LTFP helps the District prioritize its efforts to those potential projects that should be further developed for consideration by the Board.

This report summarizes current and future water demands, describes the current water supplies available to the District for groundwater recharge, presents a range of potential projects, explains the process for selecting projects for projects for focused study, and provides details of those projects including cost estimates and project benefits where possible.

If any individual potential project identified in the LTFP is carried forward, a project-specific Engineer's Report would be prepared as well as the appropriate environmental analysis in accordance with the California Environmental Quality Act (CEQA).

Inclusion of a potential project in the LTFP does not constitute an "approval" of the project, or commit the District to moving forward with that project. The LTFP is a "living document" and will be updated as new information becomes available.

WATER RESOURCES SUMMARY

Water Demands

Water demands within the OCWD boundaries for water year (WY) 2012-13 totaled 434,535 acre-feet. Future demands are projected to increase over 20 percent to 525,000 acre-feet by 2035. Key drivers in increased water demands are population growth within OCWD's service area, which is projected to increase from approximately 2.38 million to 2.54 million by 2035 (MWDOC, 2014), and a return to an average level of economic activity.

Water Supplies

The District operates and maintains an active managed aquifer recharge program that seeks to maximize recharge to the basin. The basin's primary sources of recharge water include: 1) Santa Ana River base flow; 2) storm flow from the Santa Ana River and local drainages (e.g., Santiago Creek); 3) recycled water; and 4) imported supplies from Metropolitan Water District of Southern California (MWD). Incidental recharge is natural, unmanaged recharge that also replenishes the basin.

Groundwater recharge to the basin averaged 317,700 afy from WY2008-09 to WY2012-13. The relative contribution of each recharge source over this time period is shown on Figure ES-1. The importance of these recharge sources has shifted over time as the availability of each source has changed.

In recent years, the supply of Santa Ana River base flow has declined, but at the same time, the supply of recycled water has increased. Santa Ana River base flow is projected to continue to decline as upstream agencies divert these flows for their uses. A key objective of the LFTP is to identify projects that cost-effectively provide additional sources of water including projects that increase storm water capture and increase the production of recycled water.

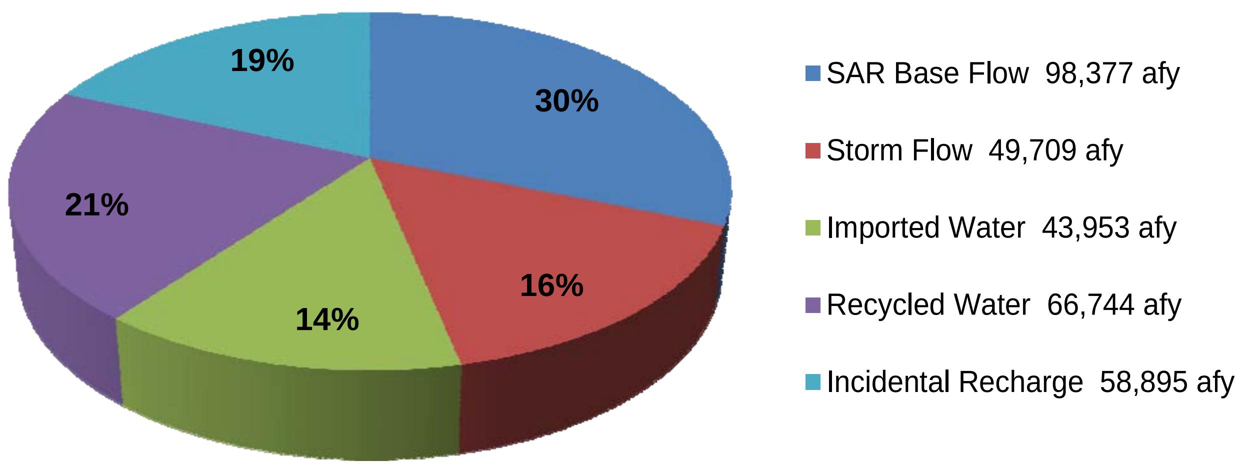

Figure ES-1
Average Annual Recharge by Source
For the Period Water Year 2008-09 to 2012-13

Groundwater Production

Maintaining a long-term balance in groundwater production and recharge is critical to sustainable basin management. The primary mechanism used to manage pumping is the Basin Production Percentage (BPP), which, in simple terms, is the percentage of each Producer's water supply that comes from the groundwater basin. It is the District's goal to work towards a BPP of 75 percent.

Producers purchase treated imported water to supply the balance of demands that are not met by groundwater. The cost of these supplies (Tier I) increased over 53 percent from approximately $580/acre-foot in 2009 to $890/acre-foot in 2014. Imported water costs are expected to continue rising. The rising costs of imported water, as well as concerns about future availability, make local water supply projects increasingly attractive.

OCWD Recharge Facilities Model

One of the challenges the District faces in determining the value of potential new recharge projects is estimating the amount of water that will be recharged into the groundwater basin if the projects were constructed. The same issue applies to determining the value of improving the District's existing facilities or storing more water at Prado Dam.

In 2009, OCWD completed the development of a desktop-operated computer model of the District's recharge system in order to have a more robust method for estimating the additional yield that could be obtained from new recharge projects as well as changes in the operation of existing facilities. The recharge facilities model is an important tool that helps the District to identify the effectiveness of investments in recharge facilities under a range of water supply scenarios. For the LFTP, 16 recharge related projects were evaluated using the recharge facilities model. These results were used to prioritize recharge related projects.

Water Quality

OCWD maintains an active water quality protection program. This includes working with water agencies in the upper watershed and the Santa Ana Regional Water Quality Control Board (Regional Water Board), operating the Prado Wetlands, monitoring surface and groundwater quality, and investigating and treating contaminated groundwater supplies. Controlling seawater intrusion is essential to maintaining the water quality of the groundwater basin. Seawater intrusion barriers are operated to protect the coastal portion of the basin. The District is also working to contain and clean up localized areas, predominately in the shallow aquifer, that have been impacted by volatile organic compounds and other contaminants.

IDENTIFICATION AND EVALUATION OF PROJECTS

Sixty-four potential projects were reviewed in preparation of the LTFP. One additional project was added in response to comments on the draft report. These potential projects are listed in Section 3.2. Short descriptions of each of these projects are included in Appendix 1. The potential projects are in various stages of development. Engineer's Reports and Feasibility Studies are complete on some potential projects; others are in the conceptual stage.

One of the primary benefits of preparing the LTFP is that it focuses the District's limited resources on projects that have the greatest potential to benefit the basin. Planning and design of some projects will require three to five years to complete due to complexities and institutional issues.

Projects were considered and evaluated internally with an emphasis on increasing the basin's yield in a cost-effective manner and protecting water quality. Data that were reviewed included the Producers' water demand forecasts, current recharge system capacity, and the future availability of local and imported water supplies. Based on this review, staff identified 15 focused study projects.

Workshops with the Producers were held in April and June 2014 to review the purpose of the LTFP, review the project prioritization approach, review preliminary project ideas, and receive feedback on the list of proposed projects that District would put the greatest focus on. These projects are referred to as the projects for focused study. This is not to imply that these projects are the only potential projects the District will evaluate. Rather, these projects identified for focused study are the potential projects District staff will prioritize for evaluation.

The final draft report was presented to the Board of Directors at the July 16, 2014 Board meeting and subsequently was sent to the Producers and made available to any interested party. Based on feedback received, two additional focused study projects were identified: North Basin Groundwater Protection Project and South Basin Groundwater Protection Project.

Proposed List of Projects for Focused Study

Based on review and analysis of the potential projects, 17 focused study projects were identified as listed in Table ES-1. These projects are described in additional detail in Appendix 2. The descriptions include planning-level cost estimates, a discussion of recommended additional analyses and project planning, and proposed schedules, if available.

Table ES-1: List of Projects for Focused Study

PROJECT	DESCRIPTION
WATER SUPPLY	
GWRS Final Expansion	Expand GWRS to 130 mgd
GWRS: Urban Runoff Diversion to OCSD Plant #1	Divert additional urban runoff to OCSD for additional supply to GWRS
Poseidon Resources Huntington Beach Ocean Desalination Plant	Partner with Poseidon to utilize purified ocean water supply from Huntington Beach facility
SARI Flow Treatment Plant at Ball Road Basin	Produce 25 mgd recycled water for surface recharge in Anaheim
Purchase Upper Watershed Wastewater	Negotiate agreements with upper watershed wastewater dischargers to purchase flows to sustain base flows reaching Prado Dam
Recovery of Evapotranspiration Loss in Prado Basin	Install production wells in Prado Basin to pump groundwater to recover evapotranspiration loss
BASIN MANAGEMENT	
Prado Basin Sediment Management	Restoration of sediment flow around Prado Dam to SAR to increase water storage capacity behind dam and replenish sediment supply to riverbed
West Orange County Enhanced Pumping	Reduce outflow to LA by increasing pumping in western portion of the basin
Sunset Gap Barrier/Desalter	Construct seawater barrier for Sunset Gap
Alamitos Barrier Extension (Landing Hill)	Expand Alamitos Seawater Intrusion Barrier
North Basin Groundwater Protection Project	Perform remedial investigation and feasibility study, cooperate with other agencies, owners, and operators, and develop and implement appropriate removal and remedial action to contain and remediate contaminated groundwater in Fullerton and Anaheim
South Basin Groundwater Protection Project	Pursue remedial investigation and other appropriate action, cooperate with other agencies, owners, and operators, and develop and implement appropriate

PROJECT	DESCRIPTION
	removal and remedial action to contain and remediate contaminated groundwater in the South Basin area
RECHARGE FACILITIES	
Enhanced Recharge in SAR Below Ball Road	Develop system to regulate flows in SAR to utilize lower reach to 22 Freeway for infiltration without loss of flows to ocean
Subsurface Recharge and Collection System in Off-River and Five Coves	Subsurface system (perforated pipes) in Off-River to collect infiltrated surface water for conveyance to Five Coves for subsurface percolation
Mid-Basin Injection	Construction of full scale Mid-Basin Injection Project (approx. 8-10 wells)
Additional Talbert Barrier Recharge Wells at Deep Well Sites	Drill new injection wells on sites of old inactive deep wells
OPERATIONAL EFFICIENCY	
Power Generation in Fountain Valley	Evaluate technical, regulatory, and economic feasibility of power generation using natural gas and photovoltaic panels at Fountain Valley campus or other sites

POLICY PRINCIPLES FOR PROJECT IMPLEMENTATION

Development of each focused study project will require separate activities for feasibility studies, testing, Engineer's/Geologist's Reports, CEQA compliance and, if ultimately approved by the Board, final design, construction, startup and initial operations. Certain projects will require additional activities unique to their implementation.

Some projects that are in the conceptual stage do not yet have cost estimates. Once they have been further refined and the project costs can be determined, these projects will have to be reevaluated to determine their cost effectiveness and how they fit into the District's overall objectives.

It is important to note that each project schedule is subject to change as the project is evaluated, considered, and potentially moves forward toward completion. This will require periodic reviews and adjustments of the LTFP. Such reviews will determine if priorities should be changed or modified.

Modifications to the LTFP and Future Updates

It is anticipated that the LTFP will be updated periodically. Changes can and will occur to the basin and California's water resources situation over time, creating the need to refocus resources and to reprioritize District activities. Examples of changing conditions include:

- Increased recycling in the upper basin resulting in decreased Santa Ana River base flows reaching Prado Dam;

- Increased water demands within District boundaries due to population growth;
- Changes in the cost and availability of imported water supplies;
- Discovery of new sites of groundwater contamination;
- The potential of purchasing purified ocean water from Poseidon Resources;
- Continuation of drought conditions necessitating a re-evaluation of basin operations; and
- Economic considerations.

SECTION 1.0 INTRODUCTION

This chapter provides a short background and history of Orange County Water District (OCWD or District), discusses the Groundwater Management Plan (GWMP), provides an update on status of projects included as priority projects in the 2009 LTFP, and outlines the purpose of this report.

1.1 BACKGROUND

OCWD is the manager of the Orange County Groundwater Basin (basin). The basin is a vital water supply source for north-central Orange County, and has played a key role in meeting the water needs for a growing population for over 100 years. Population within the District boundaries is approximately 2.4 million residents. The location of the basin, OCWD's boundaries, and selected District facilities are shown in Figure1-1.

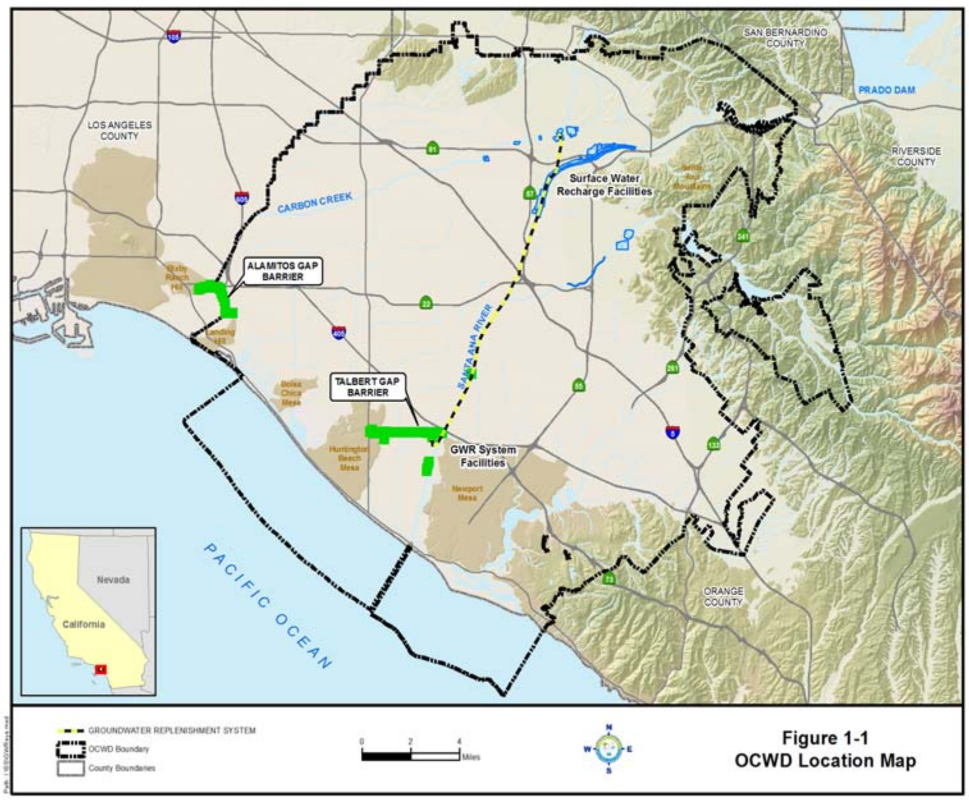

Figure 1-1: Orange County Groundwater Basin

OCWD was formed in 1933 for the purpose of managing and protecting the basin. The District's mission statement provides a concise description of OCWD's purpose:

> *It is the mission of the Orange County Water District to provide local water retailers with a reliable, adequate, high-quality local water supply at the lowest reasonable cost and in an environmentally responsible manner.*

Since its founding, the District has grown in size and population. Annual groundwater production in water year (WY) 2012-2013 was 309,295 acre-feet. Unless otherwise noted, the WY extends from July 1 to June 30. Total water demand within the District's boundaries for that same year was 434,535 acre-feet (OCWD, 2014). Demand by 2035 is estimated to increase to approximately 525,000 afy within the existing District boundaries.

OCWD manages the basin and works to maintain and increase the basin's yield and protect water quality. Other entities or individuals pump groundwater from the basin for their use or to retail to other users.

Managing the basin to increase the annual yield has enabled OCWD to meet growing demands while protecting the long-term sustainability of the basin and has fostered a history of innovation and creativity. The District has employed groundwater management techniques to increase the annual yield from the basin. Annual production increased from approximately 150,000 afy in the mid-1950s to 309,295 acre-feet in WY2012-2013.

OCWD's recharge operations have played a central role in expanding the basin's yield. Efforts to increase the capture of Santa Ana River base flows and storm flows and to recharge imported water date back to the 1930s and 1940s. Currently OCWD operates approximately 1,100 acres of recharge basins in the cities of Anaheim and Orange.

Water users, generally referred to as groundwater producers (Producers), benefit from access to the basin as groundwater pumped from the basin is less expensive than imported water. The entire southern California region also benefits because recharge of local water sources, such as storm flow and recycled water, represents water that does not have to be imported from outside the watershed. Due to the District's investments and basin management programs, annual pumping from the basin has doubled over the past 45 years.

1.2 GROUNDWATER MANAGEMENT PLAN

The District prepared the first Groundwater Management Plan (GWMP) in 1989 and published the latest update in 2009. The GWMP articulates policy and basin management objectives that were utilized as basic assumptions in the preparation of the LTFP. The basin management objectives guiding the District's management of the groundwater basin as stated in the GWMP are to:

- Cost-effectively protect and increase the basin's sustainable yield,
- Protect and enhance groundwater quality, and
- Increase operational efficiency.

The GWMP discusses the basin's hydrogeology, water quality issues, recharge of the basin, and management of pumping from the basin. The plan discusses and describes the following topics in detail:

- The District's formation, mission, and operating authorities;
- Basin management objectives;
- The District's numerical model of groundwater flow in the basin;
- The range of District activities and management programs including groundwater monitoring, water quality protection, recharge water supplies, and groundwater cleanup projects;
- The calculation of the groundwater storage level in the basin, and factors that affect the basin when the storage level is low or high; and
- Approaches the District uses to maximize yield from the basin and manage demand on the basin in light of available recharge water supplies.

1.3 PURPOSE OF THE LONG-TERM FACILITIES PLAN

The LTFP is a strategic planning tool which identifies potential projects to consider in advancing the District's mission as described above. The LTFP presents a preliminary assessment of potential projects' costs and benefits, and prioritizes potential projects for more detailed analysis based upon cost, benefit and feasibility. A wide range of potential projects were identified and evaluated. Preparation of the LTFP is a planning effort to screen potential projects and identify which ones to carry forward for more detailed analysis and consideration.

This report identifies and evaluates potential projects that could, if implemented, help the District achieve the following:

- Increase the sustainable yield of the basin in a cost-effective manner. This is generally referred to as "optimizing the basin's yield", and is achieved through:
    - Developing new sources of recharge water, such as the Groundwater Replenishment System (GWRS);
    - Maximizing recharge into the basin;

  - Minimizing Santa Ana River surface outflow to the ocean;
  - Minimizing subsurface outflow from the basin;
  - Minimizing areas of low or depressed groundwater levels; and
  - Increasing local water supply;
- Protect and enhance groundwater quality in the basin. In general terms, this is achieved through:
  - Protecting and enhancing the quality of water recharged into the basin;
  - Controlling seawater intrusion; and
  - Cleaning up contaminated groundwater.
- Increase the efficiency of OCWD's operations through:
  - Operating recharge basins in a more efficient manner;
  - Evaluating alternative energy supplies; and
  - Managing District finances to provide long-term fiscal stability.

Increasing the basin's sustainable yield and protecting groundwater quality are often interconnected. For example, projects that help prevent seawater intrusion along the coast can help maintain groundwater production from the basin and, in some cases, could increase the level of sustainable production.

The District and the Producers have an interest in maximizing the long-term sustainable basin yield, provided that it is done in a cost-effective manner. In this context 'sustainable basin yield' refers to the annual amount of production that can be maintained on a long-term basis (for example, five to ten years or more) without harming the basin. This requires that total production from the basin is balanced with total recharge on a long-term basis.

Section 2 of this report summarizes current and future estimated water demands within the District's boundaries and describes the current water supplies available to the District to recharge the basin. Section 3 discusses the potential projects evaluated in the LTFP, explains the process for selecting those projects and identifies the potential projects prioritized for more detailed evaluation and planning. Section 4 discusses the process for implementation of focused study projects. Appendix 1 contains short descriptions of each potential project considered in the LTFP and in Appendix 2 each focused study project is described in greater detail.

The LTFP reviews the proposed projects at a conceptual level to rank the various alternatives for potential further review. The LTFP does not bind, commit, or predispose the District to further consideration, approval, or implementation of any potential project identified in the LTFP.

Acceptance of the LTFP does not constitute approval of any potential project for further analysis, design or construction. Each of the District's projects must be separately initiated, and approved by the District's Board of Directors. If any individual potential project identified in the LTFP is carried forward, an Engineer's Report will be prepared for that potential project for consideration by the Board of Directors, as required by Section 20.7 of the District Act. The District will also concurrently conduct appropriate environmental analysis in accordance with the California Environmental Quality Act for any potential project that is carried forward for consideration by the Board of Directors. Therefore, the LTFP will not cause either a direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment.

1.4 STATUS OF LTFP 2009 PRIORITY PROJECTS

Nineteen projects were identified as priority projects in the 2009 LTFP. These projects are in varying stages of consideration, design, and construction as summarized in Table 1-1.

Table 1-1: Summary of 2009 LTFP Priority Projects

Completed Project	Description	Project Complete
Burris and Lincoln Basins Reconfiguration	Two basins reconfigured to remove impermeable material and backfilled with permeable sand to create more storage for captured water and maintain recharge capacity	2010
Olive Basin Pump Station	Dewatering pump station constructed to allow for more frequent basin cleanings to maintain infiltration rates	2010
Santiago Basin Pump Station	Constructed a pump station to allow for dewatering and recharging 5,000 af of stormwater stored at elevations below the outlet structure	2012
Mid-Basin Injection Demonstration Project	2 new monitoring wells and one new injection well in operation to collect data to develop a full-scale project to inject GWRS purified water into the principal aquifer	2014
Desilting Improvement Project – Demonstration Phase	Evaluated 2 methods to remove sediment from Santa Ana River water to increase the performance of recharge facilities	2014
Project Under Construction	**Status**	
GWRS Initial Expansion	Construction to be completed in 2015	
Alamitos Barrier Improvements	Awaiting final permits before starting construction in late 2014 or early 2015	

In Planning Phase and/or Design Complete	Status
Enhanced Water Conservation at Prado Dam	In planning phase
North Basin Groundwater Protection Project	In Remedial Investigation/Feasibility Study phase
South Basin Groundwater Protection Project	In remedial investigation phase
MTBE Investigation and Remediation	In investigation phase
Sediment Management in Prado Basin and Santa Ana River	In planning phase
Santiago Basins Intertie	In design phase
Placentia and Raymond Basins Improvements	Project on hold pending further investigation
Five Coves and Lincoln Basins Bypass Pipeline	Project on hold pending further investigation

Four of the nineteen projects are in the conceptual stage. These are Santiago Creek Enhanced Recharge, Subsurface Recharge, Recharge Basin Rehabilitation, and Electrical Generation with Solar Plant.

SECTION 2.0 WATER RESOURCES SUMMARY

In this section, water supply and demand issues are discussed within the context of current conditions as well as future trends and projections. This includes a discussion of:

- *Current and future water demands within OCWD boundaries;*
- *Surface water and groundwater supply availability as they relate to recharge and management of the groundwater basin;*
- *Current and future trends in groundwater production;*
- *Future availability of imported water; and*
- *Water quality of groundwater and surface water supplies.*

2.1 WATER DEMANDS

Total water demand represents all water usage in the District's boundaries, including residential, industrial, commercial, and agricultural uses. This section discusses current as well as future water demands.

2.1.1 Current Water Demands

Total water demand within the District's boundaries in water year (WY) 2012-13 was 434,535 acre-feet. Unless otherwise noted, the WY extends from July 1 to June 30. Total demand is met with a combination of groundwater, surface water from Santiago Creek and Irvine Lake, recycled water, and imported water. As shown in Figure 2-1, water demands between WY1989-90 to WY2011-12 have fluctuated from approximately 413,000 afy to 515,000 afy. Total water demands have slightly rebounded the past two water years after declining from WY2006-07 to WY2010-2011. Recovering from the economic recession and dry local hydrology has contributed to the recent increase in demand over the past few years.

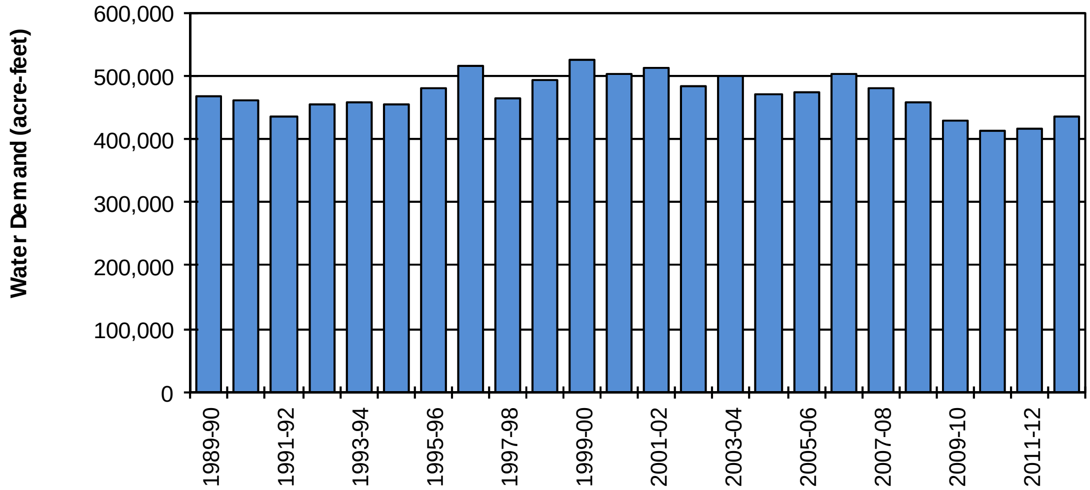

Figure 2-1: Total District Water Demands (Water Year 1989-90 to 2012-13)

2.1.2 Projected Water Demands

Estimating future water demand is necessary for planning future projects. Numerous factors impact future water demand, such as population growth, economic conditions, conservation programs, and hydrologic conditions. Estimates of future demands are therefore subject to some uncertainty and need to be updated periodically.

Demand projections within the District's service area are based on Urban Water Management Plans (UWMP), which each Producer prepares to support their long-term resources planning to ensure that adequate water supplies are available to meet existing and future water demands. The California Department of Water Resources requires that the UWMP's be updated every 5 years. One of the key factors influencing water demand is population growth. Population within OCWD's service area is expected to increase from approximately 2.38 million currently to 2.54 million by 2035 as shown in Table 2-1. Another factor affecting demands is growth of the District's service area through annexations. The most recent annexation was approved in 2014. The combination of population growth and annexations is expected to result in total water demands of 525,000 afy by 2035 as shown in Table 2-2.

Table 2-1: Estimated Population within OCWD Boundaries

2015	2020	2025	2030	2035
2,376,929	2,442,790	2,487,780	2,535,627	2,539,154

Source: MWDOC and Center for Demographics Research (2014)

Table 2-2: Projected Total Water Demands* in Fiscal Year Ending 2035

Producer	Projected Water Demands (AF) in 2035
Anaheim	77,700
Buena Park	19,900
East OCWD	1,100
Fountain Valley	10,165
Fullerton	32,792
Garden Grove	30,907
Golden State Water Co.	32,774
Huntington Beach	34,657
IRWD	88,008
La Palma	2,742
Mesa	19,700
Newport Beach	18,474
Orange	34,713
Santa Ana	50,400
Seal Beach	4,880
Serrano WD	2,852
Tustin	15,194
Westminster	12,337
Yorba Linda WD	27,784
Non-Agency**	8,000
Total Water Demand	**525,079**

*Includes 2014 Anaheim, IRWD and Yorba Linda Water District Annexations.

**Includes pumping by small system, private, domestic, irrigation, mutual water companies, and groundwater remediation systems.

2.2 WATER SUPPLIES

Water needs within OCWD boundaries are met with a combination of groundwater, imported water, and recycled water. Surface water from Santiago Creek and Irvine Lake also contribute to the water supply.

Historically, groundwater pumping or production from the basin has been the major source of supply. In order to sustain groundwater pumping, the groundwater supplies need to be replenished by recharging the basin.

2.2.1 Groundwater Recharge

The District maintains an active managed aquifer recharge program that seeks to maximize recharge to the basin. The basin's primary sources of recharge water include: 1) Santa Ana River base flow, 2) storm flow from the Santa Ana River and local drainages (e.g., Santiago Creek), 3) recycled water from the GWRS, and 4) imported supplies from Metropolitan Water District of Southern California (MWD). Incidental recharge is natural, unmanaged recharge that also replenishes the basin.

As shown in Table 2-3, groundwater recharge to the basin averaged 317,677 afy from WY2008-09 to WY2012-13. The relative contribution of each recharge source over this time-period is shown on Figure 2-2. The importance of these recharge sources has shifted over time as the availability of each source has changed. In recent years, the supply of Santa Ana River base flow has declined, but at the same time, the supply of recycled water has increased. Figure 2-3 shows how the various recharge sources to the surface recharge system have evolved since recharge operations started in 1936. Additional information on recharge system performance can be found in the Annual Reports on Groundwater Recharge in the Orange County Groundwater Basin, which are available from the OCWD website at http://www.ocwd.com/News/ReportsPublications.aspx

Table 2-3: Annual Recharge by Source Water Year 2008-09 to 2012-13

WY	Santa Ana River Base Flow (afy)	Storm Flow (afy)	Imported Water (afy)	Recycled Water (afy)	Subtotal (afy)	Incidental (afy)	Total (afy)
2008-09	105,490	53,007	28,000	54,674	241,170	69,352	310,522
2009-10	102,599	61,035	21,586	66,506	251,726	83,239	334,965
2010-11	104,469	80,087	39,053	66,795	290,404	94,484	384,888
2011-12	94,754	34,531	90,122	72,258	291,665	27,701	319,366
2012-13	84,572	19,886	41,004	73,486	218,948	19,698	238,646
5-Yr Average	**98,377**	**49,709**	**43,953**	**66,744**	**258,783**	**58,895**	**317,677**
Average %	**31%**	**16%**	**14%**	**21%**	**81%**	**19%**	**100%**

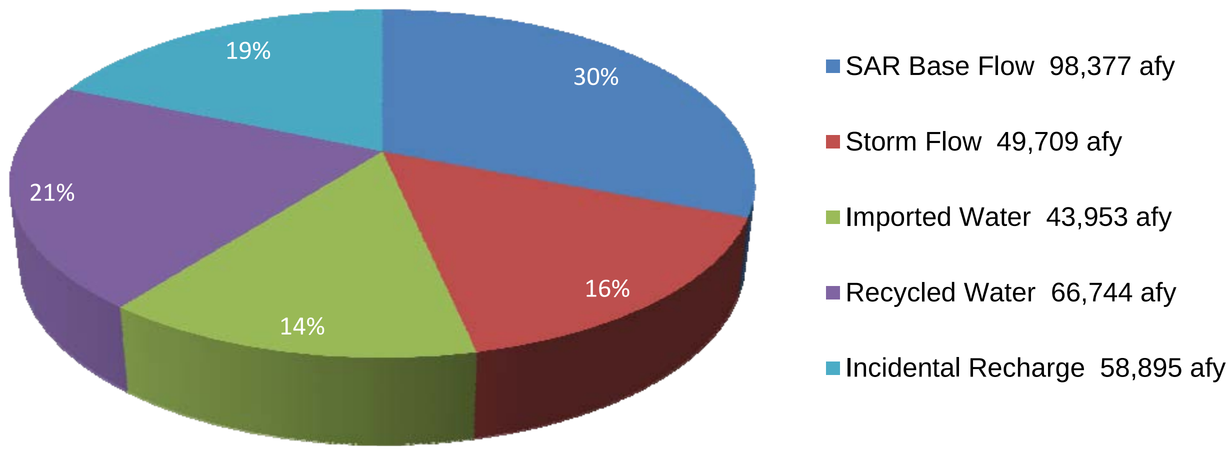

Figure 2-2: Average Annual Recharge by Source, Water Year 2008-09 to 2012-13

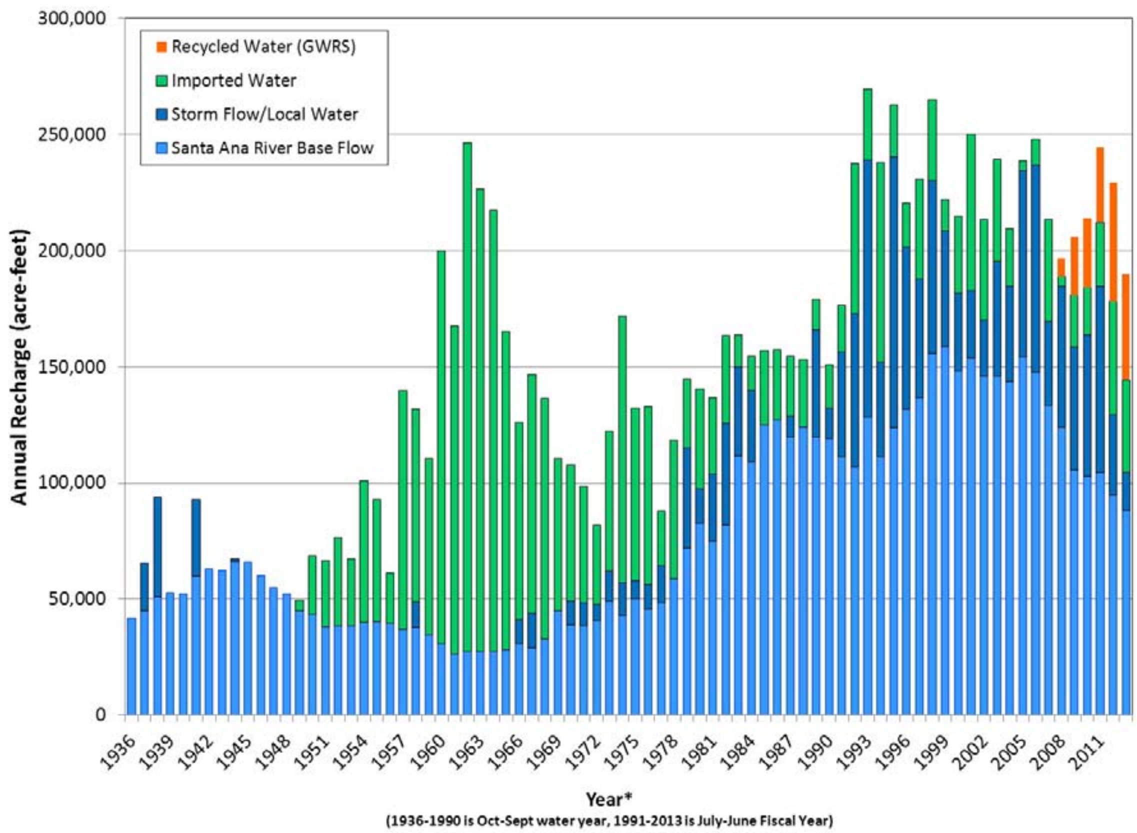

Figure 2-3: Historical Recharge in Surface Water Recharge System Water Year 1936-37 to 2012-2013

SANTA ANA RIVER: BASE FLOW AND STORM FLOW

The two main components of flow in the Santa Ana River are base flow and storm flow. A large amount of the base flow, especially in the summer months, is comprised of tertiary-treated wastewater discharged from wastewater treatment facilities upstream of Prado Dam.

In recent years, the amount of Santa Ana River base flow has declined. This decline is attributed to increased recycling by agencies in the upper watershed, decreased per capita water use due to water use efficiency programs, increased groundwater production near the Santa Ana River, recent dry hydrologic conditions, and economic conditions. While improved economic conditions are expected to lead to increased growth and perhaps increased water use in the upper watershed, it is anticipated that water and wastewater agencies upstream of Prado Dam will increase their capacity to capture storm water and produce recycled water for irrigation, industrial water use, and groundwater recharge. Therefore, it is expected that base flows will continue to decline in the future. Figure 2-4 shows how Santa Ana River base flow has changed over time.

The 1969 Judgment of the case Orange County Water District v. City of Chino et al. (Santa Ana River Watermaster, 2014), requires that a minimum base flow of 42,000 afy reach Prado Dam. However, this minimum requirement can be as low as 34,000 afy due to a system of credits contained in the Judgment.

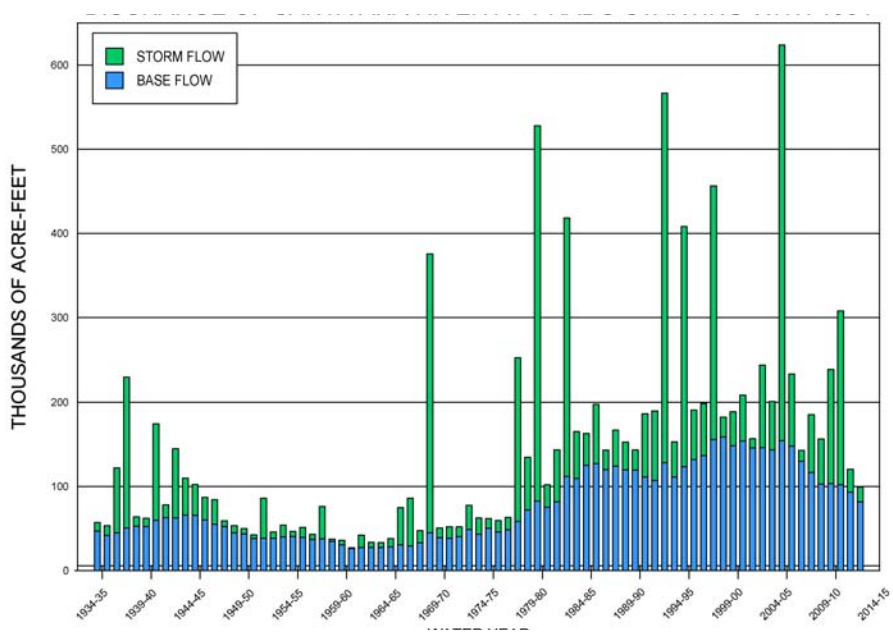

Figure 2-4: Annual Base and Storm flow in the Santa Ana River at Prado Dam Water Year (October to September) 1936-2013
Source: Santa Ana River Watermaster, 2014

The District's recharge facilities in Anaheim and Orange are able to capture and recharge all Santa Ana River base flows. However, storm flow capture and recharge varies from year to year based on the amount and distribution of precipitation. Average precipitation at the District's Field Headquarters in Anaheim is just over 14 inches per year. However, total annual precipitation can range from less than 3 inches to over 36 inches as shown on Figure 2-5. In dry years, all storm water is captured and recharged. In very wet years, a large amount of storm flow can be lost to the ocean. Lost storm water also occurs due to clogging of the recharge facilities. This is especially pronounced in the late winter and early spring months.

As shown on Table 2-3, storm flow capture over the past 5 years ranged from approximately 20,000 to 80,000 acre-feet. Uncaptured storm flow, which is storm flow that the District cannot recharge in Anaheim and Orange, is a potential source of new recharge water. To utilize this potential source of new water, the District would need to increase the capacity of the District's recharge facilities or increase the conservation pool behind Prado Dam.

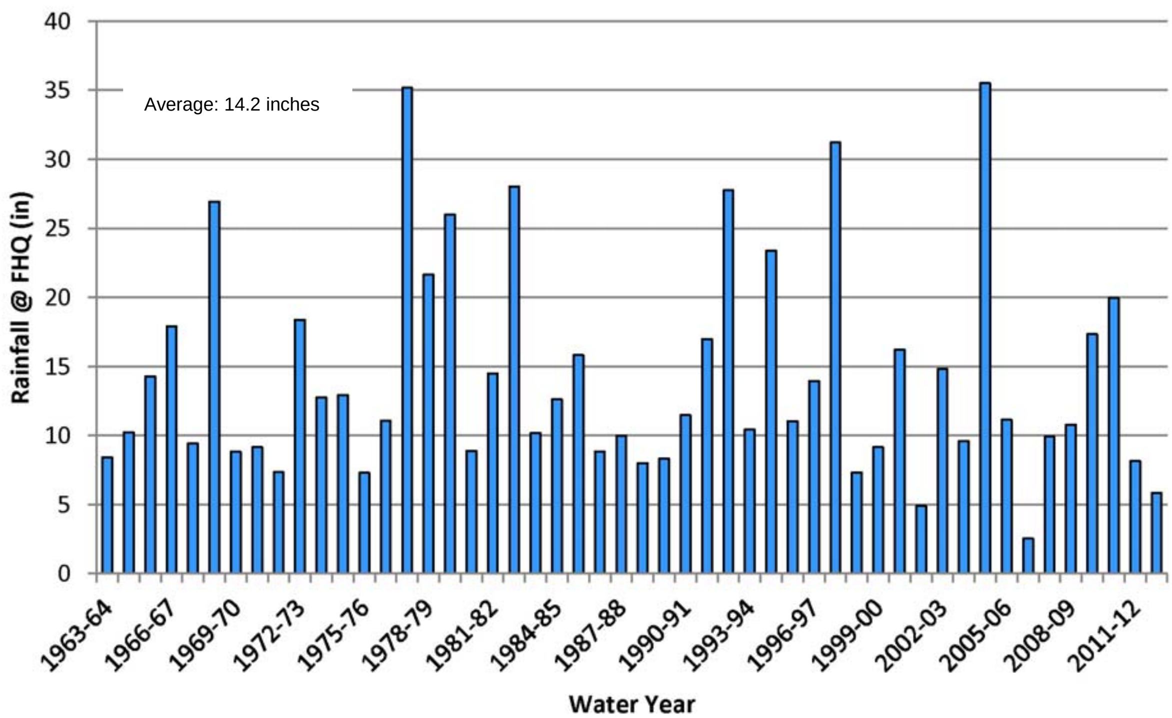

Figure 2-5: Annual Precipitation at OCWD Field Headquarters Water Year 1963-64 to 2012-13

RECYCLED WATER SUPPLIES

The GWRS began producing recycled water for groundwater recharge in January 2008. Water produced by the GWRS is recharged in the Talbert Barrier and in Miraloma, Miller and Kraemer Basins. In 2013, the GWRS produced 72,628 acre-feet of water. The GWRS is an important source of supply, providing over 20 percent of recharge to the basin over the last five years as shown in Table 2-3. The GWRS Initial Expansion, which will increase GWRS capacity to 100,000 afy, is scheduled to be completed in 2015. The additional flows produced by the Initial Expansion will be recharged in the planned La Palma Basin, which is currently being designed.

A small additional amount of recycled water is also recharged to the basin in the Alamitos Seawater Intrusion Barrier.

IMPORTED WATER SUPPLIES

Imported water from the Metropolitan Water District of Southern California (MWD) has been a key source of recharge water since 1949, when OCWD began purchasing imported water from the Colorado River for recharge in the Santa Ana River channel. Over the 10-year period from 1954 to 1964, the District purchased and recharged over 1.3 million acre-feet of Colorado River water as shown in Figure 2-6.

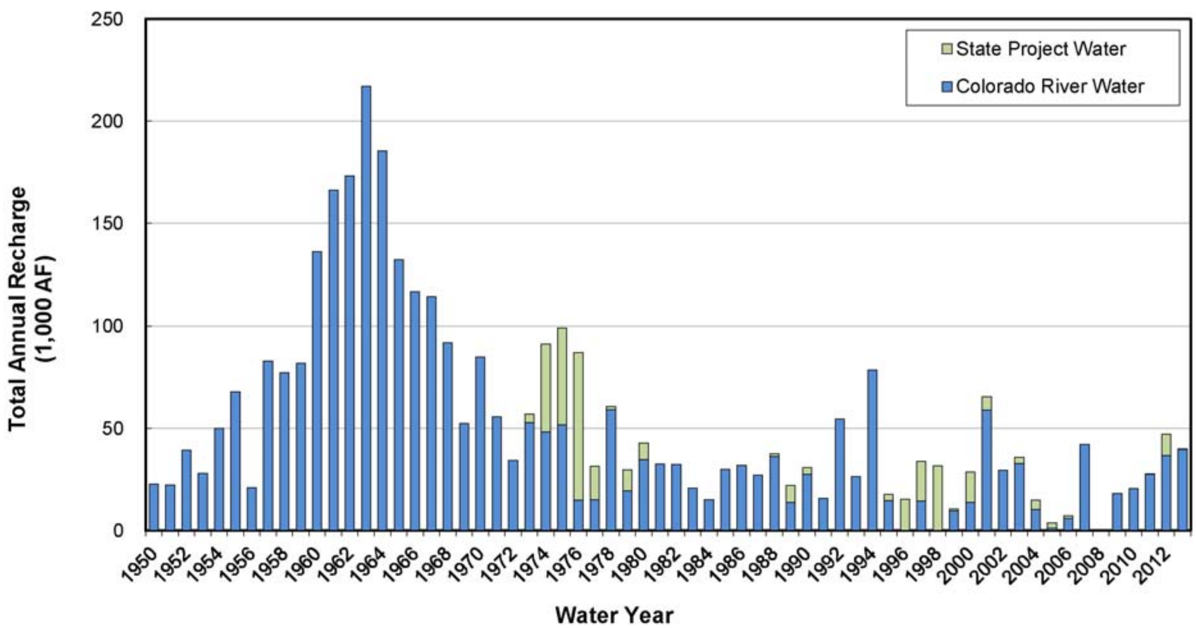

Figure 2-6: Surface Water Recharge of Imported Water
Water Year 1950-51 to 2012-13

In addition to Colorado River water, imported water is also available from the State Water Project (SWP). For many years, MWD sold water for groundwater replenishment at a discounted rate; however, in 2012, MWD terminated the replenishment program and has yet to formally adopt a new replenishment program. As a result, OCWD now purchases imported supplies for replenishment at the untreated full-service rate.

Over the past 5 years, annual imported water recharge has ranged from 21,600 to 90,000 acre-feet as shown in Table 2-3.

INCIDENTAL RECHARGE

Rain that falls within the District boundary results in storm flow and incidental recharge. Incidental recharge, which is not directly measured, tends to be widespread over the basin and consists of recharge from hills and mountains adjacent to the groundwater basin, underflow beneath the Santa Ana River and Santiago Creek, areal recharge from precipitation, irrigation return flows, and urban runoff (OCWD, 2009). Incidental recharge reported herein is net recharge to the basin after losses to Los Angeles County are subtracted from total incidental recharge. The estimated volume of incidental recharge correlates with local rainfall totals. With average rainfall, incidental recharge is estimated to be approximately 60,000 acre-feet. As shown on Table 2-3, annual incidental recharge has ranged from just under 20,000 to 94,500 acre-feet over the past five years. Incidental recharge is discussed in greater detail in the Groundwater Management Plan (OCWD, 2009).

2.3 GROUNDWATER PRODUCTION

OCWD manages total production from the basin in accordance with authorities established in the District Act. Total pumping is managed using financial incentives to encourage producers to pump only the amount of groundwater established by OCWD. The primary mechanism used to manage pumping is the Basin Production Percentage (BPP), which, in simple terms, is the percentage of each producer's total water supply that comes from groundwater. Any pumping over the BPP incurs an additional charge (i.e., Basin Equity Assessment) that makes the cost of groundwater equal with imported water. This incentivizes producers to limit their pumping to the BPP. Figure 2-7 shows the history of the BPP set by the District along with the actual BPP that was achieved by the Producers.

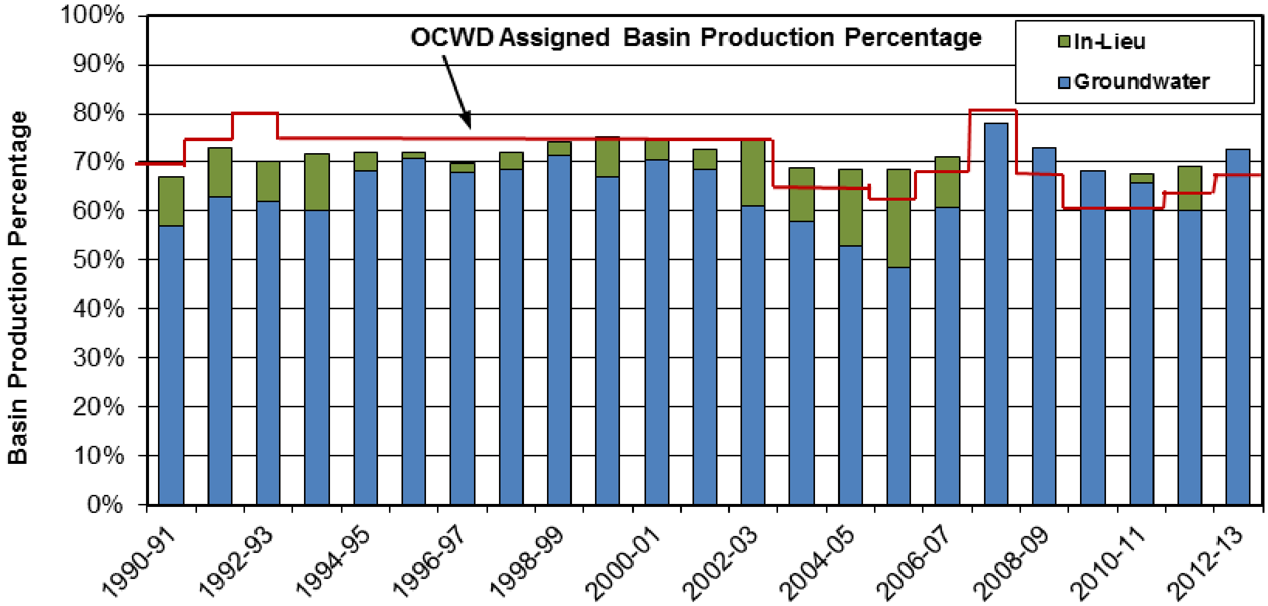

Figure 2-7: Basin Production Percentage Water Year 1990-91 to 2012-13

Over the long-term, the basin must be maintained in an approximate balance to ensure the long-term viability of basin water supplies. In one particular year, groundwater withdrawals may exceed recharged water as long as the basin remains within a safe operating range. In simple terms, this means that over the course of a number of years, periods when basin storage is reduced need to be balanced by periods when storage is increased. Storage is increased when the amount of water recharged exceeds production. Levels of groundwater production and recharge from WY1990-91 to WY2012-13 are shown in Figure 2-8.

In 2013, the District adopted a policy stating the intention to work toward achieving and maintaining a 75 percent BPP by fiscal year 2015-16. As in the past, an annual public hearing will be held in April and the Board will formally adopt a BPP for the following water year based on basin conditions and sustainable basin management. To support the 75 percent BPP policy, the District will need to expand its ability to recharge additional water supplies into the basin and purchase additional supplies of imported water for recharge.

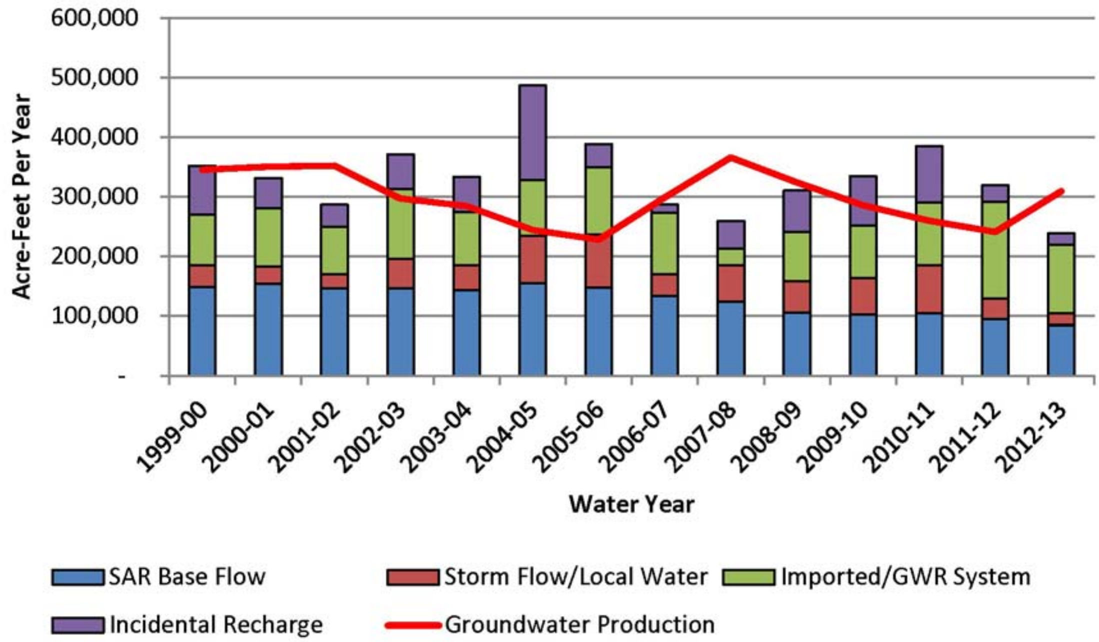

Figure 2-8: Groundwater Production and Recharge Water Year 1999-00 to 2012-13

2.4 FUTURE AVAILABILITY OF IMPORTED WATER SUPPLIES

MWD typically provides around 120,000 afy of water to the District's service territory; this will likely increase in the future as total water demands increase. Projects such as the GWRS Initial Expansion will help reduce how much imported water is needed.

MWD continues to face a number of challenges in securing reliable and sustainable supplies from the SWP and the Colorado River. For example, due to environmental issues, the average amount of water that MWD can receive from the SWP has been reduced by about one-third or by approximately 500,000 afy over the past six years. The proposed project to construct tunnels under the Sacramento Delta could restore these deliveries; however it is unknown at this time if the project will ultimately be approved for construction.

Due to water shortages in 2009 and 2010, MWD was forced to implement an allocation plan for imported water deliveries. MWD member agencies were allocated less water than historically used. Large penalties were put in place for agencies taking more than their allotment. Relatively wet periods in following years allowed MWD to recover from this situation and store significant amounts of water.

Due to more recent dry conditions, MWD has been withdrawing stored water and may take approximately 1,000,000 acre-feet out of their various storage accounts and programs to help meet water demands in southern California for calendar year 2014. If the upcoming winter is relatively dry in California, MWD may need to once again implement an allocation plan in 2015.

MWD has developed an Integrated Resources Plan (IRP) to work towards creating a reliable water supply plan for the Southern California region. The IRP identifies projects and programs that need to be implemented to accomplish this goal. Addressing conveyance through the Sacramento Delta is a large part of the IRP. MWD will be updating this plan in 2015.

The recent and projected costs of treated imported water are shown in Figure 2-9. Additionally, there is some uncertainty if MWD can be relied upon to provide additional imported water supplies necessary to meet expected growth within OCWD's service area.

At this time, average water demands for southern California exceed average water supplies, a condition that could exist for some time. MWD and other southern California water agencies are working on several fronts to reverse this situation. Efforts include:

- Increasing conservation savings through more aggressive advertising and enhancements to current conservation rebate programs;
- Seeking water transfers;
- Developing additional local supplies;
- Interim actions in the Delta such as temporary barriers to channel water around smelt rearing areas that could potentially reduce the impact of the Delta Smelt ruling; and
- A long-term reconfiguration for the Delta conveyance system through an isolated or dual conveyance system coupled with an ecosystem restoration/habitat conservation plan.

As its supplies have decreased, MWD is also facing increasing operational expenses while attempting to meet southern California water demands. Examples of these additional costs include:

- Restrictions on the time periods the SWP Harvey Banks pumping plant can operate due to the recent delta smelt ruling forcing the plant to operate during peak power load periods when electricity rates are higher;

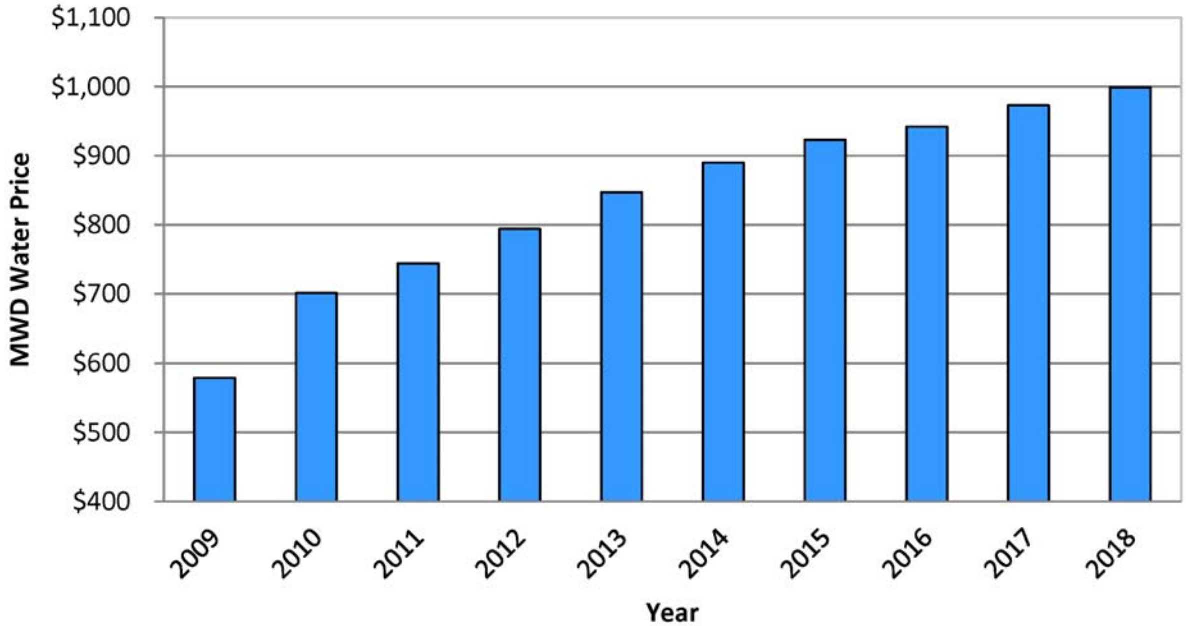

Figure 2-9: Historic and Projected MWD Tier I Water Supply Cost per Acre-Foot, Calendar Year 2009-2018

* MWD Rates do not Include separate cost for the MWD Readiness-to-Serve and capacity charges.

Source: MWD Board Report, April 18, 2014

- Purchasing water supplies on the open market in central and northern California;
- The cost of more aggressive conservation advertising, conservation program enhancements, and additional investment in local supply projects; and
- The cost to control quagga mussels which have invaded water supplies and storage reservoirs.

The cost of MWD Tier I supplies increased from approximately $580/acre-foot in 2009 to $890/acre-foot in 2014. The increasing cost of imported water makes local water supply projects more economical to pursue.

The development of local projects would directly reduce the need for MWD supplies. Local projects that can increase the supply of groundwater while maintaining the current cost advantage of groundwater relative to MWD supplies provide cost savings to the Producers and local water users.

2.5 SUMMARY OF CURRENT WATER SUPPLY SITUATION

The District expects that present water resources challenges will continue into the future. These trends include:

- Continued decline in Santa Ana River base flow;
- A continuation of cycles of below and above average precipitation with a greater frequency of extreme conditions;
- Need for greater local water supply self-sufficiency as imported water supplies continue to be less reliable; and
- An increase in water produced by the GWRS.

2.6 OCWD RECHARGE FACILITIES MODEL

One of the challenges the District faces in determining the value of improving existing recharge facilities, storing more water at Prado Dam, and purchasing new recharge facilities is estimating the amount of additional water that could be recharged due to a potential project. Given the complexity and interconnectivity of the recharge system, a model was needed to isolate the impacts of various proposed projects in order to determine the increased recharge potential due to a specific project.

In 2009, the District completed development of a Recharge Facilities Model (RFM). This model was developed with the assistance of CH2M HILL and is based on GoldSim software, which is a general simulation software solution for dynamically modeling complex systems in business, engineering and science http://www.goldsim.com/Home/) (CH2M HILL, 2009). CH2M HILL was provided with detailed operational guidelines and recharge system information. These data were the basis of the RFM, which was able to replicate recharge operations for a six year period from July 2002 to June 2008. This period was selected because it included both very wet and dry conditions. The excellent fit between the historical recharge and modeled recharge showed that the model was well calibrated and could be used to predict recharge under a variety of conditions.

Some key features the model accounts for include:

- Ability to simulate different water inflow scenarios (e.g., high base flow, low base flow, etc.)
- Different Prado Dam conservation pool elevations and release rates
- Different sedimentation levels in Prado Dam
- Inflatable rubber dam operations (e.g., diversion rates, deflation/inflation)

- Conveyance capacity of system (e.g., pipeline and pumping capacities)
- Basin recharge capacities
- Reductions in basin capacities caused by clogging
- Maintenance thresholds that cause basins to be taken out of service and cleaned
- Ability to add imported water to system when excess capacity is available

The RFM is flexible and allows for the development and simulation of a wide array of different scenarios. Figure 2-10 presents an overview of the system as it appears in GoldSim.

2.6.1 Future Santa Ana River Flow Projections

The District worked with Wildermuth Environmental, Inc. (WEI) to develop future projections of the Santa Ana River base flow and storm flow arriving at Prado Dam. This was done primarily to support work with the US Army Corps of Engineers (Corps) in studying the feasibility of increasing the volume of water that can be stored in the Prado Conservation Pool (WEI, 2014a; WEI, 2014b).

WEI and District staff collaborated to generate expected discharges to the Santa Ana River from Publically Owned Treatment Works (POTWs) for future conditions. WEI applied a monthly distribution of evapotranspiration data to the annual POTW estimates to generate a monthly distribution for each POTW discharger. WEI then used these discharges in a Waste Load Allocation Model (WLAM). The WLAM is a hydrologic simulation tool of the Santa Ana River watershed tributary to Prado Dam developed for the Santa Ana Watershed Project Authority (SAWPA) by WEI (WEI, 2009). WEI began development of the WLAM for SAWPA in 1994 and has improved it over time to support numerous water resources investigations.

The WLAM uses historic rainfall and stream flow along the model boundaries for the 50-year period from 1950 to 1999. The model also accounts for the contribution of rising groundwater to Santa Ana River flows. The volume of rising groundwater has decreased in recent years due to lower groundwater levels in the southern portion of the Chino Groundwater Basin. Groundwater levels in this area are expected to remain low as this is part of the basin management strategy to reduce the migration of poor quality groundwater water into the Santa Ana River.

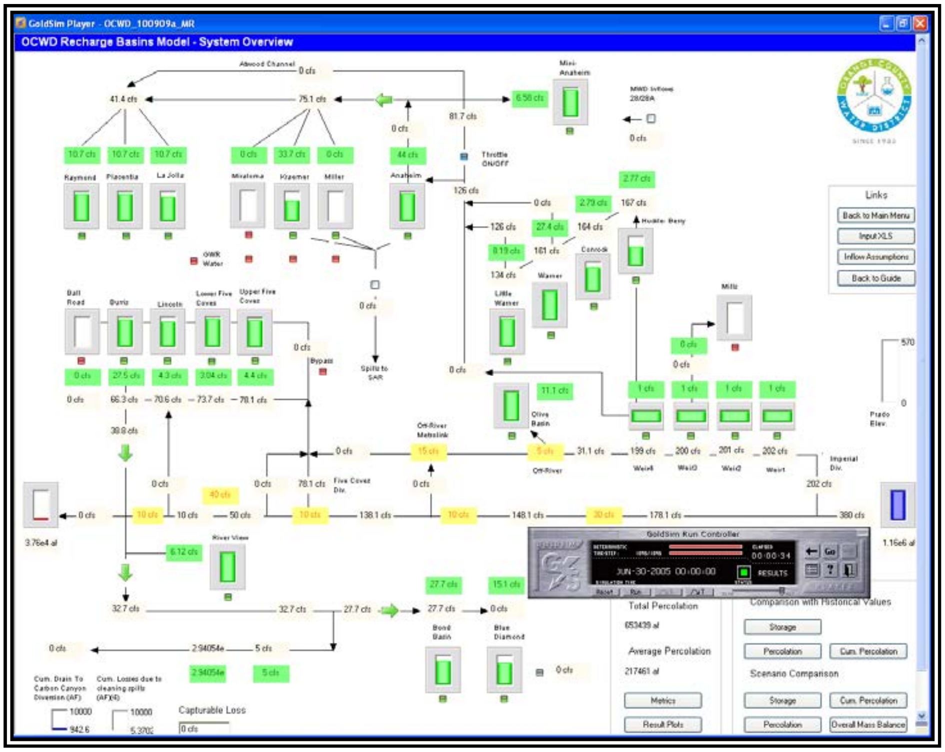

Figure 2-10: **Recharge Facilities Model System Overview**

Estimated future discharges of water from POTWs to the Santa Ana River are expected to decline due to conservation and increased recycling. This, along with reductions in rising groundwater, means that projected Santa Ana River base flows reaching Prado Dam are significantly lower that what occurred from the early 1990s to 2005.

As a result of this work, OCWD developed three Santa Ana River base flow projections as summarized below and shown on Figure 2-11.

1. High Base Flow Condition: 101,700 afy
2. Medium Base Flow Condition: 52,400 afy
3. Low Base Flow Condition: 36,000 afy

Per the 1969 Stipulated Judgment in the case of Orange County Water District v. City of Chino, et al., Case No. 117628-County of Orange, a minimum annual Santa Ana River base flow of 42,000 afy is required to reach Prado Dam. However, a system of credits in the judgment allows the Santa Ana River base flow to be as low as 34,000 afy until the credits are used up. Given the large credit that exists due to the many years Santa Ana River base flow has exceeded 42,000 afy, the minimum flow of 34,000 afy could be in place for many decades. Even though the minimum allowable base flow is 34,000 afy, the annual base flow simulated is 36,000 afy due to minor variations in rising groundwater produced by the WLAM.

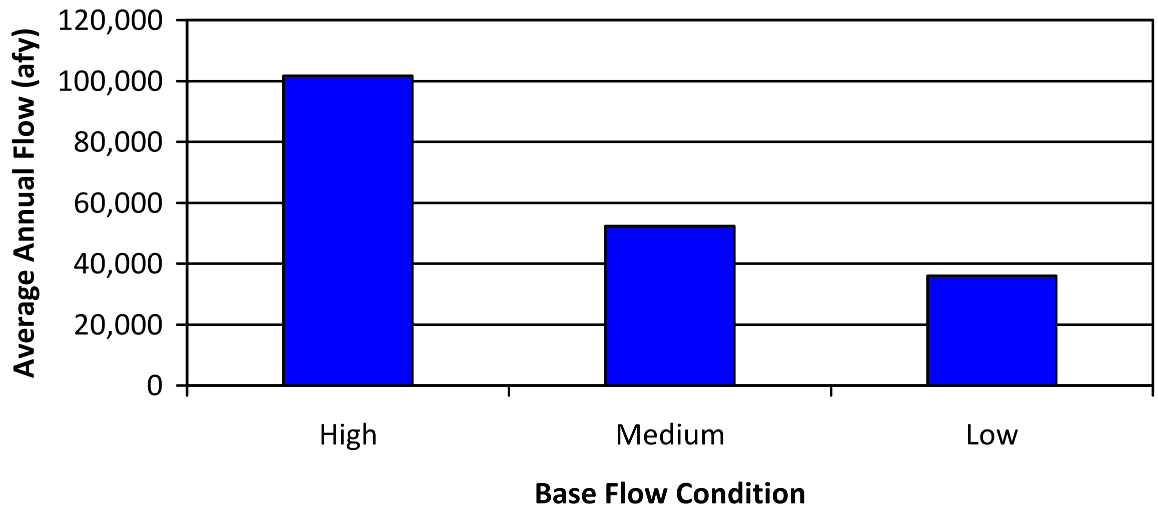

Figure 2-11: SANTA ANA RIVER BASE FLOW PROJECTIONS

In developing estimates of future Santa Ana River storm flows arriving at Prado Dam, land use conditions in the WLAM were reviewed. This is important, because it has been shown that urbanization of the upper Santa Ana River watershed has increased the amount of storm water arriving at Prado Dam for a given amount of rain (Warrick and Rubin, 2007). The storm water runoff condition with current land uses was assumed to be similar to 2005 land use conditions. The 2005 land uses are based on maps developed by the Southern California Association of Governments (SCAG) (WEI, 2009).

For future conditions, SCAG 2005 land use data was modified to represent future (2071) land uses. The assumptions made in modifying the 2005 land use data were: (1) already developed urban areas and surrounding mountain areas were assumed not to change; (2) dairy, poultry, intensive livestock, as well as land use classified as “other agriculture” were assumed to be developed; and, (3) vacant and undeveloped areas were also assumed to be developed by 2071. In addition, all new developed land use in 2071 was assumed to be high density residential. This analysis resulted in an increase in high density residential area of approximately 71 sq mi, a decrease dairy, poultry, horse ranch, etc. areas by approximately 11 sq mi, and a decrease in undeveloped areas by approximately 59 sq mi.

The increased runoff generated by future land uses is offset by plans for storm water harvesting by upstream agencies. Plans were identified for future storm water harvesting from Seven Oaks Dam, diversions from the Santa Ana River and its tributaries, and on-site infiltration that would be required by the Municipal Separate Storm Sewer System (MS4) permit. To develop the lowest flow condition possible, it was assumed that all of these projects would be constructed. As a result, the average annual storm flow arriving at Prado Dam is reduced by 27,360 afy (WEI, 2014b).

Future estimates of Santa Ana River storm flow arriving at Prado Dam are presented in Table 2-4.

Table 2-4: Estimated Future Santa Ana River Storm Flow Arriving at Prado Dam

Storm Flow Runoff Condition	Average Storm Flow to Prado Basin (afy)
Current Land Uses	118,000
Future (2071) Land Uses	125,970
Future (2071) Land Uses, Maximum Storm Water Harvesting	98,610

The three Santa Ana River base flow conditions were combined with the estimated storm flow arriving at Prado Dam to develop three inflow conditions as summarized in Table 2-5.

Table 2-5: Description of Santa Ana River Base Flow Conditions and Estimated Average Storm Flow to Prado Dam

Condition	Description	Average Santa Ana River Base Flow (afy)	Average Storm Flow to Prado Basin (afy)	Total Average Flow (afy)
High	High Base Flow, Current Land Uses	101,700	118,000	219,700
Medium	Medium Base Flow, Future (2071) Land Uses	52,400	125,970	178,370
Low	Low Base Flow, Future (2071) Land Uses, Maximum Storm Water Harvesting	36,000	98,610	134,610

2.7 WATER QUALITY

OCWD's Groundwater Quality Protection Policy, adopted in 2014, and the Groundwater Management Plan recognize the importance of maintaining an active water quality protection program. Examples of the District's multifaceted activities to protect water quality include:

- Working with water agencies above Prado Dam and the Regional Water Quality Control Board to protect the quality of Santa Ana River water;

- Operating wetlands in the Prado Basin to remove nitrate from Santa Ana River water;
- Monitoring Santa Ana River surface water quality and groundwater quality;
- Working with the groundwater producers to pump and treat contaminated groundwater;
- Constructing projects to investigate and remove contaminants in groundwater and control the migration of contaminated groundwater; and
- Providing technical support to regulatory agencies to assist their enforcement of investigations and cleanups at contaminated sites.

Controlling seawater intrusion is essential to maintaining the water quality of the groundwater basin. The Talbert, Alamito, Sunset, and Bolsa Gaps along the coast are subject to seawater intrusion. In these areas, seawater can migrate into shallow aquifers, and then farther into the groundwater basin if its migration is not controlled. OCWD maintains the Talbert Injection Barrier and cooperates with the Los Angeles County Department of Public Works and the Water Replenishment District of Southern California in the operation of the Alamitos Injection Barrier. OCWD is also investigating the potential for seawater intrusion in the Bolsa and Sunset Gaps by monitoring salinity trends in groundwater.

Currently, most of the contamination threats from volatile organic compounds are localized and occur in the shallow aquifer. However, contamination in the shallow aquifer can migrate into the deeper aquifers. The shallow aquifer is an important water supply source and it is important to maintain its beneficial use for water supply. It is also important to control the migration of shallow aquifer contamination into uncontaminated portions of the shallow aquifer and into the deeper aquifers.

SECTION 3.0 IDENTIFICATION AND EVALUATION OF PROJECTS

The section contains a complete list of projects evaluated in the preparation of the Long-Term Facilities Plan along with a brief description of each project. The process for selecting projects for focused study is discussed. Estimated capital costs and expected water yields are presented for those potential projects that have sufficient information to estimate the cost and benefits.

3.1 PROJECT EVALUATION PROCESS

Preparation of the LTFP began with staff meetings to discuss potential future projects. A staff committee was formed to brainstorm and evaluate project ideas. A wide range of concepts and potential projects were reviewed and evaluated. Sixty-three potential projects were identified through this process.

The potential projects that were reviewed in preparation of the LTFP are listed in Section 3.2. Short, one-paragraph descriptions of each of these projects are included in Appendix 1. The potential projects are in various stages of development. Engineer's Reports and Feasibility Studies are complete on some. Others remain in the conceptual stage.

Each participating staff member was asked to rate projects by distributing points to those projects of greatest importance to the District. Points for each project were compiled in order to separate out projects that received a small amount to zero points from those projects that received a larger number of points.

Senior staff reviewed each project and the ratings prepared by staff. Fourteen projects were identified from the list of 63 potential projects for additional study. Both the list of potential and proposed focused study projects were presented to the OCWD Board's Water Issues Committee and the Producers at the regularly scheduled meeting held on April 8, 2014. The fourteen proposed focused study projects were grouped into the following categories:

- Water Supply
- Basin Management
- Recharge Facilities
- Operational Efficiency

Potential projects included in the Basin Management category involve managing groundwater flow, sediment accumulation in Prado Basin, and water quality projects. Additional workshops with the Producers were held in April and May 2014 to discuss preliminary project ideas as well as the proposed list of focused study projects. Staff requested feedback to identify any new potential projects and suggestions to add or delete projects from the list of focused study projects. Meeting agendas as well as Producers' workshop attendee lists can be found in Appendix 3.

In response to the meetings and workshops, the concept of "Purchasing Upper Watershed Wastewater" was added to the list of project for focused study. Short descriptions of the potential projects are presented in Appendix 1.

The draft report was presented to the Board of Directors at the July 16, 2014 Board meeting and was made available for public review and comment on July 17, 2014. In response to an oral comment made at the Board meeting one additional project, Capture Excess Stormwater in Santa Ana Canyon and Convey Water to Irvine Lake, was added to the list of potential projects. A description of this project is included in Appendix 1.

One letter was received commenting on the draft report. This letter, with responses to comments, is included in Appendix 4.

3.2 PROJECT DESCRIPTIONS

This section contains a brief description of each of the 65 potential projects. Table 3-1 lists and summarizes each potential project with more detailed descriptions presented in Appendix 1.

Table 3-1: List of Potential Projects

PROJECT	SUMMARY
WATER SUPPLY	
GWRS Final Expansion	Expand GWRS to 130 mgd
GWRS: Urban Runoff Diversion to OCSD Plant #1	Divert additional urban runoff to OCSD for additional supply to GWRS
GWRS: Recycle all OCSD Flows	Construct facilities to enable treatment of all OCSD flows through GWRS
GWRS & GAP Intertie	Connection between GWRS and GAP to allow direct discharge of excess supply from IRWD recycled water supply
SARI Flow Treatment Plant at Ball Road Basin	Produce 25 mgd recycled water for surface recharge in Anaheim
Water Banking	Investigate opportunities to purchase and store water outside the watershed
Water Wheeling	Investigate opportunities to wheel water from outside the watershed

PROJECT	SUMMARY
New Basin Storage Above Prado	Create facilities in Prado Basin to store water above 505 feet independent of dam operations
Poseidon Resources Huntington Beach Ocean Desalination Plant	Partner with Poseidon to utilize purified ocean water supply from Huntington Beach facility
OCWD Owned/Operated Ocean Desalination Plant	OCWD build and/or operate ocean desalination plant
Divert LA sewage to OCSD Plant #1	Construct connection between LA Sanitation District to OCSD line in Buena Park for conveyance to Plant #1 (would require enhanced source control)
Slater Channel water to GWRS	Divert Slater Channel flow to GWRS
Recovery of ET Loss in Prado Basin	Install production wells in Prado Basin to pump groundwater to recover evapotranspiration loss
Off-Stream Stormwater Storage (Aliso Canyon Dam)	Construct a reservoir in Chino Hills State Park with 4,000 af of storage for pumped river water and/or excess stormwater
MS4 Regional Facilities	Increase stormwater capture capacity paid for by developers to satisfy permit requirements for on-site capture or off-site regional facilities for new developments/redevelopments
Purchase Upper Watershed Wastewater	Negotiate agreements with upper watershed wastewater dischargers to purchase flows to sustain base flows reaching Prado Dam
BASIN MANAGEMENT	
Sunset Gap Barrier/Desalter	Construct seawater barrier for Sunset Gap (injection wells, desalter production wells); potential water supply for barrier extension
Alamitos Barrier Extension (Landing Hill)	Extend Alamitos Seawater Intrusion Barrier
West Orange County Enhanced Pumping	Reduce outflow to LA by increasing pumping in western portion of the basin; new pumping wells and pump stations (evaluation of impact of project alternatives on flow to LA needed)
New Production Well(s) in Buena Park to replace new well(s) for MCWD	New well(s) in Buena Park; production charged against Mesa's BPP; increased production in West OC reduces losses to LA County
North Basin Groundwater Protection Project	Perform remedial investigation and feasibility study, cooperate with other agencies, owners, and operators, and develop and implement appropriate removal and remedial action to contain and remediate contaminated groundwater in Fullerton and Anaheim
South Basin Groundwater Protection Project	Pursue remedial investigation and other appropriate action, cooperate with other agencies, owners, and operators, and

PROJECT	SUMMARY
	develop and implement appropriate removal and remedial action to contain and remediate contaminated groundwater in the South Basin area
Basin Operating Range Expansion	Develop plan and construct facilities to allow increase in basin operating range from 500 to 700 K acre-feet accumulated overdraft
Additional Talbert Barrier Recharge Wells at Deep Well Sites	Drill new injection wells on sites of old inactive deep well sites
Talbert Barrier Southeast Expansion	Extend seawater barrier with new wells and pipelines to increase recharge and provide additional protection against seawater intrusion
Talbert Barrier Ward Street Expansion	Drill new injection wells to raise Principal Aquifer water levels, reduce potential for upwelling of colored water, and help control seawater intrusion
East Newport Bay Mesa Shallow Groundwater Desalter	Pump and treat shallow, brackish groundwater
MTBE Investigation and Remediation	Continue investigation of MTBE contamination; prioritize sites for remediation; construct and operate remediation systems
Shallow Aquifer Development	Increase production from Shallow Aquifer by constructing new production wells and pipelines for non-potable uses
RECHARGE FACILITIES	
New Recharge Facilities for Santiago Basins or Santiago Pipeline	Buy land/build new facilities to recharge water from SAR, Santiago Basins or Santiago pipeline
Desilting Santa Ana River Flows	Construction of desilting project based on results of cloth filter and riverbed filtration demonstration projects
Mid-Basin Injection	Construction of full scale Mid-Basin Injection Project (approximately 8-10 wells)
Purchase land for new basins	New basins dedicated to recharge imported water or GWRS supply
Enhanced Recharge in Santiago Creek at Grijalva Park	Reconstruct open land adjacent to park to enhance infiltration capacity; divert partial flow from Santiago Creek through area
Subsurface Recharge & Collection System (SCARS) in Off-River and Five Coves	Subsurface system (perforated pipes) in Off-River to collect infiltrated surface water for conveyance to Five Coves for subsurface percolation
Enhanced Recharge in SAR between Five Coves & Lincoln Ave.	Excavate fine grained layer and replace with clean sand to increase infiltration rate

PROJECT	SUMMARY
Enhanced Recharge in SAR Below Ball Road	Develop system to regulate flows in SAR to utilize lower reach to 22 Freeway for infiltration without loss of flows to ocean
Subsurface Recharge of GWRS water	Subsurface system in Forebay/SAR using GWRS supply
Recharge in Lower Santiago Creek	Construct facilities to convey Santiago Creek flows around Hart Park to allow for infiltration in Santiago Creek below Hart Park
Lincoln Basin Rehabilitation	Improvements in Lincoln Basin to increase percolation capacity
Five Coves & Lincoln Bypass Pipeline	Construct pipeline to transfer water between Five Coves, Lincoln, and Burris Basins to allow each to be cleaned while still allowing flows to other basins
Recharge Basin Rehabilitation	Over-excavate selected recharge basins to remove fine-grained clogging material and replace removed sediments with clean sand
Placentia Basin Improvements	Modify diversion structure and inlets, install pumps and other improvements to optimize efficiency and use of basin for recharge
Raymond Basin Improvements	Modify diversion structure and inlets, install pumps and other improvements to optimize efficiency and use of basin for recharge
New River View Basin & New Lincoln Nursery Basin	Expand basin on approx. 1.5 useable acres
Prado Basin Sediment Management	Restoration of sediment flow around Prado Dam to SAR to increase water storage capacity behind dam and replenish sediment supply to riverbed
OPERATIONAL IMPROVEMENTS	
Santiago Creek: increased MWD flows from Irvine Lake	Re-operate Irvine Lake to increase releases to Santiago Creek to increase storage opportunities and recharge
Capture Excess Stormwater in Santa Ana Canyon and Convey Water to Irvine Lake	Utilize Santiago Pipeline to convey excess stormwater captured in Santa Ana Canyon to Irvine Lake for storage and subsequent release to Santiago Creek for infiltration or other uses.
Slater Pump Station Modification	Modify Slater Pump Station to control water levels in Huntington Lake
Additional Warner to Anaheim Lake Pipeline	New pipeline to increase capacity to transfer water from Warner to Anaheim Lake
GWRS Supply Pipeline to Alamitos Barrier	Build water supply pipeline to connect seawater barriers with GWRS water
Green Acres Project Treatment Plant & Other Modifications	Replace filtration system with microfiltration to increase efficiency; other changes/reoperation of GAP system - maintain service to existing customers, keep clear well & pump station
Wildlife Exhibit Relocation	Build/renovate space in Fountain Valley to display wildlife exhibits displaced by Hallway Exhibit Project

PROJECT	SUMMARY
Warner System Modifications	Build facilities to improve water conveyance through Warner System to increase storage capacity and recharge
Increase GWRS Pipeline Capacity to Forebay	Booster pump
Turnout to SAR at Fletcher Channel- River View Basin Pipeline	Extend River View Pipeline to allow discharge to Fletcher Channel to recharge stormwater in lower reach of SAR
Reduce Evaporative Losses in Basins with removable covers	Retrofit recharge basins with plastic or other material removable cover to decrease evaporative losses and accumulation of wind-blown dust
Repurpose Nursery Property in Forebay	Use land in Forebay for recharge ops or SARI flow treatment plant
Lakeview Pipeline	Construct pipeline and rubber dam for new system to convey water to Anaheim Lake (along Lakeview Ave. to convey SAR water to Atwood Channel
Connect Santiago Pipeline with GWRS Pipeline	Construct connection between 2 pipelines to provide faster draining of Santiago Basins; allow water transfer from Santiago Basins to Kraemer & Miller
Anaheim Lake Re-contouring	Increase recharge rates by re-contouring basin and flattening islands utilizing native sand in islands
Chino Creek Wetlands	Construct wetlands for Chino Creek flows in Prado Basin
OPERATIONAL EFFICIENCY	
Energy Recovery on Santiago Pipeline	Equip pipeline with energy recovery capacity
Power Plant in Fountain Valley (cogeneration, natural gas)	Construct cogeneration or natural gas plant in Fountain Valley to provide power for GWRS
Solar Panels in Fountain Valley parking lot	Install solar arrays in Fountain Valley parking lot

3.3 PRIORITIZATION OF PROJECTS

One of the primary benefits of preparing the LTFP is that it helps the District focus on the most appropriate projects. Planning and design of some projects will require three to five years to complete due to the complexities of the projects. Additionally, resource limitations preclude moving forward with all potential projects. Only the most viable and beneficial projects will be pursued.

New projects were evaluated with an emphasis on increasing the basin's yield and protecting water quality in order to meet demands as the District responds to current water supply challenges. Recharge operations were reviewed to identify areas where percolation rates could be increased in existing basins and where modifications would enable the District to increase recharge capacity. Projects to increase water supply and water supply reliability also were discussed. The recent trend of declining base flow in Santa Ana River was evaluated in relation to the need for proposed projects.

Each project was reviewed and evaluated by District staff with regards to its economic and technical feasibility. Benefits of projects were evaluated based on the following:

- Increase supply of recharge water
- Increase recharge capacity and efficiency of recharge facilities
- Cleanup contaminated groundwater
- Protect groundwater quality
- Control seawater intrusion

3.3.1 Use of RFM for Evaluating LTFP Projects

A total of 16 projects in the LTFP that involve the surface water recharge system were evaluated using the RFM. Key assumptions used in the RFM are as follows:

1. The Prado Dam conservation pool is operating at 505 feet year round. Work to raise the flood season pool from 498 to 505 feet is ongoing and is expected to be completed and implemented in the next few years.
2. All GWRS water conveyed to Anaheim, including flows from the Final Expansion, will be recharged in Miraloma Basin and planned La Palma Basin. This assumption frees up the capacity of the remainder of the recharge system for Santa Ana River flows and imported water.

The approach to modeling each project was to compare the total system recharge with and without the project for each flow condition. For example, total system recharge was modeled for the high flow condition with and without a project. The difference in the recharge obtained for the entire system comparing the two runs defined the benefit of the project being modeled. This was then repeated for the medium and low flow conditions. Table 2-5 in Section 2.6.1 has data on the high, medium and low flow conditions.

Table 3-2 shows the additional yield produced by each LFTP project for the high, medium, and low flow conditions.

The RFM was also used to evaluate the loss of storm flow capture that will result as sediment continues to accumulate in the Prado Basin. Based on the historical rate of sediment accumulation, which is approximately 350 acre-feet per year, the storage within the conservation pool is projected to fill up within the next 50 years. When the conservation pool becomes filled with sediment, the eventual loss of storm water recharge will range from 34,000 to 38,000 acre-feet per year.

The results of the model show that the three projects that provide the greatest potential for recharge of additional Santa Ana River water are:

- Subsurface Collection and Recharge System in Off-River and Five Coves
- Enhanced Recharge in Santa Ana River Below Ball Road
- Prado Basin Sediment Management

Table 3-2: Annual Yield of Surface Water Recharge System Projects based on Recharge Facilities Model (RFM)

Project Name	Santa Ana River Flow Condition		
	High (afy)	Medium (afy)	Low (afy)
Desilting Santa Ana River Flows	10	390	10
Enhanced Recharge in Santiago Creek at Grijalva Park	10	10	85
Subsurface Collection and Recharge System in Off-River and Five Coves	**610**	**730**	**150**
Enhanced Recharge in Santa Ana River Between Five Coves/Lincoln Ave.	10	220	20
Enhanced Recharge in Santa Ana River Below Ball Road	**730**	**600**	**230**
Recharge in Lower Santiago Creek	270	150	90
Five Coves Bypass Pipeline	130	10	10
Five Coves Bypass Pipeline with Lincoln Basin Rehabilitation	710	490	100
Placentia Basin Improvements	75	170	260
Raymond Basin Improvements	40	230	350
River View Basin Expansion	10	100	10
Additional Warner to Anaheim Lake Pipeline	10	10	30
Lakeview Pipeline	10	10	10
Warner System Modifications	210	250	10
Anaheim Lake Recontouring	10	125	10

3.3.2 Evaluation of Risks

In addition, the potential risks to each project were identified, as shown in Table 3-5. Table 3-3 presents the risk categories and how risks are defined.

Table 3-3: Project Risk Categories

Category	High Risk	Low Risk
Financial	Large cost range, high uncertainty	Costs well defined
Regulatory	Numerous known and unknown regulatory requirements	Has received or likely to receive regulatory approval
Environmental	Potential significant impact to environment	Little to no impact on environment
Institutional	May have opposition from cities, agencies, or public	Little to no opposition

3.4 PROPOSED FOCUSED STUDY LIST

The 17 projects identified for focused study are listed in Table 3-4. Focused Study List projects are described in additional detail in Appendix 2. The descriptions in Appendix 2 include cost estimates for those projects sufficiently developed to estimate the cost, a discussion of recommended activities to continue analysis and project planning, and proposed schedules.

The 17 projects identified for focused study are those potential projects the District would put the greatest focus on. This is not to imply that these projects are the only potential projects the District will evaluate. Rather, these projects identified for focused study are the potential projects District staff will prioritize for continued evaluation.

For these projects, estimated costs and estimated unit costs, where available, and risks were identified. Tasks have been identified that need to be completed to move a particular project forward. These tasks include a range of different activities, such as working with regulatory agencies on evaluations of potential projects to preparing environmental documentation for CEQA, or preparing an Engineer’s Report. While most of the projects can be developed as individual, distinct projects, some are dependent upon each other and others are mutually exclusive.

As an example, final expansion of GWRS will require the concurrent development of a project or projects to increase the District's capacity to percolate or inject the product water. As a result, GWRS Final Expansion must be considered along with the Mid-Basin Injection Project, the Additional Talbert Barrier Recharge Wells at Deep Well Sites Project, or other options to recharge increased GWRS flows. In another case, the GWRS Final Expansion and SARI Flow Treatment Plant at Ball Road Basin are somewhat dependent upon the same supply of wastewater; therefore, the District may need to choose between these two options as construction of both may not be feasible.

Table 3-4: Projects for Focused Study

PROJECT	DESCRIPTION
WATER SUPPLY	
GWRS Final Expansion	Expand GWRS to 130 mgd
GWRS: Urban Runoff Diversion to OCSD Plant #1	Divert additional urban runoff to OCSD for additional supply to GWRS
Poseidon Resources Huntington Beach Ocean Desalination Plant	Partner with Poseidon to utilize purified ocean water supply from Huntington Beach facility
SARI Flow Treatment Plant at Ball Road Basin	Produce 25 mgd recycled water for surface water recharge in Anaheim
Purchase Upper Watershed Wastewater	Negotiate agreements with upper watershed wastewater dischargers to purchase flows to sustain base flows reaching Prado Dam
Recovery of Evapotranspiration Loss in Prado Basin	Install production wells in Prado Basin to pump groundwater to recover evapotranspiration loss
BASIN MANAGEMENT	
Prado Basin Sediment Management	Restoration of sediment flow around Prado Dam to SAR to increase water storage capacity behind dam and replenish sediment supply to riverbed
West Orange County Enhanced Pumping	Reduce outflow to LA by increasing pumping in western portion of the basin
Sunset Gap Barrier/Desalter	Construct seawater barrier for Sunset Gap
Alamitos Barrier Extension (Landing Hill)	Expand Alamitos Seawater Intrusion Barrier
North Basin Groundwater Protection Project	Perform remedial investigation and feasibility study, cooperate with other agencies, owners, and operators, and develop and implement appropriate removal and remedial action to contain and remediate contaminated groundwater in Fullerton and Anaheim

South Basin Groundwater Protection Project	Pursue remedial investigation and other appropriate action, cooperate with other agencies, owners, and operators, and develop and implement appropriate removal and remedial action to contain and remediate contaminated groundwater in the South Basin area
RECHARGE FACILITIES	
Enhanced Recharge in SAR Below Ball Road	Develop system to regulate flows in SAR to utilize lower reach to 22 Freeway for infiltration without loss of flows to ocean
Subsurface Recharge and Collection System in Off-River and Five Coves	Subsurface system (perforated pipes) in Off-River to collect infiltrated surface water for conveyance to Five Coves for subsurface percolation
Mid-Basin Injection	Construction of full scale Mid-Basin Injection Project (approximately 8-10 wells)
Additional Talbert Barrier Recharge Wells at Deep Well Sites	Drill new injection wells on sites of old inactive deep wells
OPERATIONAL EFFICIENCY	
Power Generation in Fountain Valley	Evaluate technical, regulatory, and economic feasibility of power generation using natural gas and photovoltaic panels at Fountain Valley campus or other sites

3.4.1 Implementation of Focused Study Projects

This section discusses the process for planning, construction, and maintenance of projects identified as projects for focused study in the LTFP.

The LTFP was prepared in order to evaluate projects that would cost-effectively increase the basin's yield and protect groundwater quality. All potential projects were evaluated and grouped into four categories:

- Water supply facilities
- Recharge facilities
- Basin management facilities
- Operational efficiency

Each of these projects was identified and reviewed. Program staffing requirements, management needs, and institutional constraints were considered. Costs and benefits of proposed projects were determined, if sufficient information was available. Seventeen projects were assessed in greater detail.

3.4.2 Evaluation of Projects for Focused Study

OCWD staff used available data to evaluate each of the 17 focused study projects. Where possible the project costs were estimated. Costs included capital and O&M as well as total estimated unit cost ($/acre-foot). The objectives and purpose of each project were evaluated in relation to the District's three basin management objectives. Financial, regulatory, environmental, and institutional risks or challenges to implementation were determined using categories of high, medium, or low risk. The results of the evaluation are shown in Table 3-5.

TABLE 3-5: SUMMARY OF 17 FOCUSED STUDY PROJECTS LONG-TERM FACILITIES PLAN 2014 UPDATE

PROJECT	BENEFIT	ESTIMATED COST		ESTIMATED UNIT COST				Objectives/Purpose			Risks (high, medium, or low)			
		Capital ($ million)	O&M ($million/yr)	Capital - new water supply ($/af)	Capital - new recharge capacity ($/af)	O&M ($/af)	Total Estimated Unit Cost ($/af)	Increase Water Supply Reliability & Basin Yield	Protect/ Enhance Groundwater Quality	Increase Operational Efficiency	Financial	Regulatory	Environmental	Institutional
WATER SUPPLY														
GWRS Final Expansion	30 mgd recycled water supply for injection and surface recharge	$138	$10	$290	NA	$390	$680	√	√		low	low	low	low
GWRS: Urban Runoff Diversion to OCSD Plant #1	Increase supply of source water for GWRS; amount to be determined	$1.4 - $9	$0.04 - $0.5	$150 - $5,000	NA	$50 - $1,400	$200 - $6,400	√			med	low	low	low
Poseidon Resources Huntington Beach Ocean Desalination Plant	50 mgd of new potable supply	$888	NA	$940	NA	$910	$1,850	√			high	med	med	high
SARI Flow Treatment Plant (at Ball Road Basin)	25 mgd recycled water supply for surface recharge.	$460	$28	$1,100	NA	$1,000	$2,100	√	√		high	med	med	high
Purchase Upper Watershed Wastewater	Negotiate agreements with upper watershed wastewater dischargers to purchase flows to sustain baseflows reaching Prado Dam	TBD	TBD	NA	NA	NA	TBD	√			high	low	low	high
Recovery of Evapotranspiration Loss in Prado Basin	Up to 5,000 afy water supply	TBD	TBD	TBD	NA	TBD	TBD	√			med	med	med	high
BASIN MANAGEMENT														
Prado Basin Sediment Management	Maintain conservation pool storage behind dam; enhance environmental values in Prado Basin & Santa Ana River	$15 - $25	TBD	TBD	NA	TBD	TBD	√			high	med	med	low
West OC Enhanced Pumping (Concept 1)	Reduce loss of groundwater to LA County to historic conditions by constructing 4 new wells and supply pipeline	$34	$0.65	$438	NA	$65	$503	√			med	low	low	med
Sunset Gap Barrier/Desalter	Injection or extraction barrier to minimize further seawater intrusion in Sunset Gap	TBD	TBD	TBD	TBD	TBD	TBD	√	√		high	med	med	low
Alamitos Barrier Extension (Landing Hill)	Extension of Alamitos Barrier to Landing Hill to control seawater intrusion	TBD	TBD	NA	TBD	TBD	TBD	√	√		med	low	low	low
North Basin Groundwater Protection Project	Perform remedial investigation and feasibility study, cooperate with other agencies, owners, and operators, and develop and implement appropriate removal and remedial action to contain and remediate contaminated groundwater in Fullerton and Anaheim	TBD	TBD	NA	NA	TBD	TBD		√		med	med	med	med
South Basin Groundwater Protection Project	Pursue remedial investigation and other appropriate action, cooperate with other agencies, owners, and operators, and develop and implement appropriate removal and remedial action to contain and remediate contaminated groundwater in the South Basin area	TBD	TBD	NA	NA	TBD	TBD		√		med	med	med	med
RECHARGE FACILITIES														
Enhanced Recharge in SAR Below Ball Road	670 afy of additional storm water recharge	$0.1 - $1	$0.10	NA	$20-$100	$50	$70 - $150	√		√	low	low	low	low
Subsurface Recharge and Collection System in Off-River and Five Coves	670 afy of additional storm water recharge	$3.8	$0.07	NA	$370	$50	$420	√		√	med	low	low	low
Mid-Basin Injection (Part 2: 4 wells; Part 3:5 wells)	Increase capacity to recharge GWRS water by up to 25 mgd	Part 2 $20.4; Part 3 $22.8	$0.4 - $1.4	NA	$115	$15 - $50	$130 - $165	√	√	√	med	low	low	low
Additional Talbert Barrier Recharge Wells at Deep Well Sites	Increase capacity to recharge GWRS water by 3-6 mgd	$7.8	$0.05 -$0.4	NA	$75 -$150	$15 - $50	$90 - $200	√	√	√	med	low	low	low
OPERATIONAL EFFICIENCY														
Power Generation in Fountain Valley	Reduce vulnerability to escalating power costs	TBD	TBD	NA	NA	TBD	TBD			√	med	low	low	low

*TBD- cost to be determined. Project cost unable to be quantified at this time as the scope of project remains to be defined. NA: not applicable

3.4.3 Project Implementation

Each of the 17 focused study projects are in different stages of development. Some are in the conceptual stage while others have completed Engineer's/Geologist's Reports. Development of each focused study project will require completing separate activities for feasibility study planning, Engineer's/Geologist's Reports, CEQA compliance, formal project approval, final design, construction, startup and initial operations. Certain projects will require completing additional activities unique to their implementation.

Some projects that are in the conceptual stage do not have cost estimates. Once they have been further refined and the project costs can be determined, these projects will have to be reevaluated to determine their cost effectiveness relative to the benefits.

Each project schedule is subject to change and will need adjusting as the project moves forward toward completion. This will require periodic reviews and adjustments of the LTFP. Such reviews will determine if priorities should be changed or modified. A change in schedule for one project may impact the staffing availability for other projects.

SECTION 4.0 POLICY PRINCIPLES FOR PROJECT IMPLEMENTATION

Implementation of projects would occur subject to examination of several important policy issues.

- The District will work to maximize the yield of the groundwater basin by implementing cost-effective projects to increase the District's recharge capacity.
- The costs and benefits of the project will be determined; however, not all projects may be amenable to calculating a benefit/cost ratio. Some projects may be determined to be beneficial and worthy of implementation based on qualitative factors.
- Capital, operations, maintenance, and replacement and refurbishment costs will be defined in an Engineer's Report.
- For recharge projects:
    - The cost-effectiveness of the proposed project should be evaluated relative to other recharge projects.
    - The technology used to implement the project should be well-defined and proven. Some experimental projects with less proven technology may be implemented, but these would be relatively small-scale projects.
    - The project will be evaluated with respect to MWD water supply costs and availability.

4.1 MODIFICATIONS TO THE LTFP AND FUTURE UPDATES

The LTFP will be periodically updated. Changes can and will occur to the basin and in the Santa Ana River Watershed over time, which could create the need to refocus resources and to reprioritize District activities. Examples of changing conditions include:

- Increased recycling in the upper basin resulting in decreased Santa Ana River base flows reaching Prado Dam;
- Increased water demands within District boundaries due to population growth;
- Changes in the cost and availability of imported water supplies;
- Discovery of new sites of groundwater contamination;

- The potential of purchasing purified ocean water from Poseidon Resources;
- Continuation of drought conditions necessitating a re-evaluation of basin operations; and
- Economic considerations.

SECTION 5.0 REFERENCES

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APPENDIX 1

SUMMARIES OF POTENTIAL PROJECTS

SUMMARIES OF POTENTIAL PROJECTS

WATER SUPPLY FACILITIES

GWRS Final Expansion

The final expansion of the Advanced Water Treatment Facility will produce an additional 30 MGD of Full Advanced Treatment (FAT) water, which will provide an additional 33,600 afy supply of recharge water. The estimated cost is $95 million. Additional recharge capacity will be needed to handle the increase in available product water. Construction and operation of Mid-Basin Injection Wells would allow for utilization of 15 MGD of GWRS product water. If the source water treated at GWRS includes wastewater from the SARI line the District would need approval from the Department of Public Health, as use of this water as source water for GWRS is currently prohibited.

GWRS: Urban Runoff Diversion to OCSD Plant #1

This project involves installing rubber dams in the lower Santa Ana River flood channels to capture urban runoff and divert this flow to OCSD Plant No.1. This would increase the amount of water being treated at OCSD Plant 1 and therefore increase the amount of wastewater available for treatment at the GWRS. OCSD currently limits the diversion of urban runoff into the sewers to a maximum of 10 MGD without charging fees. Financial impacts to the cities needs to be considered if increased runoff diversion exceeds OCSD's limit. Also, the U.S. Army Corps of Engineers would need to approve installation and use of the rubber dams.

GWRS: Recycle all OCSD Flows

In order to recycle all of OCSD's flows, facilities would be needed to treat at GWRS an additional 31 MGD of wastewater. Recycling all OCSD flows would produce an additional 25,700 afy (23 MGD) of Full Advanced Treatment (FAT) water. OCWD would need a plan to handle this new supply within the recharge system.

GWRS & GAP Intertie

As part of the IRWD/OCWD GAP Intertie agreement effective 2012, OCWD committed to construct a 24" GWRS connection with the GAP pipeline near Garfield Ave. The purpose of the 300-foot connection is to allow IRWD flows to directly enter the SEJB 6 box (GWRS influent and OCSD outfall) through the existing GAP system. This will allow IRWD to discharge water directly to OCWD without passing through OCSD. When in use, this would increase influent flows to GWRS. It is expected that IRWD would only discharge these flows while they are supplying the GAP and have excess effluent to discharge. Project cost is estimated to be approximately $400,000. The tertiary-treated influent water quality will be of higher quality than supply coming from OCSD. The amount of water provided to OCWD would vary considerably and likely only in wetter than average years depending on demands for recycled water from IRWD customers. The water would be free to OCWD and the GAP flows would have to take precedence over OCSD flows for GWRS treatment.

SARI Flow Treatment Plant at Ball Road Basin

This project would build facilities to allow for separation of brine flows from the upper watershed from the domestic wastewater generated in Orange County. This would allow the wastewater treated by OCSD that becomes source water for GWRS to exclude the brine flow. Options include a scalping plant in Anaheim, diversion of domestic wastewater to other OCSD trunklines, and construction of a separate parallel pipe to maintain separation of flows. Another option would be to demonstrate that SARI flows can be safely treated at GWRS. Options are summarized below:

OPTION	EST. COST	CONSTRAINTS
Divert the current ~24 MGD of OC domestic sewage into other OCSD trunklines	$300 million for OCSD	Agreement needed with OCSD, other trunkline capacity, may need to install pump stations
Treat total 35 MGD of SARI flow in Anaheim and then bypass OCSD Plant 2, so Plant 2 can go to GWRS	$100s of millions	land acquisition, operating a new facility, stranded assets at OCSD facilities
Investigate feasibility and/or demonstrate that SARI flows can be safely and efficiently treated by GWRS via either OCSD Plant 1 or Plant 2	Hundreds of thousands for feasibility investigation	public perception, lack of source control, CDPH/Regional Water Board permitting, higher TDS from desalter brines, unknown organic composition

Water Banking

OCWD would store water outside of Orange County to provide additional stored water for OCWD's service territory. An additional benefit may be an avoidance of storage losses to LA County. No specific sites have been identified. Water would have to be wheeled to the District and by-pass MWD. Possible constraints include large institutional issues, CEQA, how quickly the water can be delivered to OCWD and recharged, and the need to maximize existing storage in the basin.

Water Wheeling

Water would be wheeled from Northern CA or from the Colorado River via the MWD system. This creates a new source of water for OCWD that may be less expensive than

MWD supplies. Estimated cost for water would include a $445/acre-foot MWD wheeling cost, purchase of water, the cost of developing the program, and carriage losses in getting the water to OCWD. MWD assesses a 20% loss for water wheeled through the delta. Constraints include CEQA and institutional barriers. Another factor that would need to be considered is that pumping may not be available when water is needed. Another alternative would be to consider negotiating an agreement with San Bernardino Valley Municipal Water District, a SWP contractor, for purchase of their surplus imported water supplies.

New Basin Storage above Prado

OCWD would construct storage facilities behind Prado Dam above elevation 505' that could be operated independently of dam operations. Water would be released into the Prado Basin at rates that would not interfere with USACE operations or in conflict with existing agreements between OCWD and USACE regarding releasing flows from Prado Dam. This project is conceptual; there are no specific sites that have been studied or identified.

Poseidon Resources Huntington Beach Ocean Desalination Plant

This project entails the District entering into a water purchase agreement with Poseidon Resources for 47 MGD of the product water of the proposed Huntington Beach Desalination Plant at the AES site (approximately 3 MGD would currently be sold to the City of Huntington Beach). This project would create an additional water supply to the District's service territory. Anticipated benefits include decreasing the amount of purchased imported water and having a reliable, "drought-proof" source of water.

OCWD Ocean Desalination Plant

This project entails the District constructing, owning, and operating a 50 MGD ocean desalination facility located along the coast within the OCWD service territory. Anticipated benefits include decreasing the amount of purchased imported water and having a reliable "drought-proof" source of water.

Divert LA sewage to OCSD Plant #1

Unused Title 22 water from LA County system (especially in the winter) and/or raw sewage would be diverted to OCSD lines traveling to Plant 1. This would generate more source water for GWRS. The cost to construct a pipeline across the LA/OC border would have to be considered in determining the cost effectiveness of this project. Constraints include a range of institutional issues related to use of OCSD infrastructure.

Slater Channel Water to GWRS

Brackish, rising groundwater in Huntington Lake and surrounding areas discharges by gravity to the Slater Channel. The City's Slater Channel Pump Station lifts the water out of the channel and discharges it to the ocean. Groundwater discharges have ranged from 2 to 4 MGD, but are variable. The City of Huntington Beach requested OCWD assistance to pay energy costs that the City incurs to pump groundwater discharged to the Slater Channel once it flows to the Slater Pump Station.

To reduce or avoid pumping costs, this project would intercept and convey the brackish groundwater via sewer to the GWRS for treatment and recharge. This would be a new source of water to increase the yield of the GWRS. The quantity and variability of Slater Channel flows would need to be assessed to determine overall recoverable quantity. Possible constraints include need to acquire property access/purchase agreements for the pump station and conveying pipeline siting and sewer agreements with the City and OCSC. Also the pipeline capacities in the sewer line and GWRS would need to be evaluated.

Recovery of ET Loss in Prado Basin

This project would install and operate a pumping well in or above the Prado Basin to recover the water lost by evapotranspiration in the Prado Basin in accordance with a special provision in the 1969 Judgment. The 1969 Judgment allows OCWD to recover up to a maximum of 5,000 afy of evapotranspiration loss in the upper watershed above Prado Dam. This is water that would not otherwise flow to OCWD's facilities naturally and could replace some of the base flow reductions currently incurred as a result of increased pumping in the Chino Basin. An analysis would be needed to determine if additional pumping by OCWD would induce percolation losses in the SAR above Prado thereby defeating the purpose of the project and to estimate what the evapotranspiration losses are and be able to technically defend such a determination.

Off-Steam Stormwater Storage (Aliso Canyon Dam)

When Sana Ana River flow rates exceed the capacity of the District’s recharge operations water is lost to the ocean. This proposed project would construct a reservoir in Aliso Canyon located in Chino Hills State Park, creating 4,000 af of storage. In concept, excess Santa Ana River water would be pumped from the river to the reservoir when flow rates are high. Reservoir water would flow back to the Santa Ana River and be recharged months or years later when excess recharge capacity was available.

MS4 Regional Facilities

Municipal stormwater permits require new developments and significant redevelopments to capture and infiltrate stormwater on-site when feasible. OCWD is concerned that on-site systems will not be properly maintained over the long-term and that use of regional recharge basins may be more cost-effective and beneficial. Although use of regional facilities is allowable, permit conditions make such use difficult. This project would involve working with County of Orange Watershed staff and Regional Water Board staff to craft a program that allows developers to construct projects and pay an in lieu fee to OCWD to manage the stormwater at District facilities and/or construct facilities to convey stormwater to District facilities as an alternative to on-site capture and infiltration. Stormwater that would otherwise drain to ocean (such as via

Carbon Canyon Diversion) would be captured and recharged. New facilities could potentially be used to recharge other sources of water during the summer months.

Purchase Upper Watershed Wastewater

Negotiate and secure agreements with upper basin wastewater discharges for OCWD to purchase a set volume of wastewater. Dischargers would guarantee a minimum amount of wastewater discharged to the Santa Ana River on an annual basis. This project would result in increased baseflows reaching Prado Dam.

BASIN MANAGEMENT

Sunset Gap Barrier/Desalter

This project entails constructing two or more extraction wells to intercept brackish groundwater in the vicinity of the Naval Weapons Station Seal Beach. The extracted groundwater would be treated for beneficial use, which could include potable supply, and/or injection at the Alamitos Barrier, or other uses. This would improve water quality by capturing brackish groundwater that has shut down one Huntington Beach well and threatens other wells. Construction of wells, a treatment plant, and pipelines will require site access/purchase agreements. End-user agreements on water delivery also will be needed. The project concept will be refined after construction of six Sunset Gap monitoring wells to delineate the magnitude and extent of brackish groundwater and will require additional groundwater modeling and extension of the Alamitos flow model.

Alamitos Barrier Extension (Landing Hill)

This project entails extending the Alamitos Seawater Barrier south from Westminster Avenue to the Seal Beach Fault (approx. 4,000 feet). The number and spacing of the injection wells will be evaluated after construction of Sunset Gap monitoring wells near Seal Beach Blvd. and further groundwater modeling using the Alamitos flow model. The purpose of the project is to improve and protect water quality by preventing seawater intrusion from the Alamitos Gap south of Westminster Avenue. Construction of the project would include acquiring site access and purchase agreements for well sites and pipelines. The existing Alamitos Barrier injection supply pipeline would need to be upsized or a new supply pipeline installed. Possible sources of water supply include the Water Replenishment District's LVL Plant and a new colored water treatment plant. The concept for this project will be refined after construction of six Sunset Gap monitoring wells to delineate magnitude and extent of brackish groundwater and will require additional groundwater modeling and extension of the Alamitos flow model.

West Orange County Enhanced Pumping

There are a number of ways decrease outflow to Los Angeles County by increasing production near the county line. Potential projects include 1) Coastal Agencies paying for well construction and connection costs for wells in northwest Orange County and then connecting these wells to the West OC Water Board Pipelines to service the Coastal Agencies; 2) Increasing the BPP of producers in the vicinity of the county line, such as Fullerton and Anaheim, thereby shifting pumping closer to the county line; 3) Have OCWD construct four production wells near the county line and building a discharge pipeline to the West OC Water Board Pipeline. The objective of this project is to decrease groundwater losses to Los Angeles County of approximately 5,000 afy. A possible constraint is that use of the West OC Water Board Pipeline would need to be negotiated.

New Production Well(s) in Buena Park to replace new well(s) for MCWD

OCWD would encourage (provides incentives) for Coastal Producers planning new wells to construct wells inland (Buena Park area). OCWD would collect a BEA from the inland producer and transfer money to the Coastal Producer to purchase MWD water. The objectives are to decrease groundwater losses to Los Angeles County and reduce the seawater gradient from traveling inland. The reduction of groundwater losses to LA county is estimated to be 5,000 afy. Coastal Producers and Inland Producers would have to be willing to participate.

North Basin Groundwater Protection Project

Groundwater contamination consisting of chlorinated solvents and other hazardous materials from previous industrial activities has impacted production wells in Fullerton and Anaheim and continues to spread laterally and vertically in the shallow and principal aquifers, severely affecting regional groundwater. The District has extensively investigated the contamination, developed a six-well containment system, and is currently performing a remedial investigation and feasibility study in accordance with the requirements of the National Contingency Plan. It is the objective of the District to work with federal and state agencies and responsible parties to clean-up and remediate the contamination and restore and protect this groundwater resource. Subject to regulatory and legal requirements, the District is actively pursuing interim containment of the contamination as well as development of a long term clean-up remedy. All appropriate regulatory and administrative avenues, including cooperation with state and federal agencies, and negotiations with responsible parties, are also being pursued to protect and restore the groundwater of this part of the basin.

South Basin Groundwater Protection Project

The groundwater contamination in the South Basin has also been caused from industrial solvents and other hazardous materials used in past decades in the southern part of the Orange County groundwater basin. The District has extensively investigated and delineated the extent and location of the contamination, and, to date, has obtained some remediation commitments through settlements, and is working with state environmental agencies to cause issuance of orders against responsible owners and operators. The South Basin contamination is primarily found in the shallow aquifer but has impacted the principal aquifer at least in the vicinity of major production wells serving the Irvine Ranch Water District, and is continuing to migrate laterally and vertically. It is the objective of the District to work with federal and state agencies and responsible parties to cause containment and removal of the contamination in the shallow aquifer to prevent further migration into the principal aquifer. The District is currently evaluating the funding of a remedial investigation and feasibility study in accordance with the National Contingency Plan, and implementation of removal and remedial actions to protect the vital groundwater resources in the southern part of the basin.

Basin Operating Range Expansion

The basin operating range refers to the upper and lower levels of groundwater storage in the basin that can be reached without negative or adverse impacts. Each year the District determines the optimum level of overdraft and raises or lowers the BPP to manage the desired level of pumping. Only a small fraction of the water in the basin can be safely removed, primarily because of the threat of seawater intrusion. Expanding the basin operating range would involve investigating options to overcome factors that limit the amount of water that can be safely withdrawn from the basin, which may include expanding seawater barriers. Increasing the basin operating range may result in the need to deepen wells to accommodate lower water levels and may also increase the risk of causing subsidence.

Additional Talbert Barrier Recharge Wells at Deep Well Sites

This project would properly destroy deep wells 3, 4 and 5, drill new injection wells at these locations, and use the existing conveyance pipeline to supply wells with GWRS water. The objective would be to create an additional method of recharging GWRS water.

Talbert Barrier South East Expansion

The expansion would involve installing injection wells on the Newport Mesa and two multi-depth monitoring wells. The four well sites would have up to 8 MGD of capacity. A new pipeline crossing the Santa Ana River at Adams Avenue would be required. The objective is to protect Newport Mesa from water quality degradation from saline water (connate and seawater) with an additional benefit of increasing basin recharge. The total estimated cost is $15 million, which includes $8.4 million for injection and monitoring wells. Estimated unit cost (based on 20 year payback period, capital costs only with no interest) is $83/acre-feet. Constraints include obtaining well sites and installing a pipeline across the Santa Ana River at Adams Avenue.

Talbert Barrier Ward Street Expansion

Four new injection wells would be constructed along Ward Street adjacent to the existing southeast barrier pipeline. The project would raise water levels in the Principal

Aquifer, reduce the potential for colored water upwelling, and help control seawater intrusion in the Newport Mesa area. This project could conceivably either replace or defer the need for extension of the barrier along Adams Avenue. Injection capacity would be increased by 5 mgd. Capital cost is estimated to be $7 million, approximately half the cost of the proposed Adams Avenue extension project.

East Newport Bay Mesa Shallow Groundwater Desalter

This project entails pumping, treating, and beneficially using groundwater from the Shallow Aquifer in the vicinity of the I-405/Hwy 55 intersection. The extraction well locations, pumping volume, treatment methods, and potential uses have not been determined. The purpose of the project is to intercept shallow groundwater that has elevated TDS, nitrate, and potentially other constituents before it can migrate into and degrade the underlying Principal Aquifer. Downgradient production wells include IRWD's Dyer Road Well Field and Mesa Water District's wells. The extraction well and treatment system siting will require securing property access/purchase agreements and acceptance of treated water will require agreement(s) with end user(s).

MTBE Investigation and Remediation

MTBE plumes have been identified in Huntington Beach and Costa Mesa that are not being remediated. This project would evaluate alternatives and implement recommended remedial measures to address these plumes. Project objectives would be to improve and protect water quality by preventing and reducing migration of MTBE. The types of remedial measures are to be determined but will likely entail facility site access/purchase agreements with public/private landowners; other agreements may be needed.

Shallow Aquifer Development

Shallow production wells will be constructed to serve as non-potable water supplies. Possible benefits include reducing subsurface outflow across the LA county line, although this has not been documented. Possible constraints include the potential for nitrate migration to the Principal Aquifer, need for site access/purchase agreements, need to secure facility transfer/operating/water acceptance agreements, and potential need for treatment of groundwater prior to use depending on water quality. The East Newport Mesa Shallow Groundwater Development concept is a subset of this program concept.

RECHARGE FACILITIES

New Recharge Facilities for Santiago Basins or Santiago Pipeline

Increased recharge along Santiago Creek may be an important component in future expansion of recharge operations. This project focuses on developing new recharge projects in this part of the groundwater basin. New facilities would be constructed to recharge water from the Santa Ana River, Santiago Basins, or Santiago Pipeline. Recharge capacity would increase through modifications to the creek, the construction of new recharge basins, and/or new recharge facilities constructed in the vicinity of the Santiago Pipeline and Santiago Creek. Facilities would be constructed as close as possible to the Santiago Pipeline and Santiago Creek to minimize the cost of new pipelines that would be required. Possible projects include a new recharge basin near the intersection of Yorba Avenue and Chapman Avenue and removing the concrete lining in Santiago Creek just below Santiago Basins. Increasing recharge capacity in this part of the basin would provide support for pumping in the Dyer Road Wellfield.

Desilting Santa Ana River Flows

This project would reduce suspended sediment concentrations in Santa Ana River water using sediment removal technologies, e.g., cloth filter and/or riverbed filtration. The Cloth Filter could be placed at multiple locations. The Riverbed Filtration could be located in Santa Ana River channel upstream of Imperial Highway. Benefits include reduced rate of clogging in recharge basins, especially during storm season when suspended sediment concentrations are highest. This will provide greater capture of storm flow.

Mid-Basin Injection

The complete Mid-Basin Injection (MBI) project would be constructed to allow GWRS product water to be injected into the principal aquifer. The project includes new injection wells and conveyance pipelines from the existing GWRS Pipeline to wells located along the levee of the Santa Ana River. The GWRS Pipeline is located in the west levee of the Santa Ana River and would be used to convey 33,600 afy (30 MGD) of GWRS water to 10 injection wells (3 MGD or 2,100 gpm injection each). Some turnouts have been constructed in the pipeline to accommodate future service to alignments for MBI.

A single demonstration well of this project has already been approved by the Board and is nearing completion. This well with 2 monitoring wells and design has cost approximately $6.3 million. To achieve full-scale implementation of MBI, 9 more wells are required. Four of these 9 wells will likely be located in Centennial Park with an estimated cost of $20 million. The remaining 5 well locations have not been finalized and are estimated to cost $4 million each.

The full MBI project is estimated to cost an additional $40 million above the $6.3 million for the demonstration well. The benefits of this project are the utilization of the full potential of GWRS expansion(s) water production and recharge near areas of large volume pumping. Constraints include need to obtain land ownership/easements/ licenses, need to conduct tests to confirm actual injection rates, the potential that injection rates may be different at each site, potential health permit issues depending on the performance of demonstration, and project costs exceeding estimated amounts. If MBI is not pursued, then alternatives would need to be used in order to utilize GWRS product water produced by the GWRS Final Expansion project.

Purchase Land for New Basins

The addition of Miraloma Basin in 2012 increased recharge capacity of the District's facilities by approximately 24,000 afy. The newly acquired La Palma Basin is estimated to have the capacity to recharge 31,000 afy. Purchase of additional land for new recharge basins will need to be carefully evaluated to determine how much and in which locations new facilities are needed based on the availability of source water.

Enhanced Recharge in Santiago Creek at Grijalva Park

There is an approximate 3-acre area within Santiago Creek adjacent to Grijalva Park that is not wetted when normal recharge flows are being conveyed downstream. The creek is incised and therefore bypasses this area. The project would be to assess the suitability of this area for recharge (good sediment conditions). If it is found to have favorable geologic conditions, the project would involve re-grading the area and then creating an upstream diversion to force water to flow over this area. Additional recharge in Santiago Creek will allow for increased draining of Santiago Basins between storm events and allow for faster draining in the fall months prior to the storm season. Given the percolation rate of the other portions of the creek, this 3-acre area is projected to have a percolation rate of 2.7 cfs or 5.4 acre-feet per day.

Subsurface Recharge & Collection System (SCARS) in Off-River and Five Coves

Several techniques have been previously investigated by OCWD to increase groundwater recharge. One of the more innovative approaches is the use of subsurface recharge galleries, which could be constructed beneath areas with existing improvements, such as parks or school athletic fields.

A recharge gallery is a horizontal subsurface recharge system, similar to a leach field. One method of constructing a recharge gallery is with perforated pipes buried in a gravel-filled trench. An advantage of recharge galleries is that they can be constructed beneath areas with existing improvements (such as under parks, school athletic fields, greenbelts, or parking lots). A lease or easement for the project site would be required, rather than ownership, which greatly reduces the capital cost. Since the water would be conveyed to the recharge gallery through pipelines and the entire recharge system is underground, any clogging caused by biological growth attributed to sun exposure would be eliminated.

Enhanced Recharge in Santa River between Five Coves and Lincoln Ave

There is an approximate 6.5 acre area in the Santa Ana River channel between the Five Coves Dam and Lincoln Avenue that is underlain by a distinctive reddish brown fine-grained sedimentary unit that has a very low percolation rate. The project would entail removing this unit and replacing it with more permeable sediment. Given the percolation rate of the other portions of the river, this 6.5 acre area is projected to have a percolation rate of 3 cfs or 6 acre-feet per day. Additional recharge in the Santa Ana River will increase storm water capture and increase the ability to recharge imported water.

Enhanced Recharge in Santa Ana River Below Ball Road

Recharge in the Santa Ana River below Ball Road is restricted to approximately 20 cfs mainly due to need to preserve a buffer to avoid potentially losing water to the ocean. The 20 cfs takes the flow in the river to between Katella and Orangewood Avenue, depending the time of year and the condition of the river channel (clogged or clean). This project would investigate the feasibility of using the river channel down to Freeway 22 for percolation without risking losing water to the ocean. The additional recharge in the Santa Ana River will increase storm water capture and increase the ability to recharge imported water. Given the percolation rate of the other portions of the river, the lower unused reach is expected to recharge from 10 to 20 cfs.

Subsurface Recharge of GWRS Water

GWRS water would be recharged in shallow subsurface recharge galleries to create a more cost effective way to recharge GWRS water as an alternative to Mid-Basin Injection. Property near GWRS pipeline with favorable geology would have to be located and perhaps purchased.

Recharge in Lower Santiago Creek

The Santiago Creek bed below Hart Park provides additional recharge if available for this use. Hart Park has a concrete parking lot in the creek bed which restricts the flow that can be delivered below the park. Therefore, the District limits flow in the creek to 20 cfs or less to allow percolation into the ground before it reaches Hart Park. Allowing flow in this portion of Santiago Creek while protecting public safety would require either constructing a low flow notch through the parking lot or a 2,000 foot pipeline to divert water around the parking area and back into the creek. Construction of this project is estimated to create an additional 10 cfs of recharge capacity.

Lincoln Basin Rehabilitation

This project would replace or wash sandy fill material placed in Lincoln Basin as part of the Burris/Lincoln Basin Reconfiguration Project. Some of the fill material is restricting the recharge capacity of the basin. This project would be done in conjunction with the Five Coves Bypass Pipeline Project. The objective would be to increase storm water capture and increase the overall recharge capacity of the recharge system. The cost to rehabilitate Lincoln Basin is unknown but estimated at $500,000; the Five Coves project would cost approximately $7 million. Assuming that the bypass pipeline is constructed the Lincoln Basin project would percolate an additional 600 afy of stormwater at a unit cost of $800/acre-foot.

Five Coves and Lincoln Basins Bypass Pipeline

The Five Coves and Lincoln Basins Bypass Pipeline Project involves construction of a pipeline to allow the distribution of water between Upper Five Coves, Lower Five Coves, Lincoln, and Burris Basins. The transfer pipeline would have metering and valves that would allow the basins to be isolated and taken out of service to conduct cleaning operations, while maintaining flow of water to Burris and Santiago Basins. The current configuration is a "flow through" system, which requires an interruption of flow to Burris Basin to allow the cleaning of Lincoln Basin, Lower Five Coves, or Upper Five Coves Basin.

Recharge Basin Rehabilitation

All of the recharge basins are subject to clogging due to the accumulation of sediments contained in recharge water. To maintain recharge rates, the basins are periodically drained, allowed to dry, and then mechanically cleaned using heavy equipment. In the past, this process removed most of the clogging layer but also removed a portion of the underlying layer of clean sand from the basin bottom. This left some of the fine-grained clogging material on the basin sides, while progressively deepening the basin's bottom. Recharge Operations staff have improved the cleaning procedures to minimize the burial of fine-grained clogging material. However, previous cleaning practices have left an irregular mantle of fine-grained material in the upper one to two feet of some of our key recharge basins. The Recharge Basin Rehabilitation Project will remediate this problem from selected basins by over-excavating and replacing removed sediments with clean sand.

Placentia Basin Improvements

This project would construct capital improvements to Placentia Basin to increase the amount of water recharged in the basin. Placentia Basin is a flood-retarding basin owned and operated Orange County Flood Control Division. The District uses the basin to recharge both imported water, when available, and Santa Ana River water during the non-storm season. Improvements would include modification of inlets and installation of pumps, flow measuring devices, water level sensors, and equipment to remotely control water levels and flows.

Since the basin was originally constructed for flood control purposes use for recharge is constrained by a number of factors. Current operations require construction of temporary sandbag dikes just downstream of the drain in the channel. The grated drain inlet into the basin quickly becomes clogged with debris and algae. During the summer months, the grating occasionally requires cleaning on a daily basis. In addition to frequent maintenance, the current grating configuration limits the flow into the basin to an average of seven cubic feet per second (cfs), which is less than the estimated 15 cfs capacity of the basin.

The addition of a submersible pump that is capable of emptying the basin with a short amount of time to maintain the use of the basin for flood control may enable the District to use the basin during the storm season.

Raymond Basin Improvements

This project would construct capital improvements to Raymond Basin to increase the amount of water recharged in the basin. Raymond Basin is a flood-retarding basin owned and operated Orange County Flood Control Division. The District uses the basin to recharge both imported water, when available, and Santa Ana River water during the non-storm season.

The inlet into Raymond Basin is comprised of two sluice gates and inlet pipes located on the vertical wall of each side of the concrete-lined Carbon Creek Channel. In order to divert water, District staff installs flashboards just downstream of the inlet pipe to be used as a dam in the channel. The installation of these flashboards is time consuming and requires the use of a crane. Like Placentia Basin, it is estimated that the range of flows currently sent to Raymond Basin are approximately half of the recharge capacity of 15 cfs. Improvements would include modification of inlets and installation of pumps, flow measuring devices, water level sensors, and equipment to remotely control water levels and flows. The addition of a submersible pump that is capable of emptying the basin with a short amount of time to maintain the use of the basin for flood control may enable the District to use the basin during the storm season.

New River View Basin & New Lincoln Nursery Basin

This project would construct an additional surface recharge basin north of the existing River View Basin. The land is currently being used by the Sandbagger Company. A portion of the site contains an abandoned landfill. The site is approximately 2.8 acres with a potential recharge area of 1.8 acres and an expected yield of 1.29 cfs (1.42 ft/d or 933 afy based on 3 cfs at 4.2 acre existing River View). The extent and characteristics of the abandoned landfill need to be evaluated prior to proceeding with this concept. Supply and de-watering infrastructure would be required.

There is also a long, thin strip of land owned by OCWD north of the Sandbagger lot. This piece is currently leased to a nursery business. Research into past land use at this site may be required. This site is approximately 4.16 acres with a potential recharge area of 1.16 acres and an expected yield of 0.83 cfs (1.42 ft/d or 601 afy with the same assumption about the existing River View). This property is directly adjacent to existing homes that have a history of encroachment. Supply and de-watering infrastructure would be required. Both sites would require a pipe crossing Fletcher Channel, have current tenants on lease, are near a residential area, and would need to be feed by Santiago Creek Pipeline or new infrastructure. Benefit assumes that there is water to fill the basins year round.

Estimated costs and benefits are:

BASIN	EST. COST	EST. YIELD
New River View Basin	$ 1.6 million	933 afy at $890/af (Import) = $830,400/yr benefit Payback: 2 years
New Lincoln Nursery Basin	$1.9 million (smaller excavation, but longer supply pipe required)	601 afy at $890/af (Import) = $534,900/yr benefit Payback: 4 years

Prado Basin Sediment Management

The full scale implementation of the Prado Basin Sediment Management Demonstration Project will involve the restoration of sediment flow from the Prado Basin to the lower reach of the Santa Ana River. Sediment accumulation behind the dam is reducing the available conservation pool that allows temporary storage of stormwater for release at rates that allow OCWD to maximize capture and recharge in the Forebay. Removal of sediment from behind Prado Dam will increase the water storage capacity within the basin for flood control and water conservation. Below the dam sediment will be retrained to stop, and perhaps reverse streambed incision which erodes stream embankments and protect infrastructure near the Santa Ana River (SARI line and Freeway 91). Coarsening of the riverbed has reduced percolation rates in the river.

OPERATIONAL IMPROVEMENTS

Santiago Creek: Increased MWD Flows from Irvine Lake

This project would investigate the feasibility of purchasing imported water for delivery in Irvine Lake for release to Santiago Basins. This would allow for Colorado River water to be introduced to recharge system and reduce costs by not having to pump water to Santiago Basins.

Capture Excess Stormwater in Santa Ana Canyon and Convey Water to Irvine Lake

In some high storm flow conditions, the District is not able to capture all the storm flow in the Santa Ana River. Some of this excess storm flow could be captured in the Santa Ana Canyon near Weir Canyon and conveyed to Irvine Lake. The Santiago Pipeline, a raw water pipeline, could be used to convey the water from the Santa Ana Canyon to Irvine Lake. A subsurface infiltration system or well field would be constructed near Weir Canyon to pump water that would otherwise not be captured in downstream recharge facilities. Water conveyed to Irvine Lake would be stored for subsequent release to Santiago Creek for infiltration or other uses.

Slater Pump Station Modification

The City of Huntington Beach operates large capacity pumps to evacuate brackish groundwater that discharges into the Slater Channel. The pumping system was designed to operate on an occasional basis to pump stormwater but now the large and noisy pumps are operating every two days. The city seeks OCWD assistance to remedy this groundwater-related issue since its high-capacity storm water pumps are over-sized for evacuating the lower non-storm flows entering the channel. Groundwater in this area has risen due to increased Talbert Barrier injection. The project would install low flow pump(s) at existing city storm water pump station to evacuate brackish groundwater that discharges into the Slater Channel. These smaller pumps would use less energy to transfer the groundwater than the existing high volume pumps. Estimated cost for this project is estimated to be $800,000.

Additional Warner to Anaheim Lake Pipeline

Currently the Warner Transmission Pipeline capacity ranges from 150 to 200 cfs. There are periods when water is being lost to ocean that could be conveyed to the Anaheim Lake system if there were additional pipeline capacity. Potential project benefits need to be evaluated based on future of sediment removal technologies.

GWR Supply Pipeline to Alamitos Barrier

This project would construct a new pipeline connecting the Talbert Barrier to the Alamitos Barrier in order to supply the Alamitos Barrier with water from GWRS. Currently, OCWD purchases 1,800 afy at MWD rates for supply of the barrier at a cost of $1.2 million per year. Benefits would include reduced operating costs at the Alamitos Barrier, assuring an adequate supply when the barrier is expanded, provide a potential supply in the event that other gaps would require barriers, and provide another place to use the GWRS supply. Cost estimated is $20 million.

Constraints include:

- A 10 mile pipeline would cost $15-20 million vs. annual cost of $1 million for imported water (WRD) to supply the barrier.
- If barriers for Bolsa/Sunset Gaps are constructed and a water supply pipeline is needed, extending a pipeline to Alamitos may be more feasible.
- Perhaps the old GAP line can be used (currently leased to City of Huntington Beach).

Green Acres Project Treatment Plant and Other Modifications

Operation and maintenance of the Green Acres Project (GAP) continues to involve a high degree of staff time and O&M expenses to maintain effective production of recycled water. The average historical (2007-12) production of the GAP water treatment plant (WTP) is 7,400 AFY (6.6 mgd). Beginning in FY 2013-14, GAP production has decreased due to reduced demand from OCSD. A complete annual estimate has not been made for the reduced flows, but current demands seem to be 3-4 mgd.

This project replaces the current multi-media filtration system with a microfiltration (MF) treatment system. It is estimated that the MF currently has 3-6 mgd "excess" capacity that can be used to generate GAP supply water. To provide total MF treatment capacity for GAP average flows, a 7 mgd facility would need to be provided or a cap would need to be placed on the total amount of GAP water sold. This capacity could be included in the GWRS final expansion or split with the existing media treatment.

Microfiltration has been found to cost less per AF than the current media treatment and is expected to provide a better quality effluent. A study by Dunivin & Smith of 2010-11 treatment costs suggests that MF costs $71 per AF and the media filtration costs $145 per AF. The difference of $74 per AF would amount to $550,000 per year in savings (assuming 7,400 AFY).

Conversion to MF treatment will also simplify operations because the number of treatment technologies and independent process monitoring would be reduced. The existing media treatment plant can be demolished (estimated to cost about $2 million) or left standing. Part of the media building houses the distribution pumps and would need to remain.

Other operational efficiencies may be gained through distribution pump operation and reservoir control logic, although this should be evaluated to make sure that GAP efficiency does not decrease the efficiency of GWRS. The economics of GAP can also be improved through adding additional end-user demand. There are many sites along the existing pipeline alignment than can be encouraged to use GAP, although adding new users to the system would increase need for staff time. The District may wish to incentivize new users with discounted financing or capital cost assistance.

GAP distribution consists of 37 miles of high pressure pipeline (typically 100-125 psi) primarily located in public right-of-ways. It may be beneficial to add some real-time monitoring of the distribution in order to detect leaks and performance problems before they become catastrophic.

Wildlife Exhibit Relocation

The wildlife exhibits in the Fountain Valley Administration building will need to be moved to make way for the Water Education Corridor Project. These exhibits will be used as a part of the educational displays to explain the District's natural resource programs and the important role they play in the protection of the water quality and management of the Orange County groundwater basin. This project will construct an approximately 900 square foot building in the open patio area between the administration building and MWDOC offices.

Warner System Modifications

The project would install additional conveyance pipelines in the Warner System to allow for increased use of storage in the system. This would require moving the fishing concession out of Warner Basin.

Increase GWRS Pipeline Capacity to Forebay

This project would increase the capacity of the GWRS pipeline in order to recharge additional GWRS product water in the Forebay beyond the current capacity of 85 MGD. An overall plan for distribution of GWRS product water would be needed to determine if this additional capacity is needed.

Turnout to SAR at Fletcher Channel - River View Basin Pipeline

Extending the existing 24-inch River View Pipeline would allow for the discharge of approximately 25 cfs into Fletcher Channel and ultimately the lower reach of the Santa Ana River. The expected benefits include recharge of an additional 25 cfs of storm water into the lower Santa Ana River (18,000 afy). Construction and design is estimated to be $500,000. OCWD would need a permit from the Orange County Flood Control Division to discharge 25 cfs into Fletcher Channel.

Reduce Evaporative Losses in Basins with Removable Covers

Removal covers would be installed over recharge basins to reduce evaporative losses in order to increase the amount of water available for infiltration.

Repurpose Nursery Property in Forebay

This project would construct a treatment facility on District-owned land that is currently leased to a nursery business at Imperial Highway. The facility would be either a plant to treat SARI flows to pre-treat the wastewater that will be recycled at GWRS or to desilt SAR flows to maintain infiltration rates at recharge basins.

Lakeview Pipeline

The proposed Lakeview Pipeline project would construct a 66-inch pipeline in Lakeview Avenue from Mills Pond to the Atwood Channel, a 7-foot high inflatable rubber dam and discharge line, a 42-inch bypass metering facility, and a 72-inch transfer line.

The new proposed pipeline and ancillary facilities would provide OCWD with redundancy to help ensure continuous recharge reliability for Anaheim Lake in the event the Anaheim Lake Pipeline became inoperable, and would increase the flexibility of the recharge system to capture additional stormflows.

Connect Santiago Pipeline with GWRS Pipeline

This project would connect the Santiago pipeline with the GWRS pipeline. Project cost is estimated to be $1.5 - 2 million. Connecting the western end of the Santiago Pipeline to the GWRS pipeline would provide for faster draining of the Santiago Basins by allowing water from Santiago Basins to flow to Kraemer Basin or Miller Basin. Draining Santiago Basins more quickly would allow for increased storm water capture. Depending on the tie-in location, Burris Pump station could send water to Kraemer and Miller Basins as well. Another possibility is to send GWRS water to Santiago and River View Basins.

A hydraulic study would need to be performed to confirm that elevation drop and Santiago pumping can overcome the pressures in the GWRS line. This project may improve operational flexibility but has the potential to complicate operations. Constraints that would need to be considered include mixing GWRS water with storm water in GWRS pipeline, the risk of putting storm water into Miraloma & La Palma Basins, potential permit issue with GWRS, permits needed to excavate the SAR levee (ACOE and OCFCD involved), pressure limits on GWRS pipeline (between connection point and plant), and limits on pumps at the Fountain Valley plant.

Anaheim Lake Re-contouring

Anaheim Lake is the largest recharge basin of the Deep Basin System with 2,000 af of storage capacity. There are three islands in the lake. The re-contouring project would involve draining the lake, flattening the islands, and grooming the bottom in order to increase the basin's recharge capacity.

Chino Creek Wetlands

This project will build wetlands adjacent to Chino Creek to improve the water quality of Chino Creek and provide wildlife habitat enhancements. The District has established a goal of treating 100 percent of the dry weather flows of the Santa Ana River at Prado Dam with natural wetlands. Constructing wetlands for Chino Creek flow is one of the key remaining projects to achieve this goal. The design of these wetlands would be similar to that of the existing Prado Wetlands

OPERATIONAL EFFICIENCY

Energy Recovery on Santiago Pipeline

This project would place energy recovery devices at River View Basin and potentially at Burris Basin to take advantage of the over 100 feet of head in the Santiago Pipeline as water drains to these basins. While it is known that the head and flow conditions are favorable for electricity generation using new-technology in line hydrogenation systems, what is unknown is whether or not the economics are favorable based on the limited and intermittent use of the pipelines in downhill flow mode.

Power Plant in Fountain Valley

This project would involve construction of a natural gas power plant in Fountain Valley to provide power to the GWRS plant. Available technologies would need to be reviewed including combustion turbines, internal combustion engines, fuel cells, and use of co-generation steam. The objectives are to reduce energy costs and improve grid reliability through use of distributed generation. Pursuing this project would involve analyzing the regulatory, technical, and economic feasibility of building and operating a power plant at the GWRS. This would include reviewing GWRS power demands, reviewing available technology (combustion turbines, internal combustion engines, and fuel cells), considering beneficial uses of waste heat (including combined cycle, steam pumps, and forward osmosis), and developing potential alternatives and planning costs. Potential constraints include unfavorable economics and opposition to constructing a power plant from neighbors.

Solar Panels in Fountain Valley Parking Lot

Solar panels would be installed in the Fountain Valley parking lot to generate energy for operation of the GWRS plant.

APPENDIX 2

DESCRIPTIONS OF FOCUSED STUDY PROJECTS

Table of Contents

GWRS FINAL EXPANSION

Summary

Construction for the Groundwater Replenishment System (GWRS) was completed in January of 2008. The GWRS consists of an Advanced Water Treatment Facility (AWTF), a 13-mile GWRS Pipeline, and injection wells for the Talbert Seawater Barrier. The current AWTF has the ability to produce 70 million gallons per day (MGD) of recycled water to replenish the Orange County groundwater basin. The AWTF was designed with two future expansions. The first expansion, or GWRS Initial Expansion Project, will increase the production from 70 MGD to 100 MGD. The construction for the GWRS Initial Expansion Project is predicted to be complete in spring 2015. The final expansion, or GWRS Final Expansion Project, will increase the production from the AWTF from 100 MGD to 130 MGD. The GWRS Final Expansion Project is being addressed in this project description.

Project Description

The AWTF receives secondary effluent from the Orange County Sanitation District (OCSD) and further treats the secondary effluent with microfiltration, reverse osmosis and advanced oxidation. This three-stage treatment process produces what is referred to as Full Advanced Treated (FAT) water. The GWRS Final Expansion Project will increase the capacity for each of the three main processes by an additional 30 MGD.

In addition to increasing the capacities of each of the main processes, the amount of secondary effluent that flows into the AWTF will need to be increased to produce the additional 30 MGD. Currently, the AWTF receives 133 MGD of secondary effluent to produce 100 MGD of FAT water. The residual 33 MGD consists of the waste flows from the microfiltration and reverse osmosis processes. For the GWRS Final Expansion, the AWTF requires 173 MGD of secondary effluent to produce 130 MGD of product water. This additional secondary effluent will come from OCSD's two treatment plants.

Currently all the secondary effluent flows come from OCSD's Plant No. 1. To receive 173 MGD of secondary effluent, a pump station and pipeline will need to be constructed from OCSD's Plant No. 2, to pump the remaining amount of secondary effluent up to the AWTF near OCSD's Plant No. 1. There is an existing 66-inch concrete pipeline which runs from OCSD Plant No. 1 to OCSD Plant No. 2. It is being proposed to use this existing pipeline to convey the additional secondary effluent from Plant No. 2 to Plant No. 1 for the GWRS Final Expansion Project as shown in Figure 1. This pipeline will however require rehabilitation work, consisting of relining, to allow it to be used as a pressurized pipeline.

Figure 1: OCSD and OCWD GWRS Final Expansion Improvements Map

Environmental Issues

The GWR System is operating under a permit from the Santa Ana Regional Water Quality Control Board (Regional Board). The GWRS Final Expansion Project would require regulatory approval from the Regional Board and the CA Department of Public Health for the use of source water from OCSD Plant No. 2, which includes brine flow from upstream treatment processes within the Santa Ana Regional Interceptor (SARI) line. Studies will be needed to further evaluate the quality of SARI line flows for approval to use as source water for recharge.

To comply with CEQA, the original EIR for the GWRS Treatment Facility will be amended to include the new facilities (each of the three processes, pump station, and pipeline) that make up the GWRS Final Expansion Project.

Cost Estimates

The major construction items are:

- Expanded Microfiltration Building and Microfiltration Process Cells
- Equipping of Reverse Osmosis & Advanced Oxidation Processes

- Pump Station and Pipeline of Secondary Effluent to AWTF

The buildings for the final expansion of the Reverse Osmosis and Advanced Oxidation Processes were constructed as part of the GWRS Initial Expansion Project. Therefore, for the GWRS Final Expansion Project, construction for the Reverse Osmosis and Advanced Oxidation Systems only require equipment and related appurtenances to be installed within the buildings.

The pump station and pipeline rehabilitation work are being coordinated with OCSD. The cost estimates are presented below.

Cost Estimates

DESCRIPTION	COST
Design, Consulting, and Permitting	$13,000,000
Microfiltration Expansion	$34,000,000
Reverse Osmosis Expansion	$12,000,000
Advanced Oxidation Expansion	$6,500,000
Pump Expansion & Electrical Expansion	$18,000,000
OCSD Pump Station & Pipeline Rehab	$21,000,000
Oversight/Inspection	$14,000,000
Contingency (20%)	$20,000,000
Total	$138,500,0000

Implementation Schedule

Task	Schedule
Engineer's Report & CEQA	January 2014 - September 2014
Permitting & Agreements	March 2014 – March 2015
Design	March 2015 – March 2016
Construction	April 2016 – April 2019

Evaluation

Advantages:

- Use secondary effluent to produce fully advanced treated water to replenish the groundwater basin.
- Some of the infrastructure for this project was already constructed as part of the original GWRS Project and GWRS Initial Expansion Project.
- Increased local water supply reliability and reduced dependence of the region on imported water supplies.

Disadvantages:

- Water Quality Permitting

GWRS URBAN RUNOFF DIVERSION

Identification

The purpose of the GWRS Urban Runoff Diversion Project is to route urban runoff from storm drains in the summer months to Orange County Sanitation District (OCSD) for treatment. This would provide more inflow to OCSD and an end result more secondary effluent for the GWRS Advanced Water Treatment Facility.

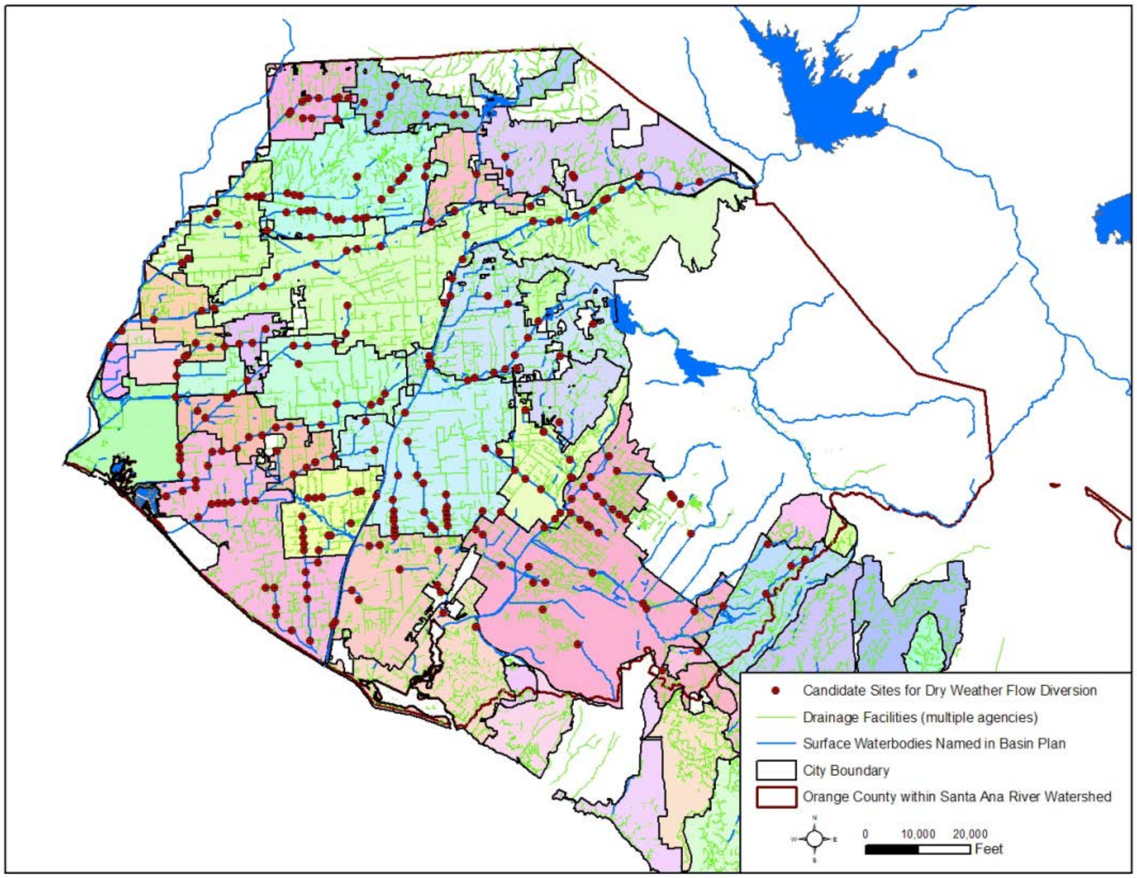
Description

The AWTF receives secondary effluent from the Orange County Sanitation District (OCSD) and further treats the secondary effluent with microfiltration, reverse osmosis and advanced oxidation to produce Full Advanced Treated (FAT) water. The AWTF treatment facility is currently being expanded. As part of the expansion, OCSD will provide additional secondary effluent for the AWTF. OCSD has completed projects which were designed to provide OCWD with this additional secondary effluent. However, recently the amount of raw wastewater coming into OCSD is decreasing, and new ideas are being looked at to increase the amount of secondary effluent that OCSD can produce. OCSD is currently developing a Dry Weather Urban Runoff Policy that prescribes a 10 MGD allowance for urban runoff diversion projects for agencies/cities without having to pay a treatment fee.

This policy will allow organizations, cities, utilities, to design diversion projects to route urban runoff to storm sewers for OCSD treatment at no additional cost. The projects would entail physical pipeline connections from storm drains to sewer lines with an automated isolation valve. This isolation valve would serve the purpose of closing with a forecasted rain event. This would allow OCSD to be able to have sufficient capacity to handle storm events.

There are currently a number of organizations that are participating in this program, they include OC Public Works, City of Huntington Beach, The Irvine Company, and Irvine Ranch Water District. OCWD could embark on a similar diversion project specifically to increase raw wastewater flows to OCSD's Plant No. 1. In order to divert a significant amount of water (greater than 4 MGD) many small diversion connections would have to be made. CDM completed a draft memorandum indicating possible diversion locations within Orange County. Figure 1 shows this map.

Figure 1: Map of Potential Runoff Diversion Sites within Orange County



Source: CDM (August 2010)

Operations

In order to move forward with this project, OCWD should evaluate potential diversion locations that could provide the most water influent to OCSD's plant No. 1 by embarking on a feasibility study. It may also be beneficial to partner with a City or Public Agency who is already pursuing these diversion projects within their jurisdictional area.

Environmental Issues

Once the project concepts have been defined, CEQA will need to be completed.

Cost Estimates

At this time, the project description is not sufficiently defined to prepare a cost estimate. Capital costs will be determined during preparation of the Engineer's Report.

POSEIDON RESOURCES HUNTINGTON BEACH OCEAN DESALINATION PLANT

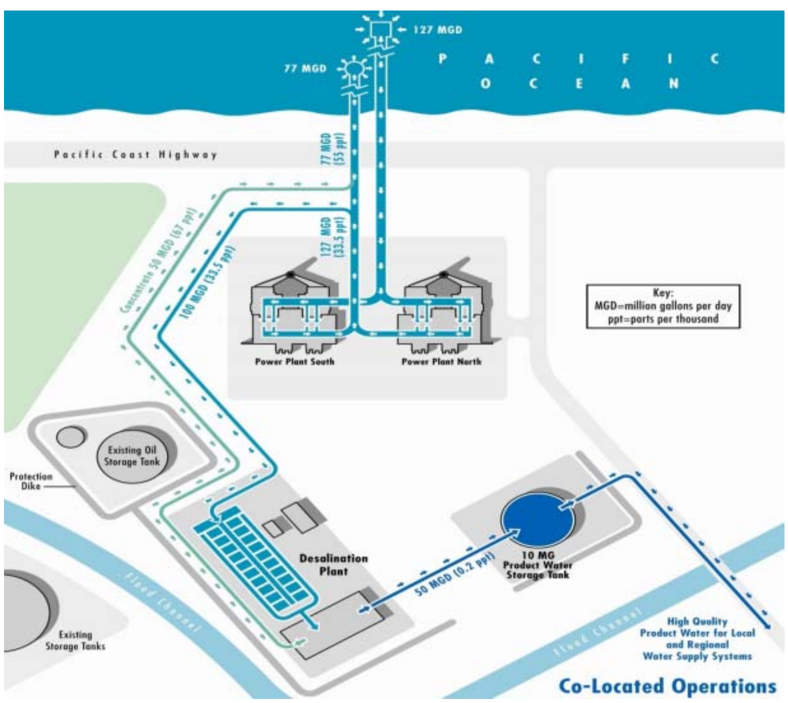
Identification

The product water from the Poseidon Resources Huntington Beach Ocean Desalination Plant would create an additional water supply to the District's service territory.

Description

The proposed Poseidon Resources Huntington Beach Ocean Desalination Plant would be located on 12 acres of property adjacent to the AES power plant facilities near Pacific Coast Highway and Newland Avenue in the City of Huntington Beach. Poseidon Resources (Poseidon) has a lease/purchase option agreement for the proposed site, along with the rights to use and purchase the existing seawater intake and outfall facilities currently being used by the power plant for their process cooling water. The power plant uses ocean water for process cooling purposes and returns it to the Pacific Ocean once used. Poseidon Resources is proposing to divert approximately 127 million gallons per day of the AES plant cooling water prior to it being returned to the ocean. The proposed desalination plant is expected to produce approximately 50 million gallons per day (56,000 acre-feet per year) of product water. Figure 1 illustrates the location of the proposed desalination plant.

Figure 1: Project Location



The District's Board approved a policy in May 2013 indicating the District should consider and develop a variety of local resources to ensure residents and businesses always had adequate water supplies. Seawater desalination was one of the resources to consider. This policy recognizes that the amount of imported water purchased by the Groundwater Producers will increase without the development of new local water supply sources.

Reducing the area's reliance upon imported water and improving the overall water reliability of the region is the primary benefit of this project.

Operations

A private company could operate and maintain the treatment plant. Should OCWD enter into an agreement with Poseidon, it may be desirable to have the District as a public entity operate and maintain the plant.

Environmental Issues

In October 2013, the California Coastal Commission released a staff report regarding Poseidon's Coastal Development Permit that was to be heard at the Commission's public meeting in November 2013. The staff report contained 21 special conditions to grant the permit to Poseidon. Included in those conditions was to analyze the feasibility of using a subsurface intake rather than the existing open ocean intake at the AES site. The special conditions also contained the need to modify the existing outfall structure to ensure salinity concentrations met specific requirements. Poseidon withdrew their application in November 2013 and is working with the Coastal Commission to resolve these issues.

The Water Quality Control Plan for Ocean Waters of California (Ocean Plan) is currently being amended by the State Water Resources Control Board to address desalination facilities, including both intake and discharge issues. This plan implements the California Water Code and the Federal Clean Water Act for ocean discharges. It also identifies the beneficial uses of California coastal and estuarine waters, and establishes the water quality objectives necessary to protect those uses. National Pollutant Discharge Elimination System permits adopted by the Regional Water Quality Control Boards must implement the requirements of the Ocean Plan and the Enclosed Bays and Estuaries Plan. The desalination amendments to the Ocean Plan are estimated to be adopted in 2014. Once adopted, Poseidon will be required to comply with the new regulations.

Cost Estimates

Based upon the construction contract for a similar desalination plant in the City of Carlsbad and the same type of arrangement with Poseidon and the San Diego County Water Authority (SDCWA), Poseidon has estimated the project capital cost will be approximately $888 million. This figure includes the construction of the treatment plant, delivery system and electrical substation. Non-construction related expenses are also included in the $888 million estimate. These expenses include land acquisition, wetland mitigation, financing costs, fees and insurance, construction period interest, reserve set asides, etc. Table below summarizes the project cost estimate provided to the District by Poseidon in 2013. The unit cost of product water is estimated to be approximately $1,800/acre-foot for the year 2013. Using an inflation factor of 2.5% provides an estimated year 2014 figure of $1,850/acre-foot.

Item	Amount (Millions)
Construction Cost	
Plant Capital Cost	$445.0
Delivery System	$70.3
Substation	$13.0
Sub Total	$528.3
Other Related Construction Cost	
City of HB Fees & OC44 payments	$6.4
Construction Period Cost – Admin and Mgmt. of contracts, rent during construction & insurance	$16.7
Site purchase costs to AES	$21.4
Construction Contingency	$20.0
Wetlands Restoration	$11.5
Development Period Cost	$65.9
Sub Total	$141.9
Financing Cost	
Working Capital & Maintenance Reserve	$21.2
Debt Service Reserve	$37.2
Land Commission Reserve	$0.5
Interest during construction – 35 month constr. Period & 6 month contingency (5.15% rate)	$125.0
Closing costs, Equity LC, Financial & legal fees	$34.2
Sub Total	$218.1
Total Project Capital Budget	$888.3
Total Annual Debt Service	$48.1
Plant Power Cost	$20.4
Plant O&M, lease, admin, taxes	$26.3
Total Annual Project Cost	$94.8
Estimated 2013 Unit Cost	$1,801/af

Implementation Schedule

Poseidon estimates the desalination plant could be operational by 2019, pending final permit approval.

Evaluation

Advantages:

- An additional water supply for the District's service territory will be created.
- Reduces dependency upon imported water

Disadvantages:

- Assuming imported water is available, water produced by the project would be relatively expensive, at least initially, when compared to imported water prices.

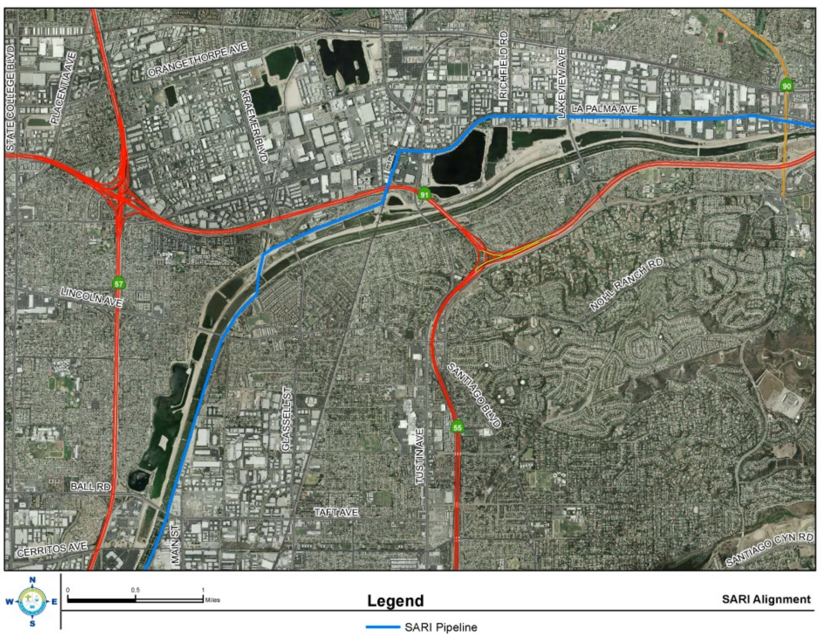
SARI FLOW TREATMENT PLANT

Summary

The Santa Ana River Interceptor (SARI) pipeline is located on the east side of the Santa Ana River across from Ball Road Basin (see Figure 1). Approximately 35 million gallons per day (MGD) of wastewater is conveyed through the pipeline at this location.

In an effort recycle wastewater near OCWD recharge facilities, the SARI flow could be diverted to a new wastewater treatment facility to be located at Ball Road Basin to produce approximately 25 mgd of recycled water.

Figure 1: SARI Line Location in Anaheim



Description

The SARI pipeline conveys a blend of industrial and domestic wastewater to Orange County Sanitation District (OCSD) Plant 2 in Huntington Beach. The wastewater has an average total dissolved solids (TDS) concentration of approximately 2,500 mg/L. This wastewater can potentially be treated and recycled in Anaheim for recharge at Burris Basin. A new supply pipeline connecting the SARI to the wastewater treatment facility and a brine discharge return pipeline could be constructed under the Santa Ana River via jack and bore method.

The wastewater treatment plant would be located on OCWD's Ball Road Basin

property which is a 19-acre property. Ball Road Basin is not used for recharge due to its unfavorable geology. The Basin does receive local runoff and storm flow at several locations which would require relocation. The largest component is the Chantilly Storm Drain which would require increasing the size to accommodate a 100-year storm event based on previous discussions/response from the County. Prior to constructing a wastewater treatment plant, the Basin would also need to be backfilled, compacted and graded for use. The wastewater treatment plant would include conventional primary and secondary treatment followed by advanced treatment similar to OCWD's Groundwater Replenishment System (GWRS). The GWRS utilizes microfiltration, reverse osmosis and ultra violet light to purify the secondary treated wastewater.

The product water would be conveyed to Burris Basin via a new pipeline or pumped to Santiago Basin for recharge.

Environmental Issues

The GWRS is operating under a permit from the RWQCB. The new wastewater treatment plant would require similar permitting. Studies and a possible tracer test will be needed to estimate groundwater flow travel times between Burris/Santiago Basins and nearby production wells to determine if travel time requirements can be met.

For CEQA, an Environmental Impact Report would be prepared.

Cost Estimates

The major construction items are:

- Chantilly Storm Drain modifications
- Site backfill (appx. 300,000 cubic yards)
- Pipeline to convey wastewater from the SARI line to the treatment plant
- Primary and Secondary Treatment Plant
- Advanced Water Quality Treatment Plant
- Pipeline to convey product water to Burris Basin

DESCRIPTION	COST
Chantilly & Storm Drain Improvements	$5,000,000
Site Backfill, Compaction & Grading	$6,000,000
Jack and Bore Pipeline	$2,000,000
Primary/Secondary Plant	$170,000,000
Advanced Water Quality Plant	$200,000,000
Contingency	$77,000,000
Total	$460,000,000

Implementation Schedule

To be determined.

Evaluation

Advantages:

- Recharge treated water at Burris/Santiago Basins, reduced energy cost for pumping compared to pumping from Fountain Valley
- Utilizing Ball Road Basin property
- With this concept, it may be possible to recycle most of OCSD Plant 2 flows

Disadvantages

- Taking SARI flow could possibly "starve" OCSD Plant 2 of necessary nutrients for this biological treatment system at night
- Possibility of stranded primary and secondary treatment facilities at OCSD Plant 2
- High capital costs
- High TDS would require higher energy demand for the reverse osmosis treatment
- Brine concentrate discharge would go back to the SARI line potentially making the GWRS final expansion project more costly and/or difficult to permit
- More expensive than the GWRS Final Expansion
- Unit capital cost is approximately $1,100/AF (not including O&M)

PURCHASE UPPER WATERSHED WASTEWATER

Summary

This project would either purchase wastewater discharged by upper watershed agencies to the SAR or use other means to prevent further declines in the amount of tertiary treated wastewater discharged to the SAR, such as exchanging imported water for wastewater discharged to the river.

Description

The amount of SAR baseflow has declined in the last approximately ten years. In water year 2004-05, the SAR baseflow was 154,307 acre-feet. In water year 2012-13, the amount of SAR baseflow was 81,452 acre-feet. This decline is believed to be due to multiple factors in the upper watershed, including increased water recycling, increased indoor water use efficiency, economic factors, and increased infiltration of water from the SAR to groundwater basins as it flows towards Prado Dam.

The District has historically not purchased treated wastewater discharged to the SAR. OCWD has historically purchased water in limited, specific situations, such as:

- Excess product water from the Arlington Desalter in Riverside
- Water from the Elsinore Valley Municipal Water District (pumped groundwater)
- Water pumped from the Bunker Hill Groundwater Basin in San Bernardino to mitigate shallow groundwater conditions and associated liquefaction potential

Most of the water agencies in the upper watershed are developing plans to recycle wastewater that is currently discharged to the SAR. These proposed recycled water projects include reusing the water in various ways, including irrigation and groundwater recharge. These recycled water projects would reduce the amount of SAR flow that reaches Orange County and is therefore available for recharge into the Orange County Groundwater Basin.

The locations of the wastewater treatment plants in the upper watershed are shown on Figure 1.

The California Water Code requires a discharger to file a change of use petition before changing the place of use of wastewater discharge. Two wastewater treatment plants have completed this process, which resulted in the State Water Resources Control Board (SWRCB) imposing a minimum annual discharge amount. The minimum annual discharge amounts imposed by the SWRCB are:

- City of Riverside – 25,000 afy (Wastewater Change Petition WW0045)
- City of Corona – 1,625 afy (Wastewater Change Petition WW0056)

The City of San Bernardino and the Western Riverside County Regional Wastewater Authority have filed petitions to change their place of use of wastewater but have not yet completed the process with the SWRCB.

The Inland Empire Utilities Agency has reduced their wastewater discharge by recycling some of their treated wastewater and has plans to expand their recycling rate in the future.

The 1969 SAR Judgment, which settled water rights litigation between OCWD and water users in the upper watershed, provides for a minimum baseflow of 42,000 afy. When the upper watershed has sufficient credits available, the minimum SAR baseflow obligation is 34,000 afy. The upper watershed currently has 3,443,000 acre-feet, so the minimum SAR baseflow obligation would be 34,000 for over 400 years until the credit is eliminated.

The purpose of this potential project is to provide for a more stable supply of SAR baseflow to Orange County. This could be achieved by:

- Purchasing wastewater from upper watershed dischargers and/or,
- Securing flows of wastewater discharge in the upper watershed so that additional amounts of flows currently discharged to the SAR are not removed from the river in the future; for example, one approach would be for OCWD to purchase imported water for water agencies in the upper watershed in exchange for a commitment to continue to discharge wastewater to the SAR

A proposal to purchase wastewater from the upper watershed agencies should take into consideration the minimum SAR baseflow obligation of the upper watershed agencies specified in the 1969 SAR Judgment and the minimum flow requirements imposed by the SWRCB.

Treatment Plants to consider approaching are:

- RIX (San Bernardino & Colton)
- City of Rialto
- City of Riverside
- Western Riverside County Regional Wastewater Authority
- Inland Empire Utilities Agency
- Eastern Municipal Water District

There are other treatment plants in the upper watershed that are located further upstream from the City of Rialto and RIX discharge locations. However, flows from these treatment plants, such as the City of Beaumont and Yucaipa Valley Water District are not contiguous with the SAR to RIX. Purchasing water or otherwise securing continued discharge from treatment plants upstream of the City of Rialto and RIX discharge points would not provide a quantifiable, sustained supply of water reaching Orange County.

There are not anticipated to be any operational changes for the District if this project is implemented.

Environmental Issues

This project, if implemented through purchasing wastewater from upper watershed agencies, would not change the existing condition and is therefore not expected to have any negative environmental impacts. It could provide environmental benefits by maintaining flow rates in the SAR.

Cost Estimates

A cost estimate for this project has not been prepared.

Implementation Schedule

An implementation schedule has not yet been prepared.

Evaluation

The benefits and issues to consider regarding this potential project are described below.

Benefits

- More reliable quantity of baseflow in SAR entering Prado Basin
- Reduced risk of declining SAR flow rates
-

Issues to Consider

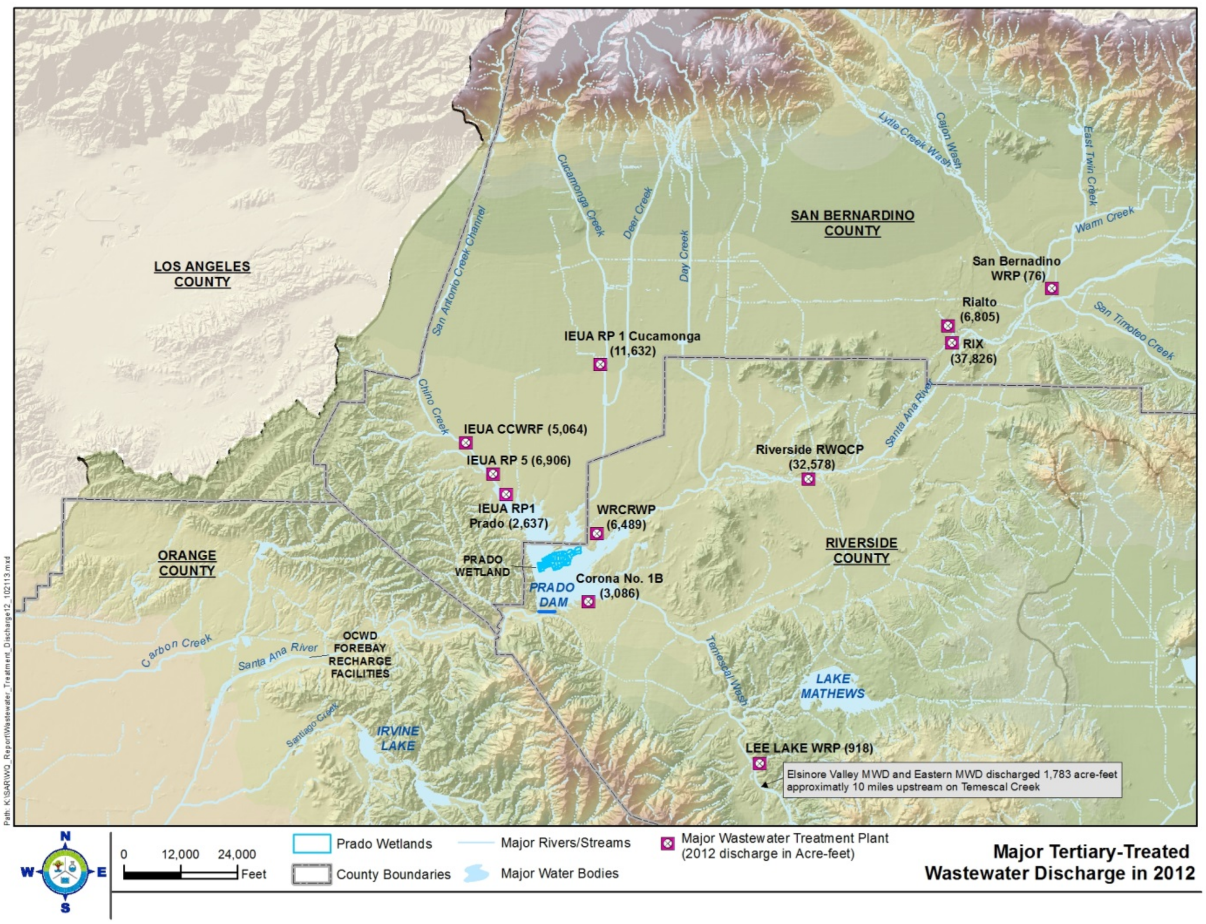
- How much of the purchased water will flow to Prado Basin
    - Distances from the discharge points to Prado Basin vary, along with losses due to evapotranspiration and infiltration
    - Risk of any future new diversions between discharge points and Prado Basin
- Need to eliminate risk of scalping flows from sewers
    - Current or specified sewershed will continue to be tributary to the treatment plant(s) and there will be no changes to the sewershed
- Impact to Replenishment Assessment
- Avoiding regulation of supply in SAR as recycled water
- Potential use of new revenue by upper watershed agencies to fund new stormwater capture projects
    - Some upper watershed stormwater capture projects have not been implemented due to financial limitations, poor benefit/cost ratio
- Not purchasing water that would come to Prado Basin as required by the minimum SAR baseflow obligation of the upper watershed agencies specified in the 1969 SAR Judgment

- Taking into consideration minimum flow requirements imposed by the SWRCB for wastewater treatment plants and not purchasing those flows that would reach Prado Basin
- 1969 SAR Judgment - Need concurrence of all upper watershed SAR Watermasters

If an agreement is proposed to sustain supplies of SAR baseflow reaching Orange County, the following deal points should be considered:

- Pay only for water that reaches Prado Basin
    - o Develop methodology to determine quantity that reaches Prado
- Upper watershed agencies agree to no additional diversions between Prado Dam and treatment plant discharge points
- Specify sewersheds for each treatment plan and require no changes to the sewershed(s)

Figure 1: Major Tertiary Treated Wastewater Discharge in 2012



RECOVERY OF EVAPOTRANSPIRATION LOSS IN PRADO BASIN

This project would install and operate a pumping well in or above the Prado Basin to recover the water lost by evapotranspiration in the Prado Basin in accordance with a special provision in the 1969 Judgment. The 1969 Judgment allows OCWD to recover up to a maximum of 5,000 afy of evapotranspiration loss in the upper watershed above Prado Dam. This is water that would not otherwise flow to OCWD's facilities naturally and could replace some of the base flow reductions currently incurred as a result of increased pumping in the Chino Basin. An analysis would be needed to determine if additional pumping by OCWD would induce percolation losses in the SAR above Prado thereby defeating the purpose of the project and to estimate what the evapotranspiration losses are and be able to technically defend such a determination.

PRADO BASIN SEDIMENT MANAGEMENT

Summary

The proposed project would remove one to two million cubic yards of sediment from within Prado Basin and re-entrain the sediment into the Santa Ana River below Prado Dam.

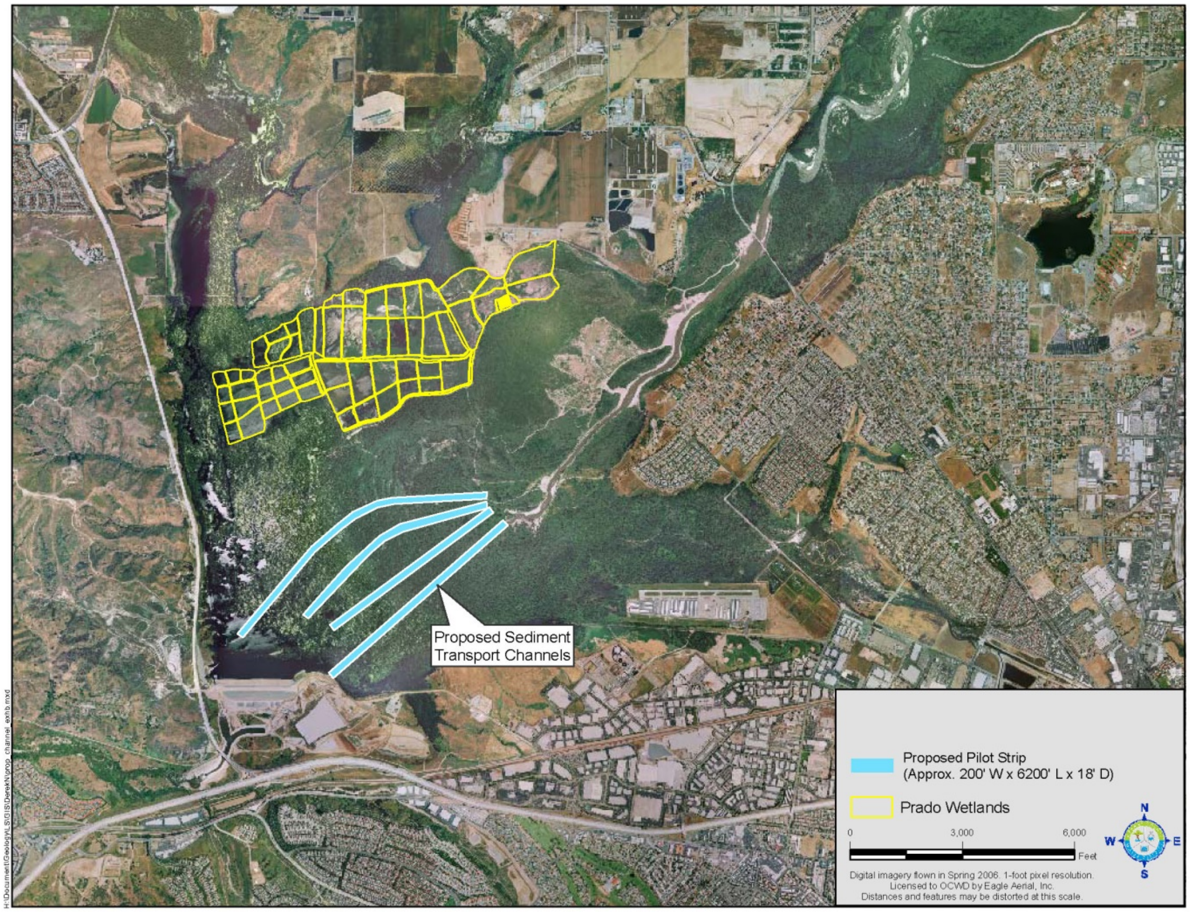
Since the construction of Prado Dam in 1941, the average annual sediment accumulation is estimated at 700 afy. This sediment accumulation is due to both the natural deposition of materials as water from the four main tributaries (Chino Creek, Mill-Cucamonga Creek, Santa Ana River and Temescal Creek) flows to Prado Basin as well as the artificial blockage of sediment flow from the dam. The modification of the natural sediment transport processes caused by Prado Dam results in armoring of the channel sediments and subsequent lowering of percolation rates.

Accumulation of sediment in Prado Basin reduces the storage capacity available to OCWD. The storage program between OCWD and the U.S. Army Corps of Engineers (Corps) is based on water storage to specified elevations. The amount of water stored at the specified elevations will decline as additional sediment accumulates in Prado Basin.

Accumulation of sediment in Prado Basin also starves the Santa Ana River of sufficient sediment below Prado Dam, resulting in degradation in this portion of the Santa Ana River. In some cases, more than 20 feet of erosion has occurred. Additionally, the lack of sufficient sand in the water exiting Prado Dam has caused coarsening in the sediment in the river channel between Imperial Highway and Orangewood Avenue. In this reach of the river, the District uses the Santa Ana River to recharge the groundwater basin. District staff has observed a decline in the recharge rate in this reach. This decline in the recharge rate is anticipated to continue unless the entrapment of sediment behind Prado Dam is addressed.

The objective of the Prado Basin Sediment Management Project is to move sediment from behind Prado Dam into the Santa Ana River below the Dam. By restoring the movement of sand through the dam, future loss of storage capacity will be reduced. Also, depending on the amount of sediment removed, Prado Dam's water storage capacity will be increased. The project will also extend the lifetime of Prado Dam. The project would also provide a supply of sediment to areas downstream of the dam that are currently sediment-starved, helping to reverse degradation of the river channel below Prado Dam. A map of the project is shown in Figure 1.

FIGURE 1: PRADO BASIN SEDIMENT MANAGEMENT PROJECT LOCATION



Description

OCWD is implementing the Prado Basin Demonstration Project with the Corps to remove 500,000 cubic yards of sediment from Prado Basin and re-entrain the sediment in the river below the dam. The goal of the Demonstration Project is to demonstrate the ability to reverse sedimentation trends within Prado Basin and restore the flow of sediment to the lower reach of the Santa Ana River. Cost information, feasibility data, and water quality data collected during the Demonstration Project are key to identifying a larger project to remove sediment from Prado Basin. The Demonstration Project will occur from 2014 to approximately 2019.

The Corps and OCWD are also preparing a Feasibility Study that evaluates ecosystem restoration, sediment removal, and water conservation opportunities in Prado Basin. This Feasibility Study will evaluate larger scale sediment removal opportunities compared to the Demonstration Project. This larger scale sediment removal project, on the order of 1,000,000 to 2,000,000 cubic yards, is the proposed project in the Long-Term Facilities Plan.

Operations

The project will involve dredging sediment from within Prado Basin and re-entraining the sediment into the Santa Ana River below Prado Dam. Dredging could be conducted under a contract awarded by OCWD or by the Corps.

Close coordination between OCWD, ACOE, the County of Orange, U.S. Fish & Wildlife Service (USFWS), California Department of Fish and Wildlife, the Regional Water Quality Control Board, and other stakeholders will be an integral part of the project.

Environmental Issues

A range of environmental issues will need to be addressed since the Prado Basin provides habitat to a range of endangered species. Sediment management in Prado Basin has the potential to provide significant environmental benefits in Prado Basin and in downstream portions of the Santa Ana River. Potential water quality impacts associated with the project will need to be monitored and addressed as necessary. The Prado Basin Feasibility Study completed by the Corps will include an EIR/EIS that will provide program-level environmental analysis.

Cost Estimate

A detailed cost estimate has not yet been prepared. The approximate cost of the project is roughly estimated to range from $15 million to $25 million. After the project is defined in additional detail, a detailed cost estimate will be completed.

Implementation Schedule

Task	Schedule
Prepare Feasibility Study	2012 – 2015
Design Sediment Removal project based on results in Feasibility Study	2016
Permitting and Environmental Evaluation	2017
Sediment Removal activity	2018-2020

Evaluation

Advantages

- Additional storage capacity will be created behind Prado Dam increasing the amount of water available for basin recharge.
- Release of natural sediments through Prado Dam will reduce armoring of the Santa Ana River channel, resulting in an increase in percolation rates.

Disadvantages

- Potential environmental impacts will need to be monitored and addressed.

WEST ORANGE COUNTY ENHANCED PUMPING PROJECT

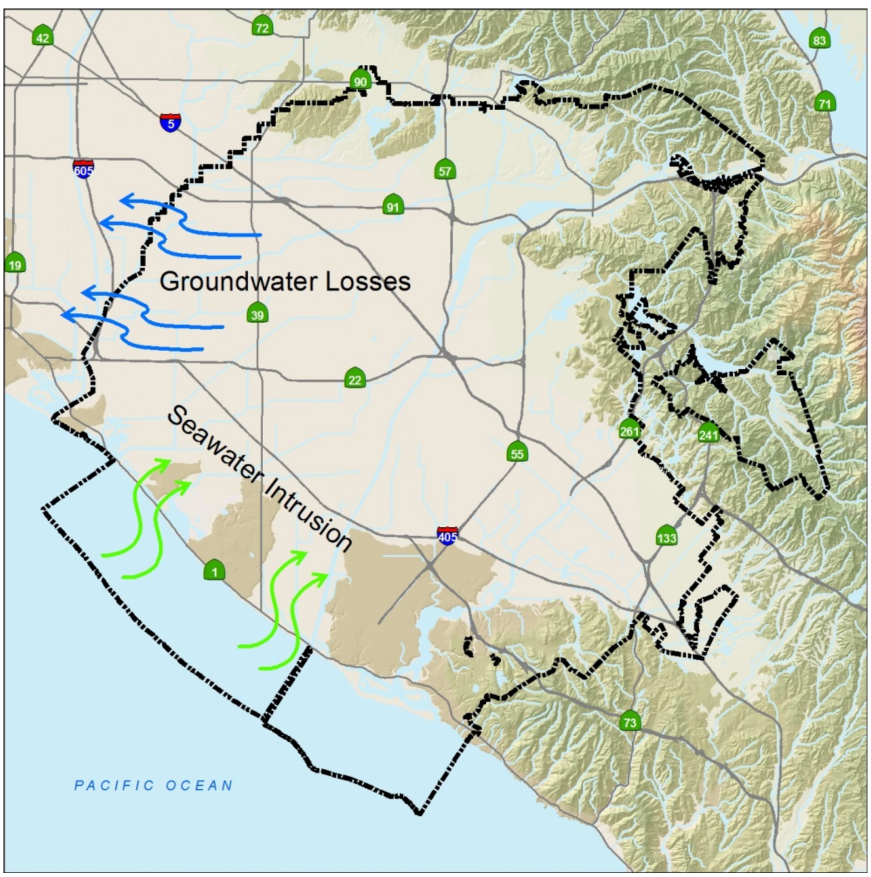
Summary

The purpose of the West Orange County Enhanced Pumping Project is to increase pumping in the western Orange County area to prevent groundwater losses to Los Angeles County and to provide additional groundwater for coastal producers.

Description

The boundaries for the Orange County (OC) groundwater basin include the county property line on the west, the Pacific Ocean on the southwest, mountain ranges on the north, and a geological boundary on the southeast, as shown in Figure 1. Pumping of groundwater by the coastal producers and cities has led to signs of seawater intrusion moving inland. A groundwater model was recently developed by OCWD that showed signs of OC groundwater being lost to Los Angeles County.

Figure 1: OCWD Groundwater Boundaries and Groundwater Trends

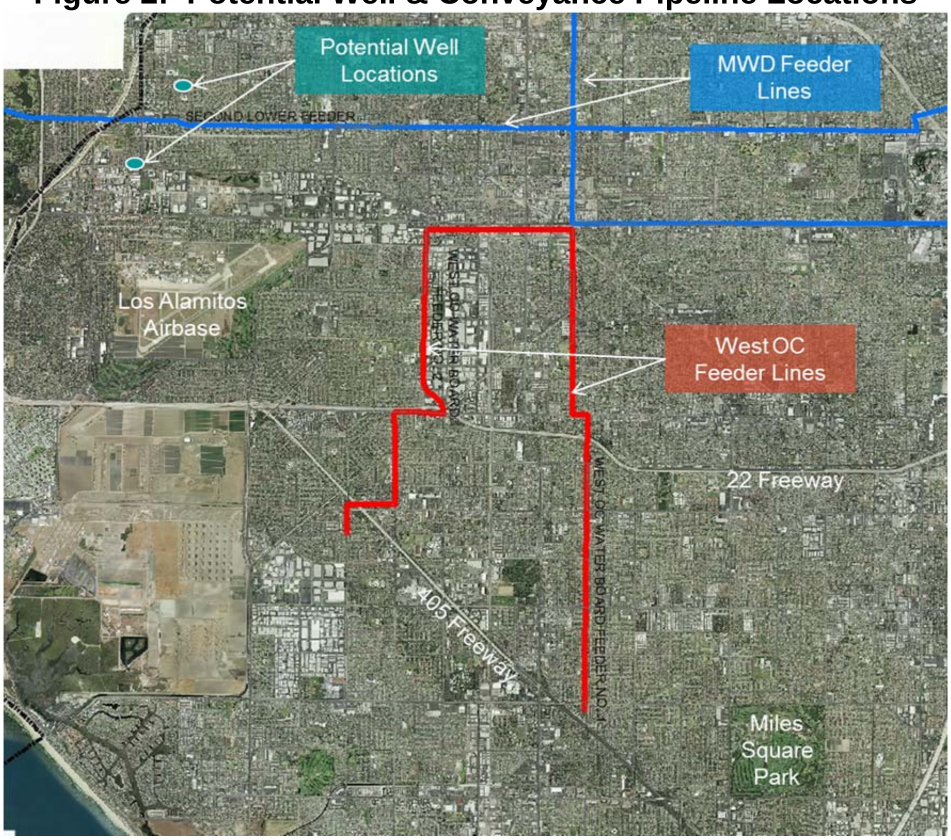


With these predictions, it is in the best interest of OCWD to decrease pumping along the coast and increase pumping in the northwest regions of the groundwater basin. Increasing groundwater production along the LA County border while reducing production along the coast could be a physical transfer of pumped groundwater to the coastal region or a paper transfer similar to the Coastal Pumping Transfer Program.

OCWD used the groundwater model to evaluate the potential effects of increased production in northwest Orange County. Model results indicate that losses to LA County could be reduced.

The groundwater produced by these inland wells could be transferred to coastal producers by way of paper transfers. Inland producers would pump the groundwater and pay OCWD the BEA for pumping above the BPP. This payment would be given to the coastal producer to purchase imported water to meet their demands. Another alternative would be to physically convey the pumped groundwater to coastal producers using existing pipelines. The production wells would have to be located optimally for nearby connections to the MWD and West OC Feeder pipelines as shown in Figure 2.

Figure 2: Potential Well & Conveyance Pipeline Locations



The product water would need to be routed into the Metropolitan Water District Feeder Pipeline and then into a privately owned West OC Feeder pipeline to reach the coastal producers. Agreements for use of these pipelines to convey the water would need to be secured.

The well construction would be paid for by the coastal producer receiving additional groundwater for either the paper transfer or physical transfer scenario. OCWD would pay for the additional pipeline segments required to convey the pumped water to the MWD and West OC Feeder Pipelines. OCWD would also enter into agreements with MWD and the West OC Feeder owners to use these pipelines. There would also be segments of pipe required to convey the pumped water from the West OC Feeder to the coastal producer's distribution connections.

Operations

In order to move forward with this project, OCWD would have to identify and coordinate with coastal producers that would like to build additional production wells. OCWD may also have to enter into agreements with these producers and pipeline owners (MWD, West OC Board) for conveyance of pumped water to the coastal producers. Once well locations have been established, OCWD should rerun a groundwater model to ensure the well locations are predicted to produce the desired results.

Environmental Issues

CEQA documentation would need to be completed for the construction of the new wells and the connecting pipeline segments.

Cost Estimates

At this time, the project description is not sufficiently defined to prepare a cost estimate. Capital and operating costs will be determined during preparation of the Engineer's Report.

Implementation Schedule

Task	Schedule
Identify Coastal Producers	May 2014 – November 2014
Coordination with Pipeline Owners	November 2014 – May 2015
Prepare Engineer's Reports and CEQA	May 2015 – November 2015
Well Sites – Acquisition	November 2015 – Sept 2016
Design and Permitting	September 2016 – May 2017
Construction	June 2017- February 2018

SUNSET GAP BRACKISH GROUNDWATER DESALTER

Summary

Previous groundwater investigations indicate that seawater intrusion is occurring at the Sunset Gap, between and inland of Landing Hill and Bolsa Chica Mesa. This area is largely covered by the Naval Weapons Station Seal Beach (NWSSB). This problem became more evident when Huntington Beach well No. 12 (HB-12) was decommissioned due to elevated chloride concentration. Recent OCWD studies, including a geophysical survey performed in 2010 and groundwater monitoring data from newly installed monitoring wells at the NWSSB, identified substantial seawater intrusion under NWSSB, and the sources of the saline groundwater are suspected to be from Alamitos Gap area, south of Westminster Boulevard, and from Huntington Harbor area.

Areas of brackish and saline groundwater occur within the upper 500 feet, which overlaps with aquifer zones produced by nearby production wells, with the highest salinity concentrations found in the Beta aquifer, at a depth of approximately 200 to 250 feet below ground surface. These areas of brackish groundwater occur west and southwest of former well HB-12 and appear to be flowing toward downgradient Huntington Beach wells 4, 7, and 13.

The Sunset Gap brackish groundwater desalter project, as currently envisioned, could be constructed with extraction wells to intercept brackish groundwater in the vicinity of the NWSSB to improve and protect Huntington Beach and other downgradient production wells. The extracted groundwater could be treated for beneficial use, which could include potable supply, injection at the Alamitos Barrier, or other uses.

Description

The concept of this project was to install brackish groundwater extraction wells upgradient of other HB production wells to hydraulically contain and capture the saline groundwater, with the goal of protecting these production wells and the groundwater basin from the advancing front of saline groundwater.

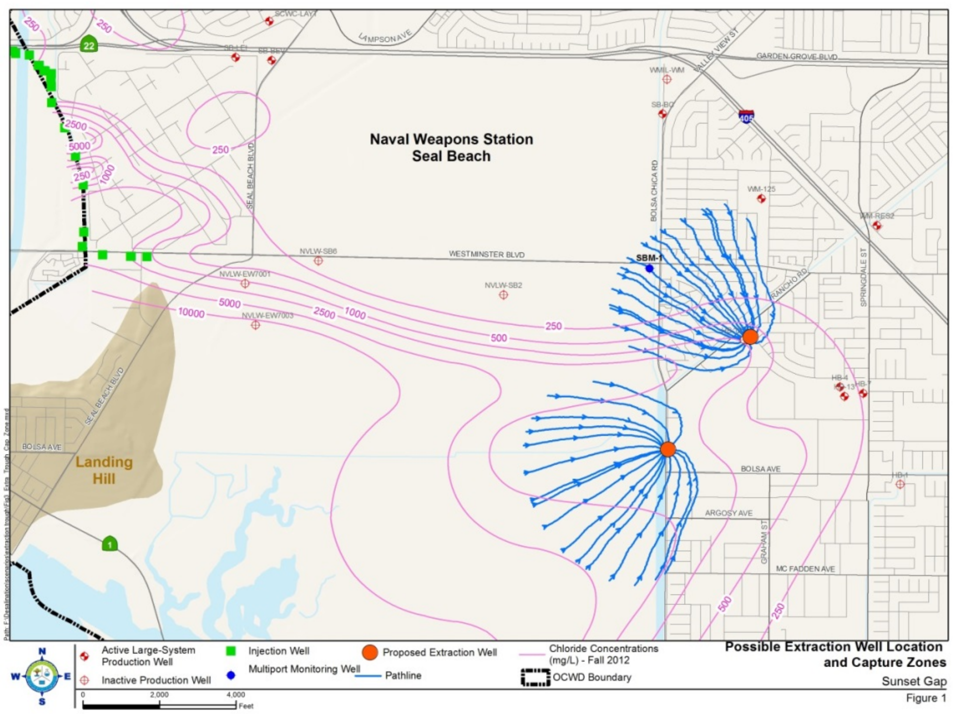
To evaluate this concept, the extended Alamitos Barrier Flow Model was used to simulate the effects of two brackish groundwater extraction wells, one north of the intersection of Bolsa Avenue and Bolsa Chica Street and another located at the former HB-12 well site (Figure 1). Extraction for the conceptual wells was assigned to the Beta aquifer only, and a pumping rate of 300 gallons per minute (gpm) and 200 gpm were assumed (500 gpm total between the two wells). These pumping rates are considered achievable in the Beta aquifer where a very coarse sand layer was found in this area. Figure 1 shows interpreted groundwater chloride concentration contours in the Beta aquifer, locations of the two conceptual extraction wells with their estimated capture zones, and downgradient HB production wells. The flowpath analysis indicates that the combination of the two capture zones would be able to capture the interpreted chloride plume above 2,500 mg/L and the majority of the chloride concentrations above 1,000 mg/L.

The locations of these two wells may be further optimized to capture an even larger portion of the chloride plume.

This analysis shows that with a small number of extraction wells with a combined extraction rate on the order of 500 gpm, the saline water front may be contained, and the potential impacts to HB production wells significantly reduced through source elimination and dilution.

Based on this preliminary assessment, the project could include construction of two or more extraction wells to intercept brackish groundwater, and a brackish water treatment plant to treat extracted groundwater to beneficial use, and pipelines to convey the treated water to the end users.

Figure 1: Possible Extraction Well Location and Capture Zones, Sunset Gap



Operations

It is anticipated that the extraction wells and treatment plant would be owned by OCWD and operated by OCWD or a local water agency.

Environmental Issues

The District would need to determine the appropriate evaluation to address potential environmental impacts associated with the project for CEQA.

Operation of a treatment plant and discharge of treated water will require permits from Department of Public Health, Regional Water Quality Control Board (RWQCB), or other agencies depending on the end use of the water.

Cost Estimates

The major construction items include new extraction wells, brackish water treatment plant, and pipelines to convey water from the extraction wells to treatment plant and to the end uses.

Since the extent of seawater intrusion needs better characterization before further evaluation of the project, the number of wells, treatment plant capacity, extracted water TDS concentrations, etc., cannot be determined and the cost cannot be estimated.

Implementation Schedule

Six monitoring wells are planned for construction at NWSSB in late 2014-early 2015 to evaluate sources and extent of the saline groundwater in the Sunset Gap. Data from these wells will be used to evaluate protective measures to stop or significantly reduce seawater intrusion near its origin(s).

Further evaluation of the project could start when we collect sufficient information to better understand the source, extent and the flow path of the saline water intrusion, approximately one year from the completion of the six new monitoring wells.

Evaluation

Advantages:

- Improve groundwater quality in Huntington Beach and the groundwater basin
- Protect the existing production wells
- Potential water source for Alamitos Barrier to further protect groundwater quality in Orange County, or extra source of water for various end use

Disadvantages:

- Short-term construction impacts
- Site access or purchase agreements for well site, treatment plant and pipeline are required
- End-user agreements on water delivery are needed

ALAMITOS BARRIER EXTENTION (LANDING HILL)

Summary

The purpose of the Alamitos Barrier Expansion Project is to control seawater intrusion south of the existing barrier alignment that is currently migrating eastward into the Sunset Gap area of the Orange County groundwater basin. The project would involve the construction of approximately 6 to 8 new injection well sites, pipeline(s), one to two nested monitoring wells, and, potentially, an alternative water supply.

Description

The Alamitos Barrier is a seawater intrusion control facility jointly owned by OCWD and Los Angeles County Department of Public Works (LACDPW) under a 1964 agreement. Under this agreement, LACDPW operates the barrier, but OCWD pays a prescribed portion the annual operations and maintenance costs. Injection water is an approximate 50/50 blend of recycled water from the Water Replenishment District of Southern California (WRD) Van der Lans treatment plant and potable supplies from MWD.

The barrier was originally constructed and placed into operation in 1965. Since then, the barrier has been expanded as its operation has been evaluated and it was determined that additional injection facilities were needed. A total of six new injection well sites were constructed by OCWD in 2000. Eight new injection well sites are planned for construction during 2014-15 and expected to be on-line in 2016. The eight planned injection well sites will be located in gaps between the existing injection wells along the north-south reach of the barrier that runs parallel to the Los Angeles/Orange County line. Thus, this planned project will address seawater intrusion pulses shown to have migrated through the existing barrier into Orange County but it is not meant to address the eastward intrusion occurring south of the existing barrier alignment.

The primary seawater pathway in Alamitos Gap is through the shallowmost Recent aquifer that is in hydraulic connection with the ocean. Once in the Recent aquifer, saline intrusion can then migrate into deeper aquifers through mergence zones where the deeper potable aquifers are hydraulically merged with the Recent aquifer. Therefore, the Recent aquifer is hydraulically connected to the deeper aquifers, such as the A-Zone and the I-Zone, both of which are susceptible to seawater intrusion. The A and I zones are both primary drinking water aquifers in the area.

Figure 1 shows that pulses of elevated chloride concentrations flow both through and south of the barrier (i.e., towards Orange County) in the I Zone. The intrusion pattern is also very similar in the A Zone. The occurrence of saline intrusion is typically indicated by chloride concentrations greater than or equal to 250 mg/L. Thus, the 250 mg/L contour in Figure 1 demarcates the leading edge of the intrusion front, with higher levels of salinity further upgradient closer to the salinity source.

The saline groundwater south of the barrier appears to be migrating relatively unimpeded to the east into Orange County as shown in Figure 1. This intrusion flow path is thought to be one of the primary sources of intrusion in the Sunset Gap area, and may have been the primary salinity source leading to the deactivation and destruction of City of Huntington Beach well 12. If left unchecked, this saline migration threatens other municipal wells in the area as well as the overall groundwater quality in this coastal area of the basin.

Two of the six monitoring wells planned for construction in 2014-15 as part of the Sunset Gap Seawater Intrusion Assessment Project will help to further define the extent of intrusion southeast of the existing barrier alignment in the vicinity of the Naval Weapons Station Seal Beach (NWSSB). The new monitoring wells will also provide important information regarding the depth, thickness and permeability of the intruded aquifers targeted for future injection. Data from these planned wells will be crucial in locating and designing the proposed injection wells.

A groundwater model was completed in 2010 (Alamitos Barrier Model) and jointly funded by WRD, LACDPW, and OCWD to provide a tool for determining future injection requirements to control seawater intrusion as well as to assist LACDPW with barrier operations and to determine recycled water travel time for WRD.

Figure 2 shows the conceptual alignment of the southerly barrier extension proposed herein for this project to halt the eastward migration of intrusion into Orange County. The proposed north-south alignment generally follows Seal Beach Blvd, spanning the gap from the southernmost portion of the existing barrier down to the Seal Beach Fault, which is largely considered to be a barrier to seawater intrusion in the A and I zones. Although still preliminary, the location of the proposed southerly barrier extension was largely based on intrusion pathways inferred from observed chloride concentrations (see Figure 1) as well as from predictive simulations using the aforementioned Alamitos Barrier Model.

As preliminarily proposed, the southerly barrier extension consists of 6 to 8 injection well sites, likely with two wells at each site screened in the A Zone and the I Zone. Based on a preliminary estimate of 100 gpm for each well at each site, total anticipated injection would be in the range of 2-3 MGD. The exact number, location, depth, and capacity of the proposed injection wells are unknown at this time and will depend on the following: site acquisition, property negotiations, results from planned Sunset Gap monitoring wells, and subsequent Alamitos Barrier Model refinement and additional predictive model scenarios. Other intrusion control alternatives may also be evaluated, such as an extraction barrier, dual injection/extraction barrier, and, possibly, a physical barrier.

In addition to 6 to 8 proposed injection well sites, one to two nested monitoring well sites may also be required for this project in addition to the Sunset Gap monitoring wells planned for 2014-15. The additional one or two monitoring wells would be used to ensure that the future barrier extension would be operated so as to maintain protective elevations along the alignment.

The existing Alamitos Barrier supply pipeline is anticipated to be fully utilized at or near its maximum capacity once the eight additional injection wells planned in 2014-15 become operational. OCWD staff developed a hydraulic model of the current barrier pipeline network to determine the pipeline capacity with the eight planned wells and how much additional water the pipeline could convey by upgrading to larger diameters for selected reaches. Instead of up-sizing selected reaches of the existing pipeline, a new pipeline could also be constructed in order to deliver the injection water supplies to the proposed injection well sites. The location of a new pipeline is unknown at this time and could potentially be located along the existing pipeline alignment, or to the north or east of the proposed new injection wells, and could potentially either connected or operated separately from the existing barrier pipeline.

The WRD's Van der Lans Advanced Water Treatment Facility currently supplies 50% of the existing Alamitos Barrier injection and is being expanded to its full potential capacity to supply 100% of the existing barrier injection. Therefore, the proposed southerly barrier extension will require an additional injection water supply. Alternatives for additional sources of water include the following:

1. Purchase of treated imported water from the West Orange County Feeder to be delivered by either a new pipeline or an existing inactive pipeline along Westminster Avenue owned by the City of Seal Beach. It is estimated that the cost of MWD's Tier I uninterruptible treated water will be at least $1,000 per af starting in 2017;
2. Purchase of treated imported water through the existing MWD barrier connection and transported through an up-sized barrier pipeline;
3. Colored water extraction wells producing from the Deep aquifer which is hydraulically separated from the zones susceptible to seawater intrusion. These wells could potentially be located on or near the NWSSB north of Westminster Ave. A membrane-type colored water treatment plant would also be needed;
4. Treated imported water delivered through a regional interconnector or the Orange County Cross Feeder. This delivery option will provide flexibility to supply Orange County with treated water from the Jensen Filtration Plant;
5. A small-scale satellite wastewater treatment plant ("skimmer plant") located somewhere in the vicinity of the proposed project that would take raw sewer water and provide primary, secondary, and advanced water treatment.

In summary, there are several tasks that need to be completed so that sufficient information is available to design the barrier expansion. The tasks include:

- Construct Sunset Gap monitoring wells and analyze data for at least one year;

- Site acquisition and property negotiations for the proposed injection and monitoring well sites;
- Refine Alamitos Barrier Model based on Sunset Gap monitoring well data (if deemed necessary);
- Perform predictive model simulations;
- Perform hydraulic model simulations for various alternatives of barrier pipeline;
- Evaluate water supply alternatives;
- Prepare Geologist's/Engineer's Reports and CEQA.

The refinement of the groundwater model (if necessary), hydraulic model simulations, and the evaluation of water supply alternatives can be performed simultaneously.

Operations

Planning for expanded barrier operations will need to be coordinated with the LACDPW and water supply alternatives will likely need to be coordinated with WRD. Additional water supplies for barrier expansion must be secured.

Environmental Issues

If possible, new injection wells will be primarily constructed within or adjacent to public rights-of-way. Temporary construction impacts would likely need to undergo review by the California Coastal Commission due to the proximity to the coast. For CEQA, the District would need to determine the appropriate evaluation to address potential environmental impacts associated with the project.

Cost Estimates

At this time, there are too many unknown factors (acquisition and number of injection well sites, alternative source of injection water and others) to adequately determine a cost estimate for this project. Capital and operating costs will be estimated during preparation of the Geologist's/Engineer's Report.

Implementation Schedule

Task	Schedule
Construct Sunset Gap monitoring wells and analyze data	August 2014 – January 2017
Alamitos Barrier Model refinement and predictive runs	March 2017 – August 2018
Evaluate water supply alternatives	January 2016 – December 2017
Prepare Geologist's/Engineer's Reports and CEQA	January 2018 – December 2018
Site(s) acquisition	April 2016 – April 2018
Design and Permitting	April 2016 – April 2018
Construction	April 2018- April 2020

Evaluation

Advantages:

- Improves and protects water quality of groundwater in the basin
- Protects drinking water wells from seawater intrusion
- Replenishes the basin (nearly all of the proposed injection expected to remain within Orange county due to eastward gradient)
- Reduces subsurface outflow to Los Angeles County if treated colored groundwater is used as the injection water supply

Disadvantages:

- Strict environmental compliance regulations and mitigation measures due to project's coastal location
- Due to proximity to NWSSB, potential for injection to move or affect Navy's on-base TCE plume
- All water supply alternatives may have a relatively high cost
- Shallow groundwater and any associated liquefaction concerns could limit the injection capacity and prevent achievement of protective elevations

FIGURE 1: 2009 CHLORIDE CONCENTRATIONS IN THE VICINITY OF THE ALAMITOS BARRIER

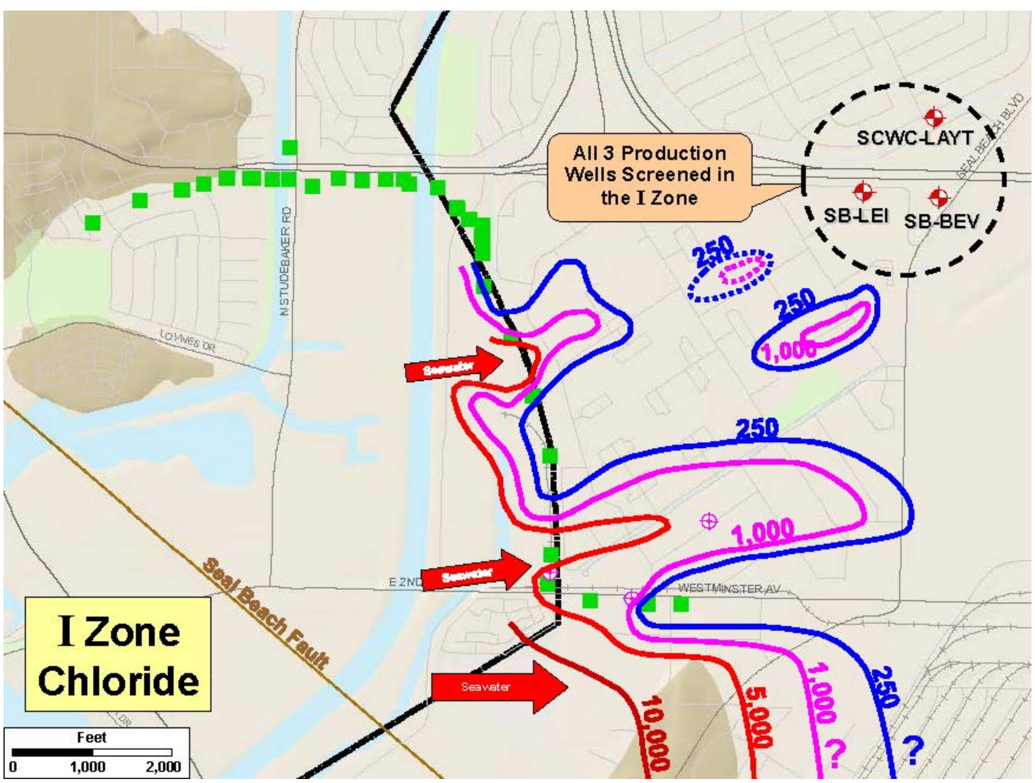
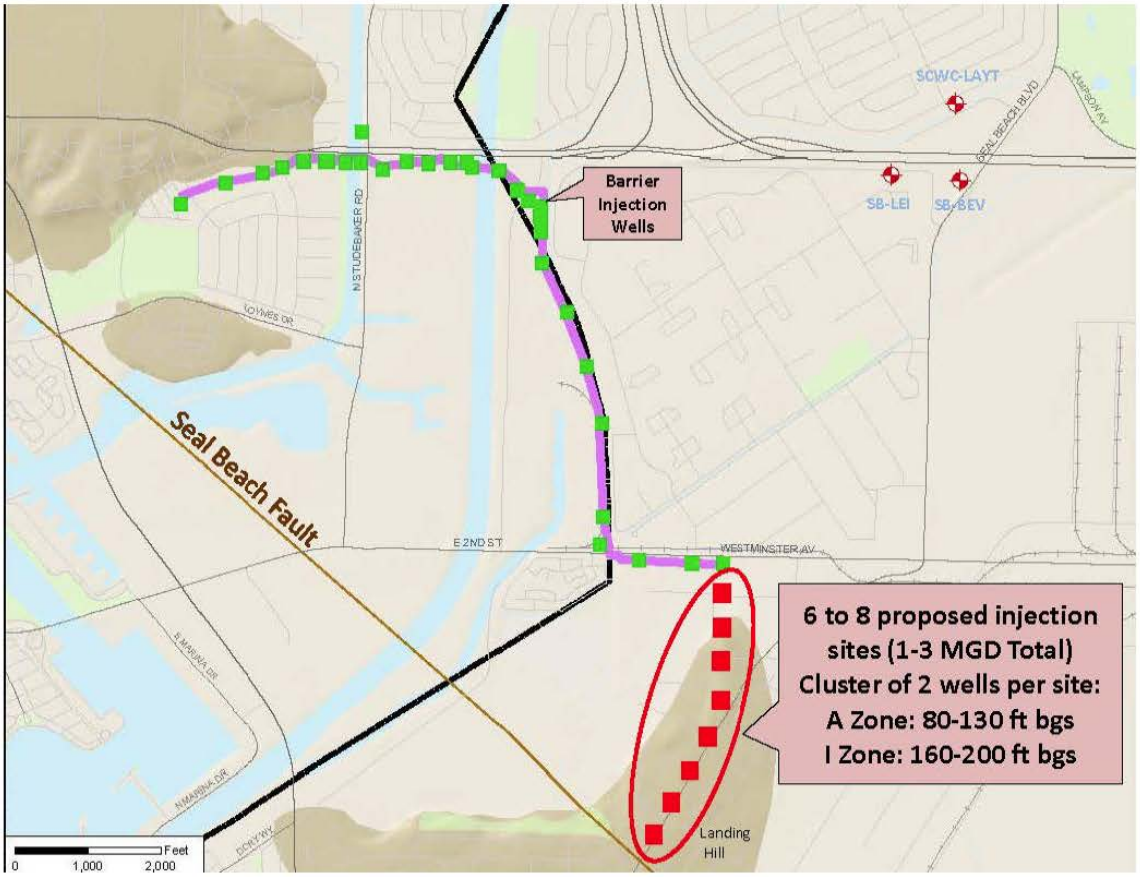


FIGURE 2: PROPOSED ALAMITOS BARRIER SOUTHERLY EXTENSION



NORTH BASIN GROUNDWATER PROTECTION PROJECT

Groundwater contamination consisting of chlorinated solvents and other hazardous materials from previous industrial activities has impacted production wells in Fullerton and Anaheim and continues to spread laterally and vertically in the shallow and principal aquifers, severely affecting regional groundwater. The District has extensively investigated the contamination, developed a six-well containment system, and is currently performing a remedial investigation and feasibility study in accordance with the requirements of the National Contingency Plan. It is the objective of the District to work with federal and state agencies and responsible parties to clean-up and remediate the contamination and restore and protect this groundwater resource. Subject to regulatory and legal requirements, the District is actively pursuing interim containment of the contamination as well as development of a long term clean-up remedy. All appropriate regulatory and administrative avenues, including cooperation with state and federal agencies, and negotiations with responsible parties, are also being pursued to protect and restore the groundwater of this part of the basin.

SOUTH BASIN GROUNDWATER PROTECTION PROJECT

The groundwater contamination in the South Basin has been caused from industrial solvents and other hazardous materials used in past decades in the southern part of the Orange County groundwater basin. The District has extensively investigated and delineated the extent and location of the contamination, and, to date, has obtained some remediation commitments through settlements, and is working with state environmental agencies to cause issuance of orders against responsible owners and operators. The South Basin contamination is primarily found in the shallow aquifer but has impacted the principal aquifer at least in the vicinity of major production wells serving the Irvine Ranch Water District, and is continuing to migrate laterally and vertically. It is the objective of the District to work with federal and state agencies and responsible parties to cause containment and removal of the contamination in the shallow aquifer to prevent further migration into the principal aquifer. The District is currently evaluating the funding of a remedial investigation and feasibility study in accordance with the National Contingency Plan, and implementation of removal and remedial actions to protect the vital groundwater resources in the southern part of the basin.

ENHANCED RECHARGE IN SANTA ANA RIVER BELOW BALL ROAD

Summary

The Santa Ana River (SAR) is one of the District's most effective recharge facilities, recharging over 60,000 acre-feet per year (afy). The District owns six miles of the river channel from Imperial Highway to Ball Road. In cooperation with the Orange County Flood Control District (OCFCD), the District uses the channel downstream of Ball Road for recharge purposes. The SAR channel is unlined for approximately 4 miles downstream of Ball Road; however, the River View golf course occupies the lowermost unlined reach just downstream of the 22 Freeway. The usable stretch from Ball Road to the 22 Freeway is approximately 2.7 miles long. Figure 1 shows the extent of the unlined SAR channel between Ball Road and the 22 Freeway.

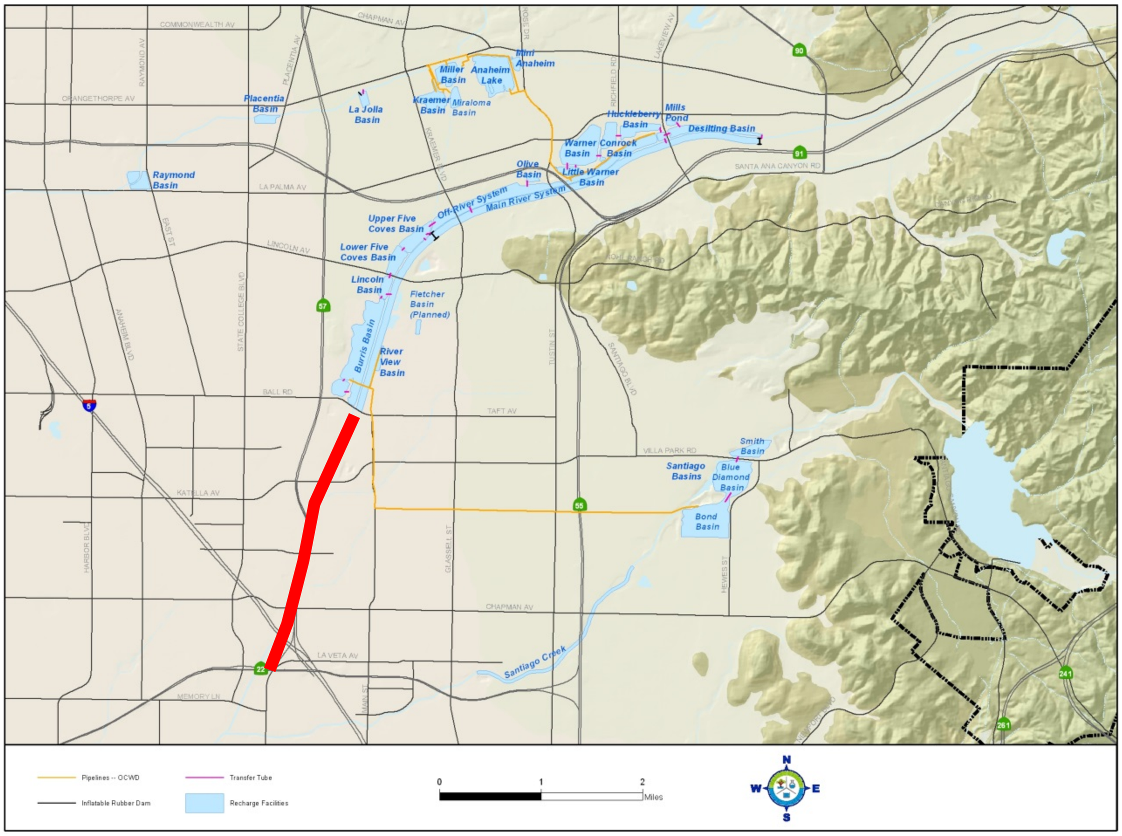
Because of clogging, the recharge capacity of the channel is constantly changing, presenting a challenge to the operators to use as much of the channel as possible and not send water to the River View golf course and potentially to the ocean. As a consequence, flows sent to the reach below Ball Road are restricted to approximately 20 cubic feet per second (cfs). This flow rate wets the channel between Katella and Orangewood Ave., depending the time of year and the condition of the river channel (clogged or clean). This means that approximately half of the reach below Ball Road is available for recharge given a way to use this reach with minimal risk of sending water to River View golf course and losing water to the ocean. It is possible that the capacity of the lower reach is upwards of 20 cfs, but to be conservative, it is assumed that the capacity of the lowermost reach ranges from 8 to 10 cfs.

Description

The facilities needed to enhance recharge below Ball Road have not been defined but could be a simple as the installation of video cameras at selected locations to as complex as installing a rubber dam in the river channel at the 22 Freeway. Meetings with Recharge Operations staff, engineering and others would be needed to define the appropriate project to accomplish this additional recharge.

The Recharge Facilities Model (RFM) was used to estimate the potential additional SAR storm water that could be recharged by the proposed project assuming that it would provide an average annual recharge rate of 8 cfs. This is deemed conservative given that the recharge rate of the utilized reach of the SAR channel below Ball Road is 20 cfs. The RFM estimated that this project would provide an annual average of 670 acre-feet per year of additional storm flow recharge.

Figure 1: Location of Unlined Santa Ana River Channel From Ball Road to 22 Freeway



Operations

Generally, recharge operations in the SAR channel would be similar to current operations, but additional activities would be required. These include monitoring the extent of recharge in the lowermost reach with video cameras or other monitoring equipment, as well as additional in-channel grading operations by heavy equipment to maintain water coverage.

Environmental Issues

For CEQA, the District would need to determine the appropriate evaluation to address potential environmental impacts associated with the project.

Cost Estimates

No cost estimates have been developed. The range in costs could be large given the potential for installation of a rubber dam on the lowermost reach of the SAR channel.

Implementation Schedule

Scoping workshops with Recharge Operations staff, engineering and other staff will be held in FY14-15. The timetable for implementation will be dependent on the complexity and cost of the facilities selected for this project.

Evaluation

Advantages:

- Expanded use of a facility that is already being used by OCWD
- Increased storm water recharge of up to 670 acre-feet per year

Disadvantages

- Short-term construction impacts
- Additional reach of river channel requiring maintenance

SUBSURFACE RECHARGE AND COLLECTION SYSTEM (SCARS) IN OFF-RIVER AND FIVE COVES BASINS

Identification

Clogging is the main constraint to maintaining elevated recharge rates. One way of minimizing the impact of clogging is to reduce the concentration of suspended solids in the recharge water. To test the ability of native sediments in the Off-River channel to filter out suspended solids, a test subsurface collection and recharge system (SCARS) was constructed in the Off-River channel near Field Headquarters in 1999. The concept is to collect filtered water below surface sediments and then convey the filtered water downstream to a location where it can be recharged into the subsurface.

The test SCARS facility had three main components 1) collection field, 2) transmission line, and 3) recharge field. The collection and recharge fields were constructed of three 1,000 ft long laterals of 6-inch diameter perforated pipe. Connecting the collection and distribution fields was a metered 12-inch transmission line. The test facility operated successfully for 4 ½ years until the flow meter failed. During this period the flow rate averaged over 480 gallons per minute (gpm) and the system showed no signs of clogging or decline in performance. Test facility results showed that this concept is a viable approach to improving recharge rates.

A similar approach is being used for the Riverbed Filtration Demonstration Project, which uses a subsurface gallery to collect filtered water and convey it to Olive Basin, where it then recharges the groundwater basin. This project was completed in April 2014 and will undergo several years of testing and evaluation. Data obtained from this project will be important in further developing the approach and design of a future SCARS in the Off-River Channel and Five Coves Basins.

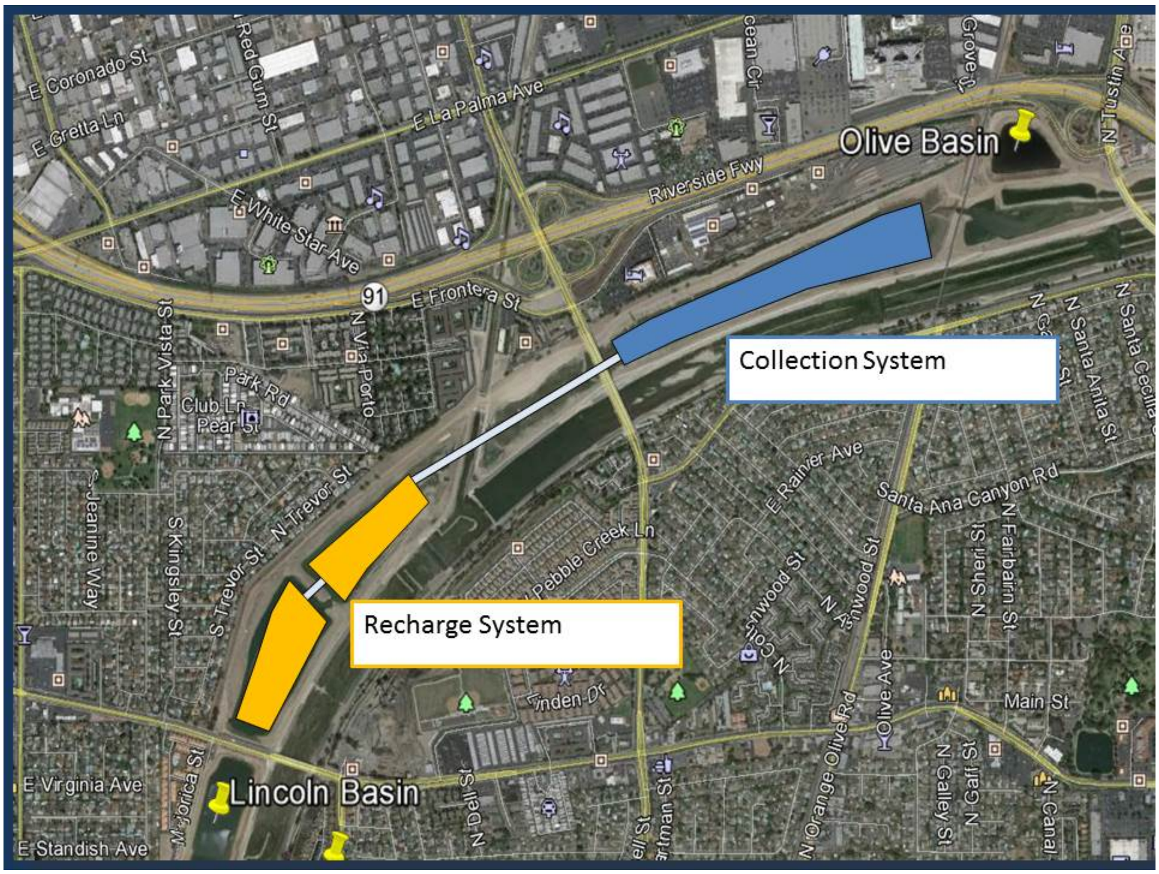
Description

The lower section of the Off-River Channel downstream of Olive Basin is a productive section of the recharge system; however, this section could also be used to filter water prior to recharge in downstream Five Coves Basins. The advantage of this approach is that water could be recharged in Five Coves Basins year-round as opposed to the current approach of taking the basins off-line for cleaning.

The project would include construction of a subsurface collection gallery in the lower section of the Off-River channel as shown on Figure 1. This gallery would collect filtered water which would then be conveyed via pipeline to the Five Coves Basins. The filtered water would then be recharged in a subsurface gallery constructed in Five Coves Basins. Because the galleries are below the surface, the conveyance functions of the Off-River channel and Five Coves Basins would not be disrupted by the subsurface collection and recharge system.

The Recharge Facilities Model (RFM) was used to estimate the potential additional Santa Ana River storm water that could be recharged by the proposed project assuming that it would provide a constant recharge rate of 15 cubic feet per second (cfs). This is deemed conservative given that the recharge potential of Five Coves Basins is 30 cfs. The RFM estimated that this system would provide an average of 670 acre-feet per year of additional storm flow recharge.

Figure 1: Location of Proposed Subsurface Collection and Recharge System



Operations

The subsurface collection and recharge system would automatically operate any time water is being conveyed through the Off-River channel. Due to more intensive use of the Off-River channel for recharge, it may require additional cleanings to keep surface recharge rates elevated. This activity will not only assist in supplying the subsurface collection and recharge system, it will assist in maximizing the natural recharge capacity of the Off-River channel.

Environmental Issues

For CEQA, the District would need to determine the appropriate mitigation requirements associated with the project.

Cost Estimate

DESCRIPTION	COST
Design and Permitting	$100,000
Collection and Recharge System	$3,000,000
Oversight/Inspection	$50,000
Contingency (20%)	$630,000
Total	**$3,780,000**

With an estimated yield of 670 acre-feet per year, the unit cost is approximately $280/af assuming a project life of 20 years. This estimated cost does not include additional operations and maintenance costs, which are expected to be minimal.

Implementation Schedule

Before proceeding with the design of this project, OCWD will be collecting data from the recently completed Riverbed Filtration Project for an extended period of time. In parallel, OCWD will collect site specific information in the Off-River Channel and Five Coves Basins, which could include construction of small pilot scale collection systems in the Off-River Channel. This may be required because sediment and groundwater conditions are different in the lower section of the Off-River channel compared to the upper section where the Riverbed Filtration System is located.

Task	Schedule
Evaluate Riverbed System Performance	2014 – 2016
Construct and Test Pilot Scale Collection System in Off-River Channel	2015 – 2017
Evaluate Subsurface Conditions in Five Coves Basins	2014 – 2017
Engineer’s Report & CEQA	2017 – 2018
Permitting	2017 – 2018
Design	2017 – 2018
Construction (Phase 1: Collection System)	2018 – 2019
Construction (Phase 2: Recharge System)	2019 – 2020

Evaluation

Advantages:

- Water would be recharged year-round in the subsurface in Five Coves Basins
- The recharge capacity of Five Coves Basins would be increased by up to 670 acre-feet per year
- Low cost alternative to Five Coves Bypass Pipeline Project

Disadvantages

- Short-term construction impacts
- Potential additional maintenance of surface sediments in Off-River channel

Implementation Schedule

Task	Schedule
Feasibility Study	September 2014 – May 2015
Engineer's Report & CEQA	May 2015 – December 2015
Design/Agreements	December 2015 – December 2016
Construction	December 2016 – August 2017

Evaluation

Advantages:

- Produce more secondary effluent from OCSD's Plant No. 1.
- Urban runoff will be fully treated

Disadvantages:

- Numerous small connections will have to be made in various locations within Orange County in order to produce a large amount of water (greater than 4 MGD).

MID-BASIN INJECTION

Summary

The Groundwater Replenishment System (GWRS) is currently being expanded to produce 100 million gallons per day (MGD) of recycled water. Final expansion of the GWRS will produce 130 MGD and is estimated to be completed in 2019. This water is currently sent to the Talbert Seawater Intrusion Barrier and to groundwater recharge basins in Anaheim. The amount of water need to supply Barrier operations varies seasonally and is typically reduced to a minimum of 20 MGD during the winter based on the amount of rainfall and local water table depth. Due to pipeline pressure constraints, the maximum amount of water that can be sent to the recharge basins is 85 MGD. Assuming a total GWRS production of 130 MGD, this means that during at least part of the year, the plant will produce a surplus of up to 25 MGD that cannot be recharged using existing facilities.

The Mid-Basin Injection (MBI) project could be constructed to allow for GWRS product water to be directly injected into the principal aquifer in the central portion of the groundwater basin. A demonstration well, MBI-1, is being equipped and is expected to begin operation in the first quarter of 2015. It is estimated that a single injection well can inject 3 MGD. It is proposed to construct 7 to 9 additional wells after evaluating the performance of the demonstration well in order to accommodate the 25 MGD of additional GWRS production.

Description

Part 1 of the project includes the construction of a single demonstration injection well, the associated conveyance pipeline from the GWRS pipeline, and two test monitoring wells. All three wells have been completed in the Principal Aquifer. The purpose of the initial testing phase is to gather hydrogeologic, water quality, and operational information to support the required permitting, Engineer's Report, and ultimate construction of the subsequent additional Mid-Basin injection wells.

The demonstration injection well site has been constructed in the vicinity of Edinger Avenue and the Santa Ana River in the City of Santa Ana. The GWRS pipeline is located in the west levee of the Santa Ana River and the injection well is being connected to the GWRS through a turnout originally constructed in the pipeline. The well is currently being equipped and is anticipated to be in service beginning the first quarter of 2015.

Part 2 of the project is currently planned to include four additional injection wells within Centennial Park, one monitoring well, and the required conveyance pipelines from the GWRS pipeline to the injection wells sites and discharge of backwash flows (Figure 1). It is proposed to connect the supply pipeline for these four wells to a connection constructed as part of the demonstration well.

Part 3 of the project will be to construct the remaining 3 to 5 wells to reach a total of 7 to 9 injection wells. These injection wells are currently proposed for construction along the Santa Ana River and possible locations are shown in

Figure 2. These locations are tentative and land negotiations have not taken place. Another possible injection well location is at the Anaheim ARTIC site, located further north of the proposed injection well sites shown in Figure 2.

Based on a preliminary evaluation, it is estimated that approximately 750-1,000 feet of spacing is required between each of the injection wells to avoid significant mounding at a targeted total injection volume of 25 MGD of GWRS product water. The final well locations and injection volume will be determined through the testing phase and will be presented in the Engineer's Report.

Each injection well would be constructed to an approximate depth of 1,200 feet. The top of the screened interval would begin in the upper portion of the Principal aquifer, at an approximate depth of 500 feet. This depth interval generally corresponds with the screened intervals of the municipal production wells in the vicinity. It is assumed that the total length of the screen within this interval would be approximately 300 feet, targeting the most permeable zones for injection.

Monitoring wells would be needed for California Department of Public Health (CDPH) and Regional Water Quality Control Board (Regional Water Board) permit compliance purposes and related water quality monitoring.

Figure 1: Proposed Mid-Basin Injection Wells at Centennial Park

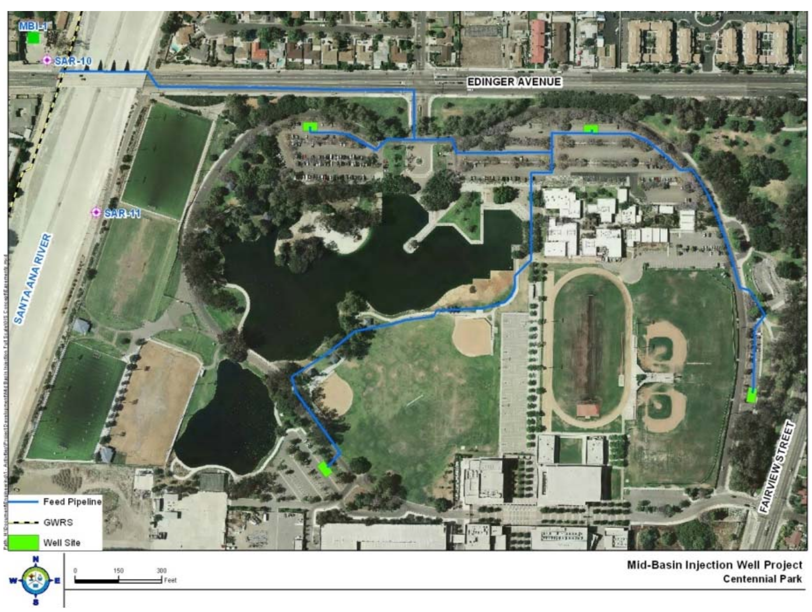
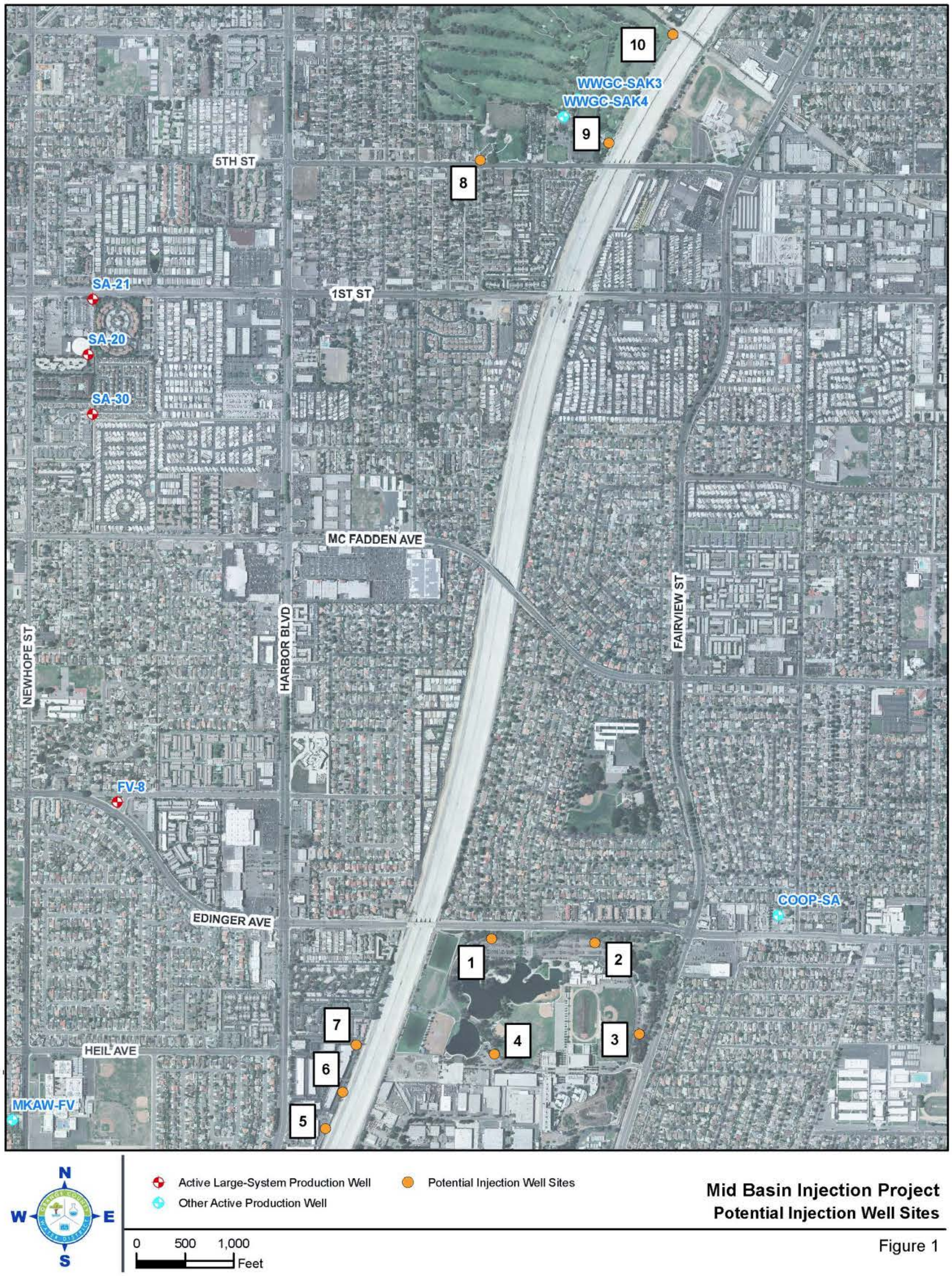


Figure 2: Proposed Future Mid-Basin Injection Well Sites



Operations

The injection wells would need a supply of water from the GWRS. It is estimated that one additional Water Production (Barrier Operations) staff would be required for the operation and maintenance of the injection wells.

Environmental Issues

The GWRS is operating under a permit from the Regional Water Board. The Mid-Basin Injection Project would require a Title 22 Report addendum and amendment to the District's GWRS permit. Studies will be needed to estimate groundwater flow travel times between the injection wells and nearby production wells. These studies will be generated through data collected as part of the demonstration well operations.

For CEQA, the District would need to determine the appropriate evaluation to address potential environmental impacts associated with the project. Staff is currently investigating the possibility that a Mitigated Negative Declaration can be used for the Centennial Park phase.

Cost Estimates

The major construction items include new injection wells, pipelines to convey water from the GWRS pipeline to the injection wells, and new monitoring wells.

It is assumed that the project will be constructed in three distinct parts. Part 1 includes one demonstration injection well (MBI-1) located near the vicinity of Edinger Avenue and the Santa Ana River, the associated pipeline connection to the GWR pipeline, and two monitoring wells located between the injection well and the closest production well (IRWD-12).

Data collection, testing, and initial operations conducted during and immediately after Part 1 construction activities will support the permitting of the remaining injection wells during Part 2 and 3. Table 1 shows the estimated costs associated with Part 1.

Part 1 Cost Estimate

DESCRIPTION	COST
Design & Permitting	$1,152,253
Injection Well & Monitoring Wells Drilling	$2,738,844
Injection Well Equipping & Site Work	$1,988,000
Oversight/Inspection	$198,273
Public Outreach	$49,691
Contingency	$192,939
Total	$6,320,000

Part 2 would include the four injection wells in Centennial Park and one monitoring well down gradient. Table 2 summarizes the estimated total costs for Part 2. The cost per well is lower in Part 2 and 3 because there will be a cost savings realized by combining multiple similar well design and construction into fewer contracts.

Part 2 Costs

DESCRIPTION	COST
Design and Permitting	$700,000
4 Injection Wells: Drilling & Construction	$6,000,000
4 Injection Wells: Equipping & Site Work	$8,000,000
Pipeline Connections and Laterals	$1,000,000
Monitoring Well: Drilling & Construction	$300,000
Oversight/Inspection	$1,000,000
Contingency (20%)	$3,400,000
Total	$20,400,000

Part 3 would include the remaining 3 to 5 injection wells and monitoring well(s). Table 3 summarizes the estimated total costs for Part 3.

Part 3 Costs

DESCRIPTION	COST
Design and Permitting	$850,000
5 Injection Wells: Drilling & Construction	$7,000,000
5 Injection Wells: Equipping & Site Work	$8,000,000
Pipeline Connections and Laterals	$1,250,000
3 Monitoring Wells: Drilling & Construction	$900,000
Oversight/Inspection	$1,000,000
Contingency (20%)	$3,800,000
Total	$22,800,000

Implementation Schedule

Task	Schedule
Part 1: Construct two monitoring wells and one injection well	
Identify & acquire well site	February 2009 – June 2009
ER & CEQA for Part 1	April 2009 – November 2009
Construct wells	June 2011 – February 2013
Conduct injection test	February 2015 – February 2016
Part 2: Construct four injection wells and one monitoring well	
Engineer's Report and CEQA	April 2014 – December 2015
Permitting	January 2016 – July 2016
Design	May 2016 – December 2016
Construction	January 2017 – April 2018
Part 3: Construct five injection wells and three monitoring wells	
Identify & acquire 5 wells sites	April 2014 – December 2015
Engineer's Report and CEQA	January 2015 – August 2015
Permitting	September 2015 – May 2016
Design	October 2016 – May 2017
Construction	June 2017 – December 2018

Evaluation

Advantages:

- Water will be injected into the groundwater basin in areas where pumping depressions have been created.
- Recharge will be more evenly distributed across the groundwater basin.
- Some of the infrastructure for this project was already constructed as part of GWRS Phase 1.
- Water is pumped approximately ¼ of the distance to the Anaheim recharge facilities thereby saving electrical costs.

Disadvantages:

- Short-term construction impacts
- Injection technology may require more maintenance than surface recharge
- Land acquisition suitable for injection wells sites may be difficult

ADDITIONAL TALBERT BARRIER RECHARGE WELLS AT DEEP WELL SITES

Summary

In 1975, five groundwater production wells were constructed by OCWD to supplement water produced by Water Factory 21. The five wells, called Deep Well No. 1 to 5, were screened in the deep aquifer not impacted by seawater intrusion. These wells produced colored water, which was blended with recycled water from Water Factory 21 and imported water. This mixture supplied the Talbert Seawater Intrusion Barrier (Barrier) for many years.

Deep Well No. 1 and 2 were constructed on OCWD property while No. 3, 4, and 5 were constructed off-site with a pipeline conveying groundwater to a blending reservoir on OCWD property. Figure 1 shows the locations of No. 1, 3, 4, and 5. Deep Well No. 2 is not shown as it was destroyed in 2004 to make way for the GWRS.

The need for groundwater from the deep wells has diminished significantly in recent years. Soon after the completion of the Groundwater Replenishment System (GWRS) in 2008, OCWD began using 100 percent recycled water to supply the Barrier. As a result, groundwater is no longer needed for the Barrier. Historically, groundwater was periodically used to supplement Green Acres Project (GAP) flows. The largest consumer of GAP water is the Orange County Sanitation District (OCSD). In the past few years, OCSD has reduced the amount of GAP water used and future use is estimated to total 1 million gallons per day (MGD), or 1,120 acre-feet per year (afy). As a result, the future need for groundwater to augment GAP supplies is minimal. Any future supplies that are needed can be provided by Deep Well No. 1, which has a capacity of 1 MGD.

With the need for off-site Deep Well No. 3, 4, and 5 to supplement GAP flows diminishing, OCWD staff evaluated the concept of converting these wells to recharge wells and using the conveyance pipeline to supply GWRS water to the wells. This approach was found to be infeasible due to the following:

1. The wells are relatively inefficient and would have low injection rates per feet of screen compared to newly constructed recharge wells.
2. Injecting GWRS water into the colored water aquifer is likely to cause well clogging due to biological growth in and around the well.
3. Injecting water into the colored water aquifer could exacerbate the migration of colored water into the shallower, clear water aquifer tapped by groundwater production wells.
4. There is a high potential for well casing failure due to corrosion of the mild-steel casing by aggressive GWRS water. A corrosion analysis conducted in 2012 found that the casing is in poor condition.

5. The pump in well No. 5 was dropped and cannot be retrieved. As a result, this well is no longer usable for any purpose and should be properly destroyed.

Moreover, the proposed widening of the 405 freeway would require the relocation of Deep Well No. 3 and required site modifications (e.g, fencing, electrical controls, etc.) at Deep Well No. 4 and 5.

Because converting the existing wells was found to be infeasible, an alternative project in which well No. 3, 4, and 5 would be replaced with new recharge wells was developed. This approach has the following advantages:

1. New, high efficiency recharge wells can be constructed with the corrosion resistant materials that target the appropriate aquifers.
2. The new wells can be located on or near the existing deep well sites, reducing the time and cost to obtain well sites.
3. The conveyance pipeline can be repurposed to supply the wells with GWRS water.
4. Backwash water from the recharge wells can be discharged to nearby drainage channels.

This project, along with mid-basin injection wells, is being considered because additional capacity to recharge GWRS water is needed, especially for the Final Expansion which will increase GWRS capacity to 130 MGD. As many as 10 mid-basin injection wells are planned to recharge some of these flows. This project has the potential to reduce the number of mid-basin injection wells required to recharge future GWRS flows if it can be shown that the cost is comparable or less than mid-basin injection wells.

One key activity that needs to be done in evaluating this project is using the Talbert Barrier groundwater flow model to assess how much interference there could be with the existing Barrier. Given close proximity of the proposed wells to the Barrier, it is possible that the wells might compete for the same space in the aquifer. The model will allow for an assessment of any interference and provide an estimate of the net recharge produced by the project, which would then be used to estimate the cost-effectiveness of the project.

Description

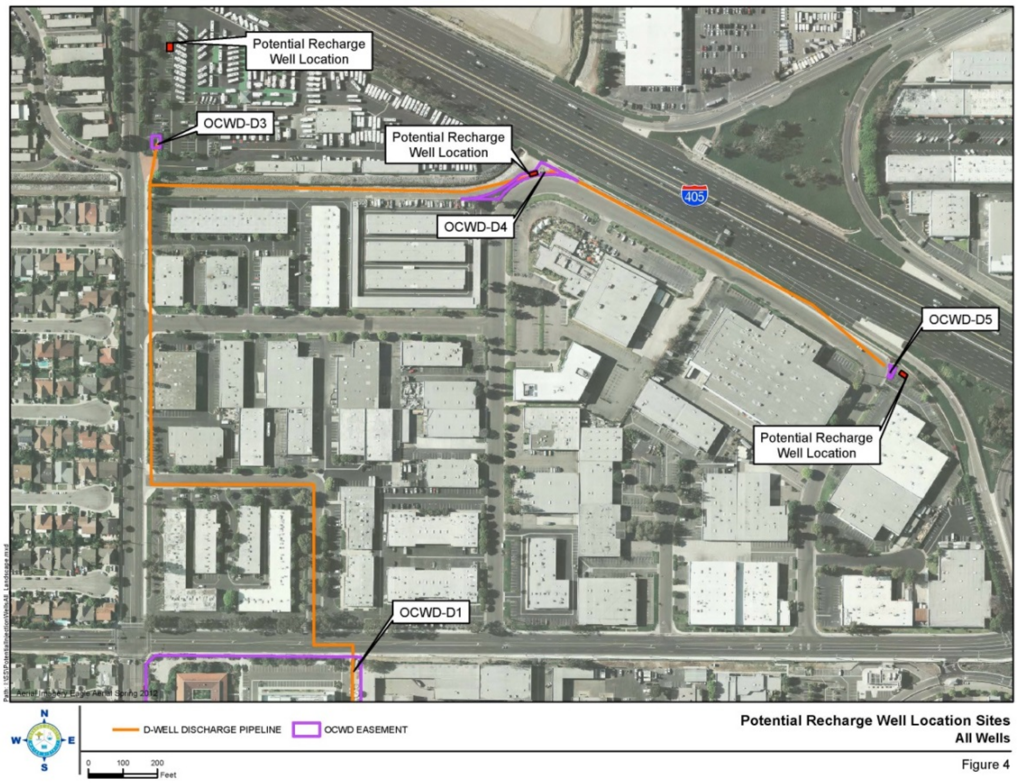
The scope of this project includes the following activities:

1. Properly destroying Deep Well No. 3, 4, and 5.
2. Negotiate new easements for wells No. 3 and 5. The site for well No. 4 is large enough that new wells can be installed on the existing well site.
3. Construct one shallow and one deep recharge well per site. Based on a preliminary evaluation, the shallow wells would be screened from 240 to

420 feet below ground surface (ft bgs) and the deep wells from 470 to 680 ft bgs. The capacity of each well is expected to range from 0.5 to 1 MGD for a total project capacity of 3 to 6 MGD.

4. Connect the conveyance pipeline to the Barrier supply pipeline.
5. Install a communication and control system and integrate the wells into the GWRS process control system.

Figure 1: Potential Talbert Barrier Recharge Well Locations at Deep Well Sites



Operations

The recharge wells would need a supply of water from GWRS. They would require periodic backflushing like other Barrier wells.

Environmental Issues

For CEQA, the District would need to determine the appropriate mitigation for this project, which would primarily to address construction of the new recharge wells.

Cost Estimate

DESCRIPTION	COST
Destroy Wells No. 3, 4, and 5	$200,000
Design and Permitting	$100,000
Property Acquisition (Relocate No. 3, 5)	$20,000
Recharge Well Drilling (6) & Construction	$4,000,000
Recharge Well Equipping (6) & Site Work	$1,700,000
Pipeline Connections and Laterals	$200,000
Install Fiber Optic System/Integrate into SCADA	$100,000
Oversight/Inspection	$200,000
Contingency (20%)	$1,300,000
Total	$7,820,000

With an estimated project capacity of 3 to 6 MGD, or 3,300 to 6,600 afy, the unit cost ranges from $60 to $120/af assuming a project life of 20 years. These costs do not include additional operations and maintenance costs.

Implementation Schedule

Task	Schedule
Conduct Modeling to Evaluate Interference	August 2014 - December 2014
Property Acquisition (Wells No. 3 and 5)	January 2015 - June 2015
Engineer's Report & CEQA	July 2015 - December 2015
Permitting	July 2015 - December 2015
Design	January 2016 - June 2016
Construction	August 2016 – December 2016

Evaluation

Advantages:

- Potential lower cost option to increase recharge capacity compared to mid-basin injection wells
- The wells would be relatively easy to maintain given the close proximity to the Barrier
- Some of the infrastructure for this project is already in place (conveyance pipeline); however, an evaluation of the pipeline material's ability to withstand the corrosive nature of GWRS water would have to be conducted during an early phase of this project.

Disadvantages

- Short-term construction impacts
- Potential competition with existing Barrier recharge.

POWER GENERATION IN FOUNTAIN VALLEY

Summary

The purpose of this project is to evaluate the technical, regulatory, and economic feasibility of power generation using natural gas and installation of solar photovoltaic panels at the District's Fountain Valley campus or a remote site. The first step includes investigation of available technologies to determine overall project feasibility.

For the power plant likely technical options will include combustion turbines, internal combustion engines, fuel cells, and use of co-generation steam. The project's ultimate objectives are to reduce energy costs for the OCWD and to improve the regional electrical grid reliability through use of distributed generation. The two main drivers for this project include the reduced cost of natural gas related to the national hydro-fracking phenomena and the regional need for distributed generation following the unplanned shutdown of the San Onofre nuclear power plant.

The initial phase of this project would include reviewing GWRS power demands, reviewing available technologies (combustion turbines, internal combustion engines, and fuel cells), considering beneficial uses of waste heat (including combined cycle, steam pumps, and forward osmosis), and developing potential alternatives and planning costs. Potential constraints include unfavorable economics and possible public opposition to constructing a power plant near residential homes. A recently completed regulatory "fatal flaw" analysis for this project in particular resulted in a favorable ruling by the South Coast Air Quality Management District.

This study will include:

- Review of power demands – Analyze billing records and operations data to understand the current and post-expansion power requirements.
- Review current and proposed regulations related to self-generation within the South Coast Air Quality Management District.
- Review GWRS electrical infrastructure design and consider the technical feasibility and logistical implications of a self-generation retrofit into the existing system
- Review available technologies for self-generation utilizing natural gas and provide a discussion of advantages/disadvantages of each. Currently the GWRS does not have a heat load, so particular emphasis must be placed on creating an efficient use of the cogenerated waste heat. Considerations will include, but not be limited to, combined cycle generation, steam pumps, and forward osmosis.

- Onsite analysis should consider the possible inclusion of parking lot solar panels and up to 5 MW of solar produced at a remote OCWD location and wheeled to the Fountain Valley location using SCE's RES-BCT tariff. The analysis will be limited to considering the reduction in size of the on-site plant that the off-site plant might offer, and not the off-site equipment itself.
- Develop potential alternatives - Develop and analyze costs associated with the alternatives as well as avoided direct access energy and Edison T&D costs. Analysis will consider asset management principles and discussions regarding projected life cycle costs and implementation schedules for each alternative.
- Review potential sources for funding assistance.

Operations

It is currently anticipated that a GWRS power generation plant would be owned and operated by the Orange County Water District.

Environmental Issues

Environmental considerations will primarily be focused on air quality impacts. Other considerations will include visual impacts of stacks, equipment vibration in the ground, and noise impacts on nearby residences. For CEQA, the District would need to determine the appropriate evaluation to address potential environmental impacts associated with the project.

Cost Estimate

The preliminary feasibility study will include conceptual designs and a cost estimate to build and operate the power plant. That cost estimate will be a primary consideration on whether or not to proceed with subsequent analysis and/or detailed design.

The major cost items of this initial feasibility study include:

1. Review Power Demands
2. Review operational history
3. Review SCE records
4. Review expansion plans for future power requirements
5. Review Available Technologies
    a. Analyze cogeneration with turbines
    b. Analyze cogeneration with engines
    c. Analyze cogeneration with fuel cells
6. Develop Potential Alternatives
7. Develop planning level costs and time requirements for implementation
8. Analyze any required GWRS shutdowns and associated time period
9. Review funding opportunities
10. Recommendations

Implementation Schedule

To be determined

Evaluation

Project will be evaluated based on technical efficacy, economic advantage over continued purchasing of electricity through a direct-access service provider, operational considerations, and environmental impacts on local community, public acceptance, and distributed generation benefit for regional grid reliability.

Advantages

Possible economic benefit to OCWD and improved SCE electricity grid reliability following closure of San Onofre

Disadvantages

Process and operational risks associated with a large complex, and costly power plant. Possible community noise and air quality impacts.

APPENDIX 3

PREPARATION DOCUMENTS

AGENDA ITEM SUBMITTAL

Meeting Date: February 12, 2014

To: Water Issues Committee
Board of Directors

From: Mike Markus

Staff Contact: G. Woodside/M. Westropp

Budgeted: N/A
Budgeted Amount: N/A
Cost Estimate: N/A
Funding Source: N/A
Program/ Line Item No. N/A
General Counsel Approval: N/A
Engineers/Feasibility Report: N/A
CEQA Compliance: N/A

Subject: LONG-TERM FACILITIES PLAN - 2014 UPDATE

SUMMARY

The Board of Directors received and filed the District's Long-Term Facilities Plan (LTFP) in July 2009. The LTFP is a strategic planning tool to identify, evaluate and prioritize future potential projects. Staff proposes to update the LTFP in 2014.

RECOMMENDATION

Informational

BACKGROUND/ANALYSIS

The District periodically updates the LTFP approximately every five years. The last plan was completed in 2009 as a strategic planning tool. The purpose of the LTFP is to identify, evaluate, and prioritize potential projects to:

- Increase the basin's sustainable yield in a cost-effective manner;
- Protect and enhance groundwater quality; and
- Increase operational efficiency.

One of the primary benefits of preparing the LTFP is to focus the District on the most appropriate projects with the understanding that the planning and design of some projects will require three to five years to complete due to the projects' complexities.

Inclusion of a potential project in the LTFP does not constitute an "approval" of that potential project or commit the District to moving forward with that project. The 2009 LTFP identified nineteen priority projects.

At this time staff proposes to begin the preparation of the 2014 LTFP according to the following schedule.

Timetable for Preparation of 2014 LTFP

Task	Proposed Date
1. Conduct staff brainstorming workshop to develop list of all potential projects to consider inclusion in LTFP.	February
2. Conduct staff meeting to review new project concepts developed from first workshop. Draft project descriptions including estimated project costs and timetable for construction.	March
3. Present proposed priority projects to WIC and Producers for review and comment.	April
4. Draft report to Producers and BOD for review and comment.	June
5. Receive comments and prepare final report.	July
6. BOD receives and files final report.	August

The 2014 LTFP will include options regarding ocean water desalination.

PRIOR RELEVANT BOARD ACTION(S):

7/15/2009, Motion 09-73, Received and filed and authorized filing of a Notice of Ex

Agenda
GROUNDWATER PRODUCERS MEETING
Sponsored by the
ORANGE COUNTY WATER DISTRICT
(714) 378-3200
Wednesday, February 12, 2014, 9:30 a.m.

Meeting to be held at the **OCWD Field Headquarters**

1. Accumulated Overdraft update/Purchasing Additional Water From Reserves
2. FY14-15 RA and BPP estimates
3. Consideration of purchasing additional Panattoni property
4. Long-Term Facilities Plan Update with ocean desalination incorporated
5. Replenishment Assessment for Agricultural uses
6. Groundwater Management Plan Update
7. Monthly update on North and South Basin lawsuits
8. Ocean desalination update
9. Other

The Producers' meetings are scheduled the second Wednesday of each month. The next regular monthly meeting is Wednesday, March 12, 2014 at 9:30 a.m.

AGENDA ITEM SUBMITTAL

Meeting Date: April 9, 2014

To: Water Issues Committee
Board of Directors

From: Mike Markus

Staff Contact: G. Woodside/M. Westropp/
A. Hutchinson

Budgeted: N/A
Budgeted Amount: N/A
Cost Estimate: N/A
Funding Source: N/A
Program/ Line Item No. N/A
General Counsel Approval: N/A
Engineers/Feasibility Report: N/A
CEQA Compliance: N/A

Subject: LONG-TERM FACILITIES PLAN: 2014 UPDATE

SUMMARY

The Long-Term Facilities Plan (LTFP) is a strategic planning tool used to identify, evaluate and prioritize future potential projects. Staff is currently updating the LTFP, which was last prepared in 2009.

Attachment(s):

- Long-Term Facility Plan 2014 Project List
- Proposed Priority Project Summaries
- Additional Recharge Facilities Model Information
- Presentation

RECOMMENDATION

Informational

BACKGROUND/ANALYSIS

(1) The purpose of the Long-Term Facilities Plan (LTFP) is to identify, evaluate, and prioritize potential projects to meet the District's objectives of:
(2)

- Increase water supply reliability and increase the basin's sustainable yield in a cost-effective manner;
- Protect and enhance groundwater quality; and,
- Increase operational efficiency.

One of the primary benefits of preparing the LTFP is to focus the District on the most appropriate projects with the understanding that the planning and design of some

projects will require three to five years to complete due to the projects' complexities. Inclusion of a potential project in the LTFP does not constitute an "approval" of that potential project or commit the District to moving forward with that project. The District's project approval process is separate from the LTFP and includes consideration of the benefits and environmental effects of a proposed project, which are typically done through preparation of environmental documentation and an Engineer's Report that are reviewed by the Board of Directors.
The District updates the LTFP approximately every five years. Staff is in the process of updating the LTFP which was last updated in 2009. In preparation for the 2014 update, staff considered potential future changes in available water supplies due to declines in Santa Ana River base flow and additional recycled water to be produced by GWRS expansion. The District's Recharge Facilities Model was used to estimate the potential new yield for proposed recharge projects. Based on projections of future baseflow, model results, and other considerations, staff selected thirteen projects to be considered priority projects.

PROJECTED SANTA ANA RIVER FLOWS

Over the past three decades, the Santa Ana River (SAR) has been the largest source of water to the District's surface water recharge system. However, due to conservation and other factors, SAR baseflow, which is comprised primarily of treated wastewater, has declined in recent years.

The District used a computer model of flow in the upper Santa Ana Watershed that was developed by the Santa Ana Watershed Project Authority to evaluate future supplies of water that are potentially available in the Santa Ana River. This was done by using the work recently done for the US Army Corps of Engineers (Corps) Prado Basin Feasibility Study.

Estimated future discharges of water from Publicly Owned Treatment Works (POTWs) to the SAR are expected to decline due to conservation and increased recycling. This, along with reductions in rising groundwater, means that projected SAR baseflow reaching Prado Dam are likely to be lower than what has occurred historically. For planning purposes, an optimistic and pessimistic baseflow range was developed to span the expected future range of baseflow. Under optimistic conditions, an average of 102,000 acre-feet per year (afy) of baseflow is expected to arrive at Prado Dam. Under pessimistic conditions, an average of 54,000 afy of baseflow is expected to arrive at Prado Dam (Figure 1). These future conditions are for the time period of 2030 to 2040.

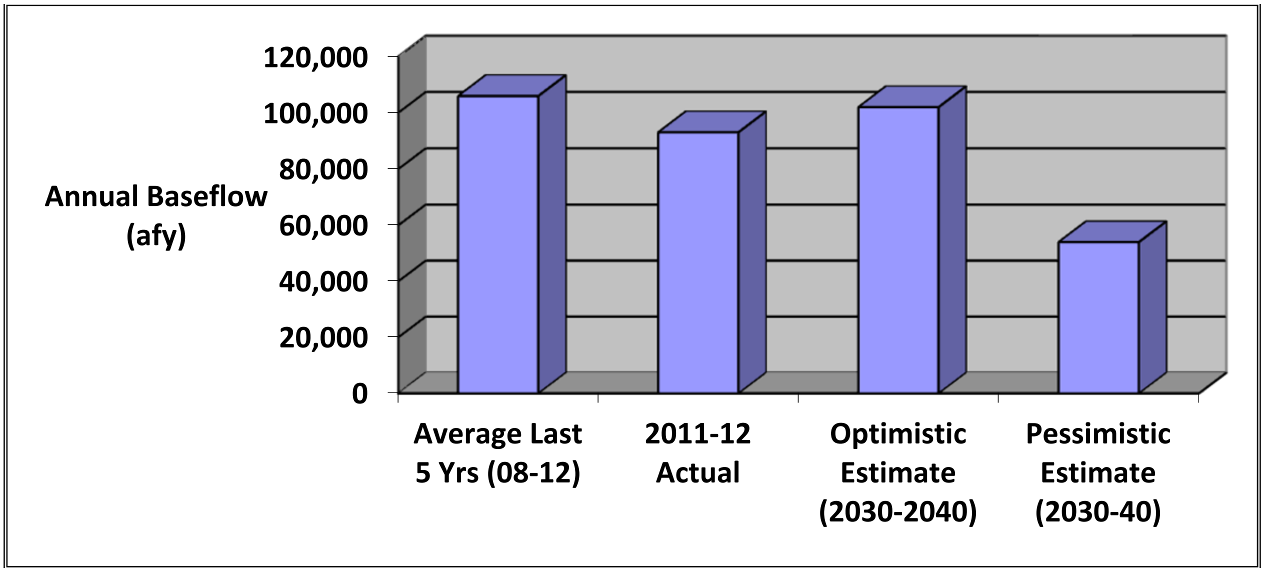


Figure 1
Historical SAR Baseflow and Future Baseflow Range

RECHARGE FACILITIES MODEL

With the assistance of CH2M HILL, OCWD developed a Recharge Facilities Model (RFM) that simulates the operation of the District's surface water recharge system. The RFM was used to estimate the additional recharge that would be obtained from 16 projects in the LTFP that involve the surface water recharge system. This information, along with other information, was used in determining which projects should be priority projects. Additional information on the RFM is included in the attached file 'Recharge Facilities Model Information'.

DEVELOPMENT OF PROJECT LIST

Staff conducted a brainstorming workshop in February and developed a list of 62 potential projects. Descriptions for these 62 projects were prepared, including estimated costs, yields, and schedules, if available. The attached document 'LTFP Project List' lists these 62 potential projects. The 62 projects were reviewed by staff and evaluated. Thirteen of these projects were identified as priority projects. The proposed priority projects are listed below.

<u>WATER SUPPLY FACILITIES</u>

- GWRS Final Expansion
- GWRS: Urban Runoff Diversion to OCSD Plant #1
- Prado Basin Sediment Management
- Huntington Beach Desalination Plant Product Water Agreement (Poseidon)
- Recovery of Evapotranspiration Loss in Prado Basin

RECHARGE FACILITIES

- Mid-Basin Injection
- Subsurface Recharge & Collection System (SCARS) in Off-River and Five Coves
- Enhanced Recharge in SAR Below Ball Road

BASIN MANAGEMENT FACILITIES

- Sunset Gap Barrier/Desalter
- Alamitos Barrier Expansion (Landing Hill)
- West Orange County Enhanced Pumping
- Additional Talbert Barrier Recharge Wells at Deep Well Sites

ALTERNATIVE ENERGY PROJECTS

- On-Site Power Generation in Fountain Valley

As stated earlier, the 13 projects listed above are projects are being proposed for additional review. These 13 projects are described in the attached file 'Priority Project Summaries'.

Inclusion in the LTFP does not constitute approval of these projects. The approval process for these projects will be the same for capital projects with the preparation of environmental documents and an Engineer's Report and will be presented individually to the Board of Directors for review and approval. This process is illustrated simply in Figure 2 below. As shown in Figure 2, identifying the 13 priority projects from the initial 62 potential projects is a screening process that helps the District focus its efforts on the projects with the most potential to meet the District's objectives.

Figure 2 – Schematic of LTFP Screening Process
Project Concepts

GWRS Final Expansion

Mid-Basin Injection (per well yield and costs shown)

Prado Basin Sediment Management

Enhanced Recharge in SAR Below Ball Road

West Orange County Enhanced Pumping

Sunset Gap Barrier/Desalter

Additional Talbert Barrier Recharge Wells at Deep Well Sites

Increase GWRS Pipeline Capacity to Forebay

GWRS: Recycle all OCSD Flows

Alamitos Barrier Expansion (Landing Hill)

Five Coves & Lincoln Bypass Pipeline

Talbert Barrier Southeast Extension

Subsurface Recharge & Collection System (SCARS)

Green Acres Project Modifications

Desilting Santa Ana River Flows

Off-Stream Stormwater Storage (Aliso Canyon Dam)
Placentia Basin Improvements
Raymond Basin Improvements
GWRS Supply Pipeline to Alamitos Barrier
Wildlife Exhibit Relocation
Lakeview Pipeline
Energy Recovery on Santiago Pipeline
River View Basin Expansion
New Recharge Facilities for Santiago Basins or Santiago Pipeline
Recharge in Lower Santiago Creek
Shallow Aquifer Development
Additional Warner to Anaheim Lake Pipeline
Repurpose Nursery Property in Forebay
Connect Santiago Pipeline with GWRS Pipeline
Water Banking
Chino Creek Wetlands
MS4 Regional Facilities
Enhanced Recharge in Santiago Creek at Grijalva Park
Basin Operating Range Extension
East Newport Bay Mesa shallow groundwater desalter
MTBE Investigation and Remediation
Santiago Creek: increased MWD flows from Irvine Lake
Slater Pump Station Modification
Enhanced Recharge in SAR between Five Coves & Lincoln Ave.
Recharge Basin Rehabilitation
Warner System Modifications
Reduce Evaporative Losses in Basins with removable covers
Divert LA sewage to OCSD Plant #1
Purchase land for new basins
Water Wheeling

Potential Priority Projects identified in 2014 LTFP

GWRS Final Expansion

Mid-Basin Injection

Prado Basin Sediment Management

West Orange County Enhanced Pumping

Enhanced Recharge in SAR Below Ball Road

Sunset Gap Barrier/Desalter

Additional Talbert Barrier Recharge Wells at Deep Well Sites

Potential Future Engineer's Report and CEQA Prepared for Board review

At this time staff proposes to prepare the 2014 LTFP according to the following schedule.

Timetable for Preparation of 2014 LTFP

Task	Proposed Date
7. Present proposed priority projects to WIC and Producers for review and comment.	April
8. Draft report to Producers and BOD for review and comment.	June
9. Receive comments and prepare final report.	July
10. BOD receives and files final report.	August

PRIOR RELEVANT BOARD ACTION(S):

7/15/2009, M09-73 - Receive and file LTFP and authorize filing of a Notice of Exemption for LTFP

Agenda
GROUNDWATER PRODUCERS MEETING
Sponsored by the
ORANGE COUNTY WATER DISTRICT
(714) 378-3200
Wednesday, April 9, 2014, 9:30 a.m.

Meeting to be held at the 18700 Ward Street Fountain Valley CA

1. Long-Term Facility Plan Review
2. FY14-15 Capital Improvement Program
3. Ocean desalination update – April 2nd Board action
4. MWD CUP Call
5. Coastal Pumping Transfer Program modification
6. Monthly update on North and South Basin lawsuits
    a. NCP Compliance
    b. AB 2712
7. MWD treated water cost recovery
8. Other

The Producers' meetings are scheduled the second Wednesday of each month. The next regular monthly meeting is Wednesday, May 14, 2014 at 9:30 a.m.

Producers Meeting to Discuss Long-Term Facilities Plan 2014

8-9:30 am, April 30, 2014
220 S. Daisy Ave, Santa Ana

AGENDA

1. Receive Feedback on List of 62 Potential Projects
    a. Any other potential project ideas

2. Present 14 Proposed Priority Projects
    a. Brief explanation of each of the proposed priority projects
    b. Explanation and presentation of table summarizing estimated costs, benefits, advantages/disadvantages, constraints, and timetables for priority projects

3. Questions/Discussion/Feedback
    a. Any information needed or questions re projects that were not prioritized
    b. Other questions or information requests

4. Next Steps:
    a. Select date for next meeting
    b. Agenda for next meeting is to discuss/recommend adding or deleting projects from priority projects list

ATTACHMENTS:

1. Short Descriptions of 62 Potential Projects
2. Powerpoint presentation ‘Long-Term Facilities Plan 2014 Update’
3. Detailed Summaries of 14 Proposed Priority Projects
4. Summary Table of 14 Proposed Priority Projects

GWP 4-30-14

LTFP Santa Ana

John Kennedy	OCWD
Greg Woodside	"
Howard Johnson	Brady
Mike Marcus	OCWD
Paul	Mesa Water
Betsy Eglash	Brady
Paul Cook	IRWD
Paul Weghorst	IRWD
Brian Ragland	HB
Rick Shintaku	Anaheim
Don Calkins	Anaheim
Toby Moore	GSWC
Michael Grisso	Buena Park
Bob McVicker	GSWC
Ken Vecchiarelli	GSWC
Luis Estevez	City of Seal Beach
Nabil Saba	Santa Ana.
Mark Sprague	Fountain Valley
Steve Conklin	YLWD
John DeCriscio	YLWD
Art Valenzuela	Tustin
Jose Diaz	Orange
Cel Pasillas	GG
Cody Nicolae	GG
Adam Hutchinson	OCWD

V/

Lisa Ohlund	EOCWD
MIKE HOOLIHAN	IRWD
DAVID SCHICKLING	Fullerton

To: Orange County Groundwater Producers

From: Betsy Eglash, Principal Water Resource Manager, Richard Brady & Associates

Subject: OCWD Groundwater Producers April 30, 2014 Meeting

Date: May 9, 2014

The following is a summary of key discussion items from the April 30th OCWD Groundwater Producers Meeting.

1. <u>2014 Long-Term Facility Plan Update:</u> Greg Woodside presented the first 10 pages of the "Long-Term Facilities Plan Update". Based on direction from the Board the plan has been updated to include a range of High, Medium and Low Baseflow Conditions from the Santa Ana River. Mr. Markus mentioned, that based on our current contract, the low range scenario could kick us into Tier 2.

   <u>Comments:</u>
   Cook: Would like to spend time to focus on "the Plan" versus a list of projects. "What is purpose of plan?"

   - Questions surfaced regarding Total Water Demands of 525,000 afy. The group would like to see MWDOC attend next meeting to speak to demand #'s.
   - Requests to evaluate and prioritize projects on a cost & environmental basis and prioritize accordingly.
   - Request to see the cons associated with the projects.

   Ohlund: We need to be concerned about when recharge is no longer available.
   Cook: We need to quantify the reliability MET has for Treated & Untreated Water.
   Markus: One more year of no recharge water from MET and the BPP% will go down.
   General – If OCWD doesn't buy MET water then Producers will have to purchase MET treated water.

2. <u>Feedback on list of 62 Potential Projects:</u> Producers are requested to send their feedback to Betsy Eglash at beglash@rbrady.net.

3. <u>Next Steps:</u>

- Next meeting scheduled for May 29, 2014 from 8:00am to 9:30am at 220 S. Daisy Avenue, Santa Ana.

- Agenda for next meeting is to discuss/recommend adding or deleting projects from priority projects list.

Groundwater Producers Meeting
to Discuss Long-Term Facilities Plan 2014 Update

8-9:30 am, Thursday May 29, 2014
220 S. Daisy Ave, Santa Ana

AGENDA

5. Receive Feedback on Proposed Priority Projects

6. Discussion of Demand Projections by MWDOC Staff

7. New Information on Proposed Priority Projects
    a. Addition of new project: Purchase Upper Watershed Wastewater
    b. Impacts of sedimentation in Prado Basin
    c. Estimates of capital and O&M costs for Proposed Priority Projects
    d. Questions on other Proposed Priority Projects

8. Discussion of additional information needed to reach consensus on Proposed Priority Projects list

9. Next Steps

ATTACHMENTS:

5. Summary of 15 Proposed Priority Projects
6. Description of new project: Purchase Upper Watershed Wastewater

Sign In Sheet

Betsy Eglash	BRADY
John Kennedy	OCWD
Greg Woodside	OCWD
Rick Shintaku	~~[illegible]~~ ANAHEIM
Don Calkins	Anaheim
PAUL COOK	IRWD
TOBY MOORE	GSWC
Michael GRISSO	BUENA PARK
KEN VECCHIARELLI	GSWC
Marsha Westropp	OCWD
KEITH LYON	MWDOC
Melissa Baum-Haley	MWDOC
Joseph Berg	MWDOC
Adam Hutchinson	OCWD
Darrick Escobedo	Seal Beach
LUIS ESTEVEZ	SEAL BEACH
ART VALENZUELA	TUSTIN
Jose Diaz	Orange
JOE LOZANO	TUSTIN
Dave Schickling	Fullerton

Sign In Sheet

Steve Conklin	YLWD
John DeCriscio	YLWD
Phil Lauri	Mesa Water
BRIAN RAGLAND	HB
Nabil Saba	S.A.

AGENDA ITEM SUBMITTAL

Meeting Date: July 16, 2014

To: Board of Directors

From: Mike Markus

Staff Contact: G. Woodside/M. Westropp/ A. Hutchinson

Budgeted: N/A
Budgeted Amount: N/A
Cost Estimate: N/A
Funding Source: N/A
Program/ Line Item No. N/A
General Counsel Approval: N/A
Engineers/Feasibility Report: N/A
CEQA Compliance: N/A

Subject: **UPDATE: PREPARATION OF LONG-TERM FACILITIES PLAN**

SUMMARY

The Draft Long-Term Facilities Plan 2014 is ready for review and comment. The proposed schedule is to receive comments from Board members and Producers by August 1.

Attachment(s):
- Draft Long-Term Facilities Plan 2014
- Presentation

RECOMMENDATION

Informational

BACKGROUND/ANALYSIS

Staff began preparations to update the LTFP in the beginning of 2014. Staff presented a list of projects and list of proposed priority projects to the Board and Producers in April and June 2014. In addition, the Producers held two workshops in April and May to discuss, consider, and provide feedback to staff on the on development of the LTFP and the proposed projects.

The draft report is completed and ready for review and comment. Staff proposes that comments be received by August 15. A final draft will then be prepared that will incorporate recommended changes as well as responses to comments.

The schedule for completing the LTFP is shown below.

Task	Schedule

11. Draft report to Producers and BOD for review and comment.	July
12. Receive comments and prepare final report.	August
13. BOD receives and files final report.	September

One of the primary benefits of preparing the LTFP is to focus the District on the most appropriate projects with the understanding that the planning and design of some projects will require three to five years to complete due to the projects' complexities. Inclusion of a potential project in the LTFP does not constitute an "approval" of that potential project or commit the District to moving forward with that project.

Groundwater Producer Comments

The Producers are in general agreement with the list of proposed priority projects in the draft LTFP. However some of the Producers have commented that the District should consider taking the LTFP a step further and developing a more detailed plan that the District would follow to consider implementing future projects. This plan would also rank the 15 priority projects identified in the LTFP and estimate when they should be considered for future implementation. District staff believes that the draft LTFP as currently prepared meets the District's needs of prioritizing the projects District staff should focus on.

PRIOR RELEVANT BOARD ACTION(S):

7/15/2009, Motion 09-73, Received and filed and authorized filing of a Notice of Exemption for the Long-Term Facilities Plan

APPENDIX 4

COMMENTS AND

RESPONSES TO COMMENTS

From: Paul Weghorst [mailto:weghorst@irwd.com]
Sent: Monday, May 26, 2014 7:38 AM
To: beglash@rbrady.net
Cc: Paul Cook; Mike Hoolihan
Subject: Comments on LTFP Process

Hi Betsy,

We appreciate the opportunity to comment on the approach to the LTFP and Proposed Priority Projects. Please consider the following comments and revisions:

1. The LTFP should be substantially more than an inventory of projects and should include an assessment of the ability of each of the proposed projects to meet the needs of the basin and the producers.
2. A new look into the projected demands of each of the producers should occur rather than relying on available estimates that are out of date.
3. An assessment of the reliability of Metropolitan Water District of Southern California water supplies needs to be included in the LTFP.
4. Capital and O&M cost estimates need to be provided for each project with ranges of uncertainty identified.
5. The projects should be ranked taking into consideration costs, the ability to meet projected needs beyond Metropolitan reliability while taking into consideration financial, regulatory, environmental and operational risks.
6. The producers should be consulted in the development of the ranking criteria and in the scoring of the projects.
7. The timing of the need for each of the ranked projects needs to be included in the LTFP.
8. The project list should include:
    - Advanced treatment and reuse of OCSD Plant 2 discharges;
    - Securing and transferring water from other areas of the state;
    - Other indirect and direct potable reuse opportunities in Orange County; and
    - Water exchange opportunities

Feel free to give me a call if you have any questions.

Sincerely,

Paul A. Weghorst
Executive Director of Water Policy
Irvine Ranch Water District
Phone: 949-453-5632
Cell: 949-485-8115

Following are OCWD's responses to IRWD's comments on the approach to the LTFP and the Proposed Priority Projects (IRWD comments in May 26, 2014 email from Paul Weghorst to Betsy Eglash)

IRWD Comment	OCWD Response
Comment #1	The LTFP update is intended by OCWD to identify, evaluate, and prioritize potential projects to meet the District's objectives. It is more than an inventory of projects because it identifies the priority projects that OCWD will focus resources on. These priority projects will be analyzed further and brought to the OCWD board for consideration of project approval. In the Engineer's Report prepared for each project prior to OCWD board approval, there is an analysis of the project's ability to meet the needs of the basin and the Producers.
Comment #2	The projected water demand estimates that are being used are the same estimates used in the 2011 Urban Water Management Plans and in evaluations of proposed annexations in 2011-2013. We believe these estimates are sufficient for the purposes of the LTFP update. If the estimates were to decrease five to ten percent due to additional water use efficiency considerations, this decrease would not significantly change the outcome of the LTFP update. Additionally as and if new water demand estimates are developed they can be incorporated into the LTFP.
Comment #3	We do not agree that an assessment of MWD's reliability should be undertaken as part of the LTFP. A review of MWD's reliability would be a significant undertaking and is not needed as part of the LTFP update.
Comment #4	Capital and O&M cost estimates will be provided for the projects that are sufficiently defined to provide this information; there will be some projects that are not sufficiently defined and the cost estimates will not be available.
Comment #5	We do not anticipate ranking projects as suggested. The LTFP is a planning document intended to identify projects for further analysis and review. The broad list of over 60 projects have been ranked to identify priority projects. We do not anticipate any further ranking of the priority projects due to the lack of specific details on some of the projects. As more detailed project information is developed in the future, the

	projects may be able to be ranked at that time. When and if projects are individually considered for construction by the OCWD board via the consideration of a Project Engineers Report, alternative projects can be considered at that time.
Comment #6	If there are any additional ranking criteria developed, the Producers would have an opportunity to provide input. The Producers will always have the opportunity to provide input on any project OCWD may consider.
Comment #7	OCWD staff will be evaluating the timing and schedule issues for the priority projects and will include estimated schedules to the extent possible.
Comment #8	The project list includes reuse of OCSD plant 2 flows, water transfers, and water exchanges. We are unclear about what is meant by 'other indirect and direct potable reuse opportunities' and would solicit more information regarding that category.

The following are OCWD's responses to comments of Peer Swan, Irvine Ranch Water District, delivered verbally at OCWD Board of Director's meeting held on July 16, 2014.

Comment of Peer Swan, IRWD	OCWD Response
Add a proposed project to capture stormwater in Weir Canyon and convey to Irvine Lake	A proposed project, Capture Excess Stormwater in Santa Ana Canyon and Convey Water to Irvine Lake, was added to the project list.
Promote more water conservation	Promoting water conservation is outside of the scope of a project to be considered in the LTFP. OCWD supports efforts of the Producers, MWDOC, and other water districts in the Santa Ana River watershed to promote water conservation and will continue to support such efforts.
Have the Producers baseload on the MWD system, the BPP would change annually, keep the groundwater basin full and ready for bad drought scenarios	This suggestion is similar in nature to one of the potential projects, Basin Operating Range Expansion, which would investigate options to expand the basin operating range. If and when this project is considered in more detail, actions to improve basin management to prepare for drought conditions will be investigated.

City of Anaheim
PUBLIC UTILITIES DEPARTMENT
Administration

August 15, 2014

John Kennedy, Assistant General Manager
Orange County Water District
18700 Ward Street
Fountain Valley, California 92708

Re: Orange County Water District's Draft Long Term Facilities Plan

Dear Mr. Kennedy:

Anaheim Public Utilities staff (APU) is responding to the invitation to review the draft "Long Term Facilities Plan" (LTFP) and provide written comments by August 15, 2014. APU's comments consist of the following:

General Comments

- Overall, APU is in support of this year 2015 update to the Orange County Water District's (District) Long Term Facilities Plan.

- APU understands that one of the primary objectives guiding the District's management of the basin is to "cost-effectively protect and increase the basin's sustainable yield". APU is concerned with the estimated unit costs of two of the proposed priority projects (See Table following page 3-11).

Comment # 1

  - The total estimated costs of the Poseidon and SARI Flow Treatment Plant (at Ball Road Basin) are $1,850 per Acre-Foot (AF) and $2,100 per AF, respectively. These unit costs are significantly higher than alternative imported water supplies; currently at $890 per AF for Tier 1 treated water from the Metropolitan Water District of Southern California (MWD). APU feels that: (1) the above proposed priority projects warrant further investigation and analysis to refine the projects and costs; and (2) in general, retail agencies that desire a higher level of supply reliability should have the choice to procure these supplies on an individual agency basis (i.e., those who want the water and benefit from it should pay accordingly).

Comment # 2

201 S. Anaheim Blvd.
M.S. #1101
Anaheim, CA 92805
TEL: 714.765.4157
FAX: 714.765.4138

Executive Summary

- Water Resources Summary (page E2):
  APU suggests that the District further analyze the water demand projections, to minimize the amount of over or under investment that the District incurs in the planning and implementation of water supply projects. Since the previous drought, a number of refined water demand forecast tools have been developed that may be of assistance to District staff.

  Comment # 3

  - Furthermore, APU suggests that the District utilize the best available information to incorporate water conservation levels within the water demand projections, rather than relying solely on retail agency water demand and conservation forecast estimates.

- Table ES-1 (page E5)

The following comment applies throughout the document, as well. APU is concerned with the scope and title of the "SARI Flow Treatment Plant at Ball Road Basin." In addition to the unit cost being high, it appears that two GWRS-type treatment facilities at different locations would complicate the District's operations and maintenance staffing and activities. APU suggest that this project be amended to consider this type of facility at the existing GWRS campus.

Comment # 4

If you have any questions, please feel free to contact Rick Shintaku, Water Resources and Planning Manager at (714) 765-4181.

Respectfully submitted,

Don Calkins

Donald C. Calkins
Assistant General Manager, Water Services

The following are OCWD's responses to comments of Donald Calkins, City of Anaheim Public Utilities Department.

Comments	OCWD Response
Comment #1	OCWD agrees. The LTFP is a planning document for the District to evaluate potential projects and prioritize projects for more detailed analysis. For any of the projects listed in the LTFP to move forward, it will be necessary to prepare an Engineer's Report, CEQA documents, and receive Board approval. This would include further investigation and analysis to refine the projects and costs for the two projects mentioned in this comment.
Comment #2	Comment noted.
Comment #3	The projected water demand estimates that are being used are the same estimates used in the 2011 Urban Water Management Plans and in evaluations of proposed annexations in 2011-2013. We believe these estimates are sufficient for the purposes of the LTFP update. If the estimates were to decrease five to ten percent due to additional water use efficiency considerations, this decrease would not significantly change the outcome of the LTFP update. Additionally as and if new water demand estimates are developed they can be incorporated into the LTFP.
Comment #4	For the "SARI Flow Treatment Plant at Ball Road Basin" project to move forward, the complexities and costs of operating a treatment plant at Ball Road Basin and the possible impacts to operation of the GWRS would have to be carefully examined. At the time that this project is more fully evaluated, the alternative of locating this facility at the existing GWRS campus will be included.

APPENDIX 5

ABBREVIATIONS AND ACRONYMS

ABBREVIATIONS AND ACRONYMS

ACOE	Army Corps of Engineers
af	acre-feet
afy	acre-feet per year
AWPF	advanced water purification facility
basin	Orange County groundwater basin
BEA	Basin Equity Assessment
BPP	Basin Production Percentage
CDPH	California Department of Health
CEQA	California Environmental Quality Act
cfs	cubic feet per second
CPT	cone penetration test
District	Orange County Water District
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
FAT	Full Advanced Treatment
GAP	Green Acres Project
gpm	gallons per minute
GWMP	Groundwater Management Plan
GWRS	Groundwater Replenishment System
IRP	Integrated Resources Plan
IRWD	Irvine Ranch Water District
LA	Los Angeles
LACDPW	Los Angeles County Department of Water & Power
LTFP	Long-Term Facilities Plan
MBI	Mid Basin Injection
MCWD	Mesa Consolidated Water District
MWD	Metropolitan Water District of Southern California
MF	microfiltration
MGD	million gallons per day
MTBE	Methyl tertiary butyl ether
MWDOC	Municipal Water District of Orange County
NBGPP	North Basin Groundwater Protection Project
NWSSB	Naval Weapons Station Seal Beach
OC	Orange County
OCFCD	Orange County Flood Control District
OCSD	Orange County Sanitation District
OCWD	Orange County Water District

POTW	Publically Owned Treatment Works
Producers	Orange County groundwater producers
RFM	Recharge Facilities Model
Regional Water Board	Regional Water Quality Control Board- Santa Ana Region
SAR	Santa Ana River
SARI	Santa Ana Regional Interceptor
SAWPA	Santa Ana Water Project Authority
SBGPP	South Basin Groundwater Protection Project
SCAG	Southern California Association of Governments
SCARS	subsurface collection and recharge system
SCE	Southern California Edison
SDCWA	San Diego County Water Authority
SWP	State Water Project
SWRCB	State Water Resources Control Board
TCE	trichloroethylene
TDS	total dissolved solids
USACE	U.S. Army Corps of Engineers
USFWS	United States Fish & Wildlife Service
UWMP	Urban Water Management Plan
VDL	Leo J. Vander Lans Water Treatment Facility
VOCs	volatile organic compounds
WLAM	Waste Load Allocation Model
WRD	Water Replenishment District of Southern California
WY	water year
WEI	Wildermuth Environmental Incorporated