treated surface water from the Weymouth Water Treatment Plant via the Upper Feeder at rates of 1,346 gpm, 6,750 gpm and 6,750 gpm respectively.

The current capacity of Glendora's groundwater production, assuming the largest single source is out of service and each well is operated 80% of the time to allow for aquifer recovery, is approximately 7,618 gpm as shown in Table 7-2:

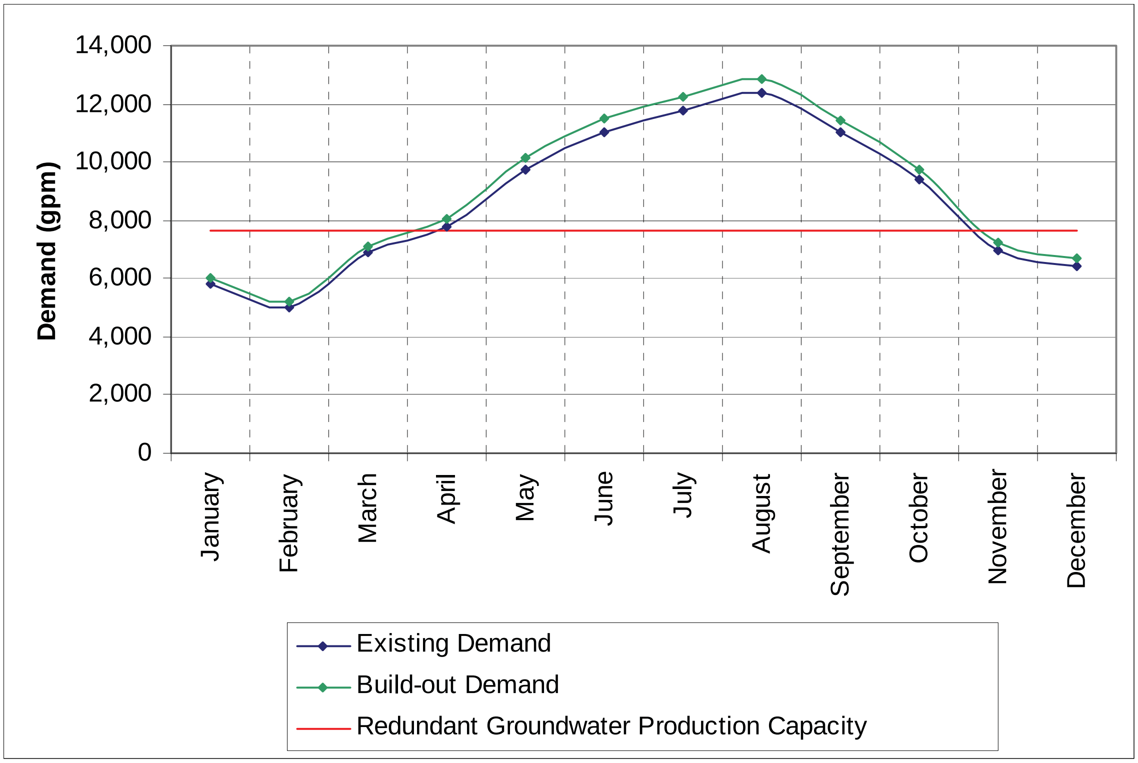
Table 7-2: Current Capacity of Glendora's Groundwater Production

Source	Test Flow (gpm)	80% of Design Flow (gpm)
Well 1E	457	366
Well 2E	611	489
Well 3G[1]	0	0
Well 4E[1]	0	0
Well 5E	2,324	1,859
Well 7G[1]	0	0
Well 8E	1,583	1,266
Well 9E	1,433	1,146
Well 10E	710	568
Well 11E	1,105	884
Well 12E	3,418	2,734
Well 13E	1,300	1,040
Capacity[2]	9,523	7,618

1 – Wells 3G, 4E and 7G are currently out of service due to contamination.
2 – Capacity is sum of the Test Flows assuming that the largest single source is out of service as a safety precaution.

Figure 7-2 represents historical monthly demand fluctuation scaled to projected levels and superimposed with Glendora's current redundant groundwater production capacity of 7,618 gpm.

Figure 7-2: Glendora's Local Production Redundancy



All production above the red line must currently come from imported water or excessive loading of the groundwater sources. Based on this analysis, Glendora would benefit from an additional local groundwater source to avoid any reliance on imported water. It is recommended that Glendora receive the equivalent of 500 gpm in April, 2,500 gpm in May, 3,900 gpm in June, 4,600 gpm in July, 5,300 gpm in August, 3,800 gpm in September and 2,100 gpm in October (3,051 acre-feet).

7.2.3: WVWD Demand

Analysis of WVWD demand is based on data from the 2005 WVWD Urban Water Management Plan (WVWD UWMP). Table 7-3 provides an overview of supply and demand and an estimate of demand during the winter.

Table 7-3: Overview of WVWD Supply and Demand

Year	Annual Demand	Local GW[1]	Local RW[2]	Imported Water[3]	Imported Water in Winter[4]	Imported Water in Winter[4]
	AFY	AFY	AFY	AFY	AFY	gpm
2010	28,754	1,184	1,731	25,839	12,920	8,010
2015	30,264	1,184	2,676	26,404	13,202	8,185
2020	30,999	1,184	3,096	26,719	13,360	8,283
2025	31,417	1,184	3,366	26,867	13,434	8,329
2030	33,726	1,184	3,516	29,026	14,513	8,998

1 – GW = Groundwater
2 – RW = Recycled Water
3 – Imported Water = Total Demand – Local GW – Local RW
4 – 50% of Imported Water (i.e. assumption for seasonal fluctuation)

Table 7-3 indicates that the estimated existing minimum demand is approximately 8,010 gpm. In other words, the average demand in February is not expected to exceed a flow rate of 8,010 gpm. The minimum flow rate is anticipated to increase gradually in the future.

7.2.4: RWD Demand

Analysis of RWD demand is based on data from the 2005 TVMWD Urban Water Management Plan (TVMWD UWMP). Table 7-4 provides a brief overview of demand and an estimate of demand during the winter.

Table 7-4: Overview of RWD Demand

Year	Annual Demand	Demand in Winter[1]	Demand in Winter
	AFY	AFY	gpm
2010	14,700	11,201	6,944
2015	15,800	12,039	7,464
2020	16,900	12,877	7,984
2025	18,200	13,868	8,598

1 – Based on existing RWD demand variation between 10 and 18 MGD.

Table 7-4 indicates that the estimated existing minimum demand is approximately 6,944 gpm. In other words, the average demand in February is not expected to exceed a flow rate of 6,944 gpm. The minimum flow rate is anticipated to increase gradually in the future.

7.2.5: Demand Summary

This summary focuses on three issues:

- Determine whether there is sufficient demand to justify keeping the plant in continuous operation.
- Based on the previous determination, estimate how production would be distributed over the course of a typical year.
- Examine availability

During the winter, ALW and Glendora will not require additional groundwater production to offset peak demand. As such, 100% of the plant's production will be exported to RWD and WVWD. Assuming the plant will be operational in five years, the minimum demand is estimated at just over 15,000 gpm:

$$Q_{WVWD} + Q_{RWD} = 7{,}464 \text{ gpm} + 8{,}185 \text{ gpm} = 15{,}649 \text{ gpm}$$

This means that continuous operation of the plant is justified at 15,000 gpm from a demand point of view.

Assuming continuous operation and considering the previous analyses, the monthly distribution of water from the treatment plant to ALW, Glendora, WVWD and RWD is represented in Figure 7-3 and Table 7-5.

Figure 7-3: Distribution of Water from Treatment Plant

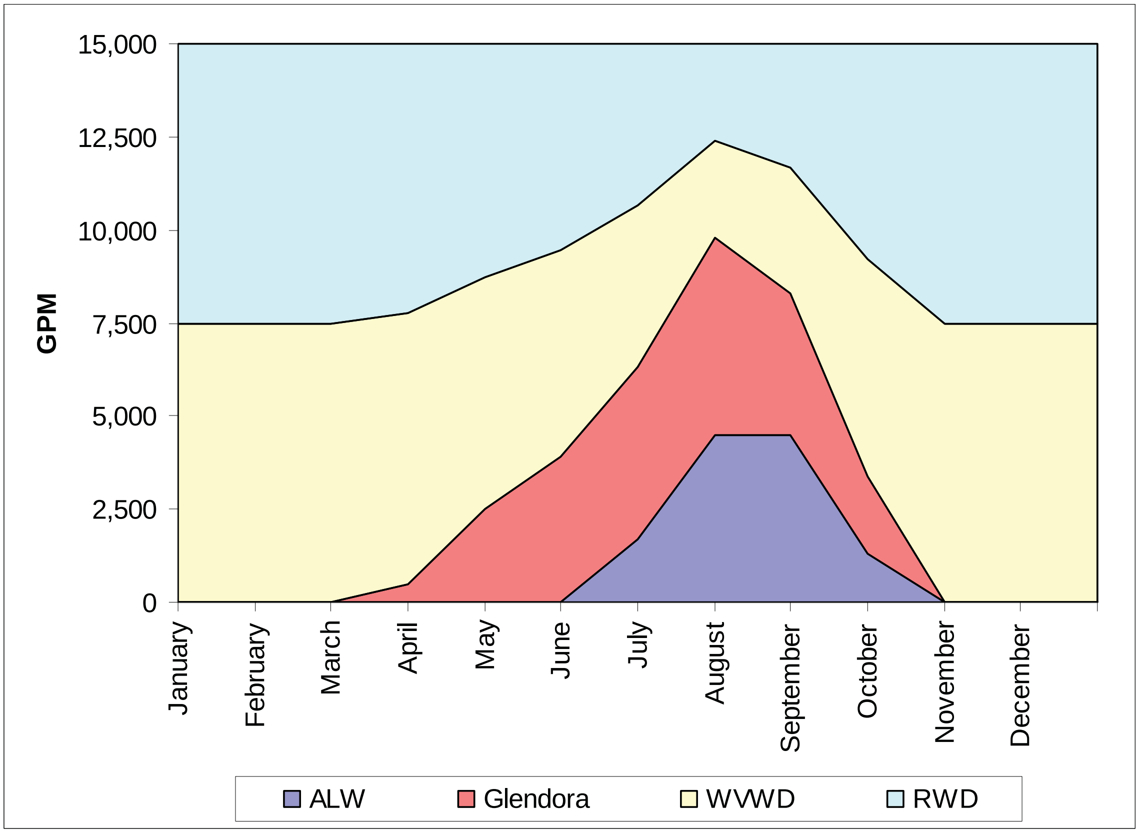


Table 7-5: Summary of Distribution of Water from Treatment Plant

	Unit	ALW	Glendora	WVWD	RWD	Total
January	(gpm)	-	-	7,500	7,500	15,000
February	(gpm)	-	-	7,500	7,500	15,000
March	(gpm)	-	-	7,500	7,500	15,000
April	(gpm)	-	500	7,250	7,250	15,000
May	(gpm)	-	2,500	6,250	6,250	15,000
June	(gpm)	-	3,900	5,550	5,550	15,000
July	(gpm)	1,700	4,600	4,350	4,350	15,000
August	(gpm)	4,500	5,300	2,600	2,600	15,000
September	(gpm)	4,500	3,800	3,350	3,350	15,000
October	(gpm)	1,300	2,100	5,800	5,800	15,000
November	(gpm)	-	-	7,500	7,500	15,000
December	(gpm)	-	-	7,500	7,500	15,000
Volume	(AF)	1,613	3,051	9,765	9,765	24,194
Percent of Total	(%)	6.67%	12.61%	40.36%	40.36%	100%

Table 7-6 is a summary of the availability of groundwater in the Basin for the participants.

Table 7-6: Availability of Basin Water for ALW

Prescriptive Rights	1.84988%
Average OSY (AFY)	198,800
Average Rights (AFY)	3,678
Surface Water (AFY)	13,400
Build-out Demand (AFY)	26,694
Deficit[1] (AFY)	9,616

1 – Deficit = Demand – Surface Water – Average Rights

ALW has an average annual deficit of 9,616 AFY which is typically acquired by transfer of pumping rights from other producers in the Basin, notably Azusa Agricultural Water Company and Azusa Valley Water Company.

Table 7-7: Availability of Basin Water for Glendora

Prescriptive Rights	4.75261%
Average OSY (AFY)	198,800
Average Rights (AFY)	9,448
Build-out Demand (AFY)	14,000
Deficit[1] (AFY)	4,552

1 – Deficit = Demand – Average Rights

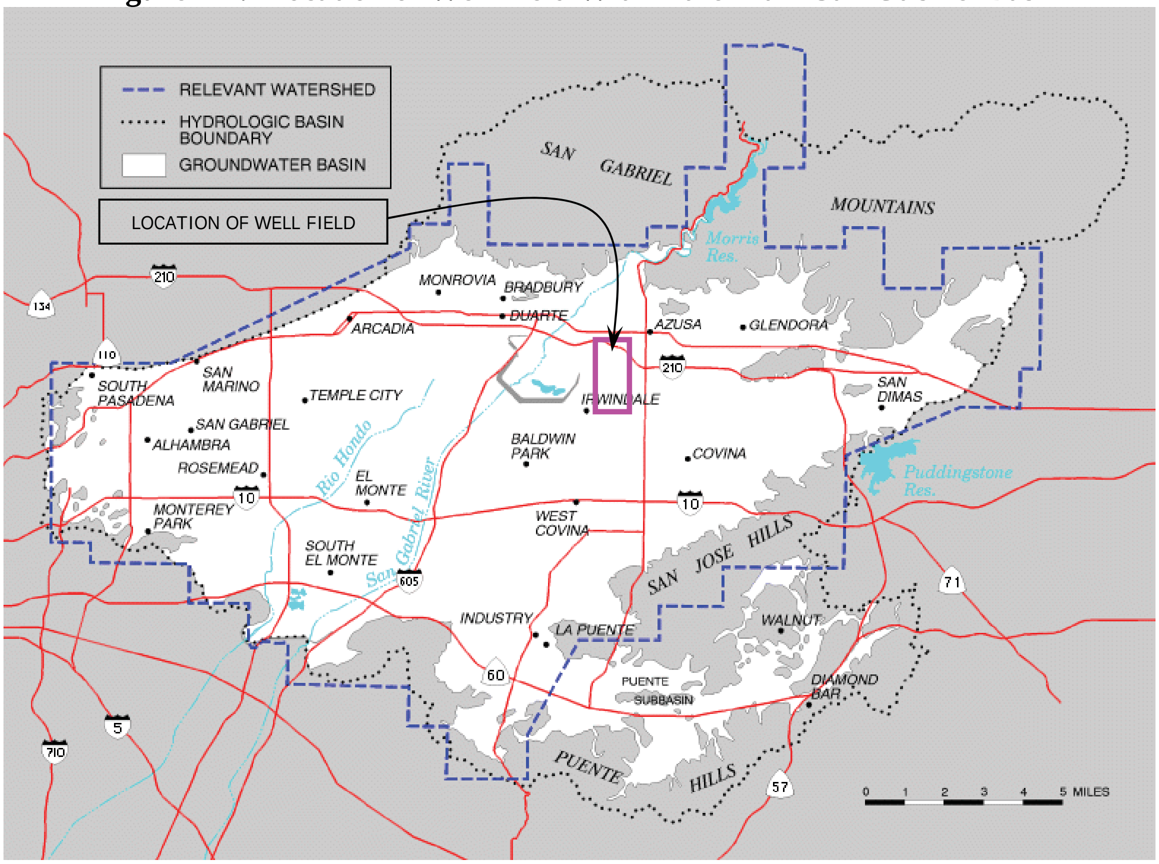
Glendora has an average annual deficit of 4,552 AFY which is typically acquired by transfer of pumping rights from other producers in the Basin and purchase of imported water from MWD.

WVWD and RWD are negotiating with Watermaster to develop a cyclical account within the Basin. WVWD and RWD must acquire and introduce into the Basin a volume of replenishment water at least equal to the volume anticipated to be consumed by these two agencies. Referring to Table 7-5, WVWD and RWD would each be responsible for approximately 9,765 AFY.

7.3 Sources

The wells that make up the well field for this project are located within the Main San Gabriel Basin as shown in Figure 7-4.

Figure 7-4: Location of Well Field Within the Main San Gabriel Basin



The Main San Gabriel Basin lies in eastern Los Angeles County, California. The hydrologic basin or watershed coincides with a portion of the upper San Gabriel River watershed, and the aquifer or groundwater basin underlies most of the San Gabriel Valley. The groundwater basin is bounded by the San Gabriel Mountains to the north, San Jose Hills to the east, Puente Hills to the south, and by a series of hills and the Raymond Fault to the west. The watershed is drained by the San Gabriel River and Rio Hondo, a tributary of the Los Angeles River.

Principal water-bearing formations of the basin are unconsolidated and semi-consolidated sediments which range in size from coarse gravel to fine-grained sands. The major sources of natural recharge are infiltration of rainfall on the valley floor and percolation of runoff from the adjacent mountains. The basin also receives imported water and return flow from applied water. Surface area of the groundwater basin is approximately 167 square miles. The fresh water storage capacity of the basin is estimated to be about 8.6 million acre-feet.

The physical groundwater basin is divided into two main parts, the Main Basin and the Puente Sub basin. The Puente Sub basin, lying in the southeast portion of the map above, is tributary to the Main Basin and hydraulically connected to it, with no barriers to groundwater movement. It is, however, not within the legal jurisdiction of Main San Gabriel Basin Watermaster, and is thus considered a separate entity for management purposes.

Following are descriptions of the subject wells for this project.

7.3.1: Aspan

Well ID Number: 19102007-017
201 N. Vernon Avenue
Inactive since 1984
Casing Length and Diameter: 656' – 20"

7.3.2: Vosburg (Glendora Well 7)

Well ID Number: 1900831
Drilled 1930 (inactive since 1980)
S. Virginia Ave. between W. 1st Street and W. Paramount Street
Casing Length and Diameter: 500' – 26"
Elevation: 532

7.3.3: Azusa 9

Well ID Number: 1902117
710 W. Gladstone Street
Inactive since 2005
Casing Length and Diameter: 660' – 26"

7.3.4: Azusa 10

Well ID Number: 8000103
Vernon Ave. at Little Dalton Wash
Currently active
Primary Energy Source: Electricity – no backup power
Nominal capacity: 2,216 gpm
Design capacity: 2,300 gpm
Casing Length and Diameter: 1152' – 14"

7.3.5: Contract

Well ID Number: 1900881

7.3.6: Glendora 3

Well ID Number: 1901525
Irwindale Plant
Drilled 1926 (inactive since 1980)
Casing Length and Diameter: 508' – 26"
Elevation: 475

7.3.7: Glendora 4

Well ID Number: 1901524
Irwindale Plant
Drilled 1920 (inactive since 1980)
Casing Length and Diameter: 408' – 26"
Elevation: 475

7.4: Methods of Rehabilitation

The condition of each well must be determined. Due to age and duration of inactivity, one or more of the wells may be subject to rehabilitation in order to maximize capacity. Some of the wells may be subject to more involved rehabilitation due to method of drilling. Knowledge of the drilling method used during well construction is key to determining the most effective method of rehabilitation. Appendix A contains a summary of recommended well rehabilitation strategies and techniques.

7.5: Existing Infrastructure

There is existing infrastructure within the ALW and Glendora water systems that was examined for possible inclusion in the new distribution system including the following:

- 0.15 MG holding tank at Irwindale Plant
- 4.4 mile 18-inch Irwindale Transmission Main
- 0.185 MG holding tank at San Gabriel Plant (in use)
- 20-inch Vosburg Transmission Main in Vernon Ave.
- 2.25 MG holding tank at Aspan Well
- Goddard Reservoir
- Goddard Booster Station

These facilities were determined to be undersized for the anticipated flow rate of the new treatment plant. Generally, the location and/or capacity of these facilities were not conducive to inclusion in the project. Furthermore, based on age and condition, the facilities were determined to be at or beyond their practical lifecycles for the given materials.

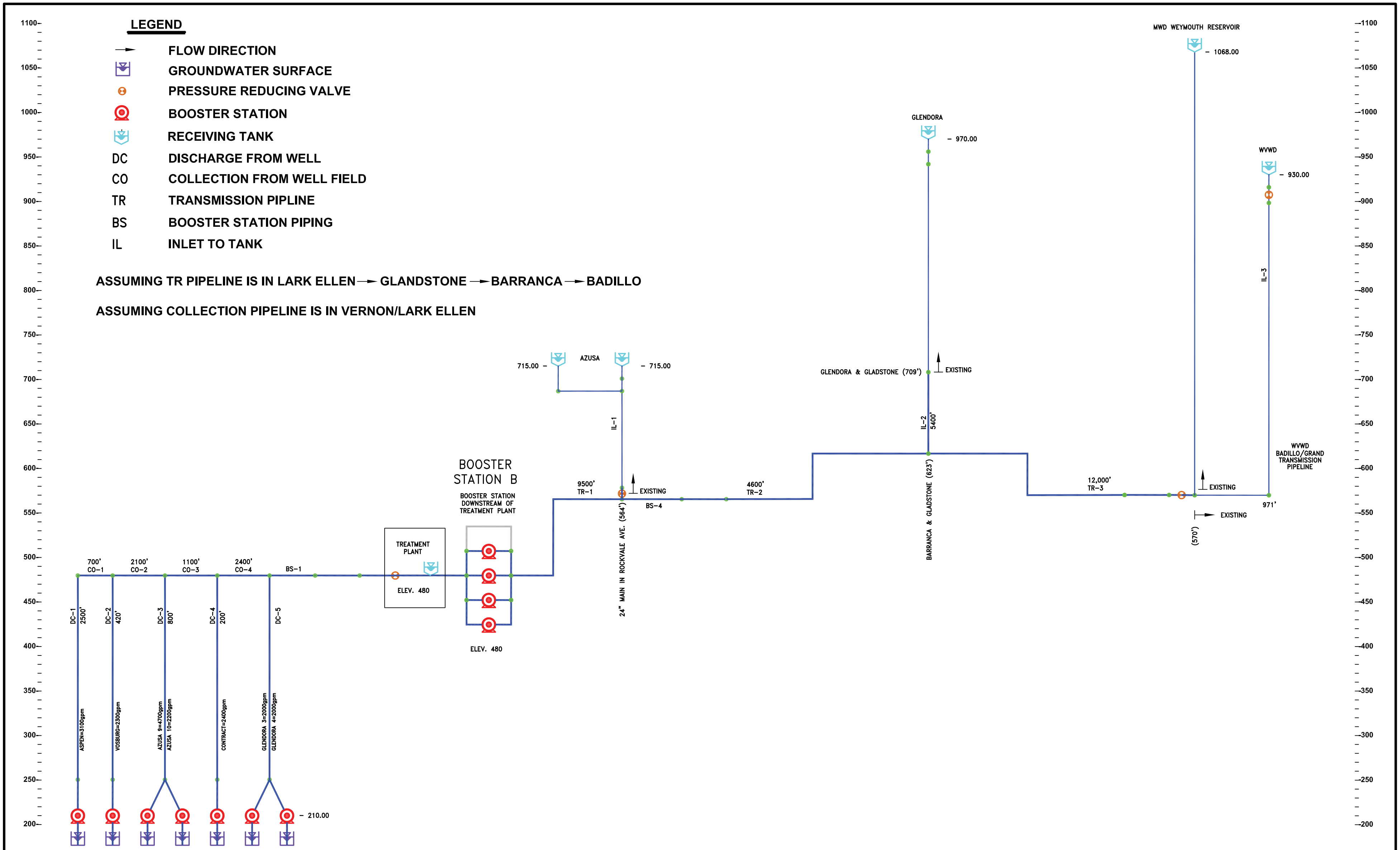
7.6: Design Criteria and Hydraulic Assumptions

To assist with sizing and determining the feasibility of the system layout, components of the collection and distribution systems were programmed as a hydraulic model using H2ONET Version 8.0 software by MWHSoft, Inc. Figure 7-5 is a representation of the hydraulic model which also serves as a hydraulic profile of the proposed system.

Pipelines were sized to accommodate the maximum simultaneous cumulative production of all wells at a pipe velocity of approximately 6 feet per second (fps). Velocities above 6 fps tend to result in significant head loss due to friction which must then be overcome by additional pumping capacity.

The receiving point for treated water is assumed to be existing tanks within the respective Water Districts.

Proposed pipes were assigned a Hazen-Williams roughness coefficient of C = 130. Existing pipes with varying roughness coefficients were converted to equivalent pipe lengths with consistent roughness coefficients.



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MULTI–AGENCY REGIONAL GROUND WATER RECOVERY PROJECT

HYDRAULIC MODEL

FIGURE

7–5

7.7 Collection System

The collection system is a set of dedicated pipelines that connect the seven well sites to the treatment facility. Items considered in the development of the collection system include alignments, pumping capacity, treatment plant requirements.

7.7.1: Pipelines

Basically, a discharge pipeline from each well site enters a collection main in Vernon Ave./Lark Ellen Ave. which terminates at the treatment plant site. Observing typical rights-of-way, the shortest practical distance from each well site to Vernon Ave./Lark Ellen Ave. was estimated for each discharge pipeline. As the discharge from each successive well was added to the collection main, the size of the collection main was increased to accommodate the cumulative flow. Table 7-8 lists the details for each segment of pipeline required to collect raw water from the well field. By convention for the Water Model, discharged pipelines are labeled DC and collection pipeline segments are labeled CO.

Table 7-8: Raw Water Collection Pipeline Details

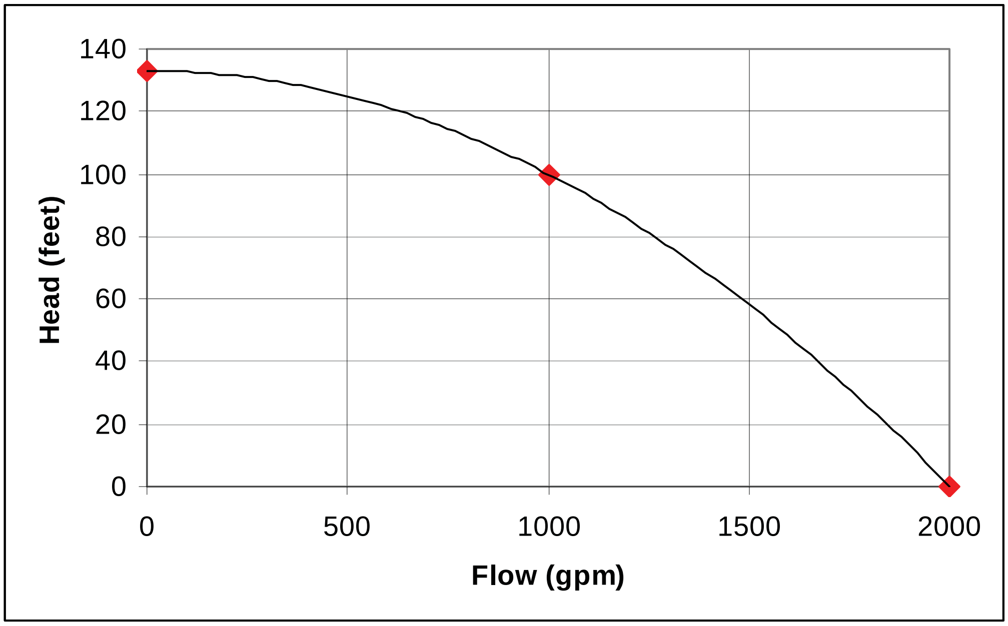
	Discharge Pipeline				Collection Pipeline			
Well Site	**Model ID**	**Flow per Site (gpm)**	**Diameter (inches)**	**Length (feet)**	**Model ID**	**Cumulative Flow (gpm)**	**Diameter (inches)**	**Length (feet)**
Aspan	DC-1	3,100	16	2,500	CO-1	3,100	16	700
Vosburg	DC-2	2,300	16	420	CO-2	5,400	20	2,100
Azusa 9 & 10	DC-3	6,900	24	800	CO-3	12,300	30	1,100
Contract	DC-4	2,400	16	200	CO-4	14,700	30	2,400
Glendora 3 & 4	DC-5	4,000	16	10	CO-5	18,700	36	10

7.7.2: Well Pumps

Since the groundwater production at the well sites has been off-line for some time, the well pumps are assumed to require maintenance, and perhaps replacement, due to age and condition. Originally, the well pumps were designed to meet the local needs of the respective agencies. The design of the collection system requires the well pumps to work together in coordination and to supply adequate pressure to the treatment facility to power the treatment processes. To that end, new design points have been assigned to each well pump to meet the new requirements while maximizing the established flow rates.

Pumps were assigned generic performance curves generated from a design point. Each pump performance curve follows a parabola that includes the design point (design head, design flow), the shutoff head (1.33 × design head, zero flow) and the maximum flow (zero head, 2 × design flow). For example, curve in Figure 7-6 would apply to a pump with a design head of 100 feet and a design flow of 1000 gpm:

Figure 7-6: Generic Pump Performance Curve



For preliminary design purposes, this type of generic curve is adequate to approximate well pump upgrades and motor sizes provided that the pump operates near the design point.

A review of groundwater contour maps published by the Main San Gabriel Basin Watermaster determined that the groundwater surface elevation in the vicinity of the well field in recent history was lowest in July 2004. As shown in Figure 7-7, an excerpt from the Groundwater Contour Map for the San Gabriel Basin – July 2004, the groundwater surface elevation for the well field was between 210 and 230 feet. To account for drawdown, the pumping water surface for all wells was assumed to be 210 feet.

Figure 7-7: Groundwater Contour of Well Field

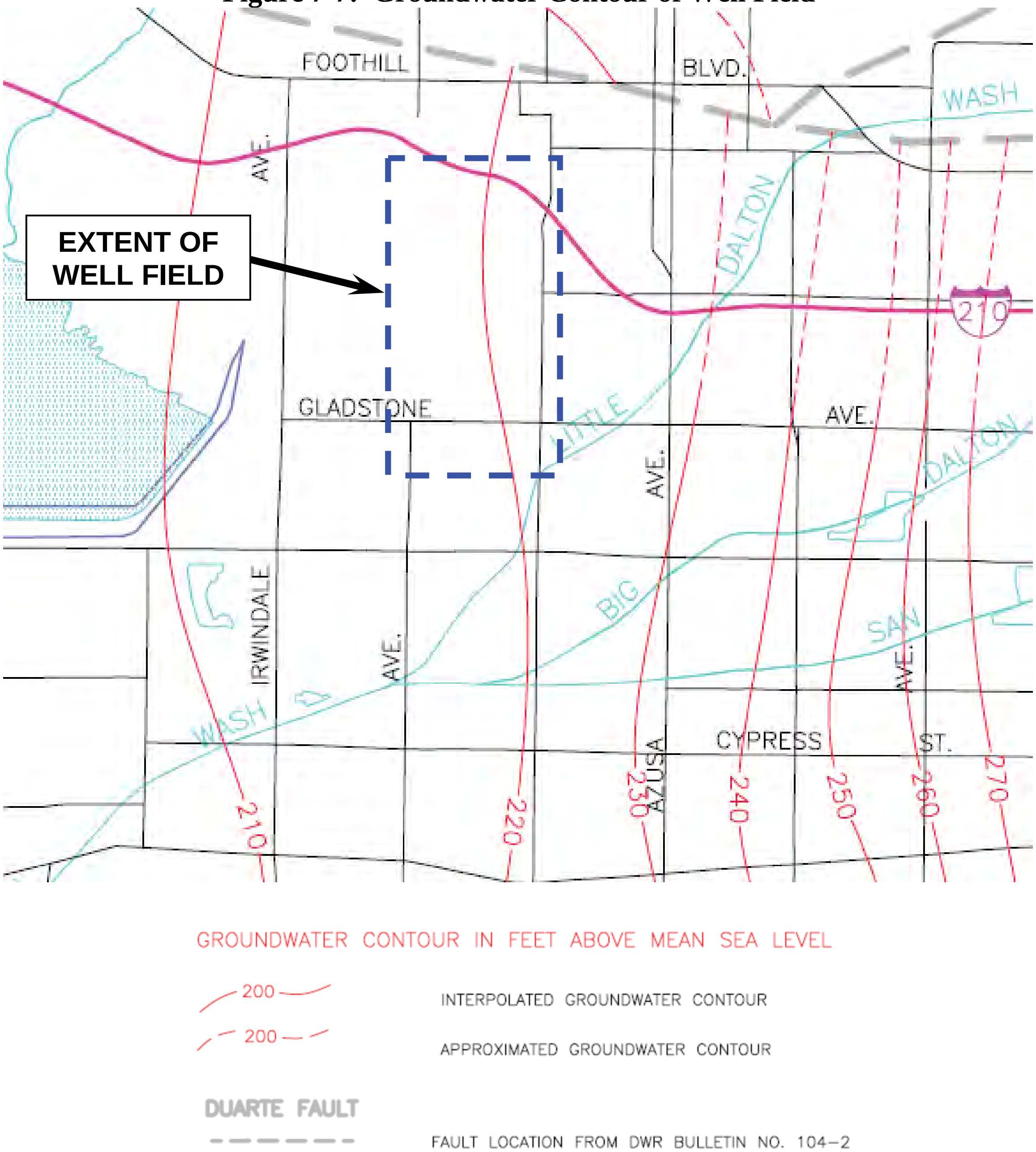


Table 7-9 lists the design points and estimated horsepower requirement for each well pump. The power estimate assumes 80% efficiency.

Table 7-9: Well Pump Design Details

Well Site	Design Head (feet)	Design Flow (gpm)	Power (HP)
Aspan	465	3,100	500
Azusa 9	455	4,700	650
Azusa 10	430	2,200	350
Contract	425	2,400	350
Glendora 3	415	2,000	300
Glendora 4	415	2,000	300
Vosburg	445	2,300	350

7.7.3: Treatment Facility

The treatment facility will ultimately consist of a series of vessels or other devices that facilitate the treatment processes. From a hydraulics point of view, a treatment facility represents a loss of pressure in the system that corresponds to the energy required to force water though a medium, filter or other apparatus. However, another important aspect is to maintain pressure within an appropriate range to protect sensitive equipment and to maximize treatment efficiency. The specific internal workings of the treatment facility will be dealt with once a treatment process is finalized. For purposes of developing the collection system, the operating pressure range of typical treatment equipment is assumed to be the governing factor for inlet pressure. Typical GAC treatment vessels by Calgon have a maximum pressure tolerance of 125 psi but are capable of operating at much lower pressures. For purposes of this analysis, three individual processes (perchlorate removal, VOC removal and nitrate removal) are assumed to each require 17 psi of differential pressure to sustain a proper flow rate for a total inlet pressure requirement of 65 psi. This pressure drop includes the energy required to force water to flow through a medium and any other losses associated pipelines, valves, meters and other appurtenances within the treatment facility. Outlet pressure is assumed to be atmospheric which is consistent with an equalization tank filled via an air gap.

7.7.4: Equalization Tank

The equalization tank serves as both a backwash water supply for certain treatment processes and as a staging point for the distribution system. The approach to designing an equalization tank is based on a number of factors including backwash supply volume, booster pump size, booster pump motor controls and SCADA interface efficiency. For purposes of this analysis, the equalization tank is assumed to have adequate volume to accommodate the normal operation of booster pumps as discussed in the following section.

7.8 Distribution System

The distribution system is an interface between the equalization tank at the treatment facility the receiving tanks in ALW, Glendora, RWD and WVWD. Items considered in the development of the distribution system include connections to existing infrastructure, alignments, pumping capacity, and system pressure. Although there are three connection points to the receiving water systems, a single pipeline and booster system was determined to be more practical than three individual pipelines. This collective approach consolidates facilities and minimizes the total length of pipeline required to meet the project objectives.

7.8.1: Connection Points

The follow sections describe the physical location of the proposed connection points between the distribution system, existing infrastructure in each receiving water system and any recommended improvements necessary to accommodate the anticipated flow rate. Also considered in this analysis are the existing transmission pipelines between the connection point and the corresponding tanks. During periods of low demand, such as during the night when tanks are typically filling, booster pumps must be adequately sized to accommodate the head losses associated with these existing transmission pipelines.

ALW

The connection point to the ALW water system is the 24-inch transmission main at the intersection of Gladstone Street and Rockvale Ave. This main is part of Pressure Zone 715 which maintains a static high water line of approximately 715 feet. Two tank sites serve Pressure Zone 715: Dalton/Sierra Madre and North/South. The Dalton/Sierra Madre site is connected to the connection point by the equivalent of 13,600 feet of 24-inch pipe with a friction coefficient of C = 125. The North/South tank site is connected to the Dalton/Sierra Madre site by the equivalent of 7,200 feet of 24-inch pipe with a friction coefficient of C = 125.

The pressure in the distribution pipeline is higher than in Pressure Zone 715 and must be reduced. A pressure reducing valve or a turbine will be installed at the connection point to reduce the head. The pressure drop is approximately from 220 feet (95 psi). If a turbine is installed to reduce the pressure, the potential to recover energy through the turbine ranges from approximately 250 kilowatts (at 7,500 gpm) to 330 kilowatts (10,000 gpm). At $0.10 per kWh and assuming the generator operates continuously for half the year, a generator can recover approximately $110k to $140k annually.

Glendora

The connection point to the Glendora water system is the 24-inch transmission main in Glendora Ave. at Gladstone Street. This main is part of Pressure Zone 1 which maintains a static high water line of approximately 970 feet. There are several tank sites within Pressure Zone 1; however, the South Hills West site is assumed to have the primary impact in hydraulics in the vicinity of the connection point due to its close proximity. The South Hills West site is connected to the connection point by the equivalent of 5,000 feet of 24-inch pipe with a friction coefficient of C = 130.

WVWD

The connection point to the WVWD water system is northwest terminus of the Badillo/Grand Transmission Main which normally delivers import water from the MWD Middle Feeder. The Badillo/Grand Transmission Main feeds the Terminal Storage Facility which has a high water line of approximately 930 feet. However, the Badillo/Grand Transmission Main is maintained at a pressure higher than the static pressure of the Terminal Storage Facility to accommodate for variation in elevation along its length. The head at the connection point is assumed to be consistent with the high water line of MWD's Weymouth Reservoir at 1,068 feet. The Badillo/Grand Transmission Main is the equivalent of 21,200 feet of 48-inch pipe with a friction coefficient of C = 130.

RWD

There is an emergency interconnection between WVWD and RWD currently in the design phase. A 24-inch pipeline will connect the southeast terminus of the Badillo/Grand Transmission Main to reservoirs owned by RWD in the vicinity of the WVWD Terminal Storage Facility.

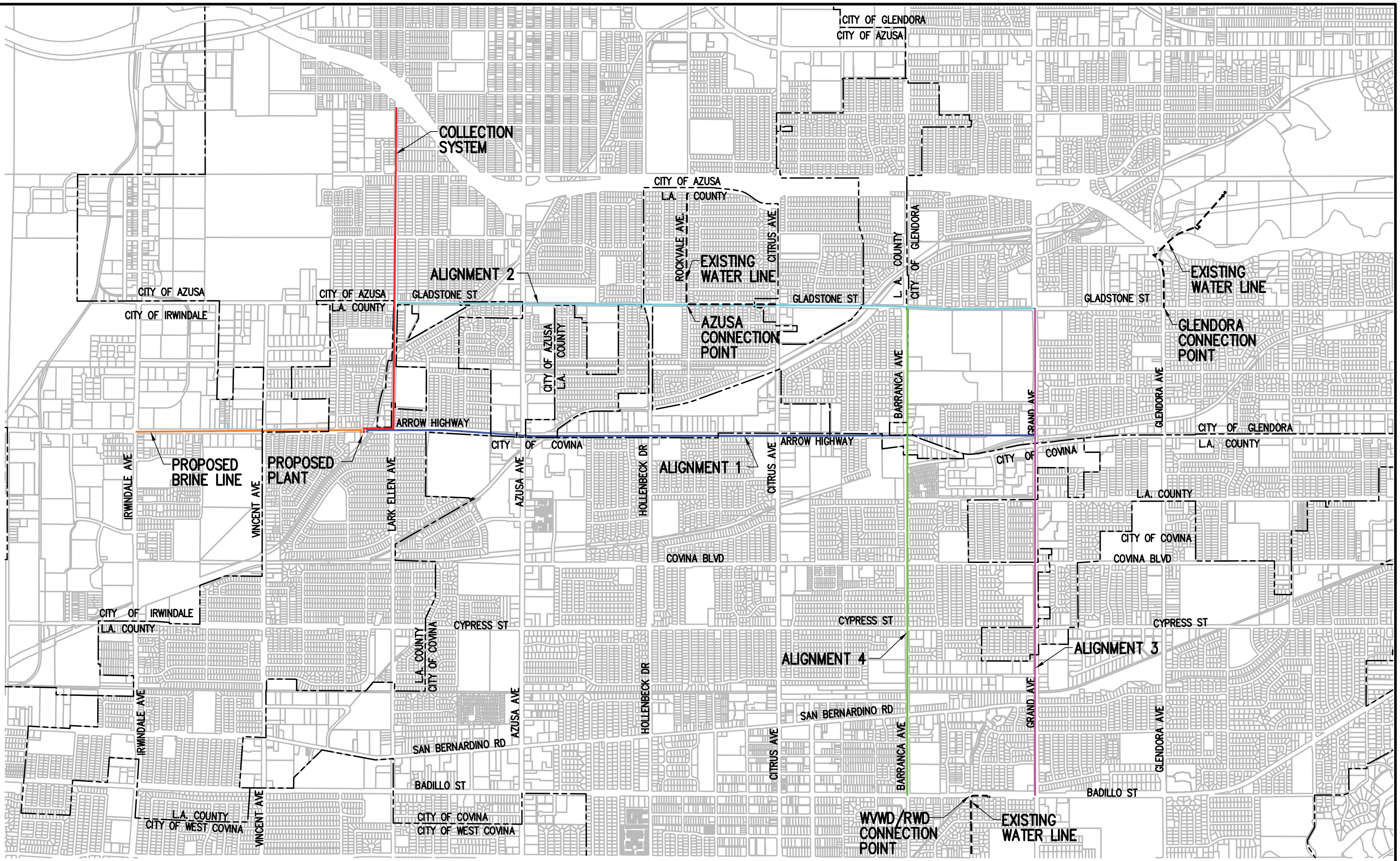
7.8.2: Pipelines

The single pipeline approach requires two principal alignments: an East-West alignment between the treatment plant and the Glendora connection point, and a North-South alignment branching off the East-West alignment and terminating at the WVWD connection point.

Alignments Considered:

- *Alignment 1* (East-West): Arrow Highway between Lark Ellen Ave. and Glendora Ave.
- *Alignment 2* (East-West): Gladstone St. between Lark Ellen Ave. and Glendora Ave.
- *Alignment 3* (North-South): Grand Ave. between Preferred East-West Alignment and Badillo St.
- *Alignment 4* (North-South): Baranca Ave. between Preferred East-West Alignment and Badillo St.

Figure 7-8 shows Alignments 1 through 4 and their relationships to other key elements of the hydraulic infrastructure. As of 2009, there were no paving moratoriums in place for any of these alignments.



CITY BOUNDRY
EXISTING PIPE
ALIGNMENT 1
ALIGNMENT 2
ALIGNMENT 3
ALIGNMENT 4
COLLECTION SYSTEM
BRINE LINE

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MULTI-AGENCY REGIONAL GROUND WATER RECOVERY PROJECT

DISTRIBUTION SYSTEM PIPELINE ALIGNMENT EVALUATION

FIGURE 7-8

Evaluation process and parameters

Weight Value – Each parameter considered carries a different degree of importance in the evaluation process. The Weigh Value is a multiplier that quantifies the relative importance of each parameter considered in the evaluation. The more important a parameter is in evaluating an alignment, the higher its weighted value.

Rating or Impact – For each alignment, every parameter is assigned a rating or impact value between one and three. This value quantifies the relative impact a particular alignment poses on a given parameter. The higher the number the less impact it has (more attractive).

Pavement Type – Roads within the study area are paved with either asphalt or concrete and must be replaced in kind following pipeline installation. The replacement cost of concrete is higher so it receives a lower rating (less attractive option).

Table 7-10: Pavement Type Alignment Parameter

Alignment	Pavement Type	Rating
1 (Arrow Highway)	AC	3
2 (Gladstone St.)	AC	3
3 (Grand Ave.)	AC	3
4 (Baranca Ave.)	AC	3

Impact to Surrounding Businesses – Construction will be performed primarily during business hours. This parameter is based on the percentage of each alignment that lies within commercial zones which may lead to impact on day to day business operations during construction. Even though the utilization of residential streets will have an adverse affect on the residents, it was determined that this affect was minimal considering a majority of residents will vacate the area (for school, work, etc.) during construction activities. The higher the percentage, the greater the impact on surrounding businesses. A higher impact means a lower rating (less attractive option).

Table 7-11: Commercial Impact Alignment Parameter

Alignment	Percent Commercial	Rating
1 (Arrow Highway)	83%	1
2 (Gladstone St.)	25%	3
3 (Grand Ave.)	61%	2
4 (Baranca Ave.)	30%	3

Impact to Traffic – This parameter quantifies the impact to traffic during construction activities. Streets are classified by function (Arterial, Collector, Residential, etc.). Arterials typically carry a higher traffic load so they receive a lower rating (less attractive option).

Table 7-12: Street Classification Alignment Parameter

Alignment	Function	Rating
1 (Arrow Highway)	Arterial	1
2 (Gladstone St.)	Arterial	1
3 (Grand Ave.)	Arterial	1
4 (Baranca Ave.)	Arterial	1

Capacity of Alignment – The alignments under consideration contain multiple existing utilities. This parameter quantifies the capacity of each alignment to accommodate the installation of a new 36" pipeline without adversely affecting the existing utilities. Generally, the wider the road, the higher the rating (more attractive option).

Table 7-13: Capacity Alignment Parameter

Alignment	Street Width	Rating
1 (Arrow Highway)	75 feet	3
2 (Gladstone St.)	60 feet	2
3 (Grand Ave.)	75 feet	3
4 (Baranca Ave.)	60 feet	2

Trench Repair – Each municipality within the study area maintains its own type of trench repair based upon standard details. The more construction intensive the trench repair, the lower the rating (less attractive option).

Table 7-14: Trench Repair Alignment Parameter

Jurisdiction	Citation	Description	Rating
Covina	R-01-98	Typical T-replacement	3
Azusa	R-12	Typical T-replacement	3
Glendora	SD&S 1.10	Typical T-replacement	3
LA County	133	Typical T-replacement	3

Impact to Schools – Construction activities may adversely impact schools. The more schools located along an alignment, the higher the impact (less attractive option).

Table 7-15: School Impact Alignment Parameter

Alignment	# of Schools	School Name	Rating
1 (Arrow Highway)	2	Gladstone High School	1
		Live Oak Canyon School	
2 (Gladstone St.)	2	Gladstone Street Elementary	1
		Azusa Unified School District	
3 (Grand Ave.)	1	Covina Valley Unified School	2
4 (Baranca Ave.)	0	None	3

Totals – The summation of the products of the *weight value* and *rating or impact* for each alignment. The higher the number the more attractive the alignment is for construction of the pipeline. Tables 7-16 to 7-17 perform the analysis and identify the selected alternate

Table 7-16: Evaluation of East-West Alignment

Type of Impact		Alignment 1 (Arrow Highway)		Alignment 2 (Gladstone St.)	
	Weight Value	Rating or Impact	Total	Rating or Impact	Total
Pavement Type	2	3	6	3	6
Impact to Businesses	2	1	2	3	6
Impact to traffic	2	1	2	1	2
Alignment Capacity	3	3	9	2	6
Trench Repair	3	3	9	3	9
Impact to Schools	1	1	1	1	1
TOTALS			**29**		**30**

<u>LEGEND:</u>
Weight Value
1 - Minimal Importance
2 - Important
3 - Very Important

<u>LEGEND:</u>
Rating or Impact
1 - Significant Impact
2 - Average Impact
3 - Minimal Impact

Table 7-17: Evaluation of North-South Alignment

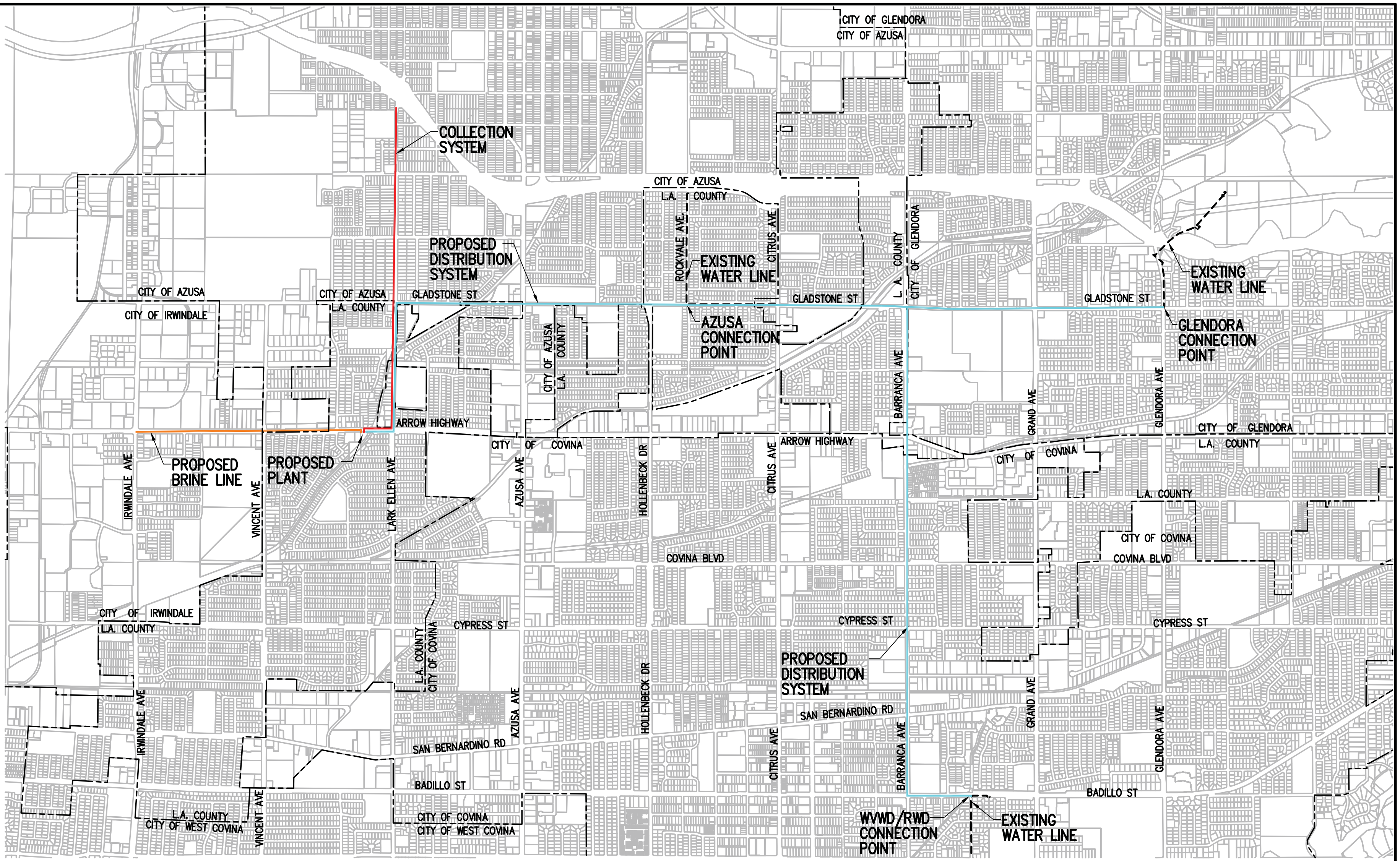
Type of Impact	Weight Value	Alignment 3 (Grand Ave.)		Alignment 4 (Baranca Ave.)	
		Rating or Impact	Total	Rating or Impact	Total
Pavement Type	2	3	6	3	6
Impact to Businesses	2	2	4	3	6
Impact to traffic	2	1	2	1	2
Alignment Capacity	3	3	9	2	6
Trench Repair	3	2	6	2	6
Impact to Schools	1	2	2	3	3
TOTALS			**29**		**29**

LEGEND:
Weight Value
1 - Minimal Importance
2 - Important
3 - Very Important

LEGEND:
Rating or Impact
1 - Significant Impact
2 - Average Impact
3 - Minimal Impact

Conclusion of Alignment Evaluation

Gladstone St. provides a slightly preferable alignment for the east-west portion of the distribution pipeline. For the north-south alignment, both options pose an equal impact. However, Baranca Ave. had more favorable ratings and shall be adopted as the preferred north-south alignment. Figure 7-9 shows the preferred pipeline alignment system configuration.



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MULTI-AGENCY REGIONAL GROUND WATER RECOVERY PROJECT

PREFERRED SYSTEM CONFIGURATION

FIGURE

7–9

Application

To maintain a pipe velocity of approximately 6 fps and to accommodate a high discharge pressure near the booster station, nominal 24-inch and 36-inch pipes with a pressure rating of 300 psi were selected as necessary. The total length of pipe is approximately 31,500 feet and is broken down by benefitting stakeholder in Table 7-18. By convention for the Water Model, transmission pipelines are labeled TR and tank inlet pipelines are labeled IL. Existing pipelines that were included in the hydraulic model (Figure 7-5) are not included in Table 7-18, notably IL-1 and IL-3.

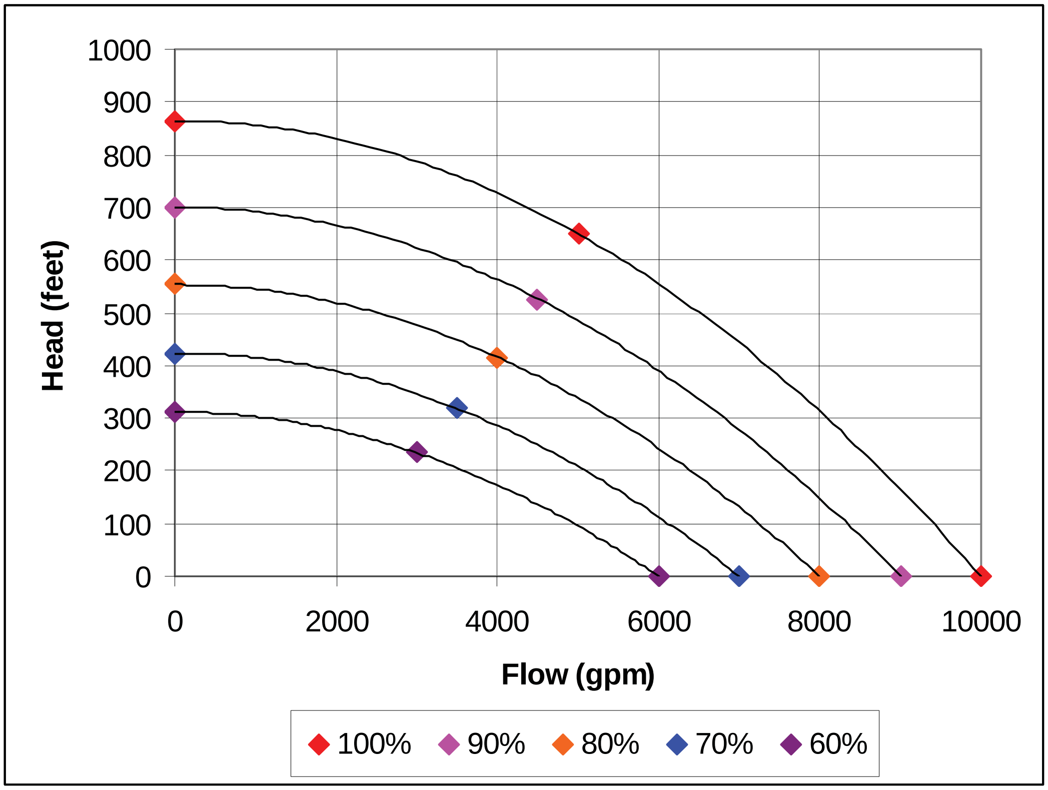
Table 7-18: Total Length of Pipe Broken Down by Benefitting Stakeholder

Stakeholder	Model ID	Length (feet)	Diameter (inches)	Location
All Stakeholders	TR-1	9,500	36	From Equalization Tank to Intersection of Gladstone and Rockvale via Lark Ellen and Gladstone
Glendora & RWD/WVWD	TR-2	4,600	36	In Gladstone between Rockvale and Barranca
Glendora Only	IL-2	5,400	24	In Gladstone between Barranca and Glendora
RWD/WVWD Only	TR-3	12,000	36	In Barranca between Gladstone and Badillo

7.8.3: Booster Station

Hydraulic modeling showed that a single booster station containing four 1,050-HP pumps each capable of producing 5,000 gpm at 650 feet of head can accommodate all possible flow regimes. All pump motors must be fitted with variable frequency drives capable varying the rotational velocity between 70% and 100% of maximum. Based on the affinity laws for centrifugal pumps, Figure 7-10 shows a set of generic performance curves that were calculated per the methodology described in Section 7.7.

Figure 7-10: VFD Curves for Recommended Booster Pumps



By operating at different rotational velocities, this booster configuration can adapt to the various anticipated loadings required for delivery to ALW and Glendora versus delivery to WVWD. Furthermore, this configuration can accommodate variations in flow through the treatment facility that may result from unforeseen conditions in the well field. Generally, with three pumps in operation, the capacity of the booster station is 15,000 gpm with an additional pump as a stand-by. With all pumps in operation, the booster station can accommodate maximization of all wells at approximately 19,000 gpm. A rotational velocity of 90% is required to provide adequate booster pumping capacity for the Summer Scenario (flow split between ALW and Glendora). A rotational velocity of 100% is required to provide adequate booster pumping capacity for the Winter Scenario (all flow to RWD/WVWD).

7.9 Summary

Table 7-19 summarizes the recommended improvements required to deliver treated water to ALW, Glendora, RWD and WVWD.

Table 7-19: Collection and Distribution System Improvements

<table>
<tr><td rowspan="6">Pipelines</td><td>Diameter</td><td>Length</td></tr>
<tr><td>16</td><td>3830</td></tr>
<tr><td>20</td><td>2100</td></tr>
<tr><td>24</td><td>6200</td></tr>
<tr><td>30</td><td>3510</td></tr>
<tr><td>36</td><td>26100</td></tr>
<tr><td rowspan="8">Well Pumps
(Motor and Casing Rehabilitation)</td><td>Name</td><td>HP</td></tr>
<tr><td>Aspan</td><td>500</td></tr>
<tr><td>Azusa 9</td><td>350</td></tr>
<tr><td>Azusa 10</td><td>650</td></tr>
<tr><td>Contract</td><td>350</td></tr>
<tr><td>Glendora 3</td><td>300</td></tr>
<tr><td>Glendora 4</td><td>300</td></tr>
<tr><td>Vosburg</td><td>350</td></tr>
<tr><td rowspan="2">Booster Pumps</td><td>Quantity</td><td>HP</td></tr>
<tr><td>4</td><td>1050</td></tr>
<tr><td>Interconnections</td><td>Quantity</td><td>Diameter</td></tr>
<tr><td>(Valve and Meter)</td><td>3</td><td>24”</td></tr>
<tr><td rowspan="2">Equalization Tank</td><td>Quantity</td><td>Volume (gal)</td></tr>
<tr><td>1</td><td>100,000</td></tr>
</table>

Chapter 8 – Preliminary Site Layouts and Cost Estimates

8.1 General Overview

This chapter provides an overview of the equipment requirements for each of the treatment processes, a preliminary site layout and a cost analysis for implementation.

8.2 Appurtenant Equipment Requirements

This section provides a description of equipment requirements for the following treatment processes:

- Particulates
- GAC
- Ion Exchange (Perchlorates)
- Ion Exchange (Nitrates)
- Nitrate Regeneration
- Disinfection

Equipment for each process was sized assuming a flow rate of 15,000 gpm.

Particulates

Particulates must be removed to prevent contamination of the resins and GAC. Particulates may render these media ineffective. Therefore, a particulate removal system is required prior to any contamination treatment. The type of particulate removal system utilized at this treatment facility will be a cartridge system. Based on ***Civiltec***'s experience with similar treatment facilities, each vessel in the particulate removal system has a flow capacity of approximately 3,750 gpm. Comparing this flow rate to the total expected discharge from the treatment plant, it was determined that a total of five vessels are required.

Ion Exchange (Perchlorates)

It is assumed a typical perchlorate ion exchange vessel setup (Lead/Lag) has the capacity to accommodate approximately 1,750 gpm. Comparing this capacity to the total expected discharge from the treatment plant, it was determined a total of seven vessel pairs (i.e. 14 individual vessels) is required. However, based upon the blending analysis from Chapter 6 the perchlorate ion exchange system would be required to process 8,900 gpm to meet the perchlorate effluent goal of 4.8 µg/L (80% of the MCL). When considering blending, a total of five vessel set pairs (10 individual vessels) is required. It is recommended that ten vessels be installed with adequate adjacent space to install four more vessels in the event perchlorate concentration increases in the future.

GAC

The concentrations of VOCs are relatively low; therefore, the GAC system will be operated in a parallel setup, as opposed to a lead/lag setup. It is assumed the capacity of the GAC vessels in a parallel setup is approximately 1,100 gpm. Comparing this capacity to the total expected discharge from the treatment plant, it was determined a total of 14 vessels is required. However, this requirement is based on treating the entire flow. As discussed in Chapter 6, the worst case scenario for VOC concentration results in a flow rate of 9,500 gpm or less. Only ten GAC vessels are required to accommodate the worst case scenario. It is recommended that ten GAC vessels be installed with adequate space adjacent thereto in order to install four more vessels in the event VOC concentrations increase in the future.

Ion Exchange (Nitrates)

It is assumed a typical nitrate ion exchange vessel setup (Lead/Lag) has the capacity to accommodate approximately 1,700 gpm. Comparing this capacity to the total expected discharge from the treatment plant, it was determined a total of nine vessel set-ups (i.e. 18 individual vessels) are required. However, based upon the blending analysis from Chapter 6, the nitrate ion exchange system would be required to process 9,655 gpm to meet the nitrate effluent goal of 36 mg/L (80% of the MCL). When considering blending, a total of six vessel setups (i.e. twelve individual vessels) are required. It is recommended that twelve vessels be installed with adequate adjacent space to install six more vessels in the event nitrate concentration increases in the future.

Regeneration Brine Equipment

The nitrate treatment media is regenerated onsite with a concentrated brine solution. The brine regeneration process requires the follows equipment and infrastructure:

- Storage for dry sodium chloride
- Brine tanks
- Discharge equalization basin (optional)
- Waste brine line to industrial sewer

Once the nitrate treatment media has become saturated, the vessel is taken offline and filled with brine for regeneration. The regeneration process is governed by the following reaction:

$$R^+NO_3^- + NaCl \rightarrow R^+Cl^- + NaNO_3$$

$$Where\ R^+ = Resin$$

Assuming the entire flow will be treated, the daily molar loading of nitrate is approximately 109,000 moles of nitrate per day:

$$Loading = QC_0$$
$$= \left(\frac{9655\ gal.}{min.}\right)\left(\frac{83\ mg\ NO_3^-}{l}\right)\left(\frac{3.78\ l}{gal.}\right)\left(\frac{24\times 60\ min.}{day}\right)\left(\frac{g}{1000\ mg}\right)\left(\frac{M\ NO_3^-}{62\ g\ NO_3^-}\right)$$
$$= 7.03\times 10^4\ M\ NO_3^-\ per\ day$$
$$Where\ Q = design\ flow\ rate$$
$$and\ C_0 = nitrate\ concentration\ (See\ Table\ 2-1)$$

To complete the regeneration process, this molar loading of nitrate requires a sodium chloride dosage of 8,995 pounds per day:

$$\left(\frac{7.03\times 10^5\ M\ NO_3^-}{day}\right)\left(\frac{M\ NaCl}{M\ NO_3^-}\right)\left(\frac{58\ mg\ NaCl}{M\ NaCl}\right)\left(\frac{lb.}{453.6\ g}\right)\cong 8{,}995\ lbs\ NaCl/day$$

Assuming a 10% brine solution (typical concentration for media regeneration), the discharge to the LACSD industrial sewer is approximately 10,548 gallons per day:

$$\left(\frac{8{,}995\ lbs\ NaCl}{day}\right)\left(\frac{100\ lbs\ brine}{10\ lbs\ NaCl}\right)\left(\frac{ft^3}{63.8\ lbs\ brine}\right)\left(\frac{7.481\ gal.}{ft^3}\right)\cong 10{,}548\ gallons\ per\ day$$

Under this loading, eight 10,000-gallon brine tanks will provide enough storage for approximately one week of regeneration. Under blending operations, the total salt requirement is significantly reduced.

Disinfection

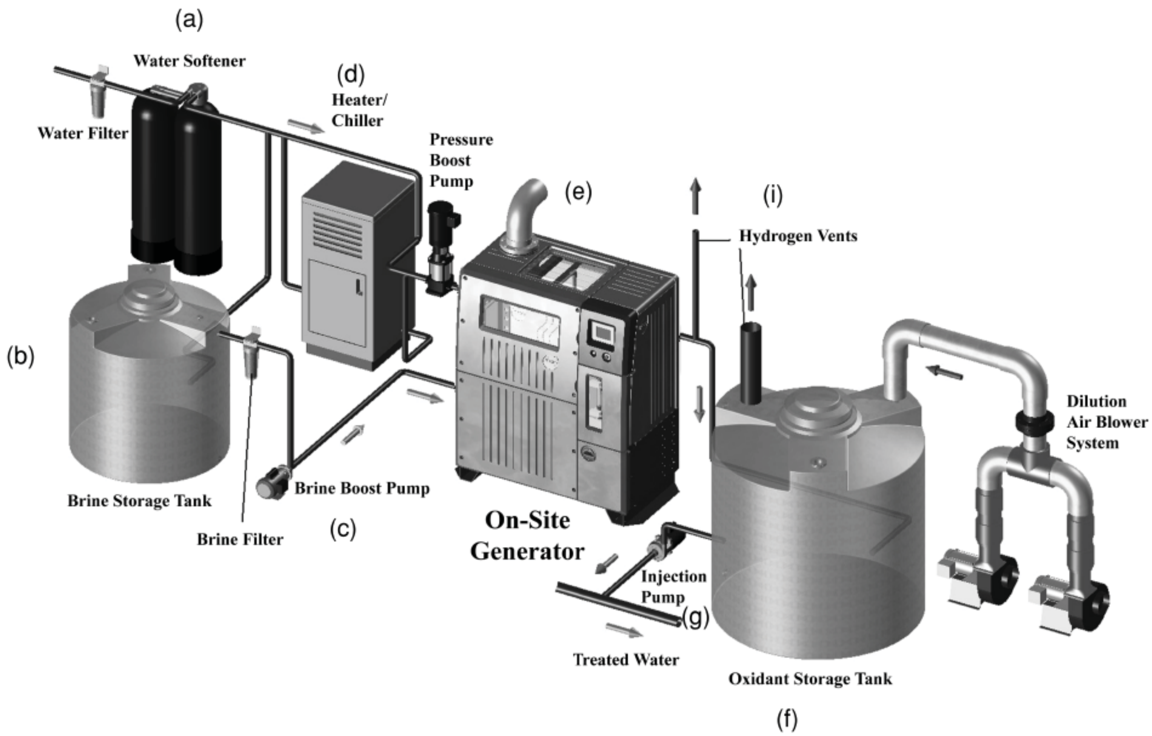
Following the treatment process and prior to discharge into the distribution system, adequate disinfection must be applied to assure a sufficient disinfectant residual in the treatment plant effluent. On-site generation and injection of chlorine provides the most benefits for this project. The on-site chlorine generation process uses the same source material (sodium chloride) as the nitrate treatment regeneration process which will simplify on-site brine generation and storage. Sodium chloride (i.e. food quality table salt) is safe to store and handle and is readily available in a high quality form.

This type of chlorination is consistent with the disinfectant methods employed by ALW and Glendora, so there is no increased risk of chemical cancellation or the development of disinfectant byproducts. However, RWD and WVWD presently receive the bulk of their water production as imported treated surface water from the MWD Weymouth Water Treatment Plant which contains chloramine as a residual disinfectant. Depending on the ratio of treated surface water to treated groundwater, the mixture of water in the Grand/Badillo Pipeline and the Terminal Reservoir may result in the chemical cancellation of residual disinfectant requiring an injection of ammonia for stabilization.

A typical on-site chlorine generation system is shown in Figure 8-1 and consists of the following components:

(a) water softener
(b) brine tank
(c) brine pump
(d) water heater/chiller
(e) electrolytic cell and cell controller
(f) oxidant tank,
(g) metering pump
(h) hydrogen vents

Figure 8-1: Typical On-Site Chlorine Generation System



Water coming into the system first goes through a softener, after which it is split into two lines. One line feeds directly into an electrolytic cell while the other is used to fill a brine tank. The brine tank stores a concentrated salt solution, prepared by having an excess of salt in the tank so that the solution is a near-saturated brine. The brine is then injected into the softened water stream entering the electrolytic cell.

When the dilute salt solution is inside the electrochemical cell, a current is passed through the cell, producing the oxidant (sodium hypochlorite or other oxidants) solution. After leaving the electrolytic cell, the oxidant solution is stored temporarily in the oxidant tank and is then metered into the water moving through the treatment process. Hydrogen gas is also produced inside the electrolytic cell, and the hydrogen must be removed from the cell and oxidant storage tank through vents.

Electrolysis occurs in the electrolytic cell producing chlorine gas which remains dissolved in the water as a disinfectant. The dosage of salt for the disinfection process is approximately 1,200 pounds per day assuming an initial chlorine concentration of 4 mg/L:

$$Dosage = Concentration \times Flow\ Rate$$

$$\left(\frac{0.004\ g\ Cl_2}{L}\right)\left(\frac{15000\ gal.}{min.}\right)\left(\frac{M\ Cl_2}{70\ g\ Cl_2}\right)\left(\frac{2\ M\ NaCl}{M\ Cl_2}\right)\left(\frac{58\ g\ NaCl}{M\ NaCl}\right)\left(\frac{2.2\ lbs}{1000\ g}\right)\left(\frac{L}{0.26\ gal.}\right)\left(\frac{60 \times 24\ min.}{day}\right)$$

$$\cong 1{,}200\ \frac{lbs\ NaCl}{day}$$

An ammonia injection facility may be required at the RWD/WVWD connection point in the vicinity of Grand Ave. and Badillo St.

Table 8-1: Summary of Treatment Plant Equipment Requirements

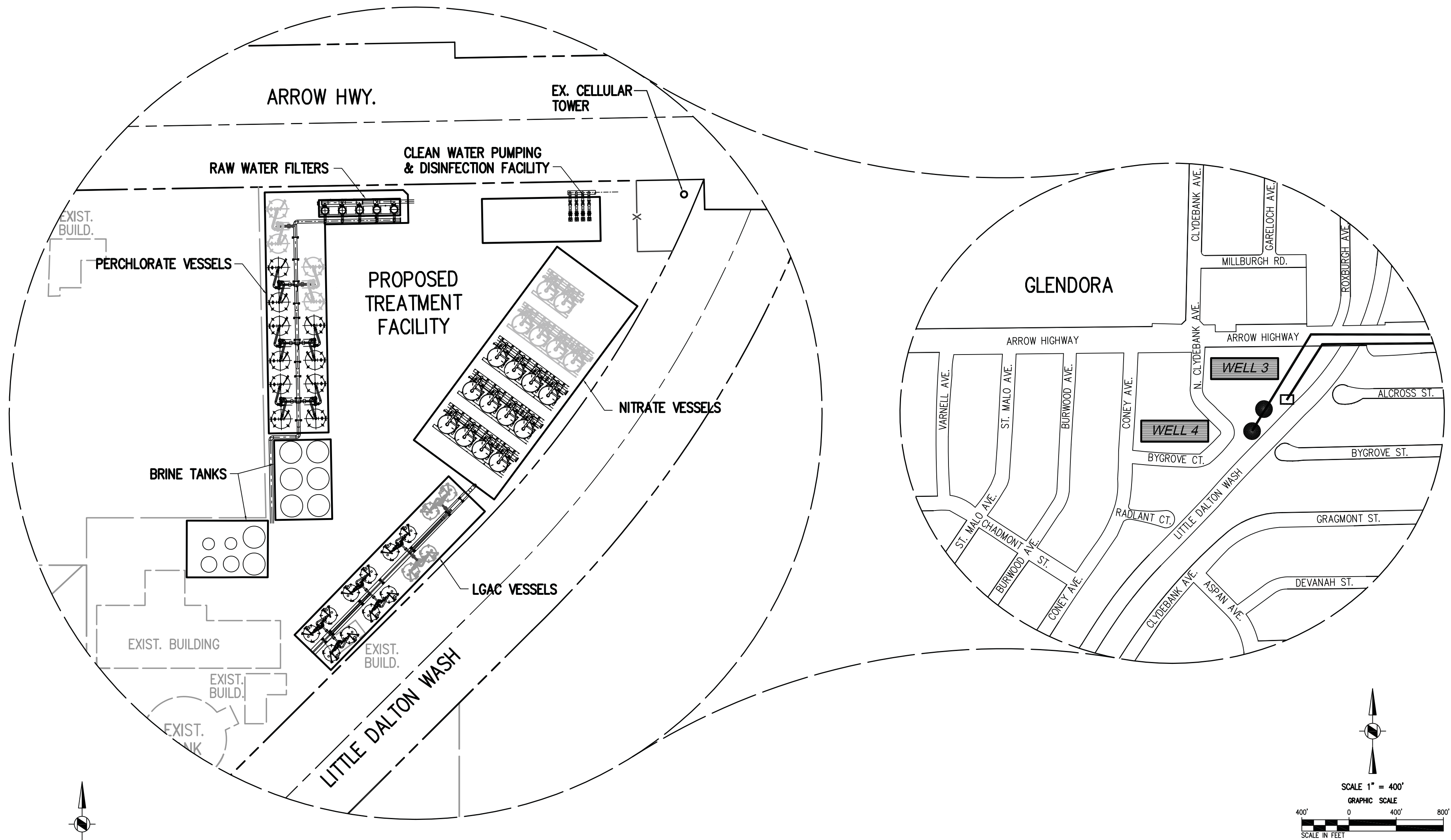
Process	Units
Particulate Removal	5 Cartridge Filter Vessels each with 3,750 gpm capacity
Perchlorate Removal	10 Perchlorate Ion Exchange Vessels in Lead/Lag configuration each pair with 1,750 gpm capacity
VOC Removal	10 GAC Vessels each with 1,100 gpm capacity
Nitrate Removal	12 Total Nitrate Ion Exchange Vessels in Lead/Lag configuration each pair with 1,700 gpm capacity
Nitrate Regeneration	8 Brine Tanks each with 10,000 gallon capacity
Brine Disposal	4700 feet of gravity brine disposal pipeline
Disinfection	On-site Chlorine Generation Unit with 1,200 lbs NaCl per day capacity

8.3 Preliminary Site Layouts

Per the site evaluation process in Chapter 4, Site 10 was determined to be the best available site.

The Site 10 is located in the vicinity of 16734 E Arrow Highway it is currently owned by the City of Glendora. Glendora Wells 3 & 4 and 0.25 million gallon holding tank are currently located at this site. There is sufficient area for all the treatment processes; in addition, the site is in a location central to the wells. The site is in close proximity to the Little Dalton Wash providing access for pump to waste during start up procedures. It was determined during an onsite visit that there is an existing discharge pipeline to the wash from the existing tank. Since the pipeline has already been constructed, a permit process has already been conducted; therefore, it is possible all the proper permits are on file and may only need to be updated. There is a cellular phone tower located at the northeasterly corner with limited access fencing. The site is currently leased to a private landscaping company whose equipment and product are temporary and easily removed.

Figure 8-2 shows the preliminary site layout based upon the equipment requirements for each of the processes, including disinfection and regeneration. This layout was development from the equipment requirements for treating the total discharge of 15,000 gpm. However, the use of blending techniques will lower the initial equipment requirements. The initial equipment is shown with dark lines and any additional equipment is shown in gray that may be required in the future. The site layout was designed to accommodate the higher equipment requirements allowing for future expansion in the event that water quality changes.



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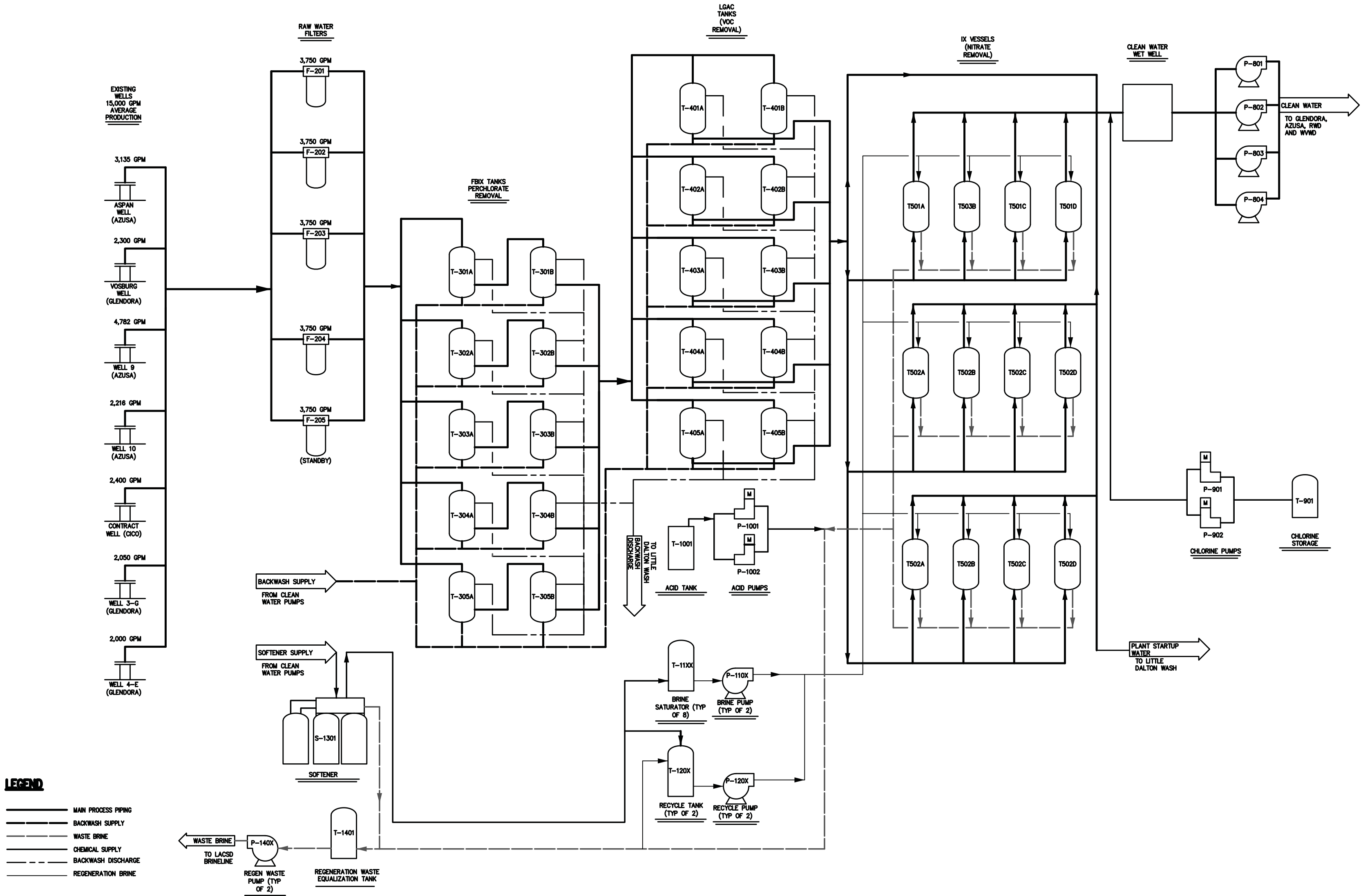
MULTI-AGENCY REGIONAL GROUND WATER RECOVERY PROJECT

PRELIMINARY SITE LAYOUT

FIGURE 8-2

Figure 8-3 is a concept process flow diagram of the treatment processes the water will undergo as it passes through the treatment facility. The first treatment process is the raw water filtration where any particulates are removed by the cartridge filter system. Then the perchlorates are removed through the perchlorate ion exchange process. The third process will be to remove VOC contamination through the GAC vessels. The final treatment process is the removal of nitrates through the nitrate ion exchange vessels. Finally, the treated water will be disinfected and distributed.



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MULTI-AGENCY REGIONAL GROUND WATER RECOVERY PROJECT

CONCEPT PROCESS FLOW DIAGRAM

FIGURE 8-3

8.4 Treatment Equipment and System Cost Estimates

A preliminary opinion of probably costs associated with the treatment facility, including collection and distribution pipelines, has been prepared. These costs are based upon typical equipment and installation requirements obtained from equipment manufactures and contractors. The total capital cost to construct the treatment facility, in 2010 dollars, is approximately 66.6 million dollars; this also includes a 10% contingency for unforeseen contingency items and 15% for engineering, planning and administration fees. The treatment facility is expected to have a 30 year life cycle; when amortized over this period, utilizing a 4% interest rate, the annual cost is approximately 3.82 million dollars. The annual cost to construct the treatment facility, transmission piping and ancillary equipment; based upon an average of 20,000 acre-foot of water treated, is approximately 158 dollars. Table 8-2 is a summary of the equipment required and the capital costs associated with each unit.

The estimate assumes that all wells will require full rehabilitation including replacement of electrical and mechanical equipment, lining of the existing casings. It may be concluded during the preliminary design and well investigation phase that such improvements are not warranted at all well facilities. The improvements at the site have been arranged in a manner to allow for sequential operation of each unit process. This will minimize extensive piping requirements and mechanical improvements. A building of 3,000 square foot area has been assigned to house the booster pump and disinfection facilities. In addition treatment systems units have been quantified based upon blending operations being fully utilized.

Table 8-2: Capital Cost Estimate for Construction of Treatment Facility

Item Number	Description	Unit	Quantity	Unit Price	Total Price
	Treatment Facility				
1	Mobilization/Demobilization	LS	1	$500,000.00	$500,000
2	Site Improvements and Piping	LS	1	$1,700,000.00	$1,700,000
3	Perchlorate IX Vessels	Pair	5	$550,000.00	$2,750,000
4	Nitrate IX Vessels	Pair	6	$550,000.00	$3,300,000
5	GAC Vessels	EA	10	$110,000.00	$1,100,000
6	Chlorine Disinfection Equipment and Electrical	LS	1	$660,000.00	$660,000
7	Particulate Filter	EA	5	$55,500.00	$277,500
8	Brine Storage Tanks	EA	8	$22,500.00	$180,000
9	Brine Waste Pipeline	LF	4,700	$600.00	$2,820,000
10	Concrete Pads for Treatment Equipment	CY	1,517	$500.00	$758,333
11	Booster Pump w/ Electrical	LS	1	$4,200,000.00	$4,200,000.00
12	Misc. Mechanical and Equipment	LS	1	$1,250,000.00	$1,250,000.00
13	Booster Pump and Disinfection Building	SF	3,000	$200.00	$600,000
14	Equalization Tank	LS	1	$500,000.00	$500,000.00
	Sub-Total Treatment				$20,595,833
	Collection and Distribution System				
15	16-inch Pipe	LF	3,830	$267.00	$1,022,610.00
16	20-inch Pipe	LF	2,100	$380.00	$798,000.00
17	24-inch Pipe	LF	6,200	$457.00	$2,833,400.00
18	30-inch Pipe	LF	3,510	$550.00	$1,930,500.00
19	36-inch Pipe	LF	26,100	$685.00	$17,878,500.00
20	500 HP Aspan Well Pump Equipping & Rehab	EA	1	$1,085,139.76	$1,085,139.76
21	650 HP Azusa 9 Well Pump Equipping & Rehab	EA	1	$1,238,533.30	$1,238,533.30
22	350 HP Azusa 10 Well Pump Equipping & Rehab	EA	1	$1,375,869.75	$1,375,869.75
23	350 HP Contract Well Pump Equipping & Rehab	EA	1	$957,211.54	$957,211.54
24	300 HP Glendora 3 Well Pump Equipping & Rehab	EA	1	$947,246.68	$947,246.68
25	300 HP Glendora 4 Well Pump Equipping & Rehab	EA	1	$907,261.83	$907,261.83
26	350 HP Vosburg Well Pump Equipping & Rehab	EA	1	$957,268.78	$957,268.78
27	Interconnection (Valve and Meter)	EA	3	$100,000.00	$300,000.00
	Sub-Total Collection and Distribution				$32,231,542

Table 8-2 Cont: Capital Cost Estimate for Construction of Treatment Facility

Sub-Total	**$52,827,374.64**
10% Contingency	$5,282,737.46
15% Engineering, Planning and Administration	$7,924,106.20
Total	**$66,034,218**
Period (Years)	30
Interest Rate	4%
Annual Cost	**$3,818,765.39**
Annual Yield (AF/Yr)	**24,200**
Annual Unit Cost ($/AF)	**$158**

The annual operation and maintenance for this treatment facility consist primarily of:

- Media Replacement (GAC, Ion Exchange Resins)
- Salt Delivery (Nitrate Vessel Regeneration and Disinfection)
- Acid injection
- Electricity (For pumping and Non-Pumping operations)
- On-Site Technicians for operations and maintenance of the facility
- Routine replacement of mechanical components
- Laboratory Testing

Table 8-3 is an estimate of the expected costs associated with the operations and maintenance of the treatment facility. The total annual cost, in 2010 dollars, is approximately 6.75 million dollars. The annual cost for operations and maintenance based upon an acre-foot of water treated is approximately 332 dollars.

Table 8-3: Operations and Maintenance Costs for Treatment Facility

Description	Unit	Quantity	Unit Cost	Total
Electrical Pumping	Ac-Ft	24,200	$185.19	$3,703,800.00
Electrical Non-Pumping	Ac-Ft	24,200	$20.00	$400,000.00
Salt	TON	1,373	$163.00	$223,799.00
Brine Discharge Permit (LCFCD)	Capacity	6	$3,408.90	$20,300.00
Perchlorate IX Resin	Ac-Ft	24,200	$62.00	$1,240,000.00
Nitrate IX Resin	Ac-Ft	24,200	$17.00	$340,000.00
O&M Costs for GAC	LS	1	$69,467.00	$69,467.00
On-Site Technicians/Operators/Maintenance Crew	LS	1	$275,000.00	$275,000.00
Lab Work	Ac-Ft	24,200	$4.00	$80,000.00
Acid Injection	GAL	2,700	$13.50	$36,450.00
System Replacement Cost	Ac-Ft	24,200	$17.50	$350,000.00
Cartridge Filter Change Out	LS	1	$15,000.00	$15,000.00
			Annual Total	**$6,753,816.00**
			Cost per AF (24,200) (2010 Dollars)	$332.14

8.5 Analysis of Cost per Agency

Following is a rationale for allocating those costs which are to be borne by the Participants. The following categories of costs have been identified and include a methodology for allocation:

Research and Studies

- Development of MOU for exporting water from the Basin
- Simulation of hydrogeologic model of Basin

Capital and O&M costs associated with treatment

- Well inspection
- Well rehabilitation
- Well equipping
- Collection system
- Treatment plant
- Media
- Waste Disposal
- Power
- JPA

Allocate treatment capital costs by production allotment per Table 7-5 (Distribution Summary) per Table 8-4.

Table 8-4: Benefits Breakdown for Treatment, Production and Collection

	Unit	ALW	Glendora	WVWD	RWD	Total
Volume	(AF)	1,613	3,051	9,765	9,765	24,194
Percent of Total	(%)	6.67%	12.61%	40.36%	40.36%	100.0%

Capital and O&M costs associated with production and distribution

- Wells
- Booster station
- Pipelines
- Interconnections
- Disinfection
- Power

Due to the relative distance from the treatment plant to the various connection points and the anticipated maximum flow rate at those connection points, the benefit to each participant has been weighted accordingly. For a more detailed description of relative benefit, refer to Table 7-5 and Figure 7-5 which delineate and quantify distribution system components. In Table 8-7, L×D was introduced as a parameter developed to account for variations in pipe length and diameter in an equitable fashion. The L×D parameter for each pipeline segment is distributed among the participants by relative benefit.

For the pipeline segments that benefit all participants, the relative benefit was calculated as a weighted percentage of anticipated maximum flow rates per Table 8-5 as follows:

Table 8-5: Benefits Breakdown for Distribution All Participants

Participant	ALW	Glendora	WVWD	RWD
Max Flow Rate (gpm)	4,500	5,300	7,500	7,500
Weighted Percentage	18.15%	21.37%	30.24%	30.24%

For the pipeline segment that benefit only Glendora, WVWD and RWD, the relative benefit was calculated as a weighted percentage of anticipated maximum flow rates per Table 8-6 as follows:

Table 8-6: Benefits Breakdown for Distribution for Glendora, WVWD, and RWD

Participant	ALW	Glendora	WVWD	RWD
Max Flow Rate (gpm)	0	5,300	7,500	7,500
Weighted Percentage	0%	26.11%	36.95%	36.95%

For the pipeline segment that benefits only WVWD and RWD, the relative benefit was set at 50% each; and, the pipeline segment benefitting only Glendora received a relative benefit of 100% for Glendora.

Table 8-7: Benefits Breakdown for Distribution

Stakeholder	Length (feet)	Diameter (inches)	L×D	ALW	Glendora	WVWD	RWD
All Stakeholders	9,500	36	342,000	19,088	84,307	119,302	119,302
Glendora, RWD & WVWD	4,600	36	165,600	0	43,235	61,182	61,182
Glendora Only	5,400	24	129,600	0	129,600	0	0
RWD & WVWD	12,000	36	432,000	0	0	216,000	216,000
Distribution of Length × Diameter			1,069,200	19,088	257,142	396,485	396,485
Percentage of Benefit			100%	1.79%	24.05%	37.08%	37.08%

Chapter 9 – Project Implementation Schedule and Permitting

9.1 General Overview

In order to further the progress of the feasibility study and to further solidify the goals of the project, it will be necessary to proceed with the preliminary planning, design and investigation to determine the merits of the project. The project inherently will be subject to financial, planning and permitting constraints prior to its ultimate completion. What's more it is becoming increasingly important to plan appropriately and ensure that each of the project participants fully engages in the necessary steps to make the project a success. As a result a preliminary master schedule has been prepared to identify the next steps to be pursued during project implementation. ALW, Glendora, RWD WVWD are actively pursuing funding of the project through grants and low interest loans as available. A summary of available funding mechanisms are included in Chapter 10. In order to achieve the goals and ultimate success of the project, a formal funding plan should be prepared. Project participants have collectively joined resources to equally fund an original grant application which was successfully awarded $200,000 from the Water Quality Authority contingent upon acceptance of a feasibility study. For this reason project participant have joined together to fund this current effort. TVMWD was integral in providing the seed funding to support this study. As result a determination of the needs of the facility and ultimate distribution of responsibility has been developed. It is anticipated that project participants will collectively apply for funding from the WQA during its February 2010 funding cycle. This application will serve to further bolster the existing funding pool and enable the project participants to apply and secure grants and loans from other funding sources. General consensus among the funding entities concludes that they will be much more open to supporting a project if multiple funding sources commit to the project as well.

Implementation of this project is important to project participants to fully offset the negative impacts of increased rates from MWD and its water supply reliability. Project implementation will ultimately be contingent upon a creation of a final agreement between the project participants. Preliminary discussions have focused on the creation of a Joint Powers Authority to pay for capital, operations, and maintenance and ownership expenses of the facility. A distribution of responsibility has been presented in Chapter 8 relating to individual benefits and responsibilities from the project. Ultimately ALW and Glendora will receive water produced from the treatment plant during the peak demand season. RWD and WVWD are prepared to receive what remaining excess production is not being utilized by ALW and Glendora. Project participants are currently developing a memorandum of understanding to be reviewed and approved by each of the respective parties. It will be critical that a full agreement be developed well before final design of the project is complete.

In addition to establishing formal agreements between the project participants, RWD and WVWD are developing a cyclic storage agreement with the Water Master. Formal discussions with the Water Master were initiated on September 14, 2009 and a formal request to develop a cyclic storage agreement with the Water Master was issued the following week of September 2009. In light of this, project participation by RWD and WVWD will be contingent on their ability to complete an out-of-area water transfer (export from the basin) and substantiate their ability to deliver and store water within the Main San Gabriel Basin. RWD and WVMD are currently developing plans to deliver water to a location within the basin for storage. Plans for and development of procurement requirements will need to be in place for the ultimate success of the project.

In parallel with development of agreements the project participants view the need for analysis of the basin as paramount in considering the impact from operation of the wells to the basin. This analysis will identify the affects of pumping from these locations to basin flow and migration of the plume. An important component to this study will be to define what the future concentrations of contaminants may be during operation of the facility. This exercise will help to characterize what the ultimate needs of the treatment plant may.

In addition, initiation of the preliminary design should be authorized as early as possible. In this manner the ultimate needs of the site will be fully characterized and developed. Part of this effort should include the development of performance specifications (RFPs) that will solicit the most equitable treatment solution from the respective vendors who provide solutions for this type of treatment. A preliminary design will establish the allowable tolerances for site implementation and will document the ultimate design plan to a 50% level. It will be important; although not necessary, that prior to initiating final design plans that the selected vendors be brought on board to support the ultimate inclusion of their equipment into the final design. The RFPs may be developed in a way so as to require the vendor to install their own equipment or for the selected site improvement contractor to perform installation of the equipment as owner selected/furnished equipment.

Well inspection activities should be scheduled in a time frame early on in the preliminary design to determine the need for well rehabilitation. Some well conditions may preclude the ability for rehabilitation to be performed. Consistent with input received from operators of the respective wells, all wells appear to have the ability to be reactivated. As a result reactivation of the wells looks favorable. Considering this it should be noted that full production from the wells to original levels may be limited due to rehabilitation activities and the condition of the wells. Water quality sampling including a full Title 22 sampling and testing analysis should be performed. This will also assist in the selection of the final equipment for the treatment processes. In addition inspection of the well through video logging will provide the framework for determining the necessary down hole improvements that will be required to reactivate the wells.

Implementing well redevelopment, rehabilitation and well equipping activities may be coordinated with construction of the treatment to improve execution of project goals. Similar projects in size and scope have utilized the treatment plant equipment with sacrificial media provided at a lower cost to treat well testing water during normal well testing events which can will handle and treat the volume of water expected during testing. Water is treated and subsequently discharged to the nearest storm drain channel. In light of this the project schedule has been developed so as to ensure that final well development and testing be performed at a time when the treatment plant is operational. This will require that electrical improvements be made at the respective well sites and that the majority of the improvements at the treatment facility are in place prior to initiation of these activities.

9.2 Preliminary Project Schedule

A project schedule has been developed to identify key milestone necessary for project implementation and success. Overall it is anticipated that preliminary planning and design phases will take place over the next two years. The timing frames identified are commensurate with planning activities of projects of comparable scope and effort. The CEQA documentation phase has considered the development of an EIR document which inherently requires additional time for preparation and review. In consideration of the project as a whole this determination may be appropriate; however only the initial study will prove toward this or another determination. Initiating the CEQA effort as early as practical will be an important process in ultimate project success. The initial study may determine that another determination is appropriate. Final design will round out the planning and design phase in late summer of 2011. Final plant installation and procurement of equipment is anticipated to begin in the Fall of 2011 and final completion will take place in Fall of 2014 with start-up and permitting completion being executed at the end of 2014 or early 2015. Table 8-4 represents a summary of the project schedule. A detailed Gantt chart of the master project schedule is included in Appendix B.

This study constitutes the completion of the project conceptualization phase of the effort. Formal acceptance of this study is expected to be complete by April of 2010. Each subsequent step of the project schedule aside from establishing the Multi-Agency and Cyclic storage agreements is preceded by completion of this study. As a result it is important that this initial step be complete to move forward with the remaining portions of the work.

Well inspection is planned to commence in the beginning of April 2010. Well repair and rehab work will commence in the middle of 2013 to allow time for treatment equipment to be installed and operational for execution of final well pump testing. It is important that wells be cleaned, tested and placed into operation within a short time frame so as not to allow the growth of bacteria in the well.

Permitting of the project can commence at any time but has been scheduled in Spring of 2010 for the City and in the summer of 2011 for other State and County Agencies to ensure input from these permitting agencies is considered prior to final the design of the facilities.

Table 9-1: Project Implementation Schedule

Description	Duration	Start	Finish
Multi-Agency Ground Water Recovery Project	1440d	Mon 6/15/09	Fri 12/19/14
Multi-Agency Agreement	320d	Wed 9/16/09	Tue 12/7/10
Cyclic Storage Agreement in the Basin	458d	Mon 9/14/09	Wed 6/15/11
Project Conceptualization	143d	Wed 9/16/09	Fri 4/2/10
Technical Report	180d	Mon 4/5/10	Fri 12/10/10
Basin Plume Study	210d	Mon 4/5/10	Fri 1/21/11
DPH Permitting	1230d	Mon 4/5/10	Fri 12/19/14
Policy Memo 97-005	405d	Mon 1/24/11	Fri 8/10/12
DPH Permit	915d	Mon 6/20/11	Fri 12/19/14
City Permitting	490d	Fri 4/16/10	Fri 3/2/12
CEQA	395d	Mon 8/30/10	Fri 3/2/12
Conditional Use Permit Processing	195d	Fri 4/16/10	Fri 1/14/11
City Department Approvals	65d	Mon 8/22/11	Fri 11/18/11
Regional Water Quality Control Board Permitting	135d	Mon 6/20/11	Fri 12/23/11
Los Angeles County Sanitation District	120d	Mon 6/20/11	Fri 12/2/11
Well Rehabilitation	1130d	Mon 4/5/10	Fri 8/1/14
Well Inspection	105d	Mon 4/5/10	Fri 8/27/10
Well Repair/Rehab	295d	Mon 6/17/13	Fri 8/1/14
Treatment System Procurement	215d	Mon 8/30/10	Fri 6/24/11
Treatment System Design	105d	Mon 3/28/11	Fri 8/19/11
Treatment System Installation	760d	Mon 11/21/11	Fri 10/17/14
Funding and Grant Applications	800d	Mon 6/15/09	Fri 4/26/13

9.3 Preliminary Permits

As early on in the preliminary design phase it will be important to determine the minimum requirements of the City pursuant to City ordinances as applicable for a variation in the land use characterization of the site. Currently the site is occupied with water pumping, storing and conveying equipment. The character of the site will be changed slightly to include water treatment facilities and appurtenances. The City may have certain requirements that will impact final design. The schedule identifies a time for initiating City coordination a number of days after preliminary design has begun. Ultimately all City coordination including SUSMP and building department approvals will be executed at the appropriate times to continue work progress.

Permitting from the State and County agencies will also need to commence as early as practical. Typically CDPH desires to review and see a preliminary design report that identifies specific features of the project coupled with the CEQA determination. It will also be necessary to evaluate the need to prepare a report in compliance with policy memo 97-005. As a result the Basin Plume study should be prepared as early as possible to support this component of the effort. CDPH will also require that the plant be operational for a certain period of time prior to acceptance and permit issuance. This typically entails operating the plant at full capacity with the majority of water being directed to waste. In this case a permit with the RWQCB will need to be issued to determine requirements for discharge. This exercise will also include interaction with the County of Los Angeles Department of Public Works and their ultimate approval of the discharge. Discharge of waste brine will also need permitting

Chapter 10 – Recommendations And Next Steps

10.1 Recommendations

By in large the ultimate success of this project will be contingent upon successful completion of a coordinated and focused effort by all project participants. It will be necessary to formalize party agreements and to solidify acceptance of the out-of-area transfer with the Watermaster. The project participants should continue efforts to apply for funding with the Water Quality Authority and other applicable agencies. This will greatly improve the attractiveness of the project from a financial standpoint and will lessen the impact of purchasing high cost MWD water now and in the future. Currently the combined Capital, Operations and Maintenance outlay of funds in year 2010 dollars equates to a cost of $490 per AF of water produced, treated and delivered. The cost of replenishment water may be as high as $526 per AF as detailed later in this chapter. However; other alternate sources for replenishment may become available at a lower cost. This may ultimately bring the total cost of producing water to a value of $1,016 per AF. Current Tier 1 rates from MWD are $701 per AF and represent a 21% increase over the previous year's rate. Continuing this trend will bring MWD water to a value over $1,000 per AF in the next two years (year 2012). This timeline converges with commencement of the construction portion of the work effort and by the time construction is complete rates from MWD may be higher than this. The attractiveness of this system is its ability to produce water from the basin for less than the cost of MWD water while providing a local supply source that is reliable and available for each of the project participants.

In light of this it is recommended that the project participants continue to develop a draft Memorandum of Understanding between each other and with the Watermaster for replenishment water. Also conduct a hydrogeologic study of the Basin with respect to the impact of activating the wells on the contamination plume and proceed with the preliminary design phase of the project.

10.2 Coordinating the Missions of the Interested Parties

Water Retailers and Wholesalers

The five agencies backing this project (WVWD, TVMWD, RWD, ALW and the City of Glendora) have essentially the same mission which is to provide high quality water to their customers at a reasonable price. Implementation of this project is consistent with this mission by securing a redundant high quality local source which will serve to temper the volatility of the cost of imported water.

Management of the Main San Gabriel Basin

The Main San Gabriel Basin Watermaster has an obligation to achieve the maximum utilization of the Basin through the monitoring and management of extraction and replenishment. The Watermaster manages and controls the withdrawal of groundwater/surface water and replenishment of imported water supplies in the basin and determines the amount that can be safely extracted. The Watermaster coordinates imported water deliveries and recharge. Watermaster coordinates local involvement in efforts to preserve and restore the quality of groundwater in the basin.

Availability of Replenishment Water

Mission Statement of the Water Replenishment District of Southern California

"To provide, protect and preserve high-quality groundwater through innovative, cost-effective and environmentally sensitive basin management practices for the benefit of residents and businesses of the Central and West Coast Basins."

The San Gabriel Valley Municipal Water District, the Upper San Gabriel Valley Municipal Water District, Three Valley Municipal Water District and the Metropolitan Water District of Southern California are directly or indirectly responsible for providing imported replenishment water used to recharge the Main San Gabriel Basin. Untreated surplus water from the SWP and the Colorado River Aqueduct is provided at a discount for replenishment purposes through these agencies. However, the availability of imported replenishment water is inconsistent. The current prolonged drought has negatively impacted the availability of imported water for replenishment, and the responsible agencies are now looking elsewhere for additional replenishment sources.

Highly purified recycled water is an attractive alternative source for replenishment and has been used extensively in the Central and West Coast Groundwater Basins for spreading and injection. Of note is the Seawater Barrier Water Conservation Project which involves injecting a mixture of imported and recycled water along the coast to prevent seawater intrusion into the groundwater supply. West Basin Municipal Water District is currently expanding its use of recycled water in an effort to deflect imported water costs and improve the reliability of its local resources.

Another such project with implications for the Main San Gabriel Basin, still in the planning stages, is the Groundwater Reliability Improvement Program (GRIP) which is a multi-agency effort to provide advanced treated recycled water produced at the San Jose Creek Water Reclamation Plant for spreading in the Main San Gabriel and Central Basins. The agencies involved are the San Gabriel Valley Municipal Water District, the Upper San Gabriel Valley Municipal Water District, the Sanitation Districts of Los Angeles County and the Water Replenishment District of Southern California. Once complete, GRIP will provide 25,000 acre-feet per year for replenishment purposes in the

Main San Gabriel Basin and 21,000 acre-feet per year in the Central Basin. Opposition to a similar proposal in 1994 caused the project to be suspended during the public outreach phase; however, similar opposition is not anticipated for the current project.

In the South Coast region, recycled water is becoming increasingly valuable given its reliability and cost-effectiveness as compared to tapping other water supplies. In addition to extending conveyance systems to deliver recycled water for non-potable uses, the region is leading implementation of groundwater recharge and reservoir augmentation with recycled water.

Referring to Section 7.2.3, approximately 21,000 AFY of replenishment water is needed to offset the volume anticipated to be exported to WVWD and RWD. Some combination of replenishment water purchased from MWD or San Jose Creek WRP (pending completion of GRIP) appears to be the most expedient method for developing a cyclical storage within the Basin. It may also be possible to develop an independent source similar to GRIP.

According to MWD, as of January 1, 2010, the rates for replenishment water are as follows:

Replenishment Water Rate (untreated)	$366/AF
Treated Replenishment Water Rate	$558/AF

However, these rates are subject to availability. According to the meeting minutes of the Regular Meeting of the Main San Gabriel Basin Watermaster held December 9, 2009, replenishment water was available from MWD (via USGVMWD) at rates of $526/AF (Untreated Tier 1) and $655/AF (Untreated Tier 2) for up to 40,000 AF.

State and Regional Integrated Resource Planning Efforts

There are ongoing planning efforts to integrate management of statewide water resources pursuant to California Water Code §10005 as indicated by the California Water Plan (Update 2009) Mission Statement:

Updating the California Water Plan provides State, federal, Tribal, regional, and local governments and organizations a continuous strategic planning forum to collaboratively:

- Recommend strategic goals, objectives, and near-term and long-term actions that would conserve, manage, develop, and sustain California's watersheds, water resources and management systems;

- Prepare response plans for floods, droughts, and catastrophic events that would threaten water resources and management systems, the environment, property, and the health, welfare and livelihood of the people of California; and

- Evaluate current and future watershed and water conditions, challenges, and opportunities.

Regional efforts include the Greater Los Angeles County Integrated Regional Water Management Plan (IRMWP) and the MWD Integrated Resource Plan (IRP). The purpose of this IRWMP is to improve water supplies, enhance water supply reliability, improve surface water quality, preserve flood protection, conserve habitat, and expand recreational access in the Region. Observations made at the state and regional levels are consistent with the following areas of concern for implementation of this project:

- Regionalization and consolidation of managerial coordination among utilities
- Increased groundwater production
- Development of recycled water as a replenishment source

10.3 Financing

The development of funding plans is based on the unique set of financial conditions of the partnership of agencies with interest in this groundwater recovery project. This section identifies some of the issues that should be considered in the development of a financing plan. This project will likely be financed by a combination of resources and funding methodologies. Some of the more common financing techniques, including common types of debt instruments applicable in this case, are reviewed herein.

10.3.1: Pay-As-You-Go

The accumulation of current funds for improvement projects is referred to as "pay-as-you-go" financing. This method of financing requires that the total capital cost of the improvements is accumulated in advance of the start of construction. Large projects may require several years to accumulate the necessary funds. This method of funding is ideally applicable to smaller projects. Pay-as-you-go financing eliminates interest costs. Projects to modernize or otherwise improve an existing system are appropriate for this method of financing. The pay-as-you-go method requires matching needed improvements to water revenues, and an adequate water rate structure to ensure proper phasing of improvements.

10.3.2: Pay-As-You-Use

Capital items with a long useful life can be financed over the life of the project on a “pay-as-you-use” basis using debt instruments. The term of borrowing should coincide with the estimated useful life of the improvements, if market conditions permit, and the debt obligation is within the community’s ability to pay.

10.3.3: State Revolving Fund (DWSRF)

The Drinking Water State Revolving Fund (DWSRF) program is an innovative method of financing for state water programs to further the goals of the SDWA. Under this program, EPA provides grants to states to set up DWSRF programs. These programs consist of federal and state matching funds placed in a revolving loan fund to finance low interest loans for construction of the eligible water projects, which address the public health and compliance priorities of SDWA. Additionally, states can set aside federal funds from each grant to be used for state water program items and/or direct assistance to water systems subject to specified maximum limits for each activity.

Provisions in the SDWA require at least 15% of the loan fund be used for the direct benefit of small systems. Other provisions allow for subsidization of loans for economically disadvantaged communities. A unique provision of the DWSRF requires that communities not receive a loan unless they can demonstrate the technical, managerial, and financial capacity to comply with the SDWA, or they agree to make the changes necessary to come into compliance.

10.3.4: DWR Water Bond 2000 – Proposition 13

The Water Bond 2000 measure, Proposition 13 approved March 2000, provides loan and grant funding for urban and agricultural water conservation, groundwater recharge and storage and infrastructure rehabilitation projects or feasibility studies. The DWR is developing administrative regulations, policies and applications for these new programs.

- Groundwater Storage Program ($200 million): Provides money for grants to public agencies and mutual water companies to fund feasibility studies, project design or the construction of facilities for conjunctive use projects.

- Interim Water Reliable Supply and Water Quality Infrastructure and Management Program ($180 million): Provides grants and/or loans to local agencies in the Delta export service areas for programs and projects designed to increase water supplies, enhance water supply reliability, or improve water quality.

10.3.5: Metropolitan Water District

MWD offers financial incentive for the development recycled water and groundwater recovery projects through the Local Resources Program (LRP) established in June 1998. New and expansion of existing water recycling and groundwater recovery projects are eligible for funding provided they include construction of new substantive treatment or distribution facilities. MWD currently provides a financial contribution of $154 for each new acre-foot of water developed from local water recycling that replaces a demand on MWD's system. Local agencies may receive up to a maximum of $250 per acre-foot of firm yield for groundwater recovery projects that treat contaminated groundwater and produce clean water. Participation in the program is through a competitive request for proposal (RFP) process that seeks to identify local projects that best meet the region's need and provide the greatest return on investment.

The LRP is open to public and private water utilities within MWD's service area. Applications must be made through the applicant's respective MWD member agency. Applicants are strongly encouraged to initiate early coordination with MWD regarding proposed projects. Submittal of a LRP application does not signify or guarantee funding approval by Metropolitan.

Prior to each fiscal year of operation, MWD will set an estimated incentive rate payment for deliveries during the year. At the end of each fiscal year, MWD will conduct a reconciliation to determine the actual incentive rate based on actual project costs and production data. At that time, over- or under-payment adjustments are made between MWD and the project sponsor. The calculated incentive rate may diminish in future years as MWD's water rates increase and each project's annual yield increases.

MWD will meet with applicants to ensure a complete understanding of the proposed project's objectives and benefits. After completion of project review and assessment, agreement terms negotiations, and environmental documentation, the proposed project would be forwarded to MWD's Board of Directors for funding consideration.

10.3.6: Revenue Bonds (1911 and 1915 Acts)

Revenue bonds are used to finance capital infrastructure which is revenue producing. Revenue bonds are special obligations of the issuing entity with repayment solely from the revenues produced by the constructed infrastructure and from no other source of funds. Normally, revenues derived from the constructed facilities must also be sufficient to cover the cost of maintaining and operating the facility. In addition, bond covenants pledge that net revenues will be equal to an amount sufficient to meet all repayment and expense obligations plus an operating margin or coverage which typically varies from about 1.2 to 1.5 times the amount of the debt service. Coverage margins typically reflect the source of the loan as well as the financial characteristics and credit worthiness of the issuing agency. Water system facilities are typically financed with the use of revenue bonds in accordance with the Revenue Bond Law of 1941. In accordance with this Act, an election must be held with a majority of the voters at the election approving the revenue bond issue.

Since the passage of Proposition 13 limiting the allowable increases in annual property taxes, the creation of assessment districts, in existence since the early 1900s, has been a popular alternative method of financing public infrastructure. Approximately one third of privately owned property in California is included within an assessment district. Assessment districts are created in accordance with either the Improvement Act of 1911 or the Municipal Improvement Act of 1913. The former act can also be used to fund improvement maintenance. These two acts set forth the procedures for implementing an improvement project and for levying the assessment to pay for such work. Assessment bonds to fund capital improvements can be issued by assessment districts in accordance with associated assessment bond acts. The prior referenced Improvement Act of 1911 provides for authorization to levy assessments and issue related bonds. However, the Improvement Act of 1913 has no bond procedures, but improvements can be financed through a subsequent bond act known as the Improvement Bond Act of 1915 (solely a bond act). These acts may be utilized in various combinations. There may be a 1911 act assessment with a 1911 or 1915 act bond; or a 1913 act assessment with a 1911 or 1915 act bond. However, there is no such thing as a 1913 act bond or a 1915 act assessment.

An assessment district is created by a local sponsoring governmental agency. Property owners typically initiate the assessment district creation by circulating a petition which must be signed by property owners representing 60% of the benefited land area. It is essential that properties within the assessment district, which will bear the burden of tax levies to pay for the bond financings receive a direct and special benefit (as distinguished from general benefits obtained by the community as a whole). Following the creation of the assessment district, bonds can be approved by the governing board only after the preparation of an Engineer's Report and at the conclusion of a public hearing. In accordance with Proposition 13, the property assessment cannot be based directly on the value of each property but on a mathematical formula that takes into account how much each property will benefit from the constructed infrastructure. Each parcel in the assessment district is obligated for a fixed percentage of the total district debt and will be assessed each year for that portion of the annual debt service.

10.3.7: State Grants - Proposition 84 and Proposition 1E

The State of California has two current grant programs available to finance water infrastructure. Proposition 84 (known as the California Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act) and Proposition 1E (Disaster Preparedness and Flood Protection Bond Act of 2006) authorized the Legislature to appropriate funds to help water agencies address the current statewide drought and provide a first step toward investing in water supply reliability under the provisions of Senate Bill SBx2 1. This grant program is administered by the Department of Water Resources.

Chapter 2 of Proposition 84 provides approximately \$1.5 billion for safe drinking water and water quality projects of which approximately \$0.5 billion has already been committed. An additional \$1 billion would be provided to local agencies and regional entities for integrated regional water management. Integrated regional water management includes actions to provide long-term reliable water supplies and other benefits. Based on past programs, \$1 billion in state investment will leverage an estimated $3 billion in local investment and provide 1 million acre-feet of new water supply or reduced demand each year.

10.3.8: Certificates of Participation

In lieu of funding capital improvement projects on a pay-as-you-go basis or by assessment proceedings, a financing vehicle referred to as Certificates of Participation (COP) may be utilized. COPs were first developed in the late 1970's in response to Proposition 13, which limited an agency's ability to finance services and capital expenditures through property tax increases and general obligation debt. Proposition 13 prohibits agencies from incurring bonded indebtedness without voter approval. However, agencies can enter into long-term lease obligations in lieu of bonded debt. The COP structure is an extension of a long-term lease sold as a tax-exempt investment in the capital markets.

Agencies typically use two types of COP structures. The first, a COP is issued that directly finances certain capital improvements and a long-term lease purchase agreement with a nonprofit lesser is entered into. The agreement requires the improvements to be leased back at an annual cost equal to the annual debt service on the COP. Upon redemption of the COP, the sponsoring agencies receive title of the financed capital improvements. The second alternative involves the mortgaging or refinancing of publicly owned land and improvements. The proceeds from the mortgage can fund projects including land acquisition, new facilities construction, capital improvements and equipment purchases. This COP structure, known as the Asset Transfer Program (ATP), enables equity in existing real property to be pledged for financing new projects. Under this method, an existing facility is sold to a non-profit corporation (typically comprised of members from the governing body) and a long-term lease purchase agreement is entered into at an annual cost equal to the debt service on the COP that initially financed the purchase of the facility. Upon redemption of the COP, title to the refinanced facility reverts to the sponsoring agencies at no additional cost.

The primary security for repayment of a COP is a pledge to establish rates and charges that will produce revenues, on an annual basis, in an amount sufficient to support the annual lease obligation to the non-profit corporation.

The ATP can provide at least four notable advantages over more conventional forms of tax-exempt financing and direct COP:

- By borrowing against the appreciated value of existing property and improvements, investors are provided with greater security, in the form of real property and existing improvements, as compared to a simple pledge of proposed capital projects.

- By refinancing existing facilities, the need to capitalize interest during construction is eliminated, thereby reducing the total size of the issue and substantially decreasing the overall cost of borrowing.
- By eliminating the need for a conditional or provisional rating to be assigned, the marketability of the COP improves.
- Water enterprise funds spent on capital improvements without the availability of ATP proceeds are invested without any arbitrage restrictions.

A COP can provide a flexible, cost effective vehicle to finance capital improvements. The COP can finance capital programs or leverage existing facilities. Additionally, the sponsoring agencies may choose to finance capital projects with a COP in lieu of enterprise funds, and invest a like amount of moneys without any arbitrage restrictions. Each of these structures can satisfy the goal of providing capital improvements at the lowest cost to customers.

10.3.9: Water Quality Authority

The WQA has and continues to be committed to the goals set forth in the §406 Plan. This project falls clearly under two of the WQA's §406 Plan goals: integrate cleanup with water supply, and minimize economic impact to the public. Further study and/or coordination with ongoing and future efforts within the Basin may also demonstrate that this project affects the remaining §406 Plan goals (accelerate removal of contaminant mass in the basin, and prevent migration of contamination into critical groundwater supplies), though to a lesser extent. As such, it is within the WQA's interest to assist in acquiring adequate funding necessary for implementation.

While the WQA recognizes that potentially responsible parties (PRPs) must fulfill their CERCLA liabilities, it is often a very slow process - a process that jeopardizes the time and cost of implementing projects. In addition, even though USEPA has urged PRPs to consider affected water supplies, the CERCLA process does not allow USEPA to require it. It is for these reasons that WQA is determined to aggressively seek funds from PRPs before, during and after project implementation, either voluntarily, through mandated CERCLA actions or through litigation measures. If funds cannot be generated from PRPs to begin an identified early action project, WQA will work with individual purveyors, Watermaster and/or other local agencies to develop funding for the project using federal and/or state funds, WQA member agency funds, including individual purveyors, and only if necessary, its own assessment. This section prioritizes each potential source of funding in the order of which it will be sought for a particular early response action.

Potentially Responsible Parities

As stated previously, WQA will seek voluntary funds from those responsible for the contamination. If the process of acquiring those funds is unilaterally stalemating or delaying the project, the WQA will move forward without this source of funds to ensure necessary cleanup/water supply projects are implemented.

The WQA is committed to securing PRP funding for any given project by providing incentives for PRPs to participate financially. In the absence of sufficient PRP funds, WQA and others may be required to combine their resources to fund a project. In this event, WQA may choose to initiate cost recovery actions. This was the case in the BPOU, in which WQA brought two separate legal actions against PRPs in the year 2000 to recover costs incurred from the La Puente Valley County Water District (LPVCWD) Treatment Plant and the Big Dalton Well Treatment Facility.

In 2002, WQA along with three affected purveyors jointly settled with 13 of the more that 60 PRPs in the South El Monte Operable Unit. Thereafter, the water entities initiated litigation against the remaining PRPs in a concerted effort to recover escalating costs and ensuring funds for future operations of the cleanup projects built with WQA participation.

Federal Government

The WQA, with the support and assistance of other local agencies, has sought and continues to seek all funding that may be available for projects in the Basin. As a result of those efforts, two federal programs have been authorized by Congress specifically for the Basin. Both of these reimbursement programs are administered through the United States Bureau of Reclamation (USBR) directly to the WQA. In February of 2001, WQA adopted a set of procedures called the Federal Funding Program Administration to guide the allocation process for both programs.

Both sources of federal funding will be used to the maximum extent possible to accelerate cleanup and to provide incentives for PRPs to address affected water suppliers while implementing cleanup actions in the Basin under CERCLA.

Restoration Fund (Dreier)

In December of 2000, Congress authorized the San Gabriel Basin Restoration Fund. The authorization of the Restoration Fund, when fully appropriated, will provide $85 million for groundwater cleanup of which $10 million is for use by the Central Basin Municipal Water District to clean up the Central Basin and $75 million is for use by the WQA to clean up the Main San Gabriel Basin. To date, the Central Basin has received its full $10 million appropriation and WQA has received $65 million of its $75 million appropriation. The WQA Board has already allocated the $65 million for cleanup projects based on criteria found in its Federal Funding Program Administration guidelines.

This program requires a 35% non-federal match deposited into the Restoration Fund to reimburse the WQA up to a maximum of 65% from federal sources. Non-federal funds are classified as funds that are not from the Department of the Interior, but rather PRP funds, state funds, local municipality funds, purveyor funds, WQA assessment funds or non-profit funds. Funds from this program may be used for design, construction and operation & maintenance for up to 10 years following construction. The Restoration Fund is administered via the USBR in conjunction with the WQA for use within the Main San Gabriel Basin.

Congress acknowledged that millions of dollars had already been spent to protect the Main San Gabriel Basin by remediating the groundwater and preventing further contamination. Due to the emergency nature of the contamination and the threat it posed to the local groundwater supply, Congress allowed the use of those past expenditures as a credit towards the 35% non-federal matching requirement under this program. The USBR is responsible for approving all qualifying prior expenditures. However, the WQA, at its discretion, will use this credit to meet the 35% matching requirement and eliminate the need to deposit additional funds into the Restoration Fund.

As of 2008, WQA had accumulated past cleanup cost information totaling more than $47 million. This amount was sufficient to meet the 35% non-federal matching requirement for the $75 million appropriated by Congress and deposited into the Restoration Fund. Based on more recent information, it is clear that additional funding will be required to continue the progress of ensuring that remedial activities will be combined with local water supply needs. The WQA expects to receive a $4 million appropriation for Fiscal Year 08-09. In 2009, the WQA will seek an additional $6 million appropriation for the Restoration Fund.

In recognition of the cleanup progress, and the need for additional funding to meet an estimated $552 million funding gap, Congressman David Dreier along with his colleagues in the San Gabriel Congressional Delegation introduced H.R. 123 in January of 2007. H.R. 123 would have raised the authorization on the Restoration Fund by $50 million and increasing the total cap to $135 million. However, while H.R. 123 passed the U.S. House of Representatives it was not heard or voted on in the U.S. Senate.

In January 2009, Congressman Dreier reintroduced the H.R. 123 language as H.R. 102 in the new Congressional session. In addition, Senator Harry Reid introduced S. 22 in the U.S. Senate and it also included the language of H.R. 102. S. 22 passed the U.S. Senate and are awaiting passage in the U.S. House of Representatives.

Title XVI

In 1992, Congress authorized the San Gabriel Basin Demonstration Project to implement conjunctive use projects in the Main San Gabriel Basin. By implementing cleanup projects that provide a reliable source of water and reduce the need for outside sources of water, many of the Basin's cleanup projects are eligible for this program.

This program requires a 75% match from non-federal sources to reimburse the project up to a maximum of 25% from federal sources. Funds from this program may be used for design and construction only. The Title XVI fund is administered via the USBR directly to the WQA for use within the Basin.

Based on the Basin's enormous need for funds, the WQA will continue to work to secure full appropriation of the remaining funds in the Title XVI authorization, and work with Congress to seek legislation authorizing the transfer of any unobligated funds in the Title XVI program to the Restoration Fund.

In 2004, Congresswoman Grace Napolitano authored H.R. 1284 which was passed and signed into law. The legislation raised the cap on the Title XVI program by $6.5 million. The total authorization for the Title XVI program is now $44.5 million.

New Water Supply Coalition/Tax Credit Bond Legislation

The WQA is a member of the New Water Supply Coalition. The Coalition is composed of water districts located from Hawaii to Florida. The Coalition seeks to fund water infrastructure projects throughout the United States by using Tax Credit Bonds. In 2007, the Coalition was successful in having Congressman Xavier Becerra and Congressman Jerry Porter introduce H.R. 3452, the Clean Renewable Water Supply Bond Act. This bond act would provide a potential source of funding for the WQA's cleanup projects and allow the WQA to float Tax Credit Bonds that would provide the holder of the bond with a tax credit to offset their tax liability. Although the bill died in Congress, the Coalition expects that some form of the Clean Renewable Water Supply Bond Act language will be reintroduced in 2009.

State Government

As described in the sections above regarding the Restoration Fund and Title XVI funds, a non-federal match is required in order to release the federal funds. While WQA will continue to work with PRPs to help meet that match, additional funds will be needed to release the millions of federal dollars dedicated to the Basin cleanup. To date, the State's participation in cleanup has been nominal. The WQA will, continue to focus on securing bond funds through Proposition 50, the Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002. The WQA will apply for bond funds from Proposition 50 for projects that meet the timeline and requirements of Chapter Guidelines in the programs available through Cycles 2 and 3 of the program. The WQA will also seek to participate in any programs it is eligible for under Proposition 84, the Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006, as well as through the Integrated Regional Water Management Plan.

To date the WQA has been precluded from participating in bond funding by the timelines and application guidelines developed by the state. State bond fund regulations preclude the use of bond funds for operating and maintaining projects which are in reality the actual cleanup. Operations and maintenance funding dollars are the primary source for the $552 million gap in cleanup cost.

The WQA will seek to place language in any proposed State Infrastructure Bonds. Working with other water entities in the Basin, the WQA will lead efforts to formulate a comprehensive approach to water infrastructure in the Basin. The WQA will look to any future proposed bond packages for much needed funding for cleanup projects in the Basin.

The WQA will work to educate State agencies on the merits of financial participation in the near term and the potential impacts of lack of participation on State Agencies in the future. The WQA will emphasize that stemming the flow and mitigating the spread of contamination will be more cost effective and have less of an impact on both the State and local ratepayers.

The WQA has actively worked with California Environmental Protection Agency and other stakeholders in Sacramento to become part of the state budget. These efforts will continue in the coming year and will include meeting with state stakeholders, state legislators and the Governor's office.

The WQA will continue to pursue legislation at the state level that would create a state Restoration Fund modeled after the federal Restoration Fund. The state Restoration Fund will be a vehicle for the WQA to seek state funding in the future from the state budget, future Bond proposals and other state funding programs.

The WQA is also actively involved in hosting, representing and financially supporting the Upper San Gabriel and Rio Hondo sub-regional areas of the Greater Los Angeles IRWMP. As the Vice-Chairperson of the Upper San Gabriel and Rio Hondo sub-regional steering committee, the WQA Executive Director provides and solicits input and opportunities for local stakeholders to network and develop multi-benefit projects. This in turn increases the likelihood of funding from IRWMP bond funds. For example, what may have been a single-purpose project to increase water supply, could become a project that enhances nearby open space, cleans-up water supply and/or provides more water storage.

The WQA Executive Director is also a Leadership Committee member of the Greater Los Angeles Integrated Regional Water management Plan (IRWMP). This committee is represented by two members from each of the five sub-regions in the Greater Los Angeles area. The duties of this group include representation of the sub-regions to the full Leadership Committee and to finalize IRWMP plans and endorse/select priority projects that represent and benefit the needs of the entire Greater Los Angeles area.

Water Quality Authority

The WQA may impose an annual assessment for capital and operational costs not to exceed $10 per acre-foot. In the past, it has been WQA's policy to utilize assessment dollars to provide incentives for PRPs to move forward on a given project. With the recent availability of significant federal funds, these funds will only be utilized if sufficient federal and/or state dollars are or will not be available in addition to PRP funds. If PRPs do not voluntarily provide funds to a project, then the WQA will, on a project-by-project basis, consider the use of assessment funds to underwrite the project costs with or without other local dollars. However, the WQA is committed to recovering its costs from non-participating PRPs at a later date, so that the cost to the local consumer will ultimately be minimized.

The WQA Act provides that WQA may issue bonds for a term not to exceed 20 years for any purpose authorized by it. Additionally, the WQA Act authorizes the State Treasurer to continue to collect assessments to payoff bond obligations in the event that WQA sunsets prior to the bonds' maturity date. WQA has begun exploring this option in addition to the other funding mechanisms available as a means to augment treatment and remediation costs over the next several decades.

Water Purveyors/Cities/Member Agencies/Other Local Water Agencies

As of January 2001, all potential projects requesting WQA participation must go through WQA's Procedure No. 38, "WQA Project Participation". As part of that procedure, the WQA requires the impacted water purveyor to fund or secure funds other than WQA's assessment representing a minimum of 25% of capital costs. In the event projects cannot be otherwise fully funded using any or all of the above funding sources, WQA will work with an affected city, member water agency and/or other local water agencies to develop potential funding sources. The WQA will pursue the recovery of these funds on behalf of the participating agency, if necessary.

10.3.10 Funding Recommendation

Given the complexities of establishing the benefits to each participating agency and procuring a reliable source of replenishment water, development of a financing plan may require further study and negotiation. WQA, through their experience in matters of financing groundwater cleanup in the Main San Gabriel Basin, is an excellent resource and should be consulted.

Methods of Well Rehabilitation

This appendix includes a summary of strategies and techniques common to well rehabilitation in the region.

Drilling Methods

Methods typically used for drilling water wells are rotary and cable tool. Municipal and irrigation wells are drilled at larger diameters than typical private wells, and such is the case for the wells in this study.

In rotary drilling, a drill bit is attached to a length of connected drill pipe. The drill bit is made of tough metals such as tungsten, and as the drill is rotated, the bit acts to grind up the rock. The broken pieces, or cuttings, are flushed upward and out of the hole by circulating a drilling fluid (sometime called drilling mud) down through the drill pipe and back to the surface. This drilling fluid also serves to cool and lubricate the drill bit, and by stabilizing the wall of the hole, it can prevent the possible cave in of unstable sands or brittle rock before the well casing or well screen is installed. As the drill intersects water bearing rock formations water will flow into the hole. Wells drilled using the rotary method typically feature a casing with a long screened interval and gravel pack. Normal chemical and mechanical cleaning techniques may be employed to recover a rotary drilled well to production rates observed previously. A decline in production may ensue but can typically be restored through a repeat of the cleaning process. If well conditions are observed to be damaged it may be necessary to reline the well with a steel-liner and associated filter pack. A video log of the well would be necessary after cleaning is performed to determine to the full extent of the damage.

Another drilling technique uses a "pounder" machine, usually referred to as cable tool drilling. This method is slow and in most places has been replaced by rotary drilling. With this method, a heavy bit is attached to the end of a wire cable and is raised and dropped repeatedly, pounding its way downward. Cable tool drilling typically consists of pulverizing the substrate through impact of the drill head and recovering drill material through bailing. Periodically, cuttings are bailed out of the hole. The borehole is stabilized with a steel casing as it is advanced down hole. Perforations are subsequently cut with knife perforations at select intervals. Wells drilled by this method typically do not have a gravel pack which makes restoration to previous production levels difficult. Cable tool installations employ wire-brushing and tight fitting swab and air lifting methods for cleaning followed by chemical treatment but rarely recover production capacity to original levels.

Implementation of rehabilitation procedures for an individual well should generally include some or all of the following steps:

1. Review well specifications and as-built drawings
2. Review historical production and annotated operation records
3. Pull and inspect the pump
4. Perform a video survey,
5. Perform mechanical cleaning of the well screen,
6. Apply the proper quantity and type of chemical treatments,
7. Allow sufficient chemical reaction time,
8. Remove spent chemicals from the well,
9. Reinstall the well pump, and
10. Conduct a performance pumping test.

The subject wells shall be subjected to additional investigation to confirm their suitability for return to service. Additional work would include contracting a well drilling company to clean and video log the well casing. If the video confirms the casing and perforations are in suitable condition, additional well work including rehabilitation and test pumping is recommended. If additional work confirms that the wells can be rehabilitated, then they can be equipped with a new pump and motor and placed in service.

Indications for Rehabilitation

Once a problem has been identified, the potential sources of the problem should be evaluated. The operation history of the well should be reviewed along with the results of any previous treatment efforts. The existing data may need to be supplemented by conducting performance tests to determine the current condition of the well and pump. If it is necessary to remove the well pump, a down hole video survey should also be performed. A proper treatment procedure should then be developed to address the specific well problems.

Typical indications for well rehabilitation include incrustation, biofouling, physical plugging of the formation or screen, and corrosion.

Incrustation, or scale, is caused by the settling out of dissolved minerals and their compounds from the groundwater. The settling out is accelerated by the turbulence and high velocity of the groundwater as it enters the vicinity of the well during pumping. Incrustation can take several forms. It may form a hard, brittle, cement-like deposit or a soft, paste-like sludge. Incrustation is often found together with biofouling.

Biofouling is the clogging of a water well by communities of natural organisms which create slime deposits in and around the well. These slime deposits are the result of the accumulation of living and dead bacteria (sheaths, stalks, secretions and other leavings) and their reactions with dissolved minerals in the well water. In addition to health related problems, bacteria and other microorganisms may affect water quality and contribute to clogging, corrosion and changes in water treatment performance. Biofouling generally causes side effects such as intermittent sulfide odor, breakthroughs of red water, and pitting-type corrosion of iron and steel. Factors that cause biofouling may include inappropriate design, material, construction, water treatment or use patterns. Long periods of non-use allow biofouling growths to build up as may be the case for the wells involved in this study given the duration of their inactivity.

Physical plugging of the formation or screen results in some loss in specific capacity over time due to the slow movement of fine particles in the near-well area where they hinder water flow into the well. The accumulation of fine creates turbulence in the near-well area increasing sand pumping. Sand pumping in screen wells can erode the screen to the point where replacement of other action needs to be taken.
Corrosion may take one or more of the following forms:

- Failure of the well casing in the form of holes allowing fines to enter the well resulting in sand pumping.
- Deposition of the products of corrosion which reduce flow and yield.
- Inflow of low quality water through holes caused by casing corrosion.
- Complete failure due to reduction in the strength of the casing or well screen.

Chemical Rehabilitation

Chemicals are used in water well rehabilitation to remove products that are blocking or plugging the well environment. Well blockage or slowdown can be caused by mineral buildup on screens or in-flow spaces of the gravel pack or formation, or biological build-up on these same surfaces. Most often, a combination of chemicals is used for the rehabilitation of the well. Following are some of the general classes of chemicals and a few examples of each.

Mineral Acids

Mineral acids are used to dissolve mineral precipitates like calcium carbonate and sulfate, magnesium hydroxide, iron and manganese oxide, phosphates, silicates, and mixtures of all of these. Carbonates are the most easily dissolved with the resulting release of carbon dioxide. An example would be the action of hydrochloric acid on calcite (calcium carbonate).

In this reaction, the acid HCl breaks apart the calcite, ($CaCO_3$) into the salt ($CaCl_2$) and carbonic acid (H_2CO_3) which further breaks down into water (HOH) and carbon dioxide (CO_2), which bubbles off. This type of reaction is carried out by most mineral acids against carbonate deposits and accounts for the rapid evolution of gas during cleaning of wells with this type of deposit. While the CO_2 gases pushing from the well can cause dangerous expulsion of cleaning chemicals, the evolution of gas at the deposit level often results in break-up of the hard scale, and leads to better dissolution of combined deposits not as easily attacked by the acid.

In the above reaction, part of the carbonate molecule is removed from the reaction by the CO_2 evolution. However, in the dissolving of gypsum, calcium sulfate and most other mineral deposits, the accumulation of byproducts occurs in the cleaning solution.

The byproducts of the dissolving reactions remain in the cleaning mixture and result in the accumulation of high concentrations of dissolved products. This congested or crowded environment can prevent the complete dissolution of the mineral deposits. It is because of this crowding principal that proper choice of both the acid and the concentration used is necessary for a good rehabilitation job.

The principal of crowding further explains why some acids are not good choices if certain types of mineral deposits are suspected. In general, two factors are important - one, the total concentration of dissolved solids, and the other, the concentration of any specific dissolved solids.

Excessive concentration of dissolved solids can be caused by choosing too high a concentration of acid, or by having too much deposit to dissolve (a factor that cannot be controlled). An excessive level of acid adds to the total dissolved solids, limiting the amount of mineral deposit that can be dissolved. Total dissolved solids are controlled by using a more dilute concentration. By staging two cleaning procedures, the deposits to be dissolved can be controlled. Divide the cleaning chemistry using the first batch to dissolve part of the mineralization, pump it from the well and use the second batch to dissolve the remaining blockage. In each situation, the total dissolved solids concentration will be lower than it would be if all the cleaner had been used in one application.

The most common and useful mineral acids used in water well rehabilitation are hydrochloric, muriatic, phosphoric and sulfamic. Muriatic acid is an industrial name for hydrochloric and usually designates a concentration of approximately 18 percent.

Hydrochloric Acid (HCl) - Hydrochloric is available commercially in concentrations of 31 percent and the highest at approximately 38 percent. This acid is very effective against many mineral deposits, is very inexpensive and readily available. The purity should always be questioned and a certificate of analysis secured before the acid is used in a potable water well or any well where contamination of an aquifer is a possibility. Hydrochloric acid is very corrosive to most metals and particularly corrosive to stainless steel because of its chloride content. The vapor given off from the acid, hydrogen chloride, it also is very corrosive. Because hydrogen chloride gas is heavy, it will settle into lower areas. Therefore, work with hydrochloric should only be done in very open spaces.

Phosphoric Acid (H_3PO_4) - This acid usually is available in food grade and NSF-certified quality. The two most common concentrations are 75 percent and 85 percent. It does not give off harmful vapors; however, sprays or mists of the acid would be acidic and dangerous. It is far less corrosive to metal than hydrochloric and can lead to some passivation of the metal with the proper chemistry. It is a slower reacting acid than hydrochloric and is very effective against iron and manganese compounds because of its ability to sequester these metals. However, it has less ability to dissolve phosphate because of the similar ion concentration. Its sequestering ability also leads to a greater ability against large concentrations of calcium and magnesium minerals.

Sulfamic Acid (H_2NSO_3H) - Sulfamic acid, also called amidosulfonic, is moderately soluble in water, being less soluble in warmer water. It is a strong acid and reacts very quickly against carbonates. However, the sulfamate ion produced by the acid hydrolyzes over time to a sulfate, rendering this acid almost ineffective against gypsum or other sulfate deposits. The acid should be dissolved in water prior to addition to the well as it requires good mechanical mixing to be put into solution. Powdered acid added directly to the well can remain in the bottom of a well for long periods of time before it is fully dissolved. Usually, the acid is reserved for smaller systems since large wells would require considerable acid and handling large amounts of dry acid presents logistical issues.

Organic Acids

Generally, those organic acids that are characterized by the presence in the molecule of a carboxyl group (COOH) are useful in well cleaning. The acids of this group most often used in well rehabilitation are acetic, citric, hydroxyacetic and oxalic.

Acetic Acid (CH_3 COOH) - Generally supplied as glacial, acetic acid is an excellent solvent for many organics, phosphates and some sulfate compounds. It should not be used on wood-cased wells, as it delignifies the wood fiber. It may be used at low levels of 3 percent to 5 percent to improve removal of organic contaminates or to enhance phosphate removal. Glacial acetic is very corrosive to the skin and produces a pungent vapor that can cause mild to severe lung damage. The empirical formula is $C_2H_4O_2$ and it is a mono carboxylic acid. In its more mild form, it is known as vinegar, but in higher concentrations, it should be treated as a strong, dangerous acid.

Hydroxyacetic Acid (HO) CH_2 (COOH) - Also known as glycolic acid, it is sold as a 70 percent solution. It is a mono carboxylic acid with one hydroxyl group. Up to a few years ago, it was registered as a biocide, proven effective against microorganisms. Hydroxyacetic acid's formula is $C_2H_4O_3$. It is a weak acid, considered a mild irritant to skin or mucous membranes. It's excellent as a buffering acid for the control of pH during chlorination. Generally, it is used with mineral acid to improve iron solubility at a 2-percent to 5-percent concentration in the total well volume.

Citric Acid (HO) C-$(CH_2)_2$-$(COOH)_3$ - This is a crystalline powder sold as 100 percent acid. It has three carboxyl groups that may be responsible for its effect on phosphate solubility. It is very soluble in hydrochloric acid and can be used with this acid to improve solubility of phosphates and iron deposits. Solutions of citric acid will support bacterial growth. In general, the acid is weak and should always be used with a stronger mineral acid. It is usually used at 5-percent to 10-percent concentrations of the well volume.

Oxalic Acid $(COOH)_2$ - Oxalic acid is a strong, reducing acid, and as such, is excellent against oxide of iron and manganese. The acid is a granular product sold at approximately 99 percent active ingredients in 50-pound bags. It is corrosive to the skin, and salts of this acid are poisonous. Exceptional care must be taken to remove all traces of the acid from the well system. Oxalic is a carboxylated acid with two carboxyl groups. It is more soluble in warmer water. Its use rate is between 5 percent and 10 percent by weight in the well volume.

Caustic Products

Alkalies or caustics occasionally are used in water well cleaning as the base chemistry to remove oil contamination and heavy biological fouling. Caustics will have no effect on mineral deposits, and they could create considerable precipitation if dispersants or specific polymer chemistry is not employed to prevent crystallization, agglomeration and deposition. Caustics usually used for this purpose are sodium hydroxide and potassium hydroxide. Alkaline products also are used to neutralize acid cleaners before disposal, following well pump out of the acid cleaning solution. The products usually used for this reaction are lime, soda ash and magnesium hydroxide.

Sodium Hydroxide (NaOH) - This product is known commercially as caustic soda and is available as a 50-percent solution. It also is sold as a 100 percent active pellet, but it is considerably easier to use the solution as dissolving of the pellets cause a severe exothermic reaction which can be extremely unsafe. The solution also will produce considerable heat when being diluted. As with strong acids, always add the concentrate to the water and not water to the product being diluted. Sodium hydroxide (NaOH) will provide an extremely high pH (12 to 14) even at low concentrations. The usual dosage for most caustics is a 3-percent solution in the total well volume. While sodium hydroxide usually is used more as a cleaner, it could be used to neutralize used acid. However, never add the concentrated material directly to a strong acid solution. Dilute the caustic to a maximum 10 percent concentration before using for neutralization.

Potassium Hydroxide (KOH) - Known commercially as caustic potash, it is available in both a pellet and a 45-percent solution. The solution is by far the easier product to use. The pellets produce considerable heat when diluted with water. Since the 45-percent solution also produces heat, it, too, should be handled with care. Potassium hydroxide has some advantages over sodium hydroxide because of its solubility and also because it is less corrosive to the metal structure of the well. It is used at approximately 3 percent of the total well volume as a cleaning solution and can be used as an acid-neutralizing agent. However, the same precautions as described for sodium hydroxide apply.

Calcium Oxide or Lime (CaO) - This product is available in powder or granular form and is used primarily to neutralize acid cleaning solutions following pump out of the well. Often, it is mixed directly into the acid solution if the spent solution is in a holding tank, or the lime is placed in a trough that provides for neutralization as the acid solution is pumped to disposal. The greatest danger in the use of lime is the heat produced if the product is dissolved in water, and the fine dust that is extremely corrosive to eyes and mucous membranes.

Soda Ash (Na2 CO3) - This product is 99 percent sodium carbonate granular and is used primarily to neutralize discharged acid following well cleaning. It is available in 50-pound and 100-pound bags. Because it is a carbonate, considerable carbon dioxide will be liberated as the acid is neutralized. Care should be taken so this release does not cause splashing or the dispersal of the cleaning solution, causing a safety concern.

Magnesium Hydroxide ($Mg(OH)_2$) - Magnesia, as the powder is often called, is commercially available in a 50-percent slurry and is an excellent product for the neutralization of acids used in well cleaning. The product imparts only a slight alkaline reaction to the water, so overuse will not produce a pH higher than 9.5. This is very important where discharge is being monitored for high pH release.

Mechanical Rehabilitation

Airlifting

Airlifting technology is a process that stimulates selected zones within the water –bearing formation with high pressure air or inert gas that generates high-energy pressure pulses in the well. This energy generates acoustic waves that breaks up and removes mineral scales, silts, sedimentation and bio-films from the borehole wall or well screen. An air bubble is generated that expands and collapses inside the well with the energy being released at 0.015 seconds after firing. This provides an intense surging action that generates a mechanical cleaning of the well as the bubble expands and collapses. As the bubble collapse, it creates a negative pressure zone in the well that pulls in mineral and biological debris dislodged during the process for easy removal with a bailer. Different styles of bailers are used to remove material and water from the well. A "sand pump bailer" has a plunger inside a pipe with a one way valve on the bottom. When the plunger is lifted quickly it creates a vacuum that sucks the material off the bottom of the well and into the bailer. A "dart valve" bailer is used to remove large amounts of water quickly. Airlifting can be utilized in conjunction with chemical rehabilitation that is specifically targeted to treat well’s condition. The mechanical surging action pushes chemistry further out into the borehole and adjacent formation for a more thorough cleaning.

Scrubbing and Surging

The special brush connected to the bottom of the drill stem and is set in the up and down motion of the cable tool. This mechanical scrubbing breaks loose built up material and breaks the barrier of slime forming bacteria. The close tolerance of the brush to the wall of the casing makes a tight fit that forces the water back and forth through the perforations or screen. This brushing and surging knocks loose the built up material and drops it to the bottom of the well where it can be bailed out.

Relining

In the event that the well casing is impaired due to corrosion or sanding, a complete or partial relining of the casing may be required to restore production.

Complete Relining

A relined well consists of an inner casing that extends from ground level to the bottom of the existing well casing. Various materials such as mild steel, copper-bearing steel, high-strength low alloy steel, and stainless steel are suitable for liners, depending upon the parameters of strength and durability that are required for specific installation. Generally, the outside diameter of the liner is on the order of 3 to 4 inches smaller than the inside diameter of the existing casing. Due to the smaller inner diameter of the liner, a new pump may be needed to meet the new physical and hydraulic conditions of the well.

A typical complete liner includes a section of blank casing that is connected to one or more sections of louvered screen or continuous wire-wrapped screen. Often, the annular space between the liner and outer casing/screen is filled with select gravel. If a gravel pack is installed in the annular space, the apertures of the inner well screen are sized to retain 100 percent of the gravel pack material.

Partial Liners

A partial liner is a section of casing that is secured in place within the well by various methods. Two types of commonly-used partial liners are swaged liners and drop-off liners.

Swaged Liner

A swaged liner is a short section of casing and/or screen that essentially functions as a patch. This type of liner is installed typically with either an electric or hydraulic swage. Electric swages are used to install corrugated steel or other thin-walled steel liners, whereas annealed steel liners are installed with a hydraulic swage. The installation procedure consists of the following steps:

- the swage and liner are lowered into position at the appropriate depth
- the swage is activated, enlarging within the casing and forcibly shaping and affixing the liner to the interior of the casing
- the swage is then removed from the well

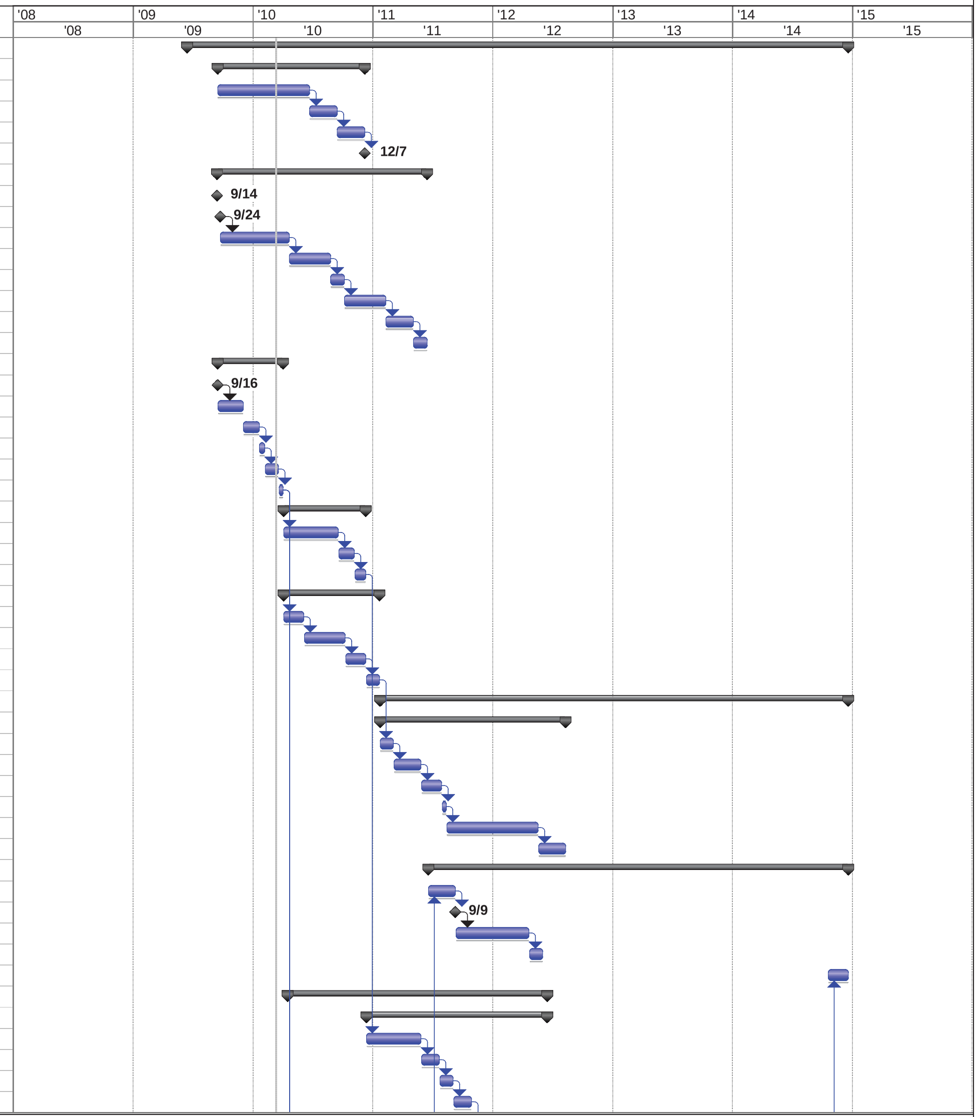
Drop-Off Liner

A drop-off liner typically consists of a length of either louvered or wire-wrapped screen that is installed at the bottom of the well. The liner is attached to a tool on the end of a string of drill pipe. After the liner is in place, the attachment between the liner and drill pipe is uncoupled, leaving the liner behind. The annular space between the drop-off liner and casing/screen can be filled with selected gravel. The liner installation may be completed by grouting around the top of the liner through a temporary tremie pipe.

APPENDIX B

MULTI-AGENCY GROUND WATER RECOVERY PROJECT

ID	Task Name	Duration	Start	Finish	Predecessors
1	**Multi-Agency Ground Water Recovery Project**	**1440 days**	**Mon 6/15/09**	**Fri 12/19/14**	
2	**Multi-Agency Agreement**	**320 days**	**Wed 9/16/09**	**Tue 12/7/10**	
3	Draft Agreement	200 days	Wed 9/16/09	Tue 6/22/10	
4	Multi-Agency Review	60 days	Wed 6/23/10	Tue 9/14/10	3
5	Final Agreement	60 days	Wed 9/15/10	Tue 12/7/10	4
6	Execute Agreement	0 days	Tue 12/7/10	Tue 12/7/10	5
7	**Cyclic Storage Agreement in the Basin**	**458 days**	**Mon 9/14/09**	**Wed 6/15/11**	
8	Initial Meeting w/ Water Master	0 days	Mon 9/14/09	Mon 9/14/09	
9	Multi-Agency Notification to WM of Project Concept	0 days	Thu 9/24/09	Thu 9/24/09	
10	Development of Draft Agreement	150 days	Thu 9/24/09	Wed 4/21/10	9
11	Multi-Agency Review of Agreement	90 days	Thu 4/22/10	Wed 8/25/10	10
12	Finalize Draft Agreement	30 days	Thu 8/26/10	Wed 10/6/10	11
13	WM Review of Draft Agreement	90 days	Thu 10/7/10	Wed 2/9/11	12
14	Final Agreement	60 days	Thu 2/10/11	Wed 5/4/11	13
15	Execute Final Agreement	30 days	Thu 5/5/11	Wed 6/15/11	14
16	**Project Conceptualization**	**143 days**	**Wed 9/16/09**	**Fri 4/2/10**	
17	Kickoff	0 days	Wed 9/16/09	Wed 9/16/09	
18	75% Report	55 days	Thu 9/17/09	Wed 12/2/09	17
19	Multi-Agency Review	35 days	Thu 12/3/09	Wed 1/20/10	
20	100% Report	12 days	Thu 1/21/10	Fri 2/5/10	19
21	Multi-Agency Review	30 days	Mon 2/8/10	Fri 3/19/10	20
22	Final Report	10 days	Mon 3/22/10	Fri 4/2/10	21
23	**Technical Report**	**180 days**	**Mon 4/5/10**	**Fri 12/10/10**	
24	Prepare Draft Design Report	120 days	Mon 4/5/10	Fri 9/17/10	22
25	Multi Agency Review	35 days	Mon 9/20/10	Fri 11/5/10	24
26	Finalize Draft Report (50% Design)	25 days	Mon 11/8/10	Fri 12/10/10	25
27	**Basin Plume Study**	**210 days**	**Mon 4/5/10**	**Fri 1/21/11**	
28	Procure Study	45 days	Mon 4/5/10	Fri 6/4/10	22
29	Prepare Draft Study	90 days	Mon 6/7/10	Fri 10/8/10	28
30	Multi-Agency Review	45 days	Mon 10/11/10	Fri 12/10/10	29
31	Finalize Study	30 days	Mon 12/13/10	Fri 1/21/11	30
32	**DPH Permitting**	**1020 days**	**Mon 1/24/11**	**Fri 12/19/14**	
33	**Policy Memo 97-005**	**405 days**	**Mon 1/24/11**	**Fri 8/10/12**	
34	Prepare Evaluation	30 days	Mon 1/24/11	Fri 3/4/11	31
35	Prepare Draft Document	60 days	Mon 3/7/11	Fri 5/27/11	34
36	Multi-Agency Review	45 days	Mon 5/30/11	Fri 7/29/11	35
37	Prepare Revised Draft	10 days	Mon 8/1/11	Fri 8/12/11	36
38	DPH Review	200 days	Mon 8/15/11	Fri 5/18/12	37
39	Prepare Final Document	60 days	Mon 5/21/12	Fri 8/10/12	38
40	**DPH Permit**	**915 days**	**Mon 6/20/11**	**Fri 12/19/14**	
41	Prepare Start-Up and O&M Plan	60 days	Mon 6/20/11	Fri 9/9/11	104
42	Application to DPH	0 days	Fri 9/9/11	Fri 9/9/11	41
43	DPH Engineering Report	160 days	Mon 9/12/11	Fri 4/20/12	42
44	Public Review Period	30 days	Mon 4/23/12	Fri 6/1/12	43
45	DPH Evaluation and Permit Issuance	45 days	Mon 10/20/14	Fri 12/19/14	111
46	**City Permitting**	**565 days**	**Fri 4/16/10**	**Fri 6/15/12**	
47	**CEQA**	**395 days**	**Mon 12/13/10**	**Fri 6/15/12**	
48	Prepare Draft Initial Study	120 days	Mon 12/13/10	Fri 5/27/11	26
49	Multi-Agency Review	40 days	Mon 5/30/11	Fri 7/22/11	48
50	Review Draft MND/EIR	30 days	Mon 7/25/11	Fri 9/2/11	49
51	Multi-Agency Review	40 days	Mon 9/5/11	Fri 10/28/11	50

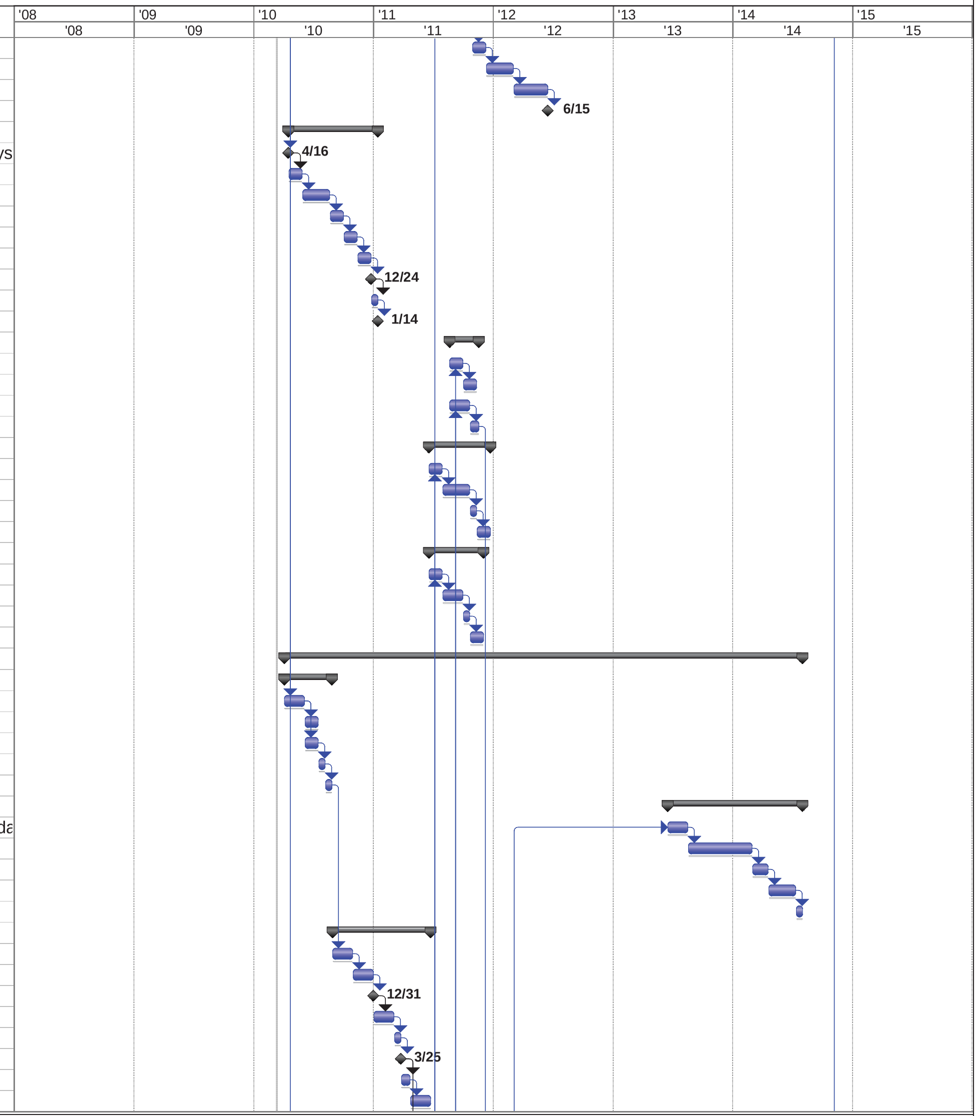


Project: Multi-Agency Master Project S
Date: Thu 3/11/10

Task | Progress | Milestone | Summary | Rolled Up Task | Rolled Up Milestone | Rolled Up Progress | Split | External Tasks | Project Summary | Group By Summary | Deadline

MULTI-AGENCY GROUND WATER RECOVERY PROJECT

ID	Task Name	Duration	Start	Finish	Predecessors
52	Approval Draft MND/EIR	30 days	Mon 10/31/11	Fri 12/9/11	51
53	CEQA Posted for Public Review	60 days	Mon 12/12/11	Fri 3/2/12	52
54	Response to Comments	75 days	Mon 3/5/12	Fri 6/15/12	53
55	Final CEQA	0 days	Fri 6/15/12	Fri 6/15/12	54
56	**Conditional Use Permit Processing**	**195 days**	**Fri 4/16/10**	**Fri 1/14/11**	
57	Pre-Design Meeting with City	0 days	Fri 4/16/10	Fri 4/16/10	22FS+10 days
58	Prepare City Documents/Application	30 days	Mon 4/19/10	Fri 5/28/10	57
59	City Review of Application	60 days	Mon 5/31/10	Fri 8/20/10	58
60	Revise CUP	30 days	Mon 8/23/10	Fri 10/1/10	59
61	City Review of Final CUP	30 days	Mon 10/4/10	Fri 11/12/10	60
62	Public Comment Period	30 days	Mon 11/15/10	Fri 12/24/10	61
63	Public Hearing and CUP Decision	0 days	Fri 12/24/10	Fri 12/24/10	62
64	Appeals Period	15 days	Mon 12/27/10	Fri 1/14/11	63
65	CUP Approval	0 days	Fri 1/14/11	Fri 1/14/11	64
66	**City Department Approvals**	**65 days**	**Mon 8/22/11**	**Fri 11/18/11**	
67	Prepare SUSMP	30 days	Mon 8/22/11	Fri 9/30/11	105
68	City Review of SUSMP	30 days	Mon 10/3/11	Fri 11/11/11	67
69	Building Department Review of Plans	45 days	Mon 8/22/11	Fri 10/21/11	105
70	Revise Plans for Building Department	20 days	Mon 10/24/11	Fri 11/18/11	69
71	**Regional Water Quality Control Board Permitting**	**135 days**	**Mon 6/20/11**	**Fri 12/23/11**	
72	Prepare Permit Application	30 days	Mon 6/20/11	Fri 7/29/11	104
73	RWQCBP to review Permit Application	60 days	Mon 8/1/11	Fri 10/21/11	72
74	Revise Permit	15 days	Mon 10/24/11	Fri 11/11/11	73
75	Permit Approval	30 days	Mon 11/14/11	Fri 12/23/11	74
76	**Los Angeles County Sanitation District**	**120 days**	**Mon 6/20/11**	**Fri 12/2/11**	
77	Prepare Permit Application	30 days	Mon 6/20/11	Fri 7/29/11	104
78	LA San to review Permit Application	45 days	Mon 8/1/11	Fri 9/30/11	77
79	Revise Permit	15 days	Mon 10/3/11	Fri 10/21/11	78
80	Permit Approval	30 days	Mon 10/24/11	Fri 12/2/11	79
81	**Well Rehabilitation**	**1130 days**	**Mon 4/5/10**	**Fri 8/1/14**	
82	**Well Inspection**	**105 days**	**Mon 4/5/10**	**Fri 8/27/10**	
83	Procure Well Inspection Contractor	45 days	Mon 4/5/10	Fri 6/4/10	22
84	Initial Well/Pump Inspection	30 days	Mon 6/7/10	Fri 7/16/10	83
85	Well Water Quality Sampling	30 days	Mon 6/7/10	Fri 7/16/10	83
86	Water Quality Testing	15 days	Mon 7/19/10	Fri 8/6/10	85
87	Perform Evaluation of Inspection	15 days	Mon 8/9/10	Fri 8/27/10	86
88	**Well Repair/Rehab**	**295 days**	**Mon 6/17/13**	**Fri 8/1/14**	
89	Procure Well Rehab Contractor	45 days	Mon 6/17/13	Fri 8/16/13	110SS+320 da
90	Perform Well Cleaning, Video and Development	140 days	Mon 8/19/13	Fri 2/28/14	89
91	Perform Test Pumping	35 days	Mon 3/3/14	Fri 4/18/14	90
92	Procure Well Equipment	60 days	Mon 4/21/14	Fri 7/11/14	91
93	Equip Wells	15 days	Mon 7/14/14	Fri 8/1/14	92
94	**Treatment System Procurement**	**215 days**	**Mon 8/30/10**	**Fri 6/24/11**	
95	Prepare Treatment System RFP	45 days	Mon 8/30/10	Fri 10/29/10	87
96	Multi Agency to Review	45 days	Mon 11/1/10	Fri 12/31/10	95
97	Distribute RFP to Potential Bidders	0 days	Fri 12/31/10	Fri 12/31/10	96
98	Vendor/s Quotations	45 days	Mon 1/3/11	Fri 3/4/11	97
99	Evaluate Quotations	15 days	Mon 3/7/11	Fri 3/25/11	98
100	Recommend Vendor/s	0 days	Fri 3/25/11	Fri 3/25/11	99
101	Negotiate w/ Selected Vendor/s	20 days	Mon 3/28/11	Fri 4/22/11	100
102	Award contract	45 days	Mon 4/25/11	Fri 6/24/11	101

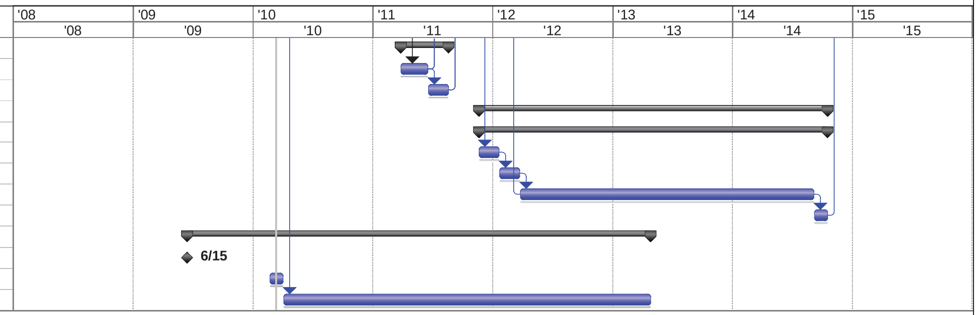


Project: Multi-Agency Master Project S
Date: Thu 3/11/10

Task | Progress | Milestone | Summary | Rolled Up Task | Rolled Up Milestone | Rolled Up Progress | Split | External Tasks | Project Summary | Group By Summary | Deadline

MULTI-AGENCY GROUND WATER RECOVERY PROJECT

ID	Task Name	Duration	Start	Finish	Predecessors
103	**Treatment System Design**	**105 days**	**Mon 3/28/11**	**Fri 8/19/11**	
104	75% Design	60 days	Mon 3/28/11	Fri 6/17/11	100
105	100% Design	45 days	Mon 6/20/11	Fri 8/19/11	104
106	**Treatment System Installation**	**760 days**	**Mon 11/21/11**	**Fri 10/17/14**	
107	**Phase 1- Collection System**	**760 days**	**Mon 11/21/11**	**Fri 10/17/14**	
108	Advertise Bid Installation	45 days	Mon 11/21/11	Fri 1/20/12	70
109	Award Bid	45 days	Mon 1/23/12	Fri 3/23/12	108
110	Construction Execution	640 days	Mon 3/26/12	Fri 9/5/14	109
111	Plant Start Up Testing	30 days	Mon 9/8/14	Fri 10/17/14	110
112	**Funding and Grant Applications**	**1010 days**	**Mon 6/15/09**	**Fri 4/26/13**	
113	WQA 1st Round Grant Application	0 days	Mon 6/15/09	Mon 6/15/09	
114	WQA Second Round	30 days	Mon 2/22/10	Fri 4/2/10	
115	Alternate Funding Sources	800 days	Mon 4/5/10	Fri 4/26/13	22



Project: Multi-Agency Master Project S
Date: Thu 3/11/10

Task	Milestone	Rolled Up Task	Rolled Up Progress	External Tasks	Group By Summary
Progress	Summary	Rolled Up Milestone	Split	Project Summary	Deadline

APPENDIX C

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CLINICAL LABORATORY OF SAN BERNARDINO, INC.
21881 BARTON ROAD
GRAND TERRACE, CA 92313
ORGANIC CHEMICAL ANALYSIS (7/98)

Date of Report: 08/28/99 Sample ID No.M95174X-1A
Laboratory Name: CLINICAL LABORATORIES OF SAN BERNARDINO Signature Lab Director:
Name of Sampler:STEVE PATTON Employed By:G.W.D.
Date/Time Sample Collected: 99/08/17/1028 Date/Time Sample Received @ Lab: 99/08/17/1700 Date Analyses Completed: 99/08/:

System Name: GLENDORA-CITY, WATER DEPT. System Number: 1910044
Name or Number of Sample Source: WELL 03G - INACTIVE

* User ID: 4th Station Number: 01S/10W-10C04 S
* Date/Time of Sample: |99|08|17|1028| Laboratory Code: 3761
* YY MM DD TTTT YY MM DD
* Date Analysis Completed: |99|08|20|
* Submitted by:________________ Phone #:________

PAGE 1 OF 1 REGULATED ORGANIC CHEMICALS

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
502.2	Tetrachloroethylene (PCE)	34475	ND	5	0.
502.2	Trichloroethylene (TCE)	39180	ND	5	0.

Laboratory comments and description of any additional compounds found:

PUMPED TO WASTE

√TC

CLINICAL LABORATORY OF SAN BERNARDINO, INC.
21881 BARTON ROAD
GRAND TERRACE, CA 92313
RADIOACTIVITY ANALYSIS (4/95)

Date of Report: 09/01/99
Sample ID No.M95174R-1A
Laboratory
Name: CLINICAL LABORATORIES OF SAN BERNARDINO
Signature Lab Director: ____
Name of Sampler:STEVE PATTON
Employed By:G.W.D.
Date/Time Sample Collected: 99/08/17/1019
Date/Time Sample Received @ Lab: 99/08/17/1700
Date Analyses Completed: 99/08/

==

System Name: GLENDORA-CITY, WATER DEPT.
System Number: 1910044
Name or Number of Sample Source: WELL 03G - INACTIVE

****

* User ID: 4th
Station Number: 01S/10W-10C04 S
* Date/Time of Sample: |99|08|17|1019|
YY MM DD TTTT
Laboratory Code: 3761
YY MM DD
Date Analysis Completed: |99|08|18|
* Submitted by: ____
Phone #: ____

****

MCL	REPORT UNITS	CHEMICAL	STORET CODE	ANALYSES RESULTS	DLR
15	pCi/l	Total Alpha	01501		1
	pCi/l	Total Alpha Counting Error	01502		
50	pCi/l	Total Beta	03501		4
	pCi/l	Total Beta Counting Error	03502		
20	pCi/l	Natural Uranium	28012		2.
	pCi/l	Natural Uranium Counting Error	A-028		
	pCi/l	Total Radium 226	09501		0.
	pCi/l	Total Radium 226 Counting Error	09502		
	pCi/l	Total Radium 228	11501		0.
	pCi/l	Total Radium 228 Counting Error	11502		
5	pCi/l	Ra 226 + Ra 228	11503		
	pCi/l	Ra 226 + Ra 228 Counting Error	11504		
	pCi/l	Total Radon 222	82303	435	10
	pCi/l	Total Radon 222 Counting Error	82302	6	
8	pCi/l	Total Strontium 90	13501		2.
	pCi/l	Total Strontium 90 Counting Error	13502		
20000	pCi/l	Total Tritium	07000		100
	pCi/l	Total Tritium Counting Error	07001		

CLINICAL LABORATORY OF SAN BERNARDINO, INC.
21881 BARTON ROAD
GRAND TERRACE, CA 92313

ED

GENERAL MINERAL & PHYSICAL, & INORGANIC ANALYSIS (4/95)

Date of Report: 09/14/99
Sample ID No.M95174-1A
Laboratory
Name: CLINICAL LABORATORIES OF SAN BERNARDINO
Signature Lab Director: [signature]
Name of Sampler: STEVE PATTON
Employed By: G.W.D.
Date/Time Sample Collected: 99/08/17/1046
Date/Time Sample Received @ Lab: 99/08/17/1700
Date Analyses Completed: 99/09/0

System Name: GLENDORA-CITY, WATER DEPT.
System Number: 1910044
Name or Number of Sample Source: WELL 03G - INACTIVE

* User ID: 4th
* Date/Time of Sample: |99|08|17|1046| (YY MM DD TTTT)
Station Number: 01S/10W-10C04 S
Laboratory Code: 3761
Date Analysis Completed: |99|09|08| (YY MM DD)
* Submitted by: ____________
Phone #: ____________

MCL	REPORTING UNITS	CHEMICAL	ENTRY #		ANALYSES RESULTS	DLR
	mg/L	Hardness, (Total) as CaCO3	00900		450	2.(
	mg/L	Calcium (Ca)	00916		134	1.(
	mg/L	Magnesium (Mg)	00927		29.7	1.(
	mg/L	Sodium (Na)	00929		22.4	1.(
	mg/L	Potassium (K)	00937		3.80	1.(
Total Cations		Meq/L Value: 10.2				
	mg/L	Alkalinity, (Total) as CaCO3	00410		297	1.0
	mg/L	Hydroxide (OH)	71830	<	1.0	1.0
	mg/L	Carbonate (CO3)	00445	<	1.0	1.0
	mg/L	Bicarbonate (HCO3)	00440		362	1.0
*	mg/L+	Sulfate (SO4)	00945		67.2	0.5
*	mg/L+	Chloride (Cl) PRIMARY VIOLATION	00940		33.4	1.0
45	mg/L	Nitrate (as NO3)	71850		111	2.0
**	mg/L	Fluoride (F) Temp. Depend.	00951		0.311	0.1
Total Anions		Meq/L Value: 10.1				
	Std.Units+	pH, Laboratory	00403		7.27	
***	uS +	Specific Conductance (E.C.)	00095		990	10
****	mg/L+	Total Filterable Residue at 180C (TDS)	70300		580	1.0
	Units	Color, Apparent (Unfiltered)	00081	<	3	3
	TON	Odor Threshold at 60 C	00086		1	1
	NTU	Turbidity, Laboratory	82079		0.5	0.1
0.5	mg/L+	MBAS	38260	<	0.020	0.02

* 250-500-600 ** 1.4-2.4 *** 900-1600-2200 **** 500-1000-1500

INORGANIC CHEMICALS M95174-1A

MCL	REPORTING UNITS	CHEMICAL	ENTRY #		ANALYSES RESULTS	DLR
1000	ug/L	Aluminum (Al)	01105	<	50	50
6	ug/L	Antimony	01097	<	6.0	6.0
50	ug/L	Arsenic (As)	01002	<	2.0	2.0
1000	ug/L	Barium (Ba)	01007		248	100
4	ug/L	Beryllium	01012	<	1.0	1.0
5	ug/L	Cadmium (Cd)	01027	<	1.0	1.0
50	ug/L	Chromium (Total Cr)	01034	<	10	10
1000	ug/L+	Copper (Cu)	01042	<	50	50
300	ug/L+	Iron (Fe) SECONDARY VIOLATION	01045		459	100
	ug/L	Lead (Pb)	01051	<	5.0	5.0
50	ug/L+	Manganese (Mn)	01055	<	20	20
2	ug/L	Mercury (Hg)	71900	<	1.0	1.0
100	ug/L	Nickel	01067	<	10	10
50	ug/L	Selenium (Se)	01147	<	5.0	5.0
100	ug/L+	Silver (Ag)	01077	<	10	10
2	ug/L	Thallium	01059	<	1.0	1.0
5000	ug/L	Zinc (Zn)	01092	<	50	50

ADDITIONAL ANALYSES

MCL	REPORTING UNITS	CHEMICAL	ENTRY #		ANALYSES RESULTS	DLR
	C	Source Temperature C	00010		16.7	
10000	ug/L	Nitrate + Nitrite as Nitrogen(N)	A-029		25100	400
1000	ug/L	Nitrite as Nitrogen(N)	00620	<	400	400
200	ug/L	Cyanide	01291	<	100	100
	ug/L	Perchlorate ACTION LEVEL @ 18 ug/L	A-031		13.0	5.0

+ Indicates Secondary Drinking Water Standards

Laboratory comments and description of any additional compounds found:

PUMPED TO WASTE

CLINICAL LABORATORY OF SAN BERNARDINO, INC.
21881 BARTON ROAD
GRAND TERRACE, CA 92313
RADIOACTIVITY ANALYSIS (4/95)

Date of Report: 09/01/99
Sample ID No.M95174R-1A
Laboratory
Name: CLINICAL LABORATORIES OF SAN BERNARDINO
Signature Lab Director:
Name of Sampler: STEVE PATTON
Employed By: G.W.D.
Date/Time Sample Collected: 99/08/17/1019
Date/Time Sample Received @ Lab: 99/08/17/1700
Date Analyses Completed: 99/08/1

System Name: GLENDORA-CITY, WATER DEPT.
System Number: 1910044
Name or Number of Sample Source: WELL 03G - INACTIVE

* User ID: 4th
* Date/Time of Sample: |99|08|17|1019| (YY MM DD TTTT)
Station Number: 01S/10W-10C04 S
Laboratory Code: 3761
* Submitted by:
Date Analysis Completed: |99|08|18| (YY MM DD)
Phone #:

MCL	REPORT UNITS	CHEMICAL	STORET CODE	ANALYSES RESULTS	DLR
15	pCi/l	Total Alpha	01501		1.(
	pCi/l	Total Alpha Counting Error	01502		
50	pCi/l	Total Beta	03501		4.(
	pCi/l	Total Beta Counting Error	03502		
20	pCi/l	Natural Uranium	28012		2.(
	pCi/l	Natural Uranium Counting Error	A-028		
	pCi/l	Total Radium 226	09501		0.5
	pCi/l	Total Radium 226 Counting Error	09502		
	pCi/l	Total Radium 228	11501		0.5
	pCi/l	Total Radium 228 Counting Error	11502		
5	pCi/l	Ra 226 + Ra 228	11503		
	pCi/l	Ra 226 + Ra 228 Counting Error	11504		
	pCi/l	Total Radon 222	82303	435	100
	pCi/l	Total Radon 222 Counting Error	82302	6	
8	pCi/l	Total Strontium 90	13501		2.0
	pCi/l	Total Strontium 90 Counting Error	13502		
20000	pCi/l	Total Tritium	07000		1000
	pCi/l	Total Tritium Counting Error	07001		

CLINICAL LABORATORY OF SAN BERNARDINO, INC.
21881 BARTON ROAD
GRAND TERRACE, CA 92313
ORGANIC CHEMICAL ANALYSIS (7/98)

EDI

Date of Report: 08/28/99
Sample ID No.M95174X-1A
Laboratory
Name: CLINICAL LABORATORIES OF SAN BERNARDINO
Signature Lab Director:
Name of Sampler:STEVE PATTON
Employed By:G.W.D.
Date/Time Sample Collected: 99/08/17/1028
Date/Time Sample Received @ Lab: 99/08/17/1700
Date Analyses Completed: 99/08/2(

==

System Name: GLENDORA-CITY, WATER DEPT.
System Number: 1910044
Name or Number of Sample Source: WELL 03G - INACTIVE

****

* User ID: 4th
* Date/Time of Sample: |99|08|17|1028|
YY MM DD TTTT
Station Number: 01S/10W-10C04 S. *
Laboratory Code: 3761 *
Date Analysis Completed: |99|08|20| *
YY MM DD *
* Submitted by: ____
Phone #: ____ *

****

PAGE 1 OF 1

REGULATED ORGANIC CHEMICALS

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
502.2	Tetrachloroethylene (PCE)	34475	ND	5	0.5
502.2	Trichloroethylene (TCE)	39180	ND	5	0.5

Laboratory comments and description of any additional compounds found:

PUMPED TO WASTE

Laboratory comments and description of any additional compounds found:

PUMPED TO WASTE

Date of Report: 08/11/28
Sample ID No. 1910007-010
Client Sample: 10- 1910007-010

RECEIVED

Laboratory Name: TESTAMERICA - IRVINE (FORMERLY DEL MAR)
Signature Lab Director:
DEC 01 2008
Name of Sampler: Rocio Olivar
Employed By: STETSON ENGINEERS INC.
Date/Time Sample Collected: 08/11/17/0945
Date/Time Sample Received @ Lab: 08/11/17/1630
Date Analysis Completed: 08/11/17

System Name: AZUSA LIGHT AND WATER
System Number: 1910007
Name or Number of Sample Source: WELL 10 (AVWC8)

User ID: 4TH
Date/Time of Sample: | 08 | 11 | 17 | 0945 |
YY MM DD TTTT
Station Number: 1910007-010
Laboratory Code: 1197
Submitted by:
Date Analysis completed: | 08 | 11 | 17 |
YY MM DD
Phone #:

MCL	REPORTING UNITS	CHEMICAL	ENTRY #	ANALYSES RESULTS	DLR
45	mg/L	NITRATE (AS NO3)	71850	61	2
6	ug/L	PERCHLORATE	A-031	9.2	4

MAILED TO

COPH Date ______ By ______
Azusa Date 12/10/08 By ______
______ Date ______ By ______
______ Date ______ By ______
Comments:

RECEIVED

SEP 05 2008

STETSON ENGINEERS INC.

ORGANIC CHEMICAL ANALYSIS (9/99)

Sample ID No. 1910007-010
Client Sample: IRH1038-09 (Well 10)

Date of Report: 08/09/05
Laboratory Name: TESTAMERICA - ONTARIO (FORMERLY DEL MAR)
Signature Lab Director: Elizabeth Cittinger
Employed By:
Name of Sampler: Rocio Olivar
Date/Time Sample Collected: 08/08/12/1045
Date/Time Sample Received @ Lab: 08/08/13/1845
Date Analysis Completed: 08/08/18

System Name: AZUSA LIGHT AND WATER
System Number: 1910007
Name or Number of Sample Source: WELL 10 (AVWC8)

User ID: 4TH
Station Number: 1910007-010
Laboratory Code: 1169
Date/Time of Sample: | 08 | 08 | 12 | 1045 |
YY MM DD TTTT
Date Analysis completed: | 08 | 08 | 18 |
YY MM DD
Submitted by:
Phone #:

Page 1 of 1

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED IN ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
******	TETRACHLOROETHYLENE	34475	0.82	5	0.5
******	TRICHLOROETHYLENE	39180	ND	5	0.5

MAILED TO

CDPH Date ____ By ____
ALW Date 9/16/08 By MW
____ Date ____ By ____
____ Date ____ By ____
Comments:

GENERAL MINERAL & PHYSICAL & INORGANIC ANALYSIS (9/99) RECEIVED

SEP 05 2008

Sample ID No. 1910007-010
Client Sample: Azusa Light & Water - 10

Date of Report: 08/09/05

Laboratory Name: TESTAMERICA - IRVINE (FORMERLY DEL MAR)

Signature Lab Director:

Name of Sampler: Rocio Olivar

Employed By: ~~STETSON ENGINEERS INC.~~

Date/Time Sample Collected: 08/08/12/1045

Date/Time Sample Received @ Lab: 08/08/12/1655

Date Analysis Completed: 08/08/12

System Name: AZUSA LIGHT AND WATER

System Number: 1910007

Name or Number of Sample Source: WELL 10 (AVWC8)

User ID: 4TH

Station Number: 1910007-010

Date/Time of Sample: | 08 | 08 | 12 | 1045 |
YY MM DD TTTT

Laboratory Code: 1197

Date Analysis completed: | 08 | 08 | 12 |
YY MM DD

Submitted by:

Phone #:

MCL	REPORTING UNITS	CHEMICAL	ENTRY #	ANALYSES RESULTS	DLR
45	mg/L	NITRATE (AS NO3)	71850	56	2
6	ug/L	PERCHLORATE	A-031	10	4

MAILED TO

COPH Date ____ By ____
ALW Date 9/8/08 By [illegible]
____ Date ____ By ____
____ Date ____ By ____

Comments:

RECEIVED EDT

JUN 05 2008

STETSON ENGINEERS INC.

ASSOCIATED LABORATORIES
806 N. BATAVIA
ORANGE, CA 92868

ORGANIC CHEMICAL ANALYSIS (9/99)

ate of Report: 08/06/04
Sample ID No.212878-900314

aboratory
Name: ASSOCIATED LABORATORIES
Signature Lab Director:

Name of Sampler:ROCIO OLIVAR
Employed By: STETSON ENGINEERS

Date/Time Sample Collected:08/05/19/0930
Date/Time Sample Received @ Lab:08/05/19/1645
Date Analyses Completed:08/05/2

System Name:AZUSA LIGHT AND WATER
System Number: 1910007

Name or Number of Sample Source:WELL 10 (AVWC8)

* User ID: 4TH
Station Number: 1910007-010

* Date/Time of Sample: |08|05|19|0930|
YY MM DD TTTT

Laboratory Code: 4792

Date Analysis completed: |08|05|24|
YY MM DD

* Submitted by:____________
Phone #:____________

Page 1 of 1

REGULATED ORGANIC CHEMICALS

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
524.2	Tetrachloroethylene (PCE)	34475	ND	5	.5

MAILED TO

CDPH Date ____ By ____
ALW Date 6/12/08 By BW
____ Date ____ By ____
____ Date ____ By ____
Comments:

RECEIVED EDT

JUN 05 2008

ASSOCIATED LABORATORIES
806 N. BATAVIA
ORANGE, CA 92868
GENERAL MINERAL & PHYSICAL & INORGANIC ANALYSIS (9/99)

Date of Report: 08/06/04
Sample ID No.212878-900314
Laboratory
Signature Lab STETSON ENGINEERS INC.
Name: ASSOCIATED LABORATORIES
Director:
Name of Sampler:ROCIO OLIVAR
Employed By: STETSON ENGINEERS
Date/Time Sample Collected:08/05/19/0930
Date/Time Sample Received @ Lab:08/05/19/1645
Date Analyses Completed:08/05/20

System Name:AZUSA LIGHT AND WATER
System Number: 1910007
Name or Number of Sample Source:WELL 10 (AVWC8)

User ID: 4TH
Station Number: 1910007-010
Date/Time of Sample: |08|05|19|0930|
YY MM DD TTTT
Laboratory Code: 4792
Date Analysis completed: |08|05|20|
YY MM DD
Submitted by: ______
Phone #: ______

PAGE 1 OF 1

ADDITIONAL ANALYSES

MCL	REPORTING UNITS	CHEMICAL	ENTRY #	ANALYSES RESULTS	DLR
6	ug/L	Perchlorate (ug/L)	A-031	ND	4.0

+ Indicates Secondary Drinking Water Standards

MAILED TO

CDPH Date ____ By ____
ALW Date 6/16/08 By TMW
____ Date ____ By ____
____ Date ____ By ____
Comments:

ASSOCIATED LABORATORIES
806 N. BATAVIA
ORANGE, CA 92868

RECEIVED EDT
JUN 05 2008

GENERAL MINERAL & PHYSICAL & INORGANIC ANALYSIS (9/

Date of Report: 08/06/04
Sample ID No.212878-900314
Laboratory Name: ASSOCIATED LABORATORIES
Signature Lab Director: STETSON ENGINEERS INC.
Name of Sampler:ROCIO OLIVAR
Employed By: STETSON ENGINEERS
Date/Time Sample Collected:08/05/19/0930
Date/Time Sample Received @ Lab:08/05/19/1645
Date Analyses Completed:08/05/20

System Name:AZUSA LIGHT AND WATER
System Number: 1910007
Name or Number of Sample Source:WELL 10 (AVWC8)

User ID: 4TH
Station Number: 1910007-010
Date/Time of Sample: |08|05|19|0930| (YY MM DD TTTT)
Laboratory Code: 4792
Date Analysis completed: |08|05|20| (YY MM DD)
Submitted by: ____________
Phone #: ____________

MCL	REPORTING UNITS	CHEMICAL	ENTRY #	ANALYSES RESULTS	DLR
	mg/L	Total Hardness (as CaCO3) (mg/L)	00900		
	mg/L	Calcium (Ca) (mg/L)	00916		
	mg/L	Magnesium (Mg) (mg/L)	00927		
	mg/L	Sodium (NA) (mg/L)	00929		
	mg/L	Potassium (K) (mg/L)	00937		
Total Cations		Meq/L Value:			
	mg/L	Total Alkalinity (AS CaCO3) (mg/L)	00410		
	mg/L	Hydroxide (OH) (mg/L)	71830		
	mg/L	Carbonate (CO3) (mg/L)	00445		
	mg/L	Bicarbonate (HCO3) (mg/L)	00440		
*	mg/L+	Sulfate (SO4) (mg/L)	00945		.5
*	mg/L+	Chloride (Cl) (mg/L)	00940		
45	mg/L	Nitrate (as NO3) (mg/L)	71850	66.0	2.0
2.	mg/L	Fluoride (F) (Natural-Source)	00951		.1
Total Anions		Meq/L Value:			
	Std.Units+	PH (Laboratory) (Std.Units)	00403		
***	umho/cm+	Specific Conductance (E.C.) (umhos/cm)	00095		
****	mg/L+	Total Filterable Residue@180C(TDS)(mg/L)	70300		
15	Units	Apparent Color (Unfiltered) (Units)	00081		
3	TON	Odor Threshold at 60 C (TON)	00086		1.
5	NTU	Lab Turbidity (NTU)	82079		
0.5	mg/L+	MBAS (mg/L)	38260		

* 250-500-600 ** 0.6-1.7 *** 900-1600-2200 **** 500-1000-1500

MAILED TO

_____ Date _____ By _____
ALW Date 6/16/08 By MW
_____ Date _____ By _____
_____ Date _____ By _____

...ORATORIES
806 N. Batavia
Orange, CA 92868

RECEIVED EDT
FEB 22 2008

ORGANIC CHEMICAL ANALYSIS (9/99)

Date of Report: 08/02/20
Laboratory
Name: ASSOCIATED LABORATORIES
Name of Sampler: Rocio Olivar
Date/Time Sample
Collected: 08/02/06/0930

Sample ID No.206450-871350
Signature Lab Director: STETSON ENGINEERS INC.
Employed By: Stetson Engineers

Date/Time Sample
Received @ Lab: 08/02/06/1815

Date Analyses
Completed: 08/02/09

System
Name: AZUSA LIGHT AND WATER
Name or Number of Sample Source: WELL 10 (AVWC8)

System
Number: 1910007

User ID: 4TH
Date/Time of Sample: |08|02|06|0930|
YY MM DD TTTT

Station Number: 1910007-010
Laboratory Code: 4792
YY MM DD
Date Analysis completed: |08|02|09|

Submitted by: ______
Phone #: ______

Page 1 of 1

REGULATED ORGANIC CHEMICALS

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
524.2	Tetrachloroethylene (PCE)	34475	0.7	5	.50

MAILED TO

DOHS Date ____ By ____
ALW Date 3/10/08 By [signature]
____ Date ____ By ____
____ Date ____ By ____

Comments:

RECEIVED EDT
FEB 22 2008
STETSON ENGINEERS INC.

ASSOCIATED LABORATORIES
806 N. Batavia
Orange, CA 92868
GENERAL MINERAL & PHYSICAL & INORGANIC ANALYSIS (9/98)

Date of Report: 08/02/20
Sample ID No.206450-871350
Laboratory Name: ASSOCIATED LABORATORIES
Signature Lab Director:
Name of Sampler: Rocio Olivar
Employed By: Stetson Engineers
Date/Time Sample Collected: 08/02/06/0930
Date/Time Sample Received @ Lab: 08/02/06/1815
Date Analyses Completed: 08/02/0

==

System Name: AZUSA LIGHT AND WATER
System Number: 1910007
Name or Number of Sample Source: WELL 10 (AVWC8)

****

* User ID: 4TH
Station Number: 1910007-010
* Date/Time of Sample: |08|02|06|0930|
YY MM DD TTTT
Laboratory Code: 4792
YY MM DD
Date Analysis completed: |08|02|08|
* Submitted by: ______
Phone #: ______

****

PAGE 1 OF 1

ADDITIONAL ANALYSES

MCL	REPORTING UNITS	CHEMICAL	ENTRY #	ANALYSES RESULTS	DLR
	ug/L	Perchlorate (ug/L)	A-031	10.4	4.

+ Indicates Secondary Drinking Water Standards

MAILED TO

DOHS Date____ By____
ALW Date 3/10/08 By
____ Date____ By____
____ Date____ By____

Comments:

ASSOCIATED LABORATORIES
806 N. Batavia
Orange, CA 92868

RECEIVED FEB 22 2008 EDT

GENERAL MINERAL & PHYSICAL & INORGANIC ANALYSIS (9/99)

Date of Report: 08/02/20 — Sample ID No.206450-871350
Laboratory Name: ASSOCIATED LABORATORIES — Signature Lab Director: STETSON ENGINEERS INC.
Name of Sampler: Rocio Olivar — Employed By: Stetson Engineers
Date/Time Sample Collected: 08/02/06/0930 — Date/Time Sample Received @ Lab: 08/02/06/1815 — Date Analyses Completed: 08/02/07

System Name: AZUSA LIGHT AND WATER — System Number: 1910007
Name or Number of Sample Source: WELL 10 (AVWC8)

User ID: 4TH — Station Number: 1910007-010
Date/Time of Sample: |08|02|06|0930| (YY MM DD TTTT) — Laboratory Code: 4792
Date Analysis completed: |08|02|07| (YY MM DD)
Submitted by: ______ Phone #: ______

MCL	REPORTING UNITS	CHEMICAL	ENTRY #	ANALYSES RESULTS	DLR
	mg/L	Total Hardness (as CaCO3) (mg/L)	00900		
	mg/L	Calcium (Ca) (mg/L)	00916		
	mg/L	Magnesium (Mg) (mg/L)	00927		
	mg/L	Sodium (NA) (mg/L)	00929		
	mg/L	Potassium (K) (mg/L)	00937		
Total Cations		Meq/L Value:			
	mg/L	Total Alkalinity (AS CaCO3) (mg/L)	00410		
	mg/L	Hydroxide (OH) (mg/L)	71830		
	mg/L	Carbonate (CO3) (mg/L)	00445		
	mg/L	Bicarbonate (HCO3) (mg/L)	00440		
*	mg/L+	Sulfate (SO4) (mg/L)	00945		.5
*	mg/L+	Chloride (Cl) (mg/L)	00940		
45	mg/L	Nitrate (as NO3) (mg/L)	71850	56	2.0
2	mg/L	Fluoride (F) (Natural-Source)	00951		.1
Total Anions		Meq/L Value:			
	Std.Units+	PH (Laboratory) (Std.Units)	00403		
***	umho/cm+	Specific Conductance (E.C.) (umhos/cm)	00095		
****	mg/L+	Total Filterable Residue@180C(TDS) (mg/L)	70300		
15	Units	Apparent Color (Unfiltered) (Units)	00081		
3	TON	Odor Threshold at 60 C (TON)	00086		1.
5	NTU	Lab Turbidity (NTU)	82079		
0.5	mg/L	MBAS (mg/L)	38260		

* 250-500-600 ** 0.6-1.7 *** 900-1600-2200 **** 500-1000-1500

MAILED TO
DOHS Date ____ By ____
ALW Date 3/10/08 By [signature]
____ Date ____ By ____
____ Date ____ By ____

Comments:

ORGANIC CHEMICAL ANALYSIS (9/99)

RECEIVED

DEC 0 1 2008

STETSON ENGINEERS INC.

Sample ID No. 1910007-010
Client Sample: IRK1734-06 (10- 1910007-010)

Date of Report: 08/11/24

Signature Lab Director: Elizabeth [illegible]

Laboratory Name: TESTAMERICA - ONTARIO (FORMERLY DEL MAR)

Employed By:

Name of Sampler: Rocio Olivar

Date/Time Sample Collected: 08/11/17/0945

Date/Time Sample Received @ Lab: 08/11/18/1940

Date Analysis Completed: 08/11/21

System Name: AZUSA LIGHT AND WATER

System Number: 1910007

Name or Number of Sample Source: WELL 10 (AVWC8)

User ID: 4TH

Station Number: 1910007-010

Date/Time of Sample: | 08 | 11 | 17 | 0945 |
YY MM DD TTTT

Laboratory Code: 1169

Date Analysis completed: | 08 | 11 | 21 |
YY MM DD

Submitted by:

Phone #:

Page 1 of 2

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED IN ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
524.2	1,1,1,2-TETRACHLORETHANE	77562	ND	n/a	0.5
524.2	1,1,1-TRICHLOROETHANE	34506	ND	200	0.5
524.2	1,1,2,2-TETRACHLOROETHANE	34516	ND	1	0.5
524.2	1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	81611	ND	1200	10
524.2	1,1,2-TRICHLOROETHANE	34511	ND	5	0.5
524.2	1,1-DICHLOROETHANE	34496	ND	5	0.5
524.2	1,1-DICHLOROETHYLENE	34501	ND	6	0.5
524.2	1,1-DICHLOROPROPENE	77168	ND	n/a	0.5
524.2	1,2,3-TRICHLOROBENZENE	77613	ND	n/a	0.5
524.2	1,2,4-TRICHLOROBENZENE	34551	ND	5	0.5
524.2	1,2,4-TRIMETHYLBENZENE	77222	ND	n/a	0.5
524.2	1,2-DICHLOROBENZENE	34536	ND	600	0.5
524.2	1,2-DICHLOROETHANE	34531	ND	0.5	0.5
524.2	1,2-DICHLOROPROPANE	34541	ND	5	0.5
524.2	1,3,5-TRIMETHYLBENZENE	77226	ND	n/a	0.5
524.2	1,3-DICHLOROBENZENE	34566	ND	n/a	0.5
524.2	1,3-DICHLOROPROPANE	77173	ND	n/a	0.5
524.2	1,3-DICHLOROPROPENE (TOTAL)	34561	ND	0.5	0.5
524.2	1,4-DICHLOROBENZENE	34571	ND	5	0.5
524.2	2,2-DICHLOROPROPANE	77170	ND	n/a	0.5
524.2	2-CHLOROTOLUENE	A-008	ND	n/a	0.5
524.2	4-CHLOROTOLUENE	A-009	ND	n/a	0.5
524.2	BENZENE	34030	ND	1	0.5
524.2	BROMOBENZENE	81555	ND	n/a	0.5
524.2	BROMOCHLOROMETHANE	A-012	ND	n/a	0.5
524.2	BROMODICHLOROMETHANE (THM)	32101	ND	--	1.0
524.2	BROMOFORM (THM)	32104	ND	--	1.0
524.2	BROMOMETHANE	34413	ND	n/a	0.5
524.2	CARBON TETRACHLORIDE	32102	ND	0.5	0.5
524.2	CHLOROETHANE	34311	ND	n/a	0.5
524.2	CHLOROFORM (THM)	32106	ND	--	1.0
524.2	CHLOROMETHANE	34418	ND	n/a	0.5
524.2	CIS-1,2-DICHLOROETHYLENE	77093	ND	6	0.5
524.2	DIBROMOCHLOROMETHANE (THM)	32105	ND	--	1.0
524.2	DIBROMOMETHANE	77596	ND	n/a	0.5
524.2	DICHLORODIFLUOROMETHANE (FREON 12)	34668	ND	n/a	0.5
524.2	DICHLOROMETHANE	34423	ND	5	0.5
524.2	ETHYLBENZENE	34371	ND	300	0.5
524.2	HEXACHLOROBUTADIENE	34391	ND	n/a	0.5
524.2	ISOPROPYLBENZENE (CUMENE)	77223	ND	n/a	0.5
524.2	M,P-XYLENE	A-014	ND	--	0.5
524.2	METHYL-TERT-BUTYL-ETHER (MTBE)	46491	ND	5	3
524.2	MONOCHLOROBENZENE	34301	ND	70	0.5

AGRICULTURAL CHEMICAL AND MISCELLANEOUS ORGANIC ANALYSIS (10/97)

Sample ID No. 1910007-010
Client Sample: IRK1734-06 (10- 1910007-010)

Date of Report: 08/11/24
Laboratory Name: TESTAMERICA - ONTARIO (FORMERLY DEL MAR)
Signature Lab Director: Elizabeth [signature]
Name of Sampler: Rocio Olivar
Employed By:
Date/Time Sample Collected: 08/11/17/0945
Date/Time Sample Received @ Lab: 08/11/18/1940
Date Analysis Completed: 08/11/21

System Name: AZUSA LIGHT AND WATER
System Number: 1910007
Name or Number of Sample Source: WELL 10 (AVWC8)

User ID: 4TH
Station Number: 1910007-010
Date/Time of Sample. | 08 | 11 | 17 | 0945 |
YY MM DD TTTT
Laboratory Code: 1169
Date Analysis completed: | 08 | 11 | 21 |
YY MM DD
Submitted by:
Phone #:

Page 1 of 1

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED IN ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
524.2	CIS-1,3-DICHLOROPROPENE	34704	ND	0.5	0.5
524.2	TRANS-1,3-DICHLOROPROPENE	34699	ND	0.5	0.5

MAILED TO

CDPH Date ______ By ______
AZLW Date 12/8/08 By [initials]
______ Date ______ By ______
______ Date ______ By ______
Comments:

CRK0742

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APR 07 2008

ORGANIC CHEMICAL ANALYSIS (9/99)

Sample ID No. 10682490001 STETSON ENGINEERS INC.

Date of Report: 08/04/04
Laboratory
Name: PACE ANALYTICAL - MINNEAPOLIS
Name of Sampler: Rocio Olivar
Date/Time Sample
Collected: 08/02/12/1330

Signature Lab
Director: [signature]
Employed By: Stetson Engineers

Date/Time Sample
Received @ Lab: 08/02/16/0935

Date Analyses
Completed: 08/02/27

System
Name: AZUSA LIGHT AND WATER

System
Number: 1910007

Name or Number of Sample Source: GENESIS 02 (CITYS) - MONITORING WELL

User ID: 4TH
Date/Time of Sample: |08|02|12|1330|
YY MM DD TTTT

Station Number: 1910007-017
Laboratory Code: 2155
YY MM DD
Date Analysis completed: |08|02|27|
Phone #: ____________

Submitted by: ____________

Page 1 of 1

REGULATED ORGANIC CHEMICALS

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
1613	2,3,7,8-TCDD (Dioxin) Units=picogram/L	34676	ND	30	5.00

MAILED TO

DOHS Date____ By____

____ Date____ By____

____ Date____ By____

____ Date____ By____

Comments:

ORGANIC CHEMICAL ANALYSIS (9/99)

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED IN ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
524.2	N-BUTYLBENZENE	A-010	ND	n/a	0.5
524.2	N-PROPYLBENZENE (1-PHENYLPROPANE)	77224	ND	n/a	0.5
524.2	O-XYLENE	77135	ND	--	0.5
524.2	P-ISOPROPYLTOLUENE	A-011	ND	n/a	--
524.2	SEC-BUTYLBENZENE	77350	ND	n/a	0.5
524.2	STYRENE	77128	ND	100	0.5
524.2	TERT-BUTYLBENZENE	77353	ND	n/a	0.5
524.2	TETRACHLOROETHYLENE	34475	0.78	5	0.5
524.2	TOLUENE	34010	ND	150	0.5
524.2	TRANS-1,2-DICHLOROETHYLENE	34546	ND	10	0.5
524.2	TRICHLOROETHYLENE	39180	ND	5	0.5
524.2	TRICHLOROFLUOROMETHANE	34488	ND	150	5
524.2	TRIHALOMETHANES (THMs) - TOTAL	82080	ND	80	0.5
524.2	VINYL CHLORIDE	39175	ND	0.5	0.5
524.2	XYLENES (TOTAL)	81551	ND	1750	--

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STETSON ENGINEERS INC.

LA Testing
159 Pasadena Avenue
South Pasadena, CA

GENERAL MINERAL & PHYSICAL & INORGANIC ANALYSIS (9/99)

Date of Report: 08/04/03 Sample ID No 873107
Laboratory Signature Lab
Name: LA TESTING Director:
Name of Sampler: Rocio Olivar Employed By: Associated Laboratories
Date/Time Sample Collected: 08/02/12/1330 Date/Time Sample Received @ Lab: 08/02/19/1130 Date Analyses Completed: 08/02/21

System Name: AZUSA LIGHT AND WATER System Number: 1910007
Name or Number of Sample Source: GENESIS 02 (CITY5) - MONITORING WELL

User ID: 4TH Station Number: 1910007-017
Date/Time of Sample: |08|02|12|1330| Laboratory Code: 2283
YY MM DD TTTT YY MM DD
Date Analysis completed: |08|02|21|
Submitted by: Phone #:

PAGE 1 OF 1 ADDITIONAL ANALYSES

MCL	REPORTING UNITS	CHEMICAL	ENTRY #	ANALYSES RESULTS	DLR
7	MFL	Asbestos (MFL)	81855	ND	.20

+ Indicates Secondary Drinking Water Standards

Laboratory comments and description of any additional components found:

LA Testing #: 320802023

Associated #: LR206867

MAILED TO
DOHS Date____By____
____ Date____By____
____ Date____By____
____ Date____By____
Comments:

	pCi/L	Gross Beta MDA95	A-077		
4	pCi/L	Gross Beta, Calculated Dose Equivalent *	A-071		
8	pCi/L	Strontium 90	13501		2.0
	pCi/L	Strontium 90 Counting Error	13502		
	pCi/L	Strontium 90 MDA95	A-078		
20000	pCi/L	Tritium	07000		1000
	pCi/L	Tritium Counting Error	07001		
	pCi/L	Tritium MDA95	A-079		
	pCi/L	RADON			
	pCi/L	Radon 222	82303		100.0
	pCi/L	Radon 222 Counting Error	82302		
	pCi/L				
	pCi/L	*MDA95 is Minimum Detectable Activity at			
	pCi/L	the 95% confidence level, per			
	pCi/L	22 CCR 64442 and 64443.			
	pCi/L				
	pCi/L	**Gross Beta, Calculated Total Body or			
	pCi/L	Organ Dose Equivalent, Per 22 CCR 64443			
	pCi/L				

MAILED TO

DDHS Date____By____

____ Date____By____

____ Date____By____

____ Date____By____

Comments:

ASSOCIATED LABORATORIES
806 N. Batavia
Orange, CA 92868

RECEIVED EDT
APR 07 2008
STETSON ENGINEERS INC.

GENERAL MINERAL & PHYSICAL & INORGANIC ANALYSIS (9/99)

Date of Report: 08/04/07 Sample ID No.206867-873107
Laboratory Signature Lab
Name: ASSOCIATED LABORATORIES Director:
Name of Sampler:ROCIO OLIVAR Employed By: STETSON ENGINEERS
Date/Time Sample Collected:08/02/12/1330 Date/Time Sample Received @ Lab:08/02/12/1800 Date Analyses Completed:08/02/21

System Name:AZUSA LIGHT AND WATER System Number: 1910007
Name or Number of Sample Source:GENESIS 02 (CITY5) - MONITORING WELL

User ID: 4TH Station Number: 1910007-017
Date/Time of Sample: |08|02|12|1330| Laboratory Code: 4792
YY MM DD TTTT
Date Analysis completed: |08|02|21| YY MM DD
Submitted by: ________ Phone #: ________

MCL	REPORTING UNITS	CHEMICAL	ENTRY #	ANALYSES RESULTS	DLR
	mg/L	Total Hardness (as CaCO3) (mg/L)	00900	257	
	mg/L	Calcium (Ca) (mg/L)	00916	77.3	
	mg/L	Magnesium (Mg) (mg/L)	00927	15.6	
	mg/L	Sodium (NA) (mg/L)	00929	20.6	
	mg/L	Potassium (K) (mg/L)	00937	4.20	
Total Cations		Meq/L Value:			
	mg/L	Total Alkalinity (AS CaCO3) (mg/L)	00410	185	
	mg/L	Hydroxide (OH) (mg/L)	71830	ND	
	mg/L	Carbonate (CO3) (mg/L)	00445	ND	
	mg/L	Bicarbonate (HCO3) (mg/L)	00440	226	
*	mg/L+	Sulfate (SO4) (mg/L)	00945	41	.5
*	mg/L+	Chloride (Cl) (mg/L)	00940	33	
45	mg/L	Nitrate (as NO3) (mg/L)	71850	15.9	2.0
2	mg/L	Fluoride (F) (Natural-Source)	00951	0.27	.1
Total Anions		Meq/L Value:			
	Std.Units+	PH (Laboratory) (Std.Units)	00403	7.49	
***	umho/cm+	Specific Conductance (E.C.) (umhos/cm)	00095	560	
****	mg/L+	Total Filterable Residue@180C(TDS)(mg/L)	70300	340	
15	Units	Apparent Color (Unfiltered) (Units)	00081	ND	
3	TON	Odor Threshold at 60 C (TON)	00086	ND	1.
5	NTU	Lab Turbidity (NTU)	82079	0.22	
0.5	mg/L+	MBAS (mg/L)	38260	ND	

* 250-500-600 ** 0.6-1.7 *** 900-1600-2200 **** 500-1000-1500

Page 2 2802150349-230833

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
531.2	Oxamyl (Vydate)	38865	<20.0	50	20.0
515.4	Pentachlorophenol (PCP)	39032	<0.2	1	0.2
515.4	Pichloram (Tordon)	39720	<1.0	500	1.0
505	Polychlorinated Biphenyls(Tot PCB's)	39516	<0.5	0.5	0.5
531.2	Aldicarb (Temik)	39053	<3.0		3.0
531.2	Aldicarb sulfone	A-020	<4.		4.
531.2	Aldicarb sulfoxide	A-019	<3.0		3.0
525.2	Aldrin	39330	<.075		.075
505	PCB 1016 Aroclor	34671	<0.5	0.5	0.5
505	PCB 1221 Aroclor	39488	<0.5		0.5
505	PCB 1232 Aroclor	39492	<0.5		0.5
505	PCB 1242 Aroclor	39496	<0.5		0.5
505	PCB 1248 Aroclor	39500	<0.5		0.5
505	PCB 1254 Aroclor	39504	<0.5		0.5
505	PCB 1260 Aroclor	39508	<0.5		0.5

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____ Date____ By____

____ Date____ By____

____ Date____ By____

Comments:

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ORGANIC CHEMICAL ANALYSIS (9/99)
Date of Report:03/28/08
Laboratory
Name: MWH Laboratories
Name of Sampler:
Date/Time Sample
Collected: 02/12/08 1330

Sample ID No. 2802150349-230833 EDT
Signature Lab STETSON ENGINEERS INC.
Director:
Employed By:
Date/Time Sample
Received @ Lab: 02/15/08
Date Analyses
Completed: 02/25/08

System Name: AZUSA LIGHT AND WATER
System Number: 1910007 COC ID: LR206867 873107
Name or Number of Sample Source: GENESIS 02 (CITY5) - MONITORING WELL

User ID: 4th Station Number: 1910007-017
Date/Time of Sample: |08|02|12|1330| (YY MM DD TTTT) Laboratory Code: 9590
Date Analysis completed: |08|02|25| (YY MM DD)
Submitted by: Danielle Roberts Phone #: (714) 920-5157

Page 1

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
505	Endrin	39390	<.1	2	.1
505	Lindane (gamma-BHC)	39340	<0.2	0.2	0.2
505	Methoxychlor	39480	<10.0	30	10.0
505	Toxaphene	39400	<1.0	3	1.0
505	Chlordane	39350	<.1	.1	.1
525.2	Diethylhexylphthalate (DEHP)	39100	<3.0	4	3.0
505	Heptachlor	39410	<0.01	.01	0.01
505	Heptachlor epoxide	39420	<0.01	.01	0.01
525.2	Atrazine	39033	<0.5	1	0.5
525.2	Molinate (Ordram)	82199	<2.0	20	2.0
525.2	Simazine (Princep)	39055	<1.0	4	1.0
525.2	Thiobencarb (Bolero)	A-001	<1.0	70	1.0
525.2	Alachlor (Alanex)	77825	<1.0	2	1.0
515.4	Bentazon (Basagran)	38710	<2.0	18	2.0
525.2	Benzo(a)pyrene	34247	<.1	0.2	.1
515.4	2,4-D	39730	<10.0	70	10.0
515.4	2,4,5-TP (Silvex)	39045	<1.0	50	1.0
531.2	Carbofuran (Furadan)	81405	<5.0	18	5.0
515.4	Dalapon (Dowpon)	38432	<10.0	200	10.0
515.4	Dinoseb (DNBP)	81287	<2.0	7	2.0
549	Diquat	78885	<4.	20	4.
525.2	Di(2-ethylhexyl)adipate	A-026	<5.0	400	5.0
548	Endothall	38926	<45.0	100	45.0
547	Glyphosate	79743	<25.0	700	25.0
525.2	Hexachlorobenzene	39700	<0.5	1	0.5
525.2	Hexachlorocyclopentadiene	34386	<1.0	50	1.0

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RADIOACTIVITY ANALYSIS (9/99)

Date of Report: 08/03/20 Sample ID No.C08020770-001
Laboratory Signature Lab
Name: ENERGY LABORATORIES Director: ____________
Name of Sampler:Rocio Olivar Employed By: Stetson Engineers
Date/Time Sample Collected:08/02/12/0000 Date/Time Sample Received @ Lab:08/02/21/0915 Date Analyses Completed:08/03/13

System Name:AZUSA LIGHT AND WATER System Number: 1910007
Name or Number of Sample Source:GENESIS 02 (CITY5) - MONITORING WELL

* User ID: 4TH Station Number: 1910007-017 *
* Date/Time of Sample: |08|02|12|0000| Laboratory Code: 2158 *
* YY MM DD TTTT YY MM DD *
* Date Analysis completed: |08|03|13| *
* Submitted by: ____________ Phone #: ____________ *

MCL	REPORT UNITS	CHEMICAL	STORET CODE	ANALYSES RESULTS	DLR
	pCi/L	TITLE 22 CALIFORNIA CODE OF REGULATIONS			
	pCi/L	SECTION 64442 (22 CCR 64442)			
15	pCi/L	Gross Alpha	01501	4.1	3.0
	pCi/L	Gross Alpha Counting Error	01502	0.6	
	pCi/L	Gross Alpha MDA95 *	A-072		
20	pCi/L	Uranium	28012	3.3	1.0
	pCi/L	Uranium Counting Error	A-028		
	pCi/L	Uranium MDA95	A-073		
	pCi/L	Radium 226	09501	< 1.0	1.0
	pCi/L	Radium 226 Counting Error	09502	0.1	
	pCi/L	Radium 226 MDA95	A-074		
	pCi/L	Radium 228	11501	< 1.0	1.0
	pCi/L	Radium 228 Counting Error	11502	0.4	
	pCi/L	Radium 228 MDA95	A-075		
5	pCi/L	Ra 226 + Ra 228, Combined	11503	< 1	
	pCi/L	Ra 226 + Ra 228 Counting Error, Combined	11504	0.4	
	pCi/L	Ra 226 + Ra 229 MDA95, Combined	A-076		
	pCi/L	RADIUM, TOTAL, (FOR NTNC ONLY, BY 903.0)			
	pCi/L	Ra-226 for CWS or Tot RA for NTNC by 903	A-080		
	pCi/L	Ra-226 or Total RA by 903.0 C.E.	A-081		
	pCi/L	Ra-226 or Total RA by 903.0 MDA95	A-082		
	pCi/L	TITLE 22 CALIFORNIA CODE OF REGULATIONS			
	pCi/L	SECTION 64443 (22 CCR 64443)			
50	pCi/L	Gross Beta	03501		4.0
	pCi/L	Gross Beta Counting Error	03502		

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STETSON ENGINEERS INC.

ORGANIC CHEMICAL ANALYSIS (9/99)

Date of Report: 08/03/12
Sample ID No. GENESIS 02 / 873107
Laboratory Name: CALSCIENCE ENVIRONMENTAL LABORATORIES
Signature Lab Director:
Name of Sampler: ROCIO OLIVAR
Employed By: STETSON ENGINEERS
Date/Time Sample Collected: 08/02/12/1330
Date/Time Sample Received @ Lab: 08/02/15/1611
Date Analyses Completed: 08/02/27

System Name: AZUSA LIGHT AND WATER
System Number: 1910007
Name or Number of Sample Source: GENESIS 02 (CITY5) - MONITORING WELL

User ID: 4TH
Station Number: 1910007-017
Date/Time of Sample: |08|02|12|1330|
YY MM DD TTTT
Laboratory Code: 4460
Date Analysis completed: |08|02|27|
YY MM DD
Submitted by: ____________________
Phone #: ____________________

Page 1 of 1

REGULATED ORGANIC CHEMICALS

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
	UNREGULATED ORGANIC CHEMICALS				
524M	1,2,3-Trichloropropane	77443	ND		.005

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STETSON ENGINEERS INC.

ORGANIC CHEMICAL ANALYSIS (9/99)

Date of Report: 08/03/12 Sample ID No GENESIS 02 / 873107
Laboratory Signature Lab
Name: CALSCIENCE ENVIRONMENTAL LABORATORIES Director:
Name of Sampler:ROCIO OLIVAR Employed By: STETSON ENGINEERS
Date/Time Sample Date/Time Sample Date Analyses
Collected:08/02/12/1330 Received @ Lab:08/02/15/1611 Completed:08/02/21

System System
Name:AZUSA LIGHT AND WATER Number: 1910007
Name or Number of Sample Source:GENESIS 02 (CITY5) - MONITORING WELL

* User ID: 4TH Station Number: 1910007-017 *
* Date/Time of Sample: |08|02|12|1330| Laboratory Code: 4460 *
* YY MM DD TTTT YY MM DD *
* Date Analysis completed: |08|02|21| *
* Submitted by: ______ Phone #: ______ *

Page 1 of 1 REGULATED ORGANIC CHEMICALS

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
	UNREGULATED ORGANIC CHEMICALS				
	1,4-Dioxane	A-032	ND		3.00

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STETSON ENGINEERS INC.

BASE, NEUTRALS, AND ACIDS ORGANIC ANALYSIS (10/97)

Date of Report: 08/03/12 Sample ID No. GENESIS 02 / 873107
Laboratory Signature Lab
Name: CALSCIENCE ENVIRONMENTAL LABORATORIES Director:
Name of Sampler: ROCIO OLIVAR Employed By: STETSON ENGINEERS
Date/Time Sample Collected: 08/02/12/1330 Date/Time Sample Received @ Lab: 08/02/15/1611 Date Analyses Completed: 08/02/23

System Name: AZUSA LIGHT AND WATER System Number: 1910007
Name or Number of Sample Source: GENESIS 02 (CITY5) - MONITORING WELL

User ID: 4TH Station Number: 1910007-017
Date/Time of Sample: |08|02|12|1330| Laboratory Code: 4460
YY MM DD TTTT YY MM DD
Date Analysis completed: |08|02|23|
Submitted by: ____________ Phone #: ____________

Page 1 of 1

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
	ADDITIONAL EXTRACTABLE PARAMETERS				
1625CM	N-Nitrosodimethylamine (NDMA)	34438	ND		.002

CEL

 REGULATED ORGANIC CHEMICALS CONTINUED 206867-873108

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
524.2	Trichlorotrifluoroethane (FREON 113)	81611	ND	1200	10.00
524.2	Vinyl Chloride (VC)	39175	ND	.5	.50
524.2	m-Xylene	81710	ND		.50
524.2	m,p-Xylene	A-014	ND		.50
524.2	o-Xylene	77135	ND		.50
524.2	p-Xylene	78132	ND		.50
524.2	Total Xylenes (m,p, & o)	81551	ND	1750	
	UNREGULATED ORGANIC CHEMICALS				
524.2	Bromobenzene	81555	ND		.50
524.2	Bromochloromethane	A-012	ND		.50
524.2	Bromomethane (Methyl Bromide)	34413	ND		.50
524.2	n-Butylbenzene	A-010	ND		.50
524.2	sec-Butylbenzene	77350	ND		.50
524.2	tert-Butylbenzene	77353	ND		.50
524.2	Chloroethane	34311	ND		.50
524.2	Chloromethane (Methyl Chloride)	34418	ND		.50
524.2	2-Chlorotoluene	A-008	ND		.50
524.2	4-Chlorotoluene	A-009	ND		.50
524.2	Dibromomethane	77596	ND		.50
524.2	1,3-Dichlorobenzene (m-DCB)	34566	ND		.50
524.2	Dichlorodifluoromethane (Freon 12)	34668	ND		0.50
524.2	1,3-Dichloropropane	77173	ND		.50
524.2	2,2-Dichloropropane	77170	ND		.50
524.2	1,1-Dichloropropene	77168	ND		.50
524.2	Hexachlorobutadiene	34391	ND		.50
524.2	Isopropylbenzene (Cumene)	77223	ND		.50
524.2	p-Isopropyltoluene	A-011	ND		
524.2	n-Propylbenzene	77224	ND		.50
524.2	1,1,1,2-Tetrachloroethane	77562	ND		.50
524.2	1,2,3-Trichlorobenzene	77613	ND		.50
524.2	1,2,4-Trimethylbenzene	77222	ND		.50
524.2	1,3,5-Trimethylbenzene	77226	ND		.50

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DOHS Date____ By____

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Comments:

ASSOCIATED LABORATORIES
806 N. Batavia
Orange, CA 92868
ORGANIC CHEMICAL ANALYSIS (9/99)

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Date of Report: 08/03/05
Sample ID No.206867-873108
Laboratory Name: ASSOCIATED LABORATORIES
Signature Lab Director: STETSON ENGINEERS INC.
Name of Sampler:
Employed By:
Date/Time Sample Collected: / / /
Date/Time Sample Received @ Lab:08/02/12/1800
Date Analyses Completed:08/02/18

System Name:AZUSA LIGHT AND WATER
System Number: 1910007
Name or Number of Sample Source:TRAVEL BLANK

User ID: 4TH
Station Number:
Date/Time of Sample: | | | | | (YY MM DD TTTT)
Laboratory Code: 4792
Date Analysis completed: |08|02|18| (YY MM DD)
Submitted by: ____________
Phone #: ____________

Page 1 of 2

REGULATED ORGANIC CHEMICALS

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
524.2	Total Trihalomethanes (TTHMs)	82080	ND	80	
524.2	Bromodichloromethane	32101	ND		1.0
524.2	Bromoform	32104	ND		1.0
524.2	Chloroform (Trichloromethane)	32106	ND		1.0
524.2	Dibromochloromethane	32105	ND		1.0
524.2	Benzene	34030	ND	1	.50
524.2	Carbon Tetrachloride	32102	ND	.5	.50
524.2	1,2-Dichlorobenzene (o-DCB)	34536	ND	600	.50
524.2	1,4-Dichlorobenzene (p-DCB)	34571	ND	5	.50
524.2	1,1-Dichloroethane (1,1-DCA)	34496	ND	5	.50
524.2	1,2-Dichloroethane (1,2-DCA)	34531	ND	.5	.50
524.2	1,1-Dichloroethylene (1,1-DCE)	34501	ND	6	.50
524.2	cis-1,2-Dichloroethylene (c-1,2-DCE)	77093	ND	6	.50
524.2	trans-1,2-Dichloroethylene (t-1,2-DCE)	34546	ND	10	.50
524.2	Dichloromethane (Methylene Chloride)	34423	ND	5	.50
524.2	1,2-Dichloropropane	34541	ND	5	.50
524.2	Total 1,3-Dichloropropene	34561	ND	.5	.50
524.2	Ethyl Benzene	34371	ND	300	.50
524.2	Methyl tert-Butyl Ether(MTBE)	46491	ND	5	3.00
524.2	Monochlorobenzene (Chlorobenzene)	34301	ND	70	.50
524.2	Styrene	77128	ND	100	.50
524.2	1,1,2,2-Tetrachloroethane	34516	ND	1	.50
524.2	Tetrachloroethylene (PCE)	34475	ND	5	.50
524.2	Toluene	34010	ND	150	.50
524.2	1,2,4-Trichlorobenzene	34551	ND	5	.50
524.2	1,1,1-Trichloroethane (1,1,1-TCA)	34506	ND	200	.50
524.2	1,1,2-Trichloroethane (1,1,2-TCA)	34511	ND	5	.50
524.2	Trichloroethylene (TCE)	39180	ND	5	.50
524.2	Trichlorofluoromethane (FREON 11)	34488	ND	150	5.00

 REGULATED ORGANIC CHEMICALS CONTINUED 206867-873107

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
524.2	Trichlorotrifluoroethane (FREON 113)	81611	ND	1200	10.00
524.2	Vinyl Chloride (VC)	39175	ND	.5	.50
524.2	m-Xylene	81710	ND		.50
524.2	m,p-Xylene	A-014	ND		.50
524.2	o-Xylene	77135	ND		.50
524.2	p-Xylene	78132	ND		.50
524.2	Total Xylenes (m,p, & o)	81551	ND	1750	
	UNREGULATED ORGANIC CHEMICALS				
524.2	Bromobenzene	81555	ND		.50
524.2	Bromochloromethane	A-012	ND		.50
524.2	Bromomethane (Methyl Bromide)	34413	ND		.50
524.2	n-Butylbenzene	A-010	ND		.50
524.2	sec-Butylbenzene	77350	ND		.50
524.2	tert-Butylbenzene	77353	ND		.50
524.2	Chloroethane	34311	ND		.50
524.2	Chloromethane (Methyl Chloride)	34418	ND		.50
524.2	2-Chlorotoluene	A-008	ND		.50
524.2	4-Chlorotoluene	A-009	ND		.50
524.2	Dibromomethane	77596	ND		.50
524.2	1,3-Dichlorobenzene (m-DCB)	34566	ND		.50
524.2	Dichlorodifluoromethane (Freon 12)	34668	0.6		0.50
524.2	1,3-Dichloropropane	77173	ND		.50
524.2	2,2-Dichloropropane	77170	ND		.50
524.2	1,1-Dichloropropene	77168	ND		.50
524.2	Hexachlorobutadiene	34391	ND		.50
524.2	Isopropylbenzene (Cumene)	77223	ND		.50
524.2	p-Isopropyltoluene	A-011	ND		
524.2	n-Propylbenzene	77224	ND		.50
524.2	1,1,1,2-Tetrachloroethane	77562	ND		.50
524.2	1,2,3-Trichlorobenzene	77613	ND		.50
524.2	1,2,4-Trimethylbenzene	77222	ND		.50
524.2	1,3,5-Trimethylbenzene	77226	ND		.50

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STETSON ENGINEERS INC.

ASSOCIATED LABORATORIES
806 N. BATAVIA
ORANGE, CA 92868
ORGANIC CHEMICAL ANALYSIS (9/99)

Date of Report: 08/03/07
Sample ID No.206867-873107
Laboratory
Name: ASSOCIATED LABORATORIES
Signature Lab Director:
Name of Sampler:ROCIO OLIVAR
Employed By: STETSON ENGINEERS
Date/Time Sample Collected:08/02/12/1330
Date/Time Sample Received @ Lab:08/02/12/1800
Date Analyses Completed:08/02/18

System Name:AZUSA LIGHT AND WATER
System Number: 1910007
Name or Number of Sample Source:GENESIS 02 (CITY5) - MONITORING WELL

User ID: 4TH
Station Number: 1910007-017
Date/Time of Sample: |08|02|12|1330| YY MM DD TTTT
Laboratory Code: 4792
Date Analysis completed: |08|02|18| YY MM DD
Submitted by:
Phone #:

Page 1 of 2

REGULATED ORGANIC CHEMICALS

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
524.2	Total Trihalomethanes (TTHMs)	82080	ND	80	
524.2	Bromodichloromethane	32101	ND		1.0
524.2	Bromoform	32104	ND		1.0
524.2	Chloroform (Trichloromethane)	32106	2.6		1.0
524.2	Dibromochloromethane	32105	ND		1.0
524.2	Benzene	34030	ND	1	.50
524.2	Carbon Tetrachloride	32102	ND	.5	.50
524.2	1,2-Dichlorobenzene (o-DCB)	34536	ND	600	.50
524.2	1,4-Dichlorobenzene (p-DCB)	34571	ND	5	.50
524.2	1,1-Dichloroethane (1,1-DCA)	34496	ND	5	.50
524.2	1,2-Dichloroethane (1,2-DCA)	34531	ND	.5	.50
524.2	1,1-Dichloroethylene (1,1-DCE)	34501	18.0	6	.50
524.2	cis-1,2-Dichloroethylene (c-1,2-DCE)	77093	ND	6	.50
524.2	trans-1,2-Dichloroethylene (t-1,2-DCE)	34546	ND	10	.50
524.2	Dichloromethane (Methylene Chloride)	34423	ND	5	.50
524.2	1,2-Dichloropropane	34541	ND	5	.50
524.2	Total 1,3-Dichloropropene	34561	ND	.5	.50
524.2	Ethyl Benzene	34371	ND	300	.50
524.2	Methyl tert-Butyl Ether(MTBE)	46491	ND	5	3.00
524.2	Monochlorobenzene (Chlorobenzene)	34301	ND	70	.50
524.2	Styrene	77128	ND	100	.50
524.2	1,1,2,2-Tetrachloroethane	34516	ND	1	.50
524.2	Tetrachloroethylene (PCE)	34475	1.0	5	.50
524.2	Toluene	34010	ND	150	.50
524.2	1,2,4-Trichlorobenzene	34551	ND	5	.50
524.2	1,1,1-Trichloroethane (1,1,1-TCA)	34506	2.5	200	.50
524.2	1,1,2-Trichloroethane (1,1,2-TCA)	34511	ND	5	.50
524.2	Trichloroethylene (TCE)	39180	3.7	5	.50
524.2	Trichlorofluoromethane (FREON 11)	34488	ND	150	5.00

ASSOCIATED LABORATORIES
806 N. BATAVIA
ORANGE, CA 92868
ORGANIC CHEMICAL ANALYSIS (9/99)

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STETSON ENGINEERS INC

Date of Report: 08/03/07
Sample ID No.206867-873107
Laboratory Name: ASSOCIATED LABORATORIES
Signature Lab Director:
Name of Sampler: ROCIO OLIVAR
Employed By: STETSON ENGINEERS
Date/Time Sample Collected: 08/02/12/1330
Date/Time Sample Received @ Lab: 08/02/12/1800
Date Analyses Completed: 08/02/22

System Name: AZUSA LIGHT AND WATER
System Number: 1910007
Name or Number of Sample Source: GENESIS 02 (CITY5) - MONITORING WELL

User ID: 4TH
Station Number: 1910007-017
Date/Time of Sample: |08|02|12|1330| YY MM DD TTTT
Laboratory Code: 4792
Date Analysis completed: |08|02|22| YY MM DD
Submitted by: ____
Phone #: ____

Page 1 of 1

REGULATED ORGANIC CHEMICALS

TEST METHOD	CHEMICAL ALL CHEMICALS REPORTED ug/L	ENTRY #	ANALYSES RESULTS	MCL ug/L	DLR ug/L
504	Dibromochloropropane (DBCP)	38761	ND	.2	.01
504	Ethylene Dibromide (EDB)	77651	ND	.05	.02

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ASSOCIATED LABORATORIES
806 N. BATAVIA
ORANGE, CA 92868

GENERAL MINERAL & PHYSICAL & INORGANIC ANALYSIS (9/89)

Date of Report: 08/03/07 Sample ID No.206867-873107
Laboratory Signature Lab STETSON ENGINEERS INC.
Name: ASSOCIATED LABORATORIES Director:
Name of Sampler:ROCIO OLIVAR Employed By: STETSON ENGINEERS
Date/Time Sample Date/Time Sample Date Analyses
Collected:08/02/12/1330 Received @ Lab:08/02/12/1800 Completed:08/02/20

System Name:AZUSA LIGHT AND WATER System Number: 1910007
Name or Number of Sample Source:GENESIS 02 (CITY5) - MONITORING WELL

User ID: 4TH Station Number: 1910007-017
Date/Time of Sample: |08|02|12|1330| Laboratory Code: 4792
YY MM DD TTTT YY MM DD
Date Analysis completed: |08|02|20|
Submitted by: ____ Phone #: ____

PAGE 1 OF 1 ADDITIONAL ANALYSES

MCL	REPORTING UNITS	CHEMICAL	ENTRY #	ANALYSES RESULTS	DLR
6	ug/L	Perchlorate (ug/L)	A-031	ND	4.0

+ Indicates Secondary Drinking Water Standards

 INORGANIC CHEMICALS 206867-873107

MCL	REPORTING UNITS	CHEMICAL	ENTRY #	ANALYSES RESULTS	DLR
1000	ug/L	Aluminum (Al) (ug/L)	01105	ND	50.0
6	ug/L	Antimony (ug/L)	01097	ND	6.0
10	ug/L	Arsenic (As) (ug/L)	01002	ND	2.0
1000	ug/L	Barium (Ba) (ug/L)	01007	107	100.0
4	ug/L	Beryllium (ug/L)	01012	ND	1.0
5	ug/L	Cadmium (Cd) (ug/L)	01027	ND	1.0
50	ug/L	Chromium (Total Cr) (ug/L)	01034	ND	10.0
1000	ug/L+	Copper (Cu) (ug/L)	01042	ND	50.0
300	ug/L+	Iron (Fe) (ug/L)	01045	ND	100.0
50	ug/L+	Manganese (Mn) (ug/L)	01055	ND	20.0
2	ug/L	Mercury (Hg) (ug/L)	71900	ND	1.0
100	ug/L	Nickel (ug/L)	01067	ND	10.0
50	ug/L	Selenium (Se) (ug/L)	01147	ND	5.0
100	ug/L+	Silver (Ag) (ug/L)	01077	ND	10.0
2	ug/L	Thallium (ug/L)	01059	ND	1.0
5000	ug/L	Zinc (Zn) (ug/L)	01092	ND	50.0

ADDITIONAL ANALYSES

		Langelier Index at 60 C	71813	0.79	
		Agressiveness Index	82383	12.0	
1000	ug/L	Nitrite as Nitrogen(N) (ug/L)	00620	ND	400
150	ug/L	Cyanide (ug/L)	01291	ND	100.0

+ Indicates Secondary Drinking Water Standards

MAILED TO

DOHS Date____ By____

____ Date____ By____

____ Date____ By____

Prepared By

CIVILTEC engineering inc.

GENERAL CIVIL, MUNICIPAL, WATER AND WASTEWATER ENGINEERING, PLANNING, CONSTRUCTION MANAGEMENT AND SURVEYING

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Rev. 10/00

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PROFESSIONAL SERVICE AGREEMENT ADDENDUM

Public Client
Addendum No. 1

THIS ADDENDUM to the AGREEMENT, made and entered into October 29, 2008, by and between Post, Buckley, Schuh & Jernigan, Inc. (PBS&J) and the Client identified herein, provides for the Additional Services described under Item 1 of this Agreement.

CLIENT: Three Valleys Municipal Water District

PROJECT NUMBER: 0D2115101

SHORT TITLE OF MAIN CONTRACT: WEP Cultural Training

SHORT TITLE OF ADDENDUM: Restoration Monitoring

1. DESCRIPTION OF ADDITIONAL PROFESSIONAL SERVICES TO BE PROVIDED BY PBS&J (If additional pages are necessary, they are identified as Attachment A):

Restoration monitoring and preparation of monitoring report. See Attachment A.

2. THE COMPENSATION TO BE PAID PBS&J for providing the requested services shall be (If additional pages are necessary, they are identified as Attachment B):

- ☐ Direct personnel expense plus a surcharge of ________, plus reimbursable costs.
- ☐ A Lump-Sum charge of $ ____________________, plus out-of-pocket expenses.
- ☑ Unit Cost/Time Charges identified in Attachment B, plus reimbursable costs.
- ☐ In accordance with the provisions for additional services compensation set forth in the aforementioned Agreement.
- ☐ Other - See Attachment B

IN WITNESS WHEREOF, this Addendum is accepted on the later date written below, subject to the terms and conditions above stated, and the aforementioned Agreement.

CLIENT: Three Valleys Municipal Water District	POST, BUCKLEY, SCHUH & JERNIGAN, INC.
SIGNED: Mike Sovich	SIGNED:
TYPED NAME: Mike Sovich	TYPED NAME: John Spranza, II
TITLE: Assistant General Manager - Engineering & Operations	TITLE: Group Manager - California Natural Resources
DATE: 10/29/08	DATE: 10/29/08

Distribution: **Copy 1** - PBS8J; **Copy 2** - Client; **Copy 3** - PBS&J Accounting

PBS&J
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ATTACHMENT A

To: Mario Garcia
Project Engineer
Three Valleys Municipal Water District
1021 E. Miramar Ave.
Claremont, CA 91711

From: May Lau, PBS&J

Date: October 14, 2008

Subject: Contract Augment Request for Restoration Monitoring of Three Valleys Municipal Water District's San Antonio Spreading Grounds Project.

Dear Mario:

As we discussed, on September 17th 2008, and the Three Valleys Municipal Water District (District) has acknowledged, additional monitoring activities to oversee restoration efforts were not included in the original scope of work for the San Antonio Spreading Grounds Conjunctive Use Project. The purpose of this scope of work and cost estimate is to provide the District with an estimated amount of labor hours and other direct costs needed to ensure that all applicable standards and thresholds identified in the San Antonio Spreading Grounds Conjunctive Use Project Habitat Mitigation and Monitoring Plan for Riversidean Alluvial Fan Sage Scrub Re-vegetation (HMMP) prepared for the project are met.

As discussed in the HMMP, a qualified "Restoration Monitor" (RM) will be retained to oversee implementation of the HMMP and provide appropriate recommendations where remedial measures are potentially required. PBS&J will provide technical oversight and coordination of site preparations and seed application as well as maintenance and monitoring. Annual progress reports will be prepared by the RM and submitted to the District as described in the tasks below.

TASK 1: MONITORING INSPECTIONS

1.1 - Monitoring Site Preparation and the Initial Seed Application
Monitoring of site preparation (i.e., soil ripping) activities and the initial seed application process (two site visits). It is expected that Task 1 will be performed by the RM.

1.2 – Quarterly Inspections and Surveys for Two Years
During the first two years after initial seeding is accomplished, monitoring of progress and attainment of performance standards will be performed by the RM. During the first two years, the re-vegetation areas will be inspected quarterly (eight site visits). Qualitative surveys, consisting of a general site walkover and characterization of the coverage and species distribution exhibited in the seeded area, will be performed during each monitoring visit. General observations, such as

presence and coverage of the seeded species, weed or pest problems, signs of erosion or other disturbance, will be noted in each site walkover. Quantitative data will be collected during the late spring/early summer inspection to determine the composition and coverage of vegetation by species as specified in the HMMP, and how these areas relate to comparable local reference habitat sites. In addition, permanent photograph stations will be established at the end and beginning of sampling transects. These stations will be used during the entire monitoring process.

TASK 2: MONITORING REPORTS

Monitoring results and recorded data will be submitted to the District. Documentation will include the following:

2.1 - Recording the Initial Seed Application
Within 30 days of the seed application, the RM will prepare and submit a memorandum to document the completion of site preparation and the seed application This record will specify the date(s) of the seed application, list the species and quantities of seed and other materials applied, Also the memorandum will identify any deviations from this plan or other significant problems encountered. The initial memorandum will include a graphic exhibit depicting the treated areas and include photographs of the treated areas. This document will provide confirmation of completion of initial installation and the commencement of the maintenance and monitoring phase.

2.2 - Annual Monitoring
Annual monitoring status reports summarizing maintenance activities and monitoring results will be prepared and distributed by the RM prior to August 15 in both 2009 and 2010. Species dominance, success or failure of seeded species, total vegetative cover, percent relative cover by native species, observed weed or pest problems, additional maintenance procedures, and general condition of the treatment areas will be summarized. Photographs will be included to provide a visual record of the progress of the re-vegetation. Recommendations for corrective measures will be identified and described in the annual reports.

COSTS

The proposed fee for performance of the above monitoring tasks is $14,618, as shown in the budget augment (Attachment B). This does not include meetings not specifically addressed in the scope of work. The proposed fee covers all efforts that could be reasonably anticipated at this point in time.

We appreciate the opportunity to continue working with the District, and value our professional relationship. Thank you for your consideration of this request for a contract addendum. If you have any questions, please call me (310) 268-8132 or (310) 736-0529.

Sincerely,

May Lau

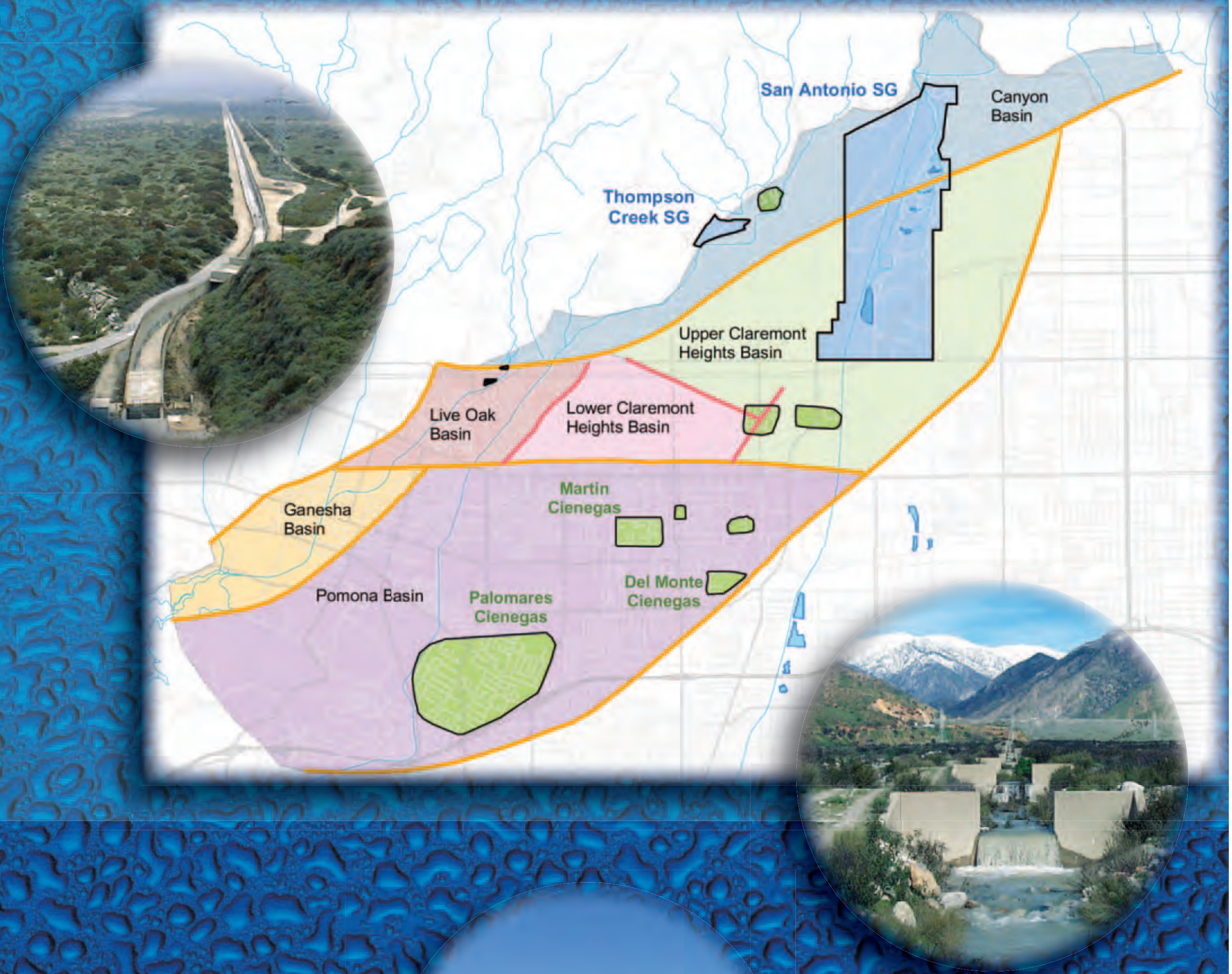
May Lau
Environmental Scientist

Attachment B
TVMWD San Antonio Spreading Grounds Project - Restoration Monitoring
PBS&J Cost Estimate

	Project Title	Project Manager	Environmental Scientist	Word Processing	GIS Technition	**Hours Per Task**	**Cost Per Subtask**	**Cost Per Task**
	Billing Title	Project Manager/ Senior Biologist	Scientist II	Administrative II	Sr. GIS Analyst I			
Task 1	**Monitoring Inspections**							**$ 11,950**
1.1	Monitoring Initial Seed Application (2 site visits)		12			12	$ 1,260	
1.2	Quarterly Inspections and Surveys (8 site visits)	10	54			64	$ 7,020	
Task 2	**Monitoring Reports**							
2.1	Recording Initial Seed Application (1 technical memo)	2	4		1	7	$ 800	
2.2	Annual Monitoring (2 annual reports)	2	10	2	2	16	$ 1,700	
	Project Management	4	6			10	$ 1,170	
	Total Hours	18	86	2	3	109		
	Hourly Rate	$ 135	$ 105	$ 80	$ 110			
	Total PBS&J Labor	$ 2,430	$ 9,030	$ 160	$ 330		$ 11,950	**$ 11,950**
								$ -
Subconsultant								
	Botanist	8						
	Hourly Rate	$ 140					$ 1,120	
	Total Subconsultant Labor	$ 1,120						**$ 1,120**
Expenses								
	Travel Expenses						$ 1,200	
	Total Expenses							**$ 1,200**
Subtotal								**$ 14,270**
PBS&J Administration Fee (15% of ODCs and Subconsultants)								**$ 348**
Total Budget								**$ 14,618**

THREE VALLEYS MUNICIPAL WATER DISTRICT

Mitigation Alternatives to Rising Groundwater Study



CDM
REPORT

March 2006

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Executive Summary

ES.1 Introduction

Spreading of local surface water is a key component of groundwater resources in the Six Basins Area; however, it is highly dependent on local precipitation and runoff patterns. During periods of high precipitation, significant amounts of local surface water have been spread which have resulted in water level increases throughout the study area; conversely, significant declines in water levels are experienced during average to below average precipitation years.

Historically, periods of high precipitation and local surface water spreading have resulted in groundwater rising to the surface at various locations in the Six Basins Area. The occurrence of rising water in the area has been an issue that local residents in the Pomona-Claremont area have periodically been concerned with for a long time. Rising water has been documented as occurring in the late 1880's during occasional wet periods and throughout the 1900's including the recent 2004-05 period of high rainfall.

Three Valleys Municipal Water District (TVMWD) would like to spread imported water in the lower portion of the San Antonio Spreading Grounds (SASG) to augment water levels in the study area; however, spreading of imported water could result in larger amounts of rising water during wet periods if the basin is not properly managed. TVMWD is in the process of designing the associated transmission pipelines and pertinent facilities from the existing connection at the Miramar water treatment plant to deliver imported water to the spreading grounds. The spreading of imported water would expand the conjunctive management of the Six Basins Area by spreading imported water in the SASG, and strategically pumping the basin to both withdraw the stored water and reduce or eliminate the occurrence of rising water in some portions of the Six Basins Area.

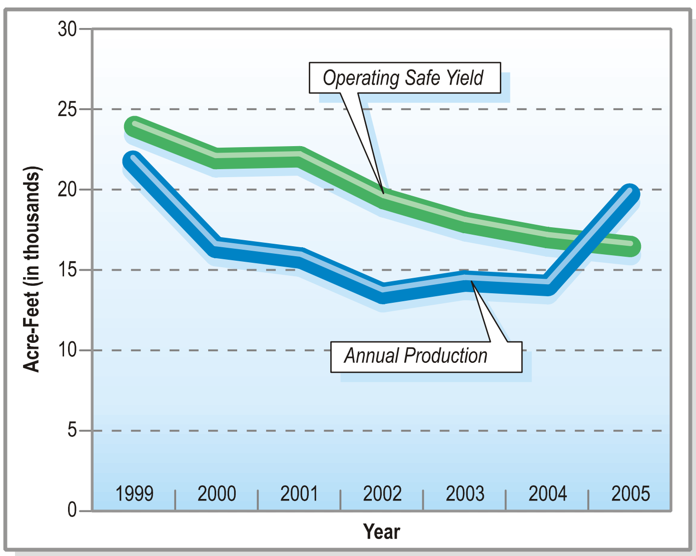
Objective of the Study

The objective of this study is to evaluate different basin management scenarios that consider approaches to further control rising water as well as different levels of imported water spreading. The study defines the basin operating parameters and identifies the necessary facilities to reduce or eliminate the occurrence of rising water and recover the stored water throughout the Six Basins Area. The study focuses on the construction of extraction wells at key locations that could be operated as normal supply wells for either local producers or exported to other purveyors in the area during most years with the provision of increasing production when water levels at certain indicator wells reach specific target levels.

Study Approach

The study evaluates four different scenarios and compares them against a Baseline condition. The first scenario identifies the necessary changes in operations of existing facilities to minimize rising water conditions resulting from spreading of local surface water only. Imported water spreading is not considered under this scenario. The remaining three scenarios simulate three different levels of imported water spreading and identify the facilities required to mitigate the occurrence of rising water and recover the stored water. The Imported Water Scenarios are then compared against the No Imported Water Scenario to document the relative changes in operations in the groundwater basin resulting from different levels of imported water spreading. All scenarios are also compared based on economic, environmental, institutional, and legal considerations. The knowledge gained from the evaluation of the scenarios is used to develop an recommended plan to spread imported water in the Six Basins Area.

Availability of Groundwater in the Six Basins Area



The long-term safe yield of the Six Basins Area was established in the Judgment at 19,300 ac-ft per year; however, in 6 out of 7 years since 1999 when the basins were adjudicated, local producers have not been able to produce enough groundwater due to declining water levels or water quality limitations as illustrated in the figure to the left. It was not until 2005, a year of near record high rainfall and surface water spreading that producers were able to pump more than the operating safe yield of the Six Basins. In 2005, significant amounts of surface water were spread at the San Antonio and Thompson Creeks spreading grounds; as a result, water levels rose significantly in the area. To minimize the potential for rising water, the Watermaster declared a 6,000 ac-ft surplus to augment the production rights of individual parties.

Two of the main reasons groundwater production fluctuates so significantly in the Six Basins Area are the relative storage capacity of the basins and the high variations in local precipitation and surface water available for groundwater recharge. Spreading of imported water would help attenuate water levels in the study area during periods of declining water levels. In addition, spreading of imported water would shave the peak demand for imported water deliveries for direct use thereby increasing the overall reliability of supply sources to the study area.

Occurrence of Rising Water in the Study Area

A number of cienega areas have historically produced rising water in the cities of Claremont and Pomona. Rising water has been a problem in the study area since the late 1800's. Rising water has been documented as occurring in different portions of the Six Basins Area in the 1940-41, 1968-69, 1977-80, and 1983-84 periods and as recently as the 2005 winter when near record precipitation and spreading of runoff resulted in high groundwater levels.

A number of previous studies have identified six main areas of concern in the Six Basins Groundwater Management Area; these studies are identified in Section 2. A brief description of each area and the relationship between rising water and water levels at selected local wells is presented also in Section 2.

ES.2 Six Basins Area Hydraulic Model

The Six Basins Area hydraulic groundwater model represents the inflow, storage, movement and discharge of groundwater. The model was developed as a tool to help PVPA manage spreading operations to control high groundwater conditions in the Upper Claremont Heights and Pomona Basins, and to evaluate alternative management scenarios such as enhanced groundwater spreading and increased groundwater pumping in localized areas.

The model was documented in the Six Basin Management Area Groundwater Model Update report (CDM 1999) and Assessment of Current Spreading Operations and Development of Spreading Operating Parameters Study (CDM, 2002). Subsequent updates are described in Section 2.4 in this report.

Use of the Model

With calibration and extension of its simulation period, the current groundwater model has become a valuable tool in assessing basin management practices. To aid in evaluating various operational conditions, a series of simulations can be run and the results compared.

With the model calibrated, it can be applied to evaluate relative impacts to the Six Basins Area caused by changes in operational procedures. Some of the operations that can be tested are the implications of increased production and/or applied spreading. In addition, various actions for controlling and/or preventing rising water and recharging and recovering imported water can be simulated. These actions include:

- Changes to production patterns at existing wells
- Addition of new production wells
- Changes to spreading of natural (winter) recharge at SASG
- Spreading of imported water at SASG and recovery of the water through increased pumping.

To assess the specific impacts of these types of changes for the alternative scenarios evaluated under this study, a trial-and-error process of varying model input parameters was undertaken. For example, various combinations of production rates and spreading rates were simulated. The results of these simulations were directly compared to each other to judge relative benefits and disadvantages. The practicality of a given scenario was assessed based on hydraulic impacts and the practical/operational changes that the scenario would require.

To assess various operational scenarios, a common Baseline Scenario was developed to serve as the benchmark for comparison.

ES.3 Baseline Scenario Evaluation

Mass balance results from the Baseline Scenario were summarized as a hypothetical 45-year simulation period based on a 45-year set of natural hydrologic conditions and into individual annual averages. Table 2-3 shows the annual mass balance results of the Baseline Scenario simulation. A description of each of the components listed in the table is presented below.

Areal and Boundary Recharge. The average areal and boundary recharge in the Baseline Scenario is simulated to be 14,563 ac-ft per year. This value represents groundwater recharge from precipitation within the basins, recharge at the edge of the basin (i.e. “mountain front” recharge), and urban return flow.

Applied Spreading. The average “natural” spreading at SASG is simulated at 6,061 ac-ft per year. Annual average values range from years with no applied spreading to over 31,000 ac-ft per year and reflect historical spreading between 1960 and 2005.

Production. Modeling results indicate variations in production rates over the 45-year study period from just under 14,500 ac-ft per year to a high of over 25,000 ac-ft per year with an overall average of 19,236 ac-ft per year. Variations in production are controlled in the model by water levels at the Monitoring Well No. 2 above the Indian Hill Fault and at the Berkeley Well below the fault.

Rising Water. North of the Indian Hill Fault, the Baseline Scenario yields five rising water periods with durations of 1 to 2 years. The volume of rising water during these events ranges from 2 to 231 ac-ft per year. Rising water in the Pomona Basin was not reported under the Baseline Scenario as water levels did not reach the ground surface.

Flow into Chino Basin. These values represent flow over and through the San Jose Fault into the Chino Basin. Outflows to the Chino Basin are relatively constant and range from approximately 1,060 ac-ft per year to 1,890 ac-ft per year with an average of 1,420 ac-ft per year.

Change in Basin Storage. Over the entire 45 year simulation, the average change in storage is a net decrease of 46 ac-ft per year in storage.

ES.4 No Imported Water Spreading Scenario

The purpose of this scenario is to identify the operational changes in the Six Basins Area to reduce or eliminate the occurrence of rising water given the historical spreading pattern. Under this scenario, a number of existing wells above the Indian Hill Fault have been identified as wells that could be used to increase production to reduce or eliminate the potential for rising water in the historical high rising water areas along Padua Avenue and at Greensboro Court in the Claremont Basins including:

- West End No. 3
- West End No. 4
- Marlboro No. 1
- Mountain View No. 1
- Mountain View No. 4
- Tunnel Wells

To reduce the potential for rising water in the Martin Cienega in the northern portion of the Pomona Basin, the existing Berkeley Well and Harrison Home No. 2 have been identified as two wells whose production could be increased to lower water levels in the area.

The following operational parameters were identified to reduce the occurrence of rising water in the historical areas.

- Begin increasing groundwater production at the six UCHB wells listed above when water level elevation at MW-2 reach 1,300 ft. Further increase production as water level elevation continues to increase up to 1,350 ft. At 1,350 ft elevation, pump the maximum possible from the identified wells.
- Increase production at the Berkeley and Harrison Home No. 2 in the Pomona Basin to the maximum possible if water levels at Berkeley No. 2 exceed 1,150 ft in elevation.
- Stop spreading of local surface water at the San Antonio Spreading Grounds when water level elevation at the MW-2 reach 1,375 ft.
- Maintain production at a rate of 1,000 ac-ft per year over current production amounts in the southwestern portion of the Pomona Basin.

Groundwater Basin Response

Rising Water. Modeling results indicate that the localize increase in pumping at the historical rising water areas is effective in reducing rising water as the volume of rising water under the No Imported Water Scenario would be substantially less than under Baseline conditions. Annual rising water amounts are depicted in Figure 4-1.

Applied Spreading. Spreading of local surface water is on the average 147 ac-ft per year lower than in the Baseline Scenario. Most of this reduction occurs in years following significantly above average spreading. Spreading in these years result in water levels at MW-2 above the 1,375 ft elevation, at which level spreading is assumed to stop.

Groundwater Production. There is virtually no change in production (19,236 ac-ft to 19,233 ac-ft per year) under this scenario when compare to the Baseline Scenario.

Capital Cost Requirements

Under this Scenario, there would be no new facilities constructed as additional production at localized areas would take place using existing facilities. Therefore, there is no new capital cost between this scenario compared to Baseline conditions.

Operational Cost

The average production cost for this No Imported Water Scenario was calculated at $69.00 per ac-ft. This figure is virtually identical to the value calculated for the Baseline condition as water levels are very similar.

Summary of Environmental Impacts

Because there are no new facilities proposed, and only limited modifications to existing pumping patterns, no potentially significant environmental impacts are anticipated.

Institutional Issues

The plan envisions that water would be produced and utilized locally by the individual water purveyors; therefore, no new or significantly different institutional arrangements would be needed to allow the additional production. The primary concern for this Scenario is the mechanism under which the local purveyors would be encouraged or directed to increase pumping in those selected locations during the periods when such production is desired.

Legal/Judgment Considerations

The simplest approach to encouraging additional production from targeted areas to control rising water without penalizing those purveyors who would be asked to produce additional water is for Watermaster to declare a Temporary Surplus of groundwater to be available for production under Section VI.B. 12 of the Judgment. While this condition does not compel the key purveyors to maximize production in the selected areas, it was generally effective in assisting with encouraging additional production and lowering water levels over the past year.

ES.5 Spreading of Imported Water Scenarios

Three different levels of imported water were considered and evaluated as part of this study.

Low Use of Imported Water Spreading. This scenario considers the annual spreading of 5,000 ac-ft of imported water in addition to the normal spreading of local surface water simulated under Baseline Conditions. Spreading of imported water is fixed at 5,000 ac-ft per year under this scenario. This scenario was conducted to simulate the anticipated level of spreading that TVMWD is currently considered and described in the San Antonio Spreading Grounds Conjunctive Use Project.

Moderate Use of Imported Water Spreading. The amount of imported water spread varies from year to year depending on water levels at MW-2. Under this scenario a long term average of 7,875 ac-ft per year of imported water were spread at the SASG. Annual spreading of imported water ranges from less than 1,000 ac-ft when water levels are high and as much as 12,000 ac-ft when water levels are low.

High Use of Imported Water Spreading. Similar to the Moderate Use Scenario, annual spreading of imported water at the SASG varies and is based on water levels at MW-2. Under this scenario an average of 11,565 ac-ft of imported water are spread every year with a maximum of 15,000 ac-ft in any given year.

Facility Requirements

The facility requirements to accommodate imported water recharge while still being able to reduce or eliminate the potential for rising water conditions in the Six Basins Area is basically the same for all scenarios. However, the scenarios differ on a) how the facilities are used to recover stored imported water and mitigate rising water and b) in the different basin operating parameters for pumping and spreading as described under Section 3.2.2.

To recover stored water and reduce or eliminate the potential for rising water in the Six Basins Area, three areas of extraction have been identified as illustrated in Figure ES-1. Area 1 is identified as the area directly south of the SASG. In this area, the need for six new pumping wells in an east-west line along or north of Baseline Road has been identified. Additional facilities in this area include the construction of a 30 inch diameter line to tie the WFA's Benson Feeder and the Miramar pipeline.

Figure ES-1

Spreading of Imported Water Scenarios
Facility Requirements

Legend

Proposed Wells

Pipelines

Proposed Pipelines

Existing Pipelines

Groundwater Basins

Canyon Basin

Upper Claremont Heights Basin

Lower Claremont Heights Basin

Live Oak Basin

Ganesha Basin

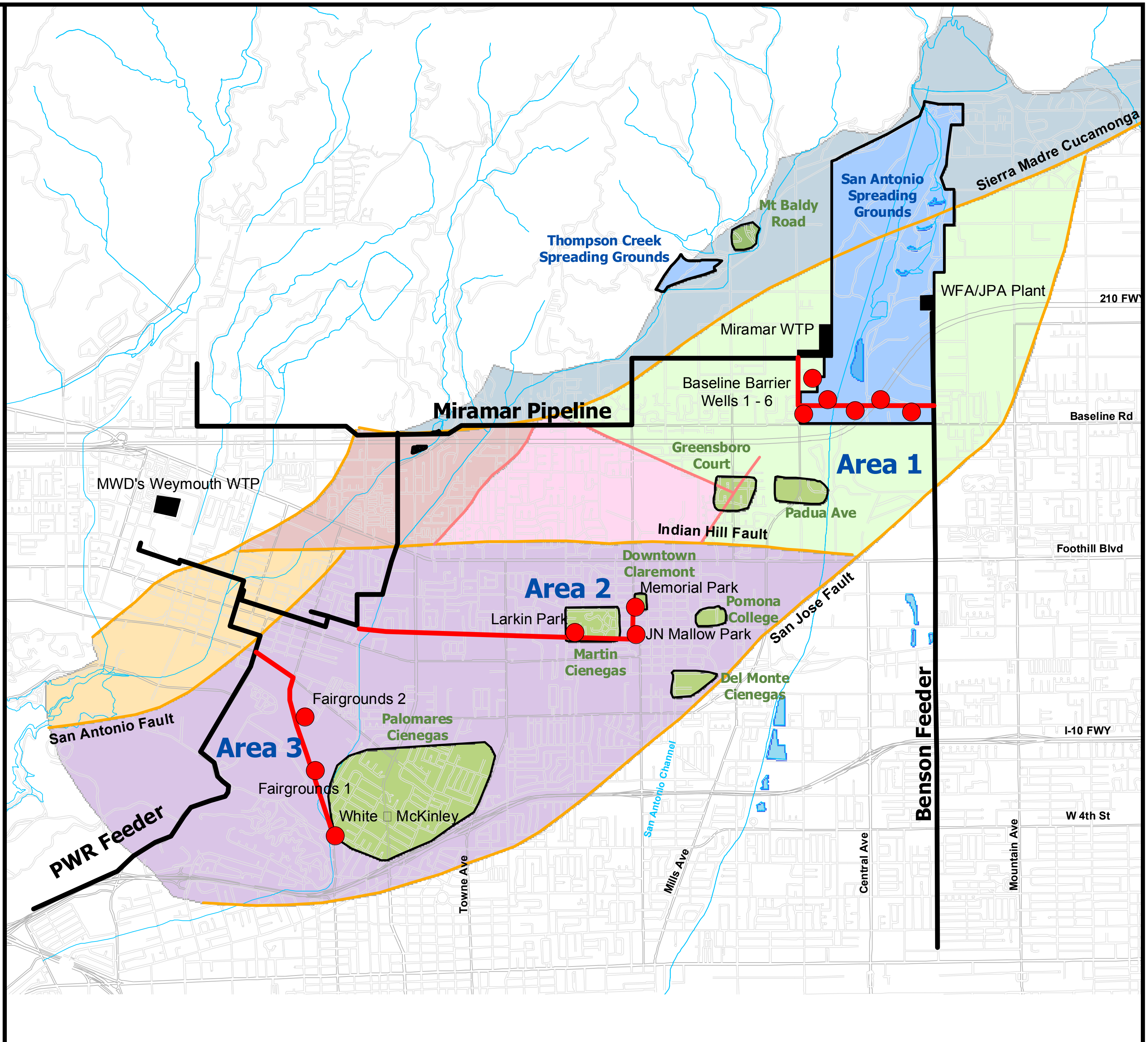
Pomona Basin

Cienegas

Spreading Grounds

0 0.5 1

Miles



Area 2 is defined as the vicinity of the Martin Cienega. To recover stored water and reduce or eliminate the potential for rising water in that area the need for three additional wells has been identified. Additional facilities to convey the extracted water to the Miramar Pipeline have also been identified for this area.

Area 3 is defined as the southern portion of the Pomona Basin in the vicinity of the Los Angeles County Fairgrounds. Three extraction wells and a transmission facility have been identified to convey production into the Pomona-Rowland-Walnut Pipeline.

Details of the use and operations of these facilities are presented in Section 3.

Basin Operating Parameters

A number of operational changes to basin operations were investigated to spread imported water in the SASG, recover stored water, and reduce or eliminate rising water from the three areas identified in Figure ES-1.

Basin operating parameters defined the amounts of imported water spreading based on water levels at MW-2. In addition, groundwater extractions from the proposed wells in the three identified areas were linked to water levels at MW-2 for those above the Indian Hill Fault and to the Berkeley Well for those wells below the fault. Details of the basin operations are presented in Section 3.

ES.6 Comparison of Basin Management Scenarios

The Basin Management Scenarios were compared against each other on the basis of the following factors:

- Basin Response including: a) control of rising water, b) average spreading, c) average production, and d) other long term changes including basin storage, losses to Chino Basin across the San Jose Fault, and subsurface losses in the southern portion of the Pomona Basin.
- Economics including: a) capital cost investments in new infrastructure, b) Operation cost, and c) maintenance costs.
- Environmental impacts related to facilities construction and operation.
- Relative differences in institutional ability or constraints to implement the proposed facilities and operations.
- Relative differences in legal challenges or constraints to implementing each of the scenarios.

Groundwater Basin Response

Under the three imported water scenarios, different levels of imported water were spread at the SASG. Table ES-1 summarizes the basin response for each of these scenarios and compares them against the No Imported Water Scenario. Details are provided in Section 4. Annual spreading, pumping, rising water, subsurface flows, flows into the Chino Basin and changes in storage are summarized in these tables. In general, the following conclusions can be drawn from the analysis:

Rising Water. The use of the recommended extraction facilities, coupled with the water level triggers established for spreading and pumping, result in rising water volumes similar to those observed under the No Imported Water Spreading Scenario and lower than in the Baseline conditions. In addition, the magnitude of individual raising water events in any given year is virtually the same for all three Imported Water Scenarios.

Applied Spreading. Spreading of imported water varies significantly between the Imported Water Scenarios based on the target level and actual groundwater conditions which are a function of local hydrology. It averages 5,016 ac-ft per year under the Low Use Scenario, 7,875 ac-ft for the Moderate Use Scenario, and 11,565 ac-ft per year for the High Use Scenario. Annual spreading remains constant under the Low Use Scenario, but varies significantly for the other two scenarios. Figure ES-2 illustrates annual spreading of imported water under each scenario. Details are presented in Section 4.

Groundwater Production. As planned, overall groundwater production from the Six Basins Area is significantly higher than under the No Imported Water Scenario and in annual volumes proportional to the amount of imported water spread. Figure ES-3 illustrates the annual production under each scenario. Details for individual scenarios are presented in Section 4.

However, to fully assess the impact of imported water spreading on production, scenarios must be compared while taking into consideration the differences in basin storage. Table ES-2 illustrates this comparison. Production amount under the Moderate and High Use scenarios are slightly lower than the total amount of imported water spread. This results from slightly increased losses from the modeled area in the form of sub-surface losses in the Ganesha Basin, the Southern portion of the Pomona Basin, and across the San Jose Fault to the Chino Basin. These changes are detailed in Section 4.

Table ES-1
Summary of Basin Response for All Scenarios

Summary of Basin Response for All Scenarios (ac-ft)				
		Imported Water Spreading Scenarios		
Basin Response	***No Imported Water***	**Low**	**Moderate**	**High**
Modeled Area Inflows				
Areal and Boundary Recharge	14,576	14,552	14,598	14,552
Surface Water Spreading				
SASG: Local	5,914	6,050	6,079	5,992
SASG: Imported	0	5,016	7,875	11,565
Thompson Creek/Pomona	543	543	540	540
Sub Total	6,457	11,609	14,495	18,097
Total: All Inflows	**21,033**	**26,161**	**29,093**	**32,649**
Modeled Area Outflows				
Total Pumping	19,233	24,213	26,478	30,001
Water Losses from Modeled Area				
Rising Water				
- Above Indian Hill	7	4	7	9
- Below Indian Hill	0	0	0	0
Subsurface Flows				
- Ganesha Basin	269	277	284	303
- Southwest Portion of Model	185	233	326	350
- Flow into Chino Basin	1,398	1,392	1,470	1,461
Sub Total	1,859	1,906 (103%)	2,087	2,124
Total: All Outflows	**21,092**	**26,119 (124%)**	**28,565**	**32,125**
Change in Storage	**-113**	**2**	**484**	**468**

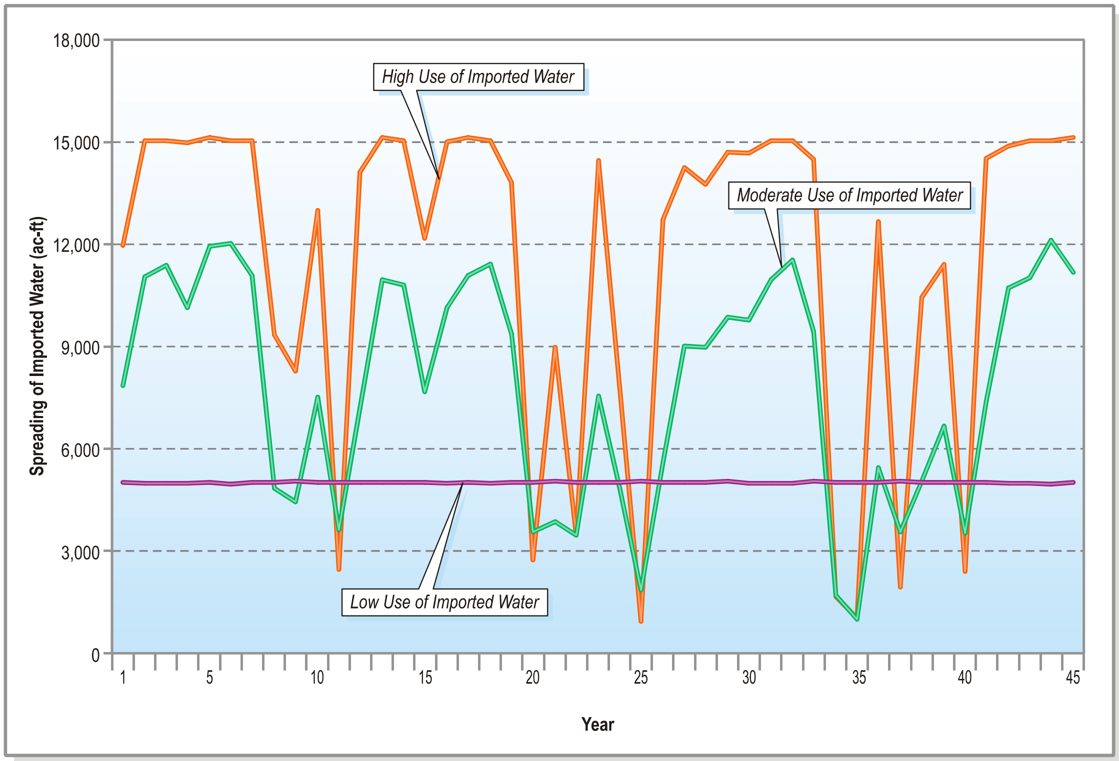


Figure ES-2
Annual Spreading of Imported Water - Low, Moderate, and High Use Scenarios

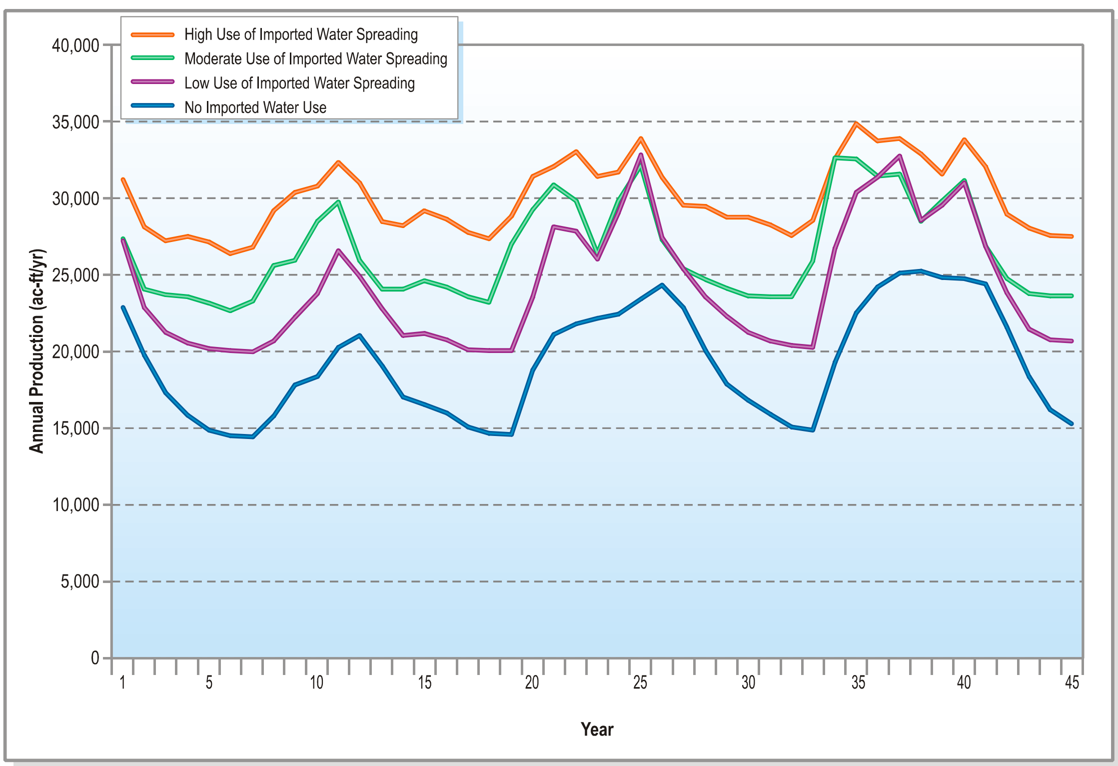


Figure ES-3
Total Production - All Scenarios

Table ES-2

Comparison of Imported Water Spreading vs. Additional Pumping – All Scenarios

Comparison of Imported Water Spreading vs. Additional Pumping for All Scenarios (ac-ft)				
Basin Response	*No Imported Water*	*Imported Water Spreading Scenarios*		
		Low	Moderate	High
Total Pumping	19,233	24,213	26,478	30,001
Change in Storage	-113	2	484	468
Sub Total	19,119	24,216	26,962	30,469
Additional Pumping from Spreading of Imported Water	, 0	5,096	7,843	11,350
Imported Water Spreading	0	5,016	7,875	11,565
Difference (Pumping - Spreading)	0	80	-33	-215
Difference as Percent of Spreading	N/A	1.6%	-0.4%	-1.9%

Economic Analysis

The economic comparison between the imported water scenarios was based on the average cost per ac-ft of additional production when compared to the No Imported Water Scenario. To calculate this cost the following parameters were considered:

- ***Capital Cost.*** Capital cost is the same for all three scenarios at 32.5 million dollars as presented in Table 4-7. Estimated costs are based on actual construction cost for similar projects and included a 25 percent contingency to cover miscellaneous cost and unknown conditions.
- ***Capital Amortization.*** Amortization is based on a 30 year municipal bond at six percent interest. It is assumed that 50 percent of the total cost would be financed from Federal Funds with a matching participation by local agencies.
- ***Cost of Imported Water.*** This cost is based on purchasing replenishment water from MWD at $238 per ac-ft.
- ***Pumping Energy Cost.*** The average water level for all the wells over the 45-year modeling period is used to calculate this cost. Provisions are made for drawdown and discharge head. An average cost of $0.10 per kwh and a 70 percent pump efficiency are used.

Table ES-3 summarizes the cost per ac-ft under the three imported water scenarios. The estimated cost for the Moderate and High Use Scenarios compares favorably to the use of imported water for direct delivery at $566 per ac-ft for Tier 2 Treated Water at the Miramar water treatment plant.

Table ES-3
Comparison of Imported Water Spreading vs. Additional Pumping – All Scenarios

Summary Cost of Scenarios			
Cost	Use of Imported Water for Spreading Scenario		
	Low	Moderate	High
Capital Amortization (1)	$231.66	$150.52	$104.01
Cost of Imported Water	$238.00	$238.00	$238.00
Pumping Cost	$68.87	$69.14	$70.09
Well Operations and Maintenance	$20.00	$20.00	$20.00
Administrative	$10.00	$10.00	$10.00
Total Cost:	**$568.53**	**$487.66**	**$442.10**

(1) Assumes that 50 percent of capital cost funded by Federal Programs

Environmental Impacts

For all of the Imported Water Scenarios, the same new facilities would be required. This includes new wells in the Lower Claremont Heights Basin, at the Martin Cienagas, and in the Southwest portion of the Pomona basin, pipelines that would connect the wells to regional distribution systems, and if necessary wellhead treatment (GAC) facilities at the latter two locations.

A detailed Preliminary Environmental Assessment was conducted for the construction and operation of the systems and is contained in Appendix A. In general, the impacts were assumed to be similar for all of the Imported Water Scenarios as the facilities would be the same, with the primary difference being the extent of use. A brief summary of the potential environmental impacts is presented in Section 4; detailed environmental analysis is presented in Appendix A.

Institutional Issues

While the No Imported Water Scenario relies on additional directed use of existing wells and purveyor distribution systems and therefore no significant change in the normal institutional patterns, the Imported Water Scenarios introduce new types of facilities and operations that will require new arrangements. While the extent of the use of any of the new facilities differs between the Imported Water Alternatives, they all share similar considerations. The issues are briefly described below with full details provided in Section 4.

- *Spreading of imported water.* The basic institutional arrangements exist today to allow TVMWD to spread water.
- *New wells and transmission pipelines.* While wells could be owned by local purveyors, it may be desirable for TVMWD to construct and operate some or all of the wells as recovered water could at times be delivered to other TVWMD member agencies. Transmission facilities should be owned and operated by TVMWD.

- ***Well head treatment.*** Institutionally, any necessary wellhead treatment facilities could be constructed, owned and operated either by local purveyors or TVMWD.

Legal Issues

In general, there is language in the Judgment and precedential agreements that establish the basis for implementing the Imported Water Scenarios. However, agreements would have to be modified to allow the levels of potential imported water storage contemplated under the Scenarios, subject to approval by all parties and following additional CEQA review to the extent that a program greater than that already covered under the current TVMWD plan is proposed.

One area in the Judgment that needs further definition and clarification relates to the losses of stored water from the basin. Item B7 of Section III of the Judgment, Declaration of Rights and Responsibilities, indicates that if the Watermaster reasonably determines that Replenishment had to be terminated or curtailed in any year because of insufficient storage capacity, some or all of Party's unproduced Carryover rights or Storage and Recovery rights may be deemed lost based on different priorities. Storage of imported water has the fourth priority and could be loss under these circumstances. This could result in substantial financial losses for TVMWD under the current Judgment.

ES.7 Recommended Plan

Controlling rising water at various locations in the Six Basins Area, in the absence of introducing imported water, can be attained by managing more closely spreading operations at the SASG and increasing pumping at certain locations to control water levels without incurring significant additional cost relative to Baseline Scenario. However, control of rising water can also be attained under the three imported water scenarios by operating the basin within the given parameters and by constructing a series of spreading, transmission, and pumping facilities. In addition, spreading of imported water offers the following benefits to the operations of Six Basins:

- Reduced imported water deliveries during peak demand conditions
- Increased reliability of local supply sources
- Increased groundwater availability and safe yield of the basin
- Maintained higher water levels during extended droughts
- Decreased fluctuations in water levels
- Lower overall cost per ac-ft when compared to direct delivery of imported water

As previously discussed in this section, the Low Use Scenario maintains spreading of imported water at 5,000 ac-ft per year regardless of water levels, while the other two scenarios consider variations in water levels as surrogates to increase or decrease spreading of imported water. Spreading of imported water under these scenarios varies from less than 1,000 ac-ft per year during high water level conditions to 15,000 ac-ft per year when levels are low. Long-term spreading under the Moderate Use Scenario averages approximately 7,900 ac-ft per year and 11,350 ac-ft per year under the High Use Scenario. These two scenarios represent a more realistic condition under which the basin could be operated.

Modeling results indicate that is feasible to spread up to 15,000 ac-ft per year under certain conditions while reducing or eliminating rising water. While, this level of spreading may be an ultimate goal, a phased approach is recommended. A phased approach will enable TVMWD and the Six Basins Watermaster to learn more about how the basin would respond to the additional spreading of imported water by evaluating data from a series of dedicated monitoring wells that are in place at various locations in the Six Basins Area.

Therefore, it is recommended that spreading of up to 8,000 ac-ft per year be considered in the initial phase with an overall average of approximately 5,000 ac-ft per year. Annual spreading should be limited when water levels are relatively high and further increased as water levels at MW-2 decreased. As additional knowledge is gained on how the basin responds to the imported water spreading, further increases in spreading should be considered to reflect those illustrated under the Moderate Use Scenario. Implementation details of the recommended plan are presented in Section 5.

Section 1
Introduction and Project Background

The occurrence of rising water in the Six Basins Area has been an issue that local residents in the Pomona-Claremont area have periodically been concerned with for a long time. Rising water has been documented as occurring in the late 1880's during occasional wet periods and throughout the 1900's including the recent 2004-05 period of high rainfall. Rising water occurs at certain locations within the Six Basins Area when shallow groundwater comes up to the surface in the form of a nascent spring. This phenomenon tends to occur during very wet periods over one or more years when significant amounts of rainfall and surface water percolate into the ground and quickly recharge the groundwater basin. Historically, many of the affected areas have been known as Cienegas, which are defined as marsh areas where groundwater surfaces.

While rising water has been an issue during occasional wet periods, there have been extensive periods in which water levels have been significantly below optimal. This has resulted in a reduction in groundwater extractions as existing wells yield less as water levels decline. Imported water has been used in the basin as a source of direct delivery from the local water treatment plants; however, it has not been used to recharge the basins.

Spreading of imported water would allow for conjunctive use of the Six Basins Area. The use of imported water to supplement local surface water spreading at the San Antonio Spreading Grounds (SASG) would substantially increase the availability of groundwater to the different agencies in the Six Basins Area and help reduce periods of significantly declining water levels during below average hydrologic cycles. Spreading of imported water however, must be coupled with corresponding increases in groundwater production to withdraw the water either for use within the Six Basins Area or for delivery to other outside agencies, and to reduce or eliminate the occurrence of rising water in the area.

This section presents the project background, describes the study area, lists previous studies documenting the occurrence of rising water in the Six Basins Area, describes historical spreading activities in the area, introduces the Legal Judgment that governs groundwater activities in the area, and presents the objective of the study.

1.1 Study Area

The study area for this project consists of the Six Basins Area, which refers to the areas overlying six interconnected groundwater basins in the Pomona-Claremont area. These groundwater basins are the Canyon, Upper Claremont Heights (UCHB), Lower Claremont Heights (LCHB), Pomona, Live Oak, and Ganesha Basins as depicted in Figure 1-1. This figure also depicts the location of the SASG and Thompson Creek Spreading Grounds. Water extracted from these aquifers is a vital source of supply for the purveyors that serve the overlying area, which includes the cities of Claremont, La Verne, Pomona, and Upland and surrounding unincorporated areas of Los Angeles and San Bernardino counties.

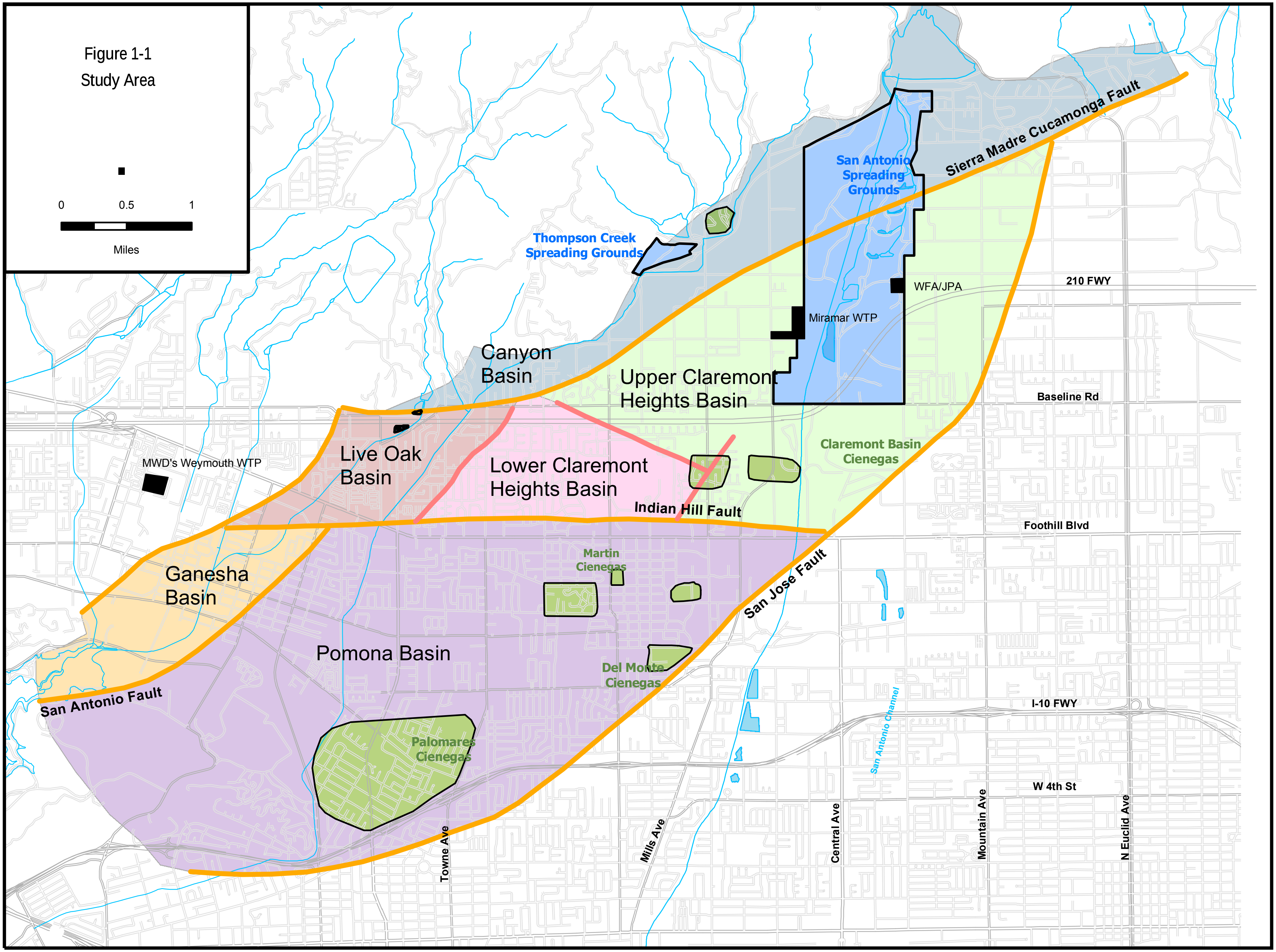


Figure 1-1
Study Area
0
0.5
1
Miles
Thompson Creek Spreading Grounds
San Antonio Spreading Grounds
Sierra Madre Cucamonga Fault
WFA/JPA
210 FWY
Miramar WTP
Canyon Basin
Upper Claremont Heights Basin
Baseline Rd
MWD's Weymouth WTP
Live Oak Basin
Lower Claremont Heights Basin
Claremont Basin Cienegas
Indian Hill Fault
Foothill Blvd
Martin Cienegas
Ganesha Basin
San Jose Fault
Pomona Basin
Del Monte Cienegas
San Antonio Fault
I-10 FWY
Palomares Cienegas
San Antonio Channel
W 4th St
Towne Ave
Mills Ave
Central Ave
Mountain Ave
N Euclid Ave

The study area encompasses 19 square miles bounded on the north by the San Gabriel Mountains, on the east and the south by the San Jose Fault, which separates it from the Chino Groundwater Basin, on the southwest by the San Jose Hills, and on the west by a surface water divide that separates it from the San Gabriel Basin.

1.2 Brief History of Water Activities in the Basins

Water development in the study area began in the mid 1800's as surface water flows were being diverted from local creeks, springs, and cienegas for agricultural use. As the area began to grow, the natural surface water sources were not enough to meet local demands. In the late 1800's, wells were dug in and around the cienega areas and tunnels were dug to intercept subsurface water from the local canyons. As the area continued to grow in the early 1900's, new wells equipped with pumps were drilled to draw water from deeper portions of the aquifer. At that time, most of groundwater production from local wells was used for agricultural purposes; however, as the area began to urbanize the demand for water began to transfer from agricultural use to potable supplies. Subsequent growth and urbanization eventually led to the local use of imported water from the State Water Project to meet additional water demands in the study area.

In 1909, the major local water interests formed the Pomona Valley Protective Association (PVPA) to develop and enhance the local water supply and protect it from outside interests. PVPA currently owns the San Antonio and Thompson Creek spreading grounds where the majority of surface water runoff from local canyons is captured and recharged during the winter and spring months.

Spreading of local surface water at the San Antonio and Thompson Creek spreading grounds constitutes an essential part of managing water resources in the study area. Spreading of surface water helps maintains adequate groundwater levels in the area; however, the groundwater basin needs to be managed properly as to minimize the potential for rising water in some portions of the basin that could result during years of high runoff and capture. Until now, the goal in managing the groundwater basins has been to maximize the use of local surface water as this water is relatively free.

Imported water has been used extensively in the Six Basins Area in the form of direct delivery from Metropolitan Water District of Southern California's (MWD) Weymouth water treatment plant or from Three Valleys Municipal Water District's (TVMWD) Miramar facility. Until now, imported water has not been used to augment groundwater sources in the area. However, TVMWD, as administrator of the Six Basins Watermaster, has recently completed a feasibility study to spread imported water in the lower portions of the SASG. Spreading of imported water would significantly augment the availability of groundwater in the area; however, it could also increase the probability of rising water occurrences.

1.3 Rising Water Previous Studies

The occurrence of rising water in several portions of the study area has been an issue since recorded history. The extent and impact of rising water have been investigated in numerous studies in the past and was first documented in 1936 by Thayer in its evaluation of the San Antonio Spreading Grounds. Some of the most relevant studies include the following:

- Warren N. Thayer, L. W. Jordan, and O. D. Hofmann, 1936, San Antonio Spreading Grounds Investigation and Ground Water in the San Antonio Drainage Area, prepared for the Los Angeles County Flood Control District.
- Robert T. Bean, 1980, Groundwater Discharge to the Surface, Claremont, California, prepared for the City of Claremont, California.
- Robert T. Bean, 1982, Rising Water Conditions and Their Alleviation Pilgram Place, Claremont, prepared for Pilgrim Place.
- Bookman-Edmonston Engineering, Inc., 1987, Water Management Study for City of Claremont, Phase II Report Ground Water.
- James M. Montgomery, Consulting Engineers Inc., 1985, Ground Water Management Study, prepared for the Pomona Valley Protective Association.
- Richard C. Slade & Associates, 1999, Preliminary Hydrogeologic Ass
- Camp Dresser & McKee Inc, 2001, Assessment of Spreading Operations in the San Antonio Spreading Grounds, prepared for the Pomona Valley Protective Association.
- Camp Dresser & McKee Inc, 2002, Assessment of Current Spreading Operations and Development of Spreading Operating Parameters, prepared for the Pomona Valley Protective Association.

1.4 Six Basins Judgment and Adjudication

In 1996, the local producers and other interested parties began formal negotiations to resolve the issues surrounding water production, storage and recharge of the Six Basins. The negotiations included an extensive effort to collect data concerning extractions, water quality, and groundwater levels.

Based upon previous safe yield studies conducted by PVPA and supplemented by the collected data, the safe yield of the Six Basins Area was established at 19,300 acre feet (ac-ft) per year. This figure became the basis of the safe yield used in the adjudication. In the fall of 1998, the parties filed a stipulated Judgment with the Superior Court of California for the County of Los Angeles. The court entered the stipulated judgment on December 18, 1998 under Case No. KC029152. The Judgment set the pumping rights for each of the parties. It also set provisions for spreading, storage, high groundwater, and water quality mitigation in the Six Basins Area. The Judgment set up a Watermaster Board, initially composed of ten members, to oversee its administration. The board met for the first time on January 27, 1999.

Each year, the safe yield is evaluated based on precipitation, the location and amount of the pumping within the basins and the ground water levels recorded throughout the year.

1.5 Objective of the Study

Annual spreading of local surface water is a key component of water resources in the Six Basins Area; however, it is highly dependent on local hydrology and precipitation patterns. During periods of high precipitation, significant amounts of local surface water have been spread which have resulted in water level increases throughout the study area; conversely, significant declines in water levels are experienced during average to below average precipitation years.

To augment water levels in the study area, TVMWD, as the Six Basins Watermaster, would like to spread imported water in the lower portion of the SASG. TVMWD is in the process of designing the associated transmission pipelines and pertinent facilities from the existing connection at the Miramar water treatment plant to deliver imported water to the spreading grounds. The spreading of imported water would enable Watermaster to conjunctively manage the Six Basins Area by spreading in the SASG, pumping the stored water and reducing or eliminating the occurrence of rising water in some portions of the Six Basins Area.

The objective of this study is to evaluate different basin management scenarios that consider different levels of imported water spreading. The study defines the basin operating parameters and identifies the necessary facilities to recover the stored water and reduce or eliminate the occurrence of rising water throughout the Six Basins Area. The study focuses on the construction of extraction wells at key locations that could be more or less operated as normal supply wells during most years with the provision of increasing production when water levels at certain indicator wells reach specific target levels.

The study evaluates four different scenarios and compares them against a Baseline condition. The first scenario identifies the necessary changes in operations of existing facilities to minimize rising water conditions resulting from spreading of local surface water only. Imported water spreading is not considered under this scenario. The remaining three scenarios simulate three different levels of imported water spreading and identify the facilities required to recover the stored water and mitigate the occurrence of rising water. The Imported Water Scenarios are then compared against the No Imported Water Scenario to document the relative changes in operations in the groundwater basin resulting from different levels of imported water spreading. These scenarios are also compared based on economic, institutional, and legal considerations. The knowledge gain as a result of the evaluation of scenarios is used to develop an implementation plan to spread imported water in the Six Basins Area.

1.6 Report Organization

This report is organized into five sections as follows:

Section 1 presents the project background, a narrative of historical use of water in the Six Basins Area and the occurrence of rising water, a brief description of the Judgment regulating water operations in the area, and a description of the objectives of the study.

Section 2 describes the use of the groundwater model and introduces the evaluation of Baseline conditions.

Section 3 presents the four basin management scenarios that were evaluated. This section includes a description of the scenarios, the facilities required for implementation, and the operational parameters that need to be implemented to recover the stored water and reduce or minimize the occurrence of rising water.

Section 4 compares the different basin management scenarios. The basis for comparison include a) groundwater basin response, b) construction and operating cost, c) environmental impacts, d) institutional issues, and e) legal considerations. In addition, this section presents the recommended basin management plan.

Section 5 presents the implementation plan to spread imported water, increase groundwater production, and reduce the potential for rising water in the Six Basins Area.

Section 2
Production Patterns, Model Development and Baseline Evaluation

This section introduces the agencies involved in the Six Basins Area, presents the production patterns of local water purveyors, and discusses water quality issues in the area. This section also describes the hydraulic model used in the evaluation of different groundwater management scenarios and presents the results of the Baseline evaluation.

2.1 Six Basin Water Agencies

Groundwater sources from the Six Basins Area constitute an important source of supply to a number of public and private utilities and other local and regional agencies. This section presents a brief description of the operations of each entity and the role they serve as it relates to water resources in the Six Basins Area.

2.1.1 Six Basins Watermaster

The Watermaster is a committee composed of one representative of each of the parties to the Judgment and includes representatives from the City of La Verne, the City of Pomona, the City of Upland, the City of Claremont, Golden State Water Company (GSWC), TVMWD, PVPA, Pomona College, San Antonio Water Company (SAWC), and West End Consolidated Water Company (WECWC). The Watermaster committee meets six times a year and in general is in charge of overseeing the overall management of groundwater sources in the Six Basins Area.

Under the Judgment, the Watermaster has the power to exercise certain duties and responsibilities. Some of the main responsibilities of the Watermaster include the following:

- Develop, maintain and implement the Operating Plan
- Adopt rules, regulations, procedures, criteria, and time schedules
- Levy Assessments
- Acquire or invest in facilities or facility improvements
- Inspect and test measuring devices
- Adopt an annual budget for monitoring and reporting legal and administrative costs
- Enter and administrate Storage and Recovery Agreements
- Report annually to the Court

2.1.2 Three Valleys Municipal Water District

TVMWD serves many roles as a wholesale water supplier in the Pomona, Walnut, and eastern San Gabriel Valleys. One of those roles is the administrator for the Six Basins Watermaster. As Watermaster, TVMWD is charged with carrying out the rights and responsibilities of the adjudication of the Six Basins.

In addition, TVMWD is a member of the Metropolitan Water District of Southern California (MWD). Through MWD, TVMWD has access to imported State Project Water which it treats at the Miramar water treatment plant. This plant takes water from MWD's Foothill Feeder, which carries imported water from the State Water Project. Treated water from this plant is delivered to a number of agencies in the TVMWD service area through regional transmission pipelines.

2.1.3 Metropolitan Water District of Southern California

MWD is a consortium of 26 member agencies, including 14 cities, 11 municipal water districts, and one county water authority. MWD's member agencies serve residents in more than 143 cities and 89 unincorporated communities in parts of Los Angeles, Orange, San Diego, Riverside, San Bernardino and Ventura Counties. MWD currently delivers an average of 1.7 billion gallons of water per day to a 5,200 square mile service area. MWD owns and operates the Foothill Feeder to deliver raw water from the State Water Project stored in Lake Silverwood in the San Bernardino Mountains to the Miramar, Agua de Lejos WFA/JPA, and Weymouth water treatment plants in the general vicinity of the Six Basins Area. The Weymouth plant is owned and operated by MWD and delivers treated water to many southern California communities.

2.1.4 Pomona Valley Protective Association

PVPA was established in 1909 to protect the rights of the water users in the Claremont, Pomona, Upland, and La Verne areas from outside interests developing and exporting local water from the area, to protect the rights of its stockholders, and to maintain the supply of water to the Pomona Valley. PVPA owns and operates approximately 1,100 acres of land in the San Antonio and Thompson Creek spreading grounds and has historically been responsible for spreading surface water from local canyons at these two facilities. Under the Judgment, the Six Basins Watermaster directs PVPA to conduct spreading of local surface water at these facilities. Local water spread by PVPA is an integral component of the yield of the Six Basins Area.

2.1.5 Water Purveyors

There are eight major water purveyors that produce groundwater from the Six Basins Area to meet residential, commercial, institutional, and agricultural demands. All of these agencies are represented on the Watermaster Board as they are integral to the management of water resources in the Six Basins Area. A brief description of each agency is presented below.

- City of La Verne. La Verne is a general law city located in the County of Los Angeles overlying the western portion of the Six Basins Area. This agency pumps primaryly from the Live Oak and Pomona basins to partially meet potable water demands within its service area. Groundwater production from these basins represented approximately 19 percent of the total water consumption within the city during 2005 with imported water from the Miramar water treatment plant providing the main source of supply.
- City of Pomona. Pomona is a charter city located in the County of Los Angeles. Portions of the city overlie the southern portion of the Pomona Basin. Pomona produces groundwater from the Pomona and Upper Claremont Heights basins in the Six Basins Area and from the Chino and Spadra basins. Supplies from the Six Basins Area represented approximately 17 percent of the total water consumed in the city in 2005. Other sources of water available to Pomona include local surface water from San Antonio Canyon treated at the city's Pedley filtration plant and a small amount of imported water from the Miramar water treatment plant.
- City of Upland. Upland is a general law city located in western San Bernardino County; portions of the city overlie the easterly portion of the Six Basins Area. The City of Upland has majority ownership of the San Antonio Water Company and the West End Consolidated Water Company. Both mutual water companies pump from the Six Basins Area and other surrounding basins. Supplies to the city from the Six Basins Area, excluding those from SAWC and WECWC, represented approximately 24 percent of the total water produced by the city in 2005. The city also obtains imported water from the Agua de Lejos water treatment plant as a member of the Joint Powers Authority that operates this treatment plant.
- San Antonio Water Company. SAWC is a mutual water company incorporated under the laws of the State of California. The majority of SAWC shares are owned by the City of Upland. SAWC produces groundwater from the Six Basins Area, Chino and Cucamonga basins. In addition, it has significant surface water rights in San Antonio Creek that are used to meet potable and irrigation demands of its shareholders. SAWC does not use imported water as a source of supply.
- West End Consolidated Water Company. WECWC is a mutual water company incorporated under the State of California. WECWC is owned primarily by the City of Upland with a very small stake owned by the City of Ontario. WECWC produces groundwater from the Six Basins Area and from the Chino Basin. No imported water is used by this agency.

- Golden State Water Company. GSWC, formerly known as Southern California Water Company, is an investor-owned public utility incorporated under the laws of the State of California. GSWC produces significant amounts of groundwater from the Six Basins Area to deliver to its customers in the City of Claremont. In 2005, supplies from the Six Basins Area represented 54 percent of its overall supply. Imported water, obtained from the Miramar water treatment plant, was used to meet the remaining demands.
- Pomona College. Pomona College is a California corporation that owns lands and groundwater production facilities that overlie the Six Basins Area and it has executed operating leases with GSWC to operate its facilities.

Table 2-1 below summarizes the water use by Six Basins Parties in 2005. This table summarizes the amount of groundwater produced by individual parties to the Judgment from the Six Basins Area and from other supply sources including imported water, surface water and groundwater produced from other basins.

Table 2-1
Summary of Water Use By Six Basins Parties in 2005

Summary of Water Use by Six Basins Parties: Calendar Year 2005 (ac-ft)					
	Groundwater Production				
Water Agency	Six Basins	Outside Six Basins	Surface Water Use	Imported Water Use	Total Water Use
City of La Verne	1,678	–	–	6,949	8,627
City of Pomona	3,551	13,721	2,755	5,867	25,894
Pomona College	2,193	–	–	–	2,193
San Antonio Water Company	1,102	–	–	–	1,102
Golden State Water Company	5,452	–	–	4,680	10,132
City of Upland	2,492	2,945	577	4,313	10,327
West End Consolidated Water Company	2,657	–	–	–	2,657
Total	**19,126**	**16,666**	**3,332**	**21,808**	**60,932**

2.1.6 Availability of Groundwater in the Six Basins Area

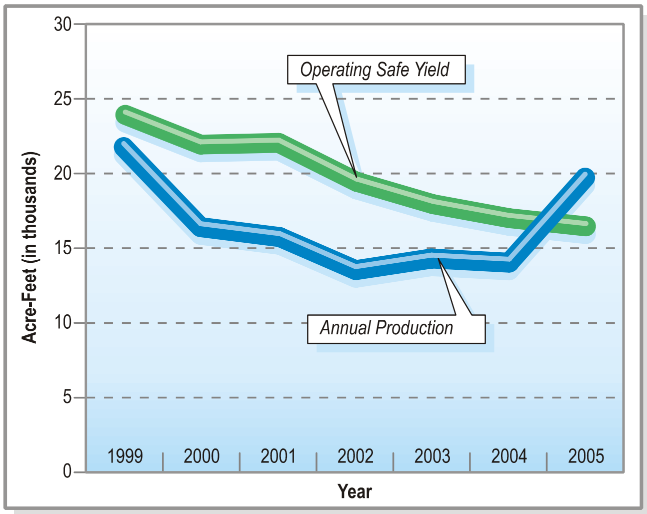


Figure 2-1
Comparison of Production and Operation Safe Yield

The long-term safe yield of the Six Basins Area was established in the Judgment at 19,300 ac-ft per year; however, in 6 out of 7 years since 1999 when the basins were adjudicated, local producers have not been able to produce enough groundwater due to declining water levels or water quality limitations as illustrated in Figure 2-1 to the left. It was not until 2005, a year of near record high rainfall and surface water spreading that producers were able to pump more than the operating safe yield of the Six Basins. In 2005, significant amounts of surface water were spread at the San Antonio and Thompson Creeks spreading grounds; as a result, water levels rose significantly in the area. To minimize the potential for rising water, the Watermaster declared a 6,000 ac-ft surplus to augment the production rights of individual parties. Groundwater production by individual parties since the adjudication is illustrated in Figure 2-2.

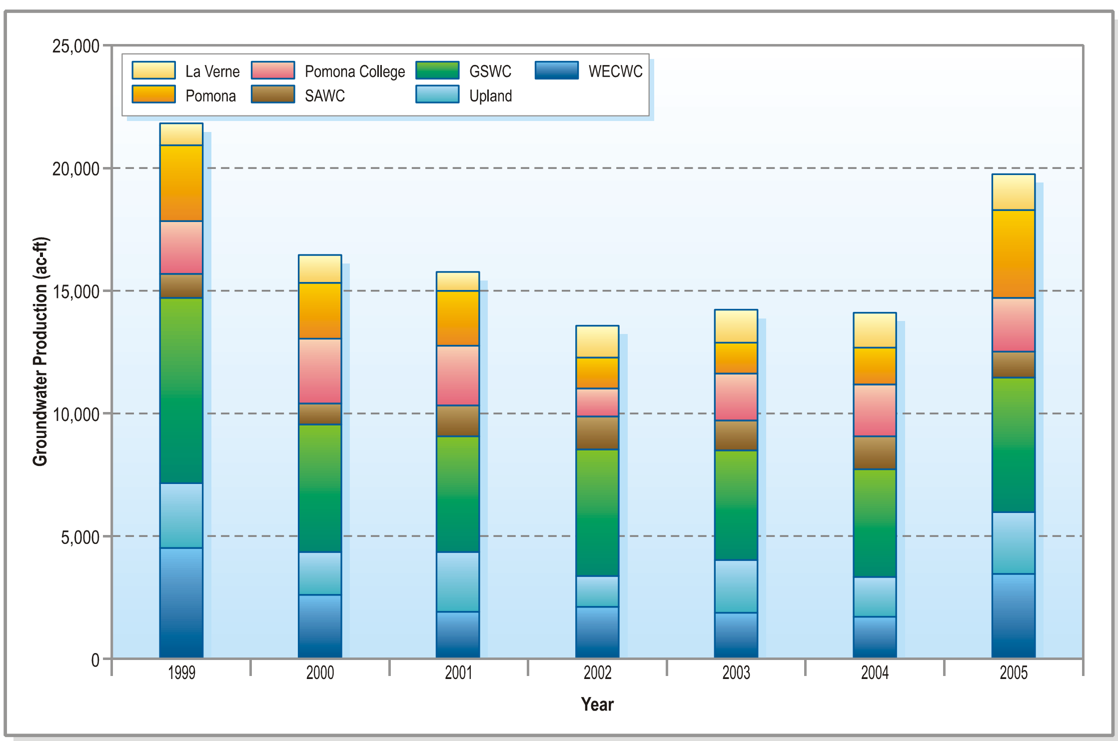


Figure 2-2
Annual Groundwater Production by Water Agency Since 1999

Two of the main reasons groundwater production fluctuates so significantly in the Six Basins Area are the relative storage capacity of the basins and the high variations in local precipitation and surface water available for groundwater recharge. Figure 2-3 shows rainfall and surface water spread in the Six Basins Areas since 1990. During this period, spreading has ranged from less than 100 ac-ft (1990) to over 30,000 ac-ft (2005). These variations in the amount of water spread have a direct impact on water levels in the basin with levels in some wells varying by as much as 150 feet or more from one year to the next.

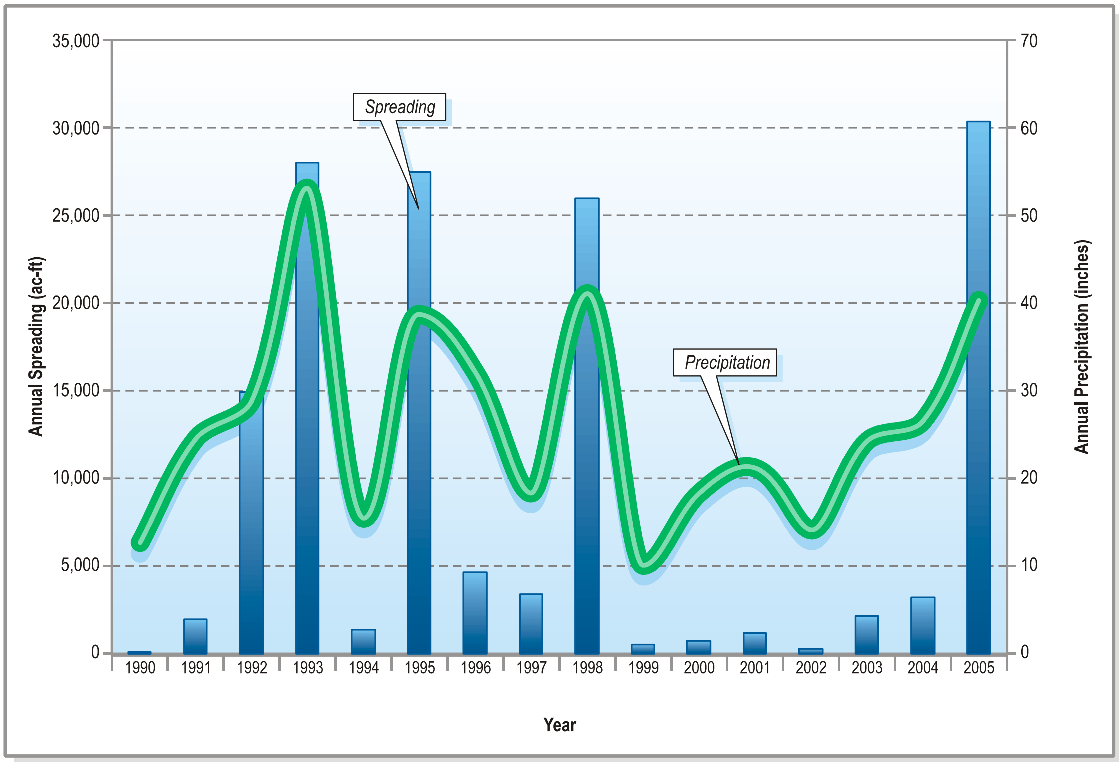


Figure 2-3
Annual Precipitation vs. Surface Water Spreading (1990-2005)

Spreading imported water to help maintain adequate water levels during average to below average conditions is currently being considered by TVMWD, as the administrator of the Six Basins Watermaster, to augment the amount of water that can be relied upon on a yearly basis. The challenge, with spreading of imported water is to ensure that it would not increase the potential for rising water during years when large quantities of local water are available for recharge. Spreading of significant amounts of imported water, followed by a significantly above average wet year could result in rising water in different locations of the Six Basins Area. The potential for rising water could be significantly diminished if adequate production capacity is developed at key locations in the Six Basins Area and spreading of local surface water is concentrated in the northern portion of the SASG. It should be noted that the SASG are not currently operated in this mode and significant improvements will be required above the Drabble Pit area. Section 3 discusses three management scenarios that consider various levels of imported water spreading and present the operational changes that need to be made to minimize the potential for rising water at various locations in the Six Basins Area.

2.2 Occurrence of Rising Water in the Study Area

A number of cienega areas have historically produced rising water in the cities of Claremont and Pomona. Rising water has been a problem in the study area since the late 1800's. Rising water has been documented as occurring in different portions of the Six Basins Area in the 1940-41, 1968-69, 1977-80, and 1983-84 periods and as recently as the 2005 winter when significantly above average precipitation and spreading of runoff resulted in high groundwater levels.

A number of previous studies have identified six main areas of concern in the Six Basins Groundwater Management Area as illustrated in Figure 1-1. A brief description of each area and the relationship between rising water and water levels at selected local wells is presented below.

2.2.1 Padua Avenue

A review of several studies conducted in the 1980's for the City of Claremont[1,2] and PVPA[3] indicate that rising water occurred in the vicinity of Padua Avenue and Shenandoah Drive in the late 1960's as well as in the late 70's and early 80's. The occurrence of rising water in this area is probably related to spreading activities at the SASG. Historical high groundwater impacts have been limited to local flooding of gravel operations in this area. A review of water levels at the Golden State Water Company's (GSWC) Mill No. 1 well, located about half of a mile to the west, indicate that water levels rose considerably in this well during the same periods, but never reached the ground surface. It has been recommended that water levels at this well be closely monitored to assess the potential for rising water along Padua Avenue to maintain levels below the 1,400 ft elevation to minimize rising water.

2.2.2 Greensboro Court

Rising water in this area has been documented as occurring in 1969 and 1980. This area is located in the Upper Claremont Heights Basin, a few hundred feet directly south of the Pomona Tunnel wells and the Pomona Spreading Grounds, as illustrated in Figure 1-1. A review of historical levels at Tunnel wells 1 and 3 indicate that water levels at both of these wells rose to within 65 ft of the surface in June of 1969. Similar behavior was recorded in October 1980 when levels came within 60 ft of the surface coinciding with the occurrence of rising water in the area downstream.

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1 Robert T. Bean. "Groundwater Discharge to the Surface, Claremont, California", September 1980.
2 Bookman-Edmonston Engineering, Inc. "City of Claremont, California. Water Management Study for City of Claremont", November 1987.
3 James M. Montgomery, Consulting Engineers, Inc. "Pomona Valley Protective Association, Ground Water Management Study", March 1985.

The tunnel wells were drilled directly on top of the Indian Hill formation and have an approximate depth of 300 ft; occurrence of bedrock in this area has been documented in the range of 380 to 400 ft below ground surface. These wells were drilled in the early 1900's and there are no records of their perforations; however, it is assumed that their perforations are in the middle to lower portion of the well. The reason for this assumption is that since water levels in these wells only came within 60-65 ft. of the surface when rising water was occurring just downstream, the levels were representative of the lower aquifer. It can be inferred therefore that rising water in this area is the result of local perched water conditions in the upper portion of the aquifer and not necessarily a direct result of water levels in the lower aquifer. Previous studies conducted by CDM for PVPA have recommended that water levels at these two wells should be closely monitored since their rise has closely matched historical periods of rising water in the area. Water levels should be maintained below the 1,300 ft elevation at the Tunnel wells to minimize rising water in the area.

2.2.3 Downtown Claremont

Downtown Claremont represents a localized area in the northern portion of the Pomona Basin. While there is little information of rising water in the area, Bookman-Edmonston in the 1987 study for the City of Claremont used two hydrographs from nearby wells to illustrate that a shallow perched aquifer occurs over a deeper aquifer in this area. Well 4489B (Bookman-Edmonston, 1987 Figure IV-4) shows groundwater elevations consistently at about 1,150 feet, where as well 4489 shows groundwater elevations below 1,150 feet. This demonstrates that the local high groundwater conditions are probably the result of local perched groundwater and not related to surface water spreading at the SASG.

2.2.4 Pomona College

The Pomona College rising water area is located north of the Del Monte Cienega. Some historical reports have combined it with the Del Monte Cienega (Bookman-Edmonston, 1987) while others combined the area with the Downtown Claremont area and the Del Monte Cienega (Robert T. Bean, 1980). The cause of the historical high groundwater in this area is unknown. Bean (1980) suggested that groundwater flowed laterally from blocked artesian wells until it was able to escape to the surface. Until recently the only well in the area was College Well 2 for which a well log was not available; however, TVMWD, as the Six Basins Watermaster, recently drilled Monitoring Well No. 3 (MW-3) in the area. Driller information about this well indicates a depth to bedrock of approximately 1,270 ft with no clay layer encountered to produce a confining layer which would cause artesian or perched groundwater conditions. MW-3 was installed with a submersible pressure transducer to provide continuous groundwater elevation monitoring. This will assist in understanding the cause of high groundwater in this area.

2.2.5 Martin Cienega

The Martin Cienega, also called Pilgrim Place in previous studies, is located in the central portion of the Pomona Basin on the north side of the Intermediate Fault. Groundwater discharge to the surface has occurred numerous times in this area. The hydrograph for the Berkeley well shows that groundwater levels reached the ground surface in 1959, from 1969 to 1971, from 1979 to 1981, and again in 1983. GSWC's wells Berkeley No. 1 and Harrison Home No. 1 are located directly in the area where rising water has occurred. A review of historical water levels at these two wells since the early 1960's indicate that water levels at the Berkeley No. 1 well rose to the surface during the same periods when rising water occurred. Similarly, water levels at the Harrison Home No. 1 well came within four feet of the surface during the same periods. These two wells are shallow, approximately 160 feet, and are perforated between 100 and 150 ft below surface. It is believed that water levels in these wells are indicative of perched conditions in the upper aquifer in the Pomona Basin similar to that found in the Downtown Claremont area.

A review of water levels for deeper wells located within or just to the north of the Martin Cienega area are inconsistent with the levels recorded at the Berkeley and Harrison Home wells. Water levels at the Dreher well, located approximately 1,500 ft to the west of the Berkeley well and within the Martin Cienega area, were in the 200 to 250 ft below surface range during these periods of rising water. While there is no information on the perforations of this well, it is a much deeper well (364 ft) and it is probably perforated in the lower layer of the aquifer. Two other wells in the area, the Richard 160 (total depth 532 ft with perforations between 236 and 509 ft) and the Ford No. 1 well (total depth 452 – no perforation data available), show water levels in the 260 to 280 ft range for the same time period consistent with the Dreher well.

This comparison indicates that water levels in deeper wells north of the Martin Cienega can not be used as a gauge to forecast when rising water conditions will occur. Therefore, monitoring of the Berkeley well is recommended as indicative of rising water in the Martin Cienega. Water levels in this well should be maintained below the 1,150 ft elevation. Additional recommendations on the pumping in the vicinity of the Martin Cienega area provided in Section 4 of this report.

Bookman-Edmonston, in a study prepared for TVMWD in 2005, indicated that the most likely cause of the high groundwater in the Martin Cienega is that high quantities of water recharged in the UCHB becomes trapped against the Intermediate Fault and produces a rise in the perched groundwater when the Pomona Basin becomes saturated next to the fault. This report further indicates that a second explanation could be that the perched groundwater in the Martin Cienega extends to the Indian Hill Fault and high recharge in the SASG produces a rise in the groundwater level of the perched groundwater that is then prevented from flowing south by the Intermediate Fault or by a reduction in the thickness of the perched aquifer.

2.2.6 Del Monte Cienega

Rising water in this area has been reported in the early 1980's. GSWC Del Monte wells are located within the area where this Cienega has occurred. A review of historical water levels at the GSWC Del Monte wells No. 1 and 2 between 1960 and 1992 indicate that water levels rose considerably in the late 1970's from 300 to 350 ft below surface to within 60 ft in 1981 and within 30 ft in late 1983 but never reached the surface. These two wells are relatively deep and extract water from the lower portion of the aquifer. Water levels at these wells are not consistent with the occurrence of rising water in the Del Monte Cienega. Rising water in this area was reported in early 1980 when water levels at these wells were within 60 to 100 ft of the surface. However, it is believed that rising water in this portion of the study area is caused by groundwater rising against the San Jose Fault, which separates the Six Basins area from the Chino Groundwater Basin.

2.2.7 Palomares Cienega

This cienega is the largest of all the cienegas in the study area and it is located in the lower portion of the Pomona basin. Rising water in this area was not observed for more than fifty years; but in recent years has become a significant problem in this area. A review of water levels at the Pomona No. 3 and No. 8 wells indicate that water levels through the 1960's and 70's were between 400 to 500 ft below the surface. Water levels began to rise in 1980 and continued to rise in the 1980's and 90's and reached within 30 ft. of the surface in the year 2000. In May 1998, water was observed coming to the surface at the City of Pomona Well No. 3, located at the corner of San Bernardino Avenue and Gibbs Street. By April 1999 water rising to the surface was reported in several locations.

The increase in water levels in this area appears to be primarily associated with the reduction of production due to degrading water quality in the area. The rising water problem will continue as long as production from this portion of the basin is not increased. Recently, the City of Pomona constructed nitrate removal facilities and activated two wells in the area resulting in a decline of water levels in the area.

2.3 Six Basins Water Quality

Water quality degradation in some portions of the Six Basins Area has been an issue of significant concern as water agencies have in general avoided production from contaminated areas. Water quality degradation has been a primary concern in the southern and easterly portions of the Pomona Basin, where some of the historical cienegas are located. Issues of concern include nitrates and volatile organic compounds (VOCs).

While production from the Pomona Basin declined significantly in the 1990's and early 2000's, water agencies are now beginning to increase groundwater production as new nitrate and Granulated Activated Carbon (GAC) treatment plants are built to remove VOCs and additional facilities installed to allow for blending so that delivered water meets all drinking water regulations. The City of Pomona recently activated two production wells in the vicinity of the Palomares Cienega by constructing nitrate removal facilities. Likewise, GSWC has installed GAC facilities at the Del Monte wells to increase groundwater production from that area.

To assess the extent of water quality degradation in the Six Basins Area, the California Department of Health Services (DOHS) database was used. Selected historical data for nitrate, VOCs, and Perchlorate for all production wells was analyzed and the average reading for each constituent was calculated, as well as the number of records that exceeded the pertinent Maximum Contaminant Level (MCL) where applicable. It should be noted that the total number of readings from individual wells and individual compounds varied significantly in the database.

The average reading for nitrate and selected VOCs and exceedance data was compiled for the Pomona, Upper Claremont Heights, and Lower Claremont Heights groundwater basins to examine the spatial distribution of groundwater quality problems. Figure 2-4 illustrates the location of existing wells with water quality concerns as of 2004 based on the DOHS database. A general description of water quality concerns in the Six Basins Area for nitrate and VOCs is presented below.

2.3.1 Nitrate

In general, wells with the highest nitrate concentrations are in the Pomona Basin. Within this basin, the highest levels are near the Palomar Cienegas at the wells owned by the City of Pomona. Wells located in the northeast corner of the basin generally had lower nitrate levels. In the Lower Claremont Heights Basin, nitrate concentrations are higher on the west side of the basin near the Live Oak Basin; wells on the east side had nitrate levels well below the MCL. None of the analyzed wells in the Upper Claremont Heights Basin exceeded the MCL consistently; however, the Indian Hills No. 3 well, on the westerly side of this basin, had an average concentration of 42.6 mg/l including 22 readings that exceeded the 45 mg/l MCL. Examination of the time trend data indicates that nitrate levels are generally remaining steady at this well.

The results of this analysis indicate that existing and future wells located in the Pomona Basin, especially those located further south and west, will need to be equipped with nitrate removal treatment technologies or have their production blended with lower Nitrate sources.

Figure 2-4

Water Quality Concerns in the Six Basins Area

Legend

Groundwater Basins

- Canyon Basin
- Upper Claremont Heights Basin
- Lower Claremont Heights Basin
- Live Oak Basin
- Ganesha Basin
- Pomona Basin
- Cienegas
- Spreading Grounds

Water Quality Concerns

Production Wells

- High VOCs
- High Nitrate
- High Nitrate and High VOCs
- Others

N E S W

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Miles

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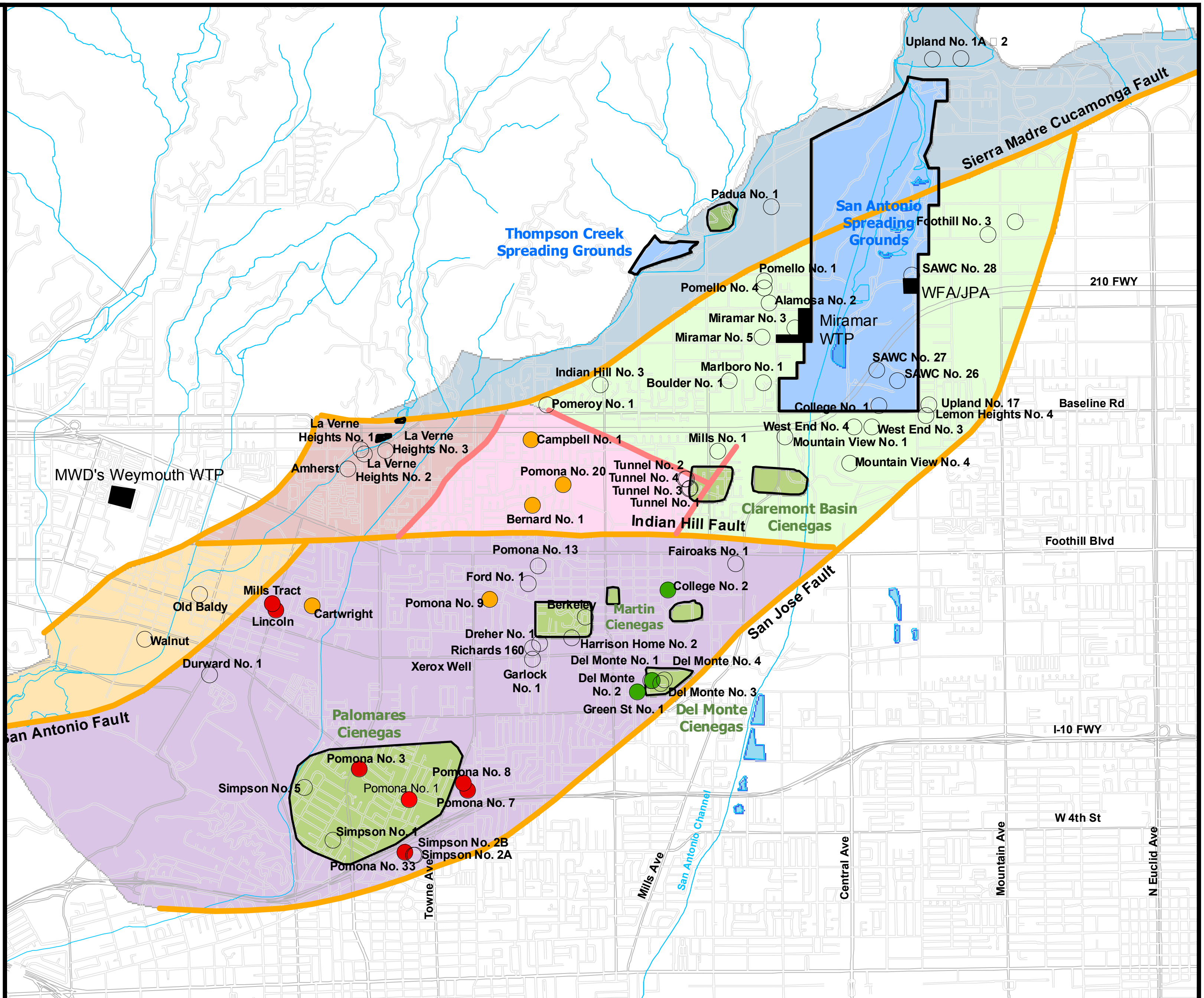

2.3.2 VOCs

Although wells in all basins had isolated low level occurrences of various VOCs, the highest sustained readings were all observed in the Pomona Basin. As with Nitrate, high VOCs seem to be more common on the vicinity of the Palomares and Del Monte Cienegas where some concentrations of Trichloroethylene (TCE) and Dichloroethylene (DCE) exceed their MCL of 5 ug/l and 7 ug/l respectively. It should be noted that some wells in the northeast portion of the Pomona Basin also show elevated levels of TCE.

The average VOC readings for the wells in the other basins were below the MCL. The only exception was an isolated MCL exceedance for MTBE at Harrison Home No. 2 and an isolated MCL exceedance for Tetrachloroethylene (PCE) at Indian Hills No. 3, both in the Upper Claremont Heights Basin. The results indicate that future wells in the Pomona Basin will likely require VOC treatment to be able to meet municipal supply requirements.

2.4 Six Basins Area Hydraulic Model

The Six Basins Area hydraulic groundwater model represents the inflow, storage, movement and discharge of groundwater. The model was developed as a tool to help PVPA manage spreading operations to control high groundwater conditions in the Upper Claremont Heights and Pomona Basins, and to evaluate alternative management scenarios such as enhanced groundwater spreading and increased groundwater pumping in localized areas.

2.4.1 Model History

- The initial model was developed in 1993 for the PVPA by MWH (formerly James M. Montgomery Engineers) as a long term groundwater management tool. (Montgomery, 1993). A simplified spreadsheet model was also developed to assist with short term decision making. The spreadsheet model allowed PVPA to perform preliminary assessments of available storage in the basin and adjust the amount of spreading accordingly.

- In 1998 CDM updated the 1993 groundwater model. The updated model built on the previous model, and incorporated revised basin concepts to better predict how the groundwater basins would react under different operating scenarios. The revised basin concepts related to faults, bedrock elevation, aquifer layers and identification of the Ganesha basin. The revised concepts were developed in large part by an Ad Hoc Technical Committee representing the main groundwater producers. This version of the Six Basins groundwater model was documented in the Six Basin Management Area Groundwater Model Update report (CDM 1999).

- The Six Basins Area model was applied by CDM in 2002 to assess alternative spreading ground basin configurations and strategies for sequencing water application to SASG. Prior to applying the model, the computational structure was refined to provide more detail in the vicinity of the spreading grounds. The spatial distribution of recharge flux assignments at the spreading grounds was similarly refined. Additionally, modifications were made to improve the model's representation of historical conditions and to streamline the input data structure. The new input data structure greatly facilitates the simulation of multiple management scenarios. In the current study, over 60 different preliminary management scenario simulations were completed. Model updates made in 2002 are documented in the Assessment of Current Spreading Operations and Development of Spreading Operating Parameters Study (CDM, 2002).

- Updates made to the model since 2002 are described in Section 2.3.3 of this report. The updates were based on new stratigraphic data obtained from three monitoring wells installed in 2004, and on an expanded model calibration effort which included a longer historical calibration period (1960 to 1996) and data from additional monitoring wells. The updated model was used to simulate the alternative groundwater spreading and production scenarios presented in this report.

2.4.2 Model Description

The model was documented in the Six Basin Management Area Groundwater Model Update report (CDM 1999) and Assessment of Current Spreading Operations and Development of Spreading Operating Parameters Study (CDM, 2002). Subsequent updates are described in Section 2.4.3 in this report. A brief summary of model features is presented below.

Domain

Figure 2-5 shows the outline of the model area. The model area includes the Canyon Basin, Upper Claremont Heights Basin, Lower Claremont Heights Basin, Live Oak Basin, Pomona Basin, and Ganesha Basin. The model area is bounded by the San Gabriel Mountains to the north, the San Jose Fault to the east and south, and by the San Jose Hills to the southwest.

Layering

The model layering represents a sequence of bedrock, overlain by older alluvium, then younger alluvium. The younger alluvium is typically more permeable than the older alluvium. The presence of a semi-confining unit separating the two alluviums is also represented in the model. Figure 2-6 shows the model layering in a northeast-southwest cross section.

Figure 2-5
Model Domain

Legend

Canyon Basin

Groundwater Basins

- Canyon Basin
- Upper Claremont Heights Basin
- Lower Claremont Heights Basin
- Live Oak Basin
- Ganesha Basin
- Pomona Basin
- Cienegas
- Spreading Grounds

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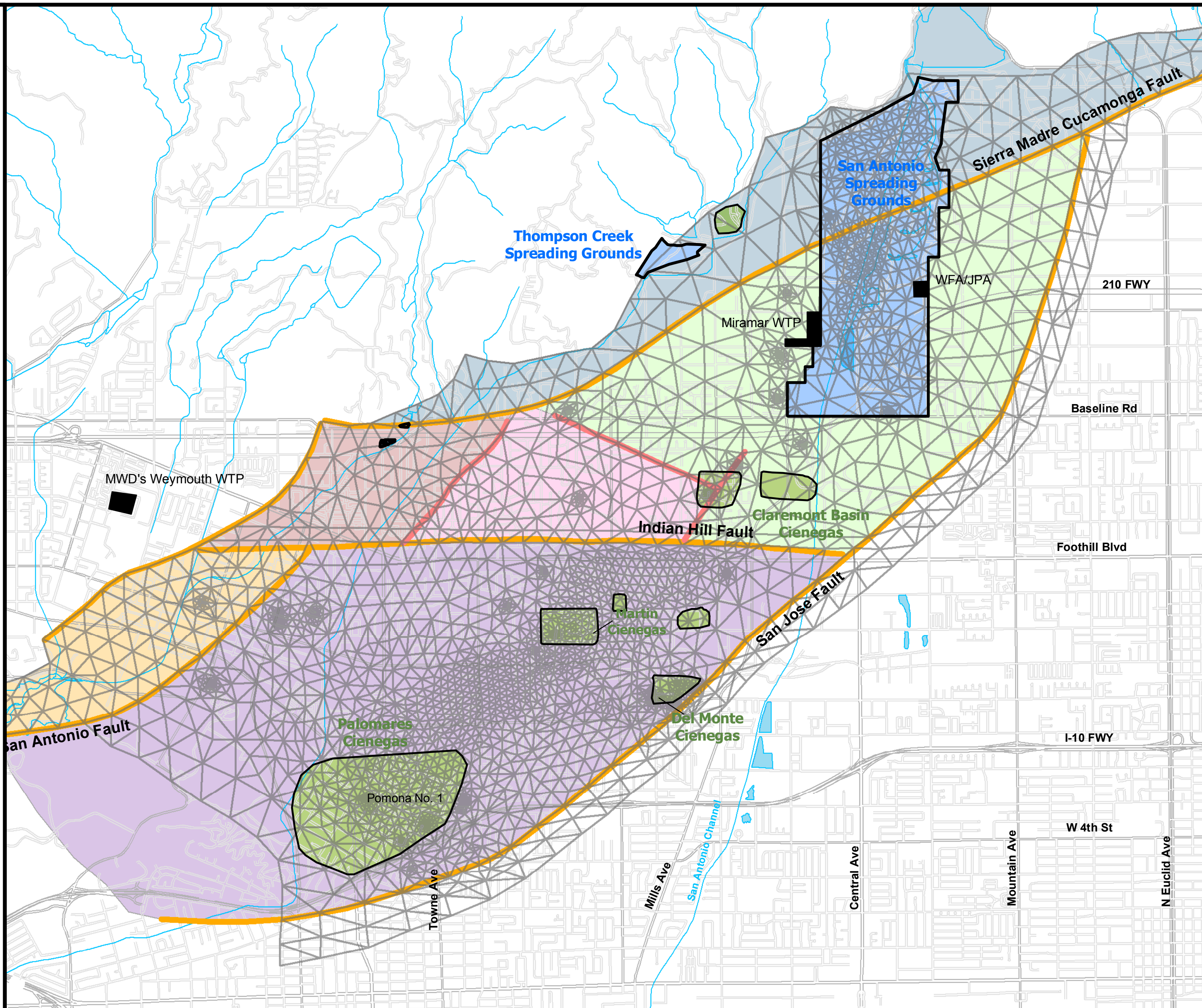
Miles



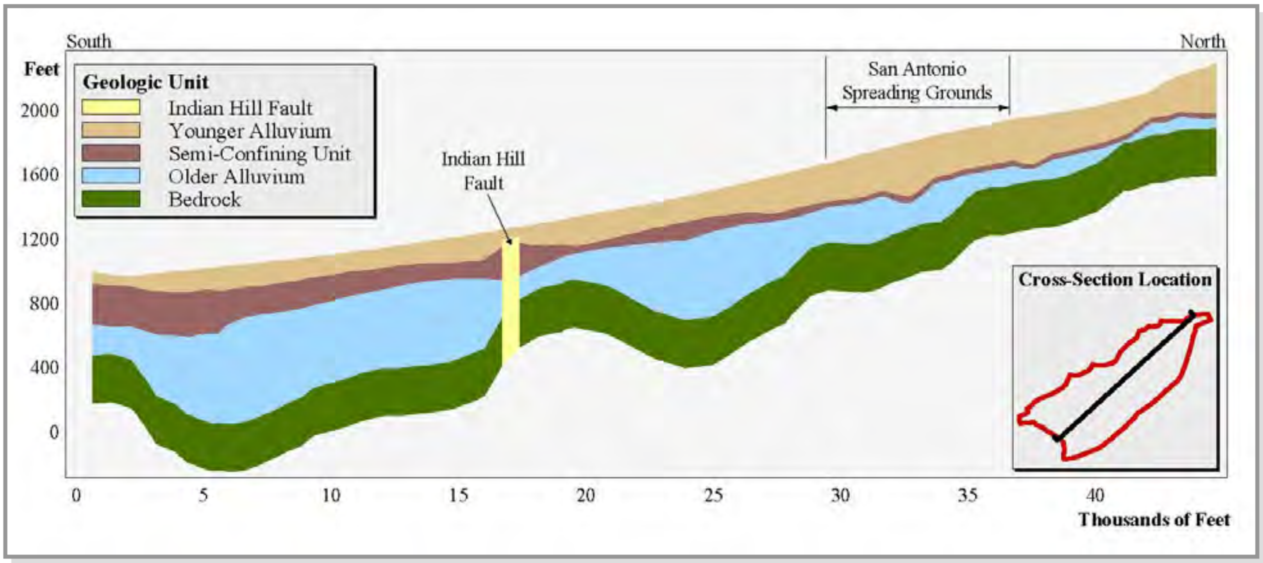


Figure 2-6
Northeast to Southwest Cross-Sectional Representation of Model Area

Bedrock – The top 300 feet of bedrock is included at the base of the model. The bedrock layer adds to the computational stability of the model, but has relatively little impact on the groundwater flow regime simulated in the water-bearing layers because a low value of horizontal conductivity has been assigned, which is consistent with the relatively impervious nature of the bedrock.

Older Alluvium - The thickness of the older alluvium averages approximately 350 feet in the model. It is thickest in the Pomona Basin. The older alluvium is divided into two computational layers. This allows vertical hydraulic gradients and the vertical location of well pumping to be represented in greater detail. The hydraulic property assignments are generally the same in each of the older alluvium layers.

Semi-confining Unit - In some sections of the modeled area, this layer is a relatively continuous clay layer, such as in the Pomona Basin south of the Indian Hill Fault. In other sections of the modeled area the clay lenses are less continuous and this layer presents less of a barrier to flow between the younger and older alluvium. South of the Indian Hill Fault the clay layer can be a few hundred feet thick. The semi-confining unit has been subdivided into two model layers.

Younger Alluvium – The younger alluvium is 100 to 200 feet thick. It is generally more permeable than the older alluvium, especially in the vicinity of the San Antonio Creek. The younger alluvium is divided into 3 computational layers. The top layer, which is 2.5 feet thick and represents the root zone, is used for recharge computations. The remainder of the younger alluvium is subdivided to represent in greater detail the vertical hydraulic gradients and the vertical location of well pumping.

Faults

San Jose Fault – The southeastern model boundary is aligned with the San Jose Fault, which divides the Six Basin Area from the Chino Basin. A band of model elements with low hydraulic conductivity representing the fault allows limited discharge across the fault into the Chino Basin.

Indian Hill Fault - The Indian Hill fault is represented as a band of low hydraulic conductivity elements which inhibit flow from the Upper and Lower Claremont Heights basins into the Pomona Basin through the Older Alluvium. However, the Indian Hill Fault is not considered to be a significant barrier to subsurface flows in the Younger Alluvium, therefore it is not represented there.

San Antonio Fault - The San Antonio Fault, which inhibits subsurface flow from the Ganesha Basin into the westerly portion of the Pomona Basin, is represented in the model. Water levels at wells lying to the west of the fault were generally 200 to 250 ft higher than those observed in the Pomona Basin.

Intermediate Fault – As described in Section 2.4.3, recent updates to the model included the addition of the Intermediate fault. This fault runs northeast-southwest in the northeast part of the Pomona Basin, approximately 3,000 to 5,000 feet northwest of the San Jose Fault.

Sierra Madre - Cucamonga Fault – The Sierra Madre - Cucamonga Fault is not represented in the model because it does not appear to significantly affect groundwater flow between the Canyon Basin and the Upper and Lower Claremont Heights basins.

Boundary Conditions

Northern Boundary – The northern model boundary is represented with specified fluxes that represent recharge to the basin from mountain front watersheds.

Southern Boundary – Specified heads representative of Chino Basin head levels are assigned on the Chino Basin side of the San Jose Fault at the model's southern boundary. This boundary condition allows limited discharge from the Six Basins Area to the Chino Basin. The computed rate of discharge depends on simulated groundwater levels north of the fault. Beyond the east end of the San Jose Fault, a small rate of inflow to the basin results from the specified head boundary condition at that location.

Western Boundary - The western boundary along the San Jose Hills and San Gabriel Basin is defined as a no-flow boundary, representing the limits of the alluvial deposits.

External Stresses

The Six Basins Area model includes four types of external stresses to represent the climatic conditions and water supply activities which occur in the area. These stresses are production pumping, water recharged at spreading basins, mountain front recharge, and areal recharge resulting from precipitation and returned water.

Pumping – Groundwater pumping fluxes are applied at model locations (horizontal and vertical) corresponding to the screen intervals of production wells in the basin. Pumping flux assignments were varied on a monthly basis for individual wells. For the calibration simulations, historical pumping rates were applied to the model. These historical pumping rates were derived from pumping data compiled by the groundwater producers in the area. The development of pumping fluxes used in the Baseline and Scenario simulations is described in detail under Section 2.4.4.

Spreading Basin Recharge - Water which is recharged in spreading basins is applied to the water table at locations corresponding to the San Antonio Spreading Grounds, the Thompson Creek Spreading Grounds, the Pomona Spreading Grounds, and the Live Oak Spreading Grounds. Spreading recharge flux assignments were varied on a monthly basis based on historical data. Native water recharge amounts were obtained from monthly spreading records maintained by PVPA. Additional imported water spreading was simulated for some management scenarios.

Availability of Surface Water – A full hydrologic model of the San Antonio Canyon watershed was not conducted to determine the maximum amount of surface water that could be available for spreading at the SASG. In addition, spreading losses resulting from local surface water bypassed at the dam were not considered in the model.

Mountain Front Recharge - Inflow from the surrounding uplands (mountain front recharge) is treated as a specified boundary flux applied at the model northern boundary. Mountain front recharge flux assignments were varied on a monthly basis. Estimated mountain front recharge was computed based on precipitation records at the San Bernardino and Lake Arrowhead gauges. The Lake Arrowhead gauge was used since no recording gauges were available for the upper elevations in San Antonio Canyon.

Recharge from Precipitation and Returned Water - The quantity of water infiltrating to the subsurface was computed by subtracting estimates of runoff and interception from the rainfall and applied water on a monthly basis. Evapotranspiration (ET) of infiltrated water from the root zone (estimated to be the top 2.5 feet) is accounted for, and the remainder is routed through the unsaturated zone to the water table. Monthly rainfall depths from the San Bernardino gauge were used to represent precipitation in the valley.

Numerical Modeling Code

The DYNFLOW modeling code used for the Six Basins Area model is a fully three-dimensional, finite element groundwater flow modeling code. The finite element method provides significant flexibility in model grid configuration, which allows for the more natural matching of physical features, such as the complex shape of the alluvial valley at this site, and rapid variations in bedrock elevation and alluvium thickness. It also allows model detail to be focused in areas of particular interest, e.g. in the vicinity of production wells, while areas of less interest can be incorporated at a low level of computational intensity. Another feature of DYNFLOW critical to this study is the ability to reliably simulate water table rise and fall into and out of model layers, particularly the rewetting of previously unsaturated layers. This is a practical necessity in the Six Basins Area because of the large changes in water level observed in the Claremont Heights Basin.

The DYNFLOW code has been reviewed and tested by the International Groundwater Modeling Center (van Der Heijde, 1985 and 1999). The code has been extensively tested and documented by CDM (1997).

2.4.3 Recent Model Updates

Updates to the Six Basins Area model since the Assessment of Current Spreading Operations and Development of Spreading Operating Parameters Study (CDM, 2002) are summarized below. These updates have been based primarily on the acquisition and compilation of additional data including:

- Boring and geophysical logs and water level data for dedicated groundwater monitoring wells MW-1, MW-2 and MW-3 installed in 2004
- Groundwater production and spreading data for the period from 1960 to 1988 which supplemented data previously compiled for 1989-1996
- Spreading data for 1997-2005
- Water level data for additional monitoring well locations including wells installed by industrial facilities in the basin

The new boring and well logs provided the basis for adjusting model layering. The additional production, spreading and water level data provided the basis for extending the model calibration period and increasing the number of locations where model results could be compared with field data. Based on the supplemented calibration testing, adjustments to model parameters were made to improve the consistency of the model with field conditions.

Layering

Top of Bedrock - The top of bedrock elevation was adjusted based on logs of monitoring wells MW-1, MW-2 and MW-3. In the vicinity of MW-1 the top of bedrock elevation was lowered by approximately 100 feet based on the MW-1 logs. No adjustment to the model was required at well MW-2. In the vicinity of well MW-3, model top of bedrock was lowered more than 300 feet based on the MW-3 logs. Adjustments were also made in other areas of the model, especially the southern area of the Pomona Basin extending southwest from MW-3 approximately 2 miles, based on a review of all available boring logs and well depths.

Bottom of Younger Alluvium – To improve model calibration, minor adjustments were made to the elevation of the bottom of younger alluvium along the Indian Hill Fault. The Indian Hill Fault is considered to be a significant barrier to subsurface flow in the older alluvium, but not in the younger alluvium. Therefore, small adjustments to the elevation of the bottom of younger alluvium there affect simulated water levels upgradient of the fault, and the timing and magnitude of subsurface flow from upgradient of the fault to the Pomona Basin.

Faults

Intermediate Fault – Model simulation of historical groundwater levels in the Pomona Basin, especially near the Martin Cienegas, was improved by representing the Intermediate Fault in the model. This fault has been mapped by Bean (1993) and Montgomery Watson, Inc. (1993). In the updated model, it runs nearly parallel to the San Jose Fault, approximately 3,000 to 5,000 feet northwest, extending southwest from the Indian Hill Fault for a distance of approximately 15,000 feet.

San Jose Fault – As noted previously, the San Jose Fault is represented by a band of low hydraulic conductivity model elements. A specified head boundary condition, with heads representative of Chino Basin head levels, is assigned south of the fault. Previously the fault was represented using a general head boundary condition, which defines a relationship between computed head in the basin and discharge across the boundary. Computationally, the two representations are similar; however, it is easier to visualize and assign parameter values for the new representation.

Hydraulic Properties

San Antonio Creek Area – The model representation of groundwater heads in the vicinity of San Antonio Spreading Grounds and the San Antonio Creek was improved by increasing the horizontal hydraulic conductivity assigned to the younger alluvium near the creek from 15-30 feet/day to 100 feet/day. Also, this zone of relatively high conductivity was deepened in the vicinity of well MW-1 based on MW-1 boring and geophysical logs.

Monitoring Well No. 3 Area – As noted previously, depth to bedrock in the model was increased in the vicinity of MW-3 based on the MW-3 boring and geophysical logs. The MW-3 logs also indicated the presence of coarse grained soils in the bottom 600 feet of the alluvium there. Based on this, the horizontal hydraulic conductivity assigned to the older alluvium over this depth interval near MW-3 was increased from 4 to 20 feet/day.

Minor Adjustments – A number of other minor adjustments to hydraulic property assignments were made to improve model calibration. As noted previously, the calibration period has been extended in time duration, and comparisons between model results and field data were made at a greater number of locations.

Computational Grid

Horizontal Refinement – The finite element grid was further refined in the eastern part of the Pomona Basin and in the vicinity of key production wells (See Figure 2-5). The reason for refining the grid near production wells was to improve the model representation of heads in close proximity to the wells. The revised grid contains 6,641 triangular elements in plan view formed by 3,377 nodes at the element vertices, compared with approximately 2,149 elements and 1,130 nodes in the previous model.

Vertical Refinement – The older alluvium, younger alluvium and the semi-confining unit which separates them were each subdivided into two computational layers. This was done to refine the model representation of vertical gradients and flow, and to better define vertically the location of pumping fluxes. The total number of computational layers was increased from 5 to 8.

San Antonio Spreading Grounds

A much more detailed representation of the spatial distribution of recharge fluxes at the San Antonio spreading grounds was developed in 2002, as documented by CDM (2002). The same representation was used for recent historical simulations made using the updated model. However, for simulations of alternative future scenarios, a new spatial distribution of San Antonio spreading ground fluxes was developed consistent with current plans to reconfigure the spreading basins.

2.4.4 Development of Production Patterns

Previous modeling studies in the Six Basins Area have used the model of the groundwater basins to replicate past conditions. To accomplish this, actual historical production, rainfall, water levels, and spreading values have been used. Modeling for this study differs from previous studies as the model is being used as a predictive tool to assess what could happen under different management scenarios.

As a predictive tool, the model uses historical rainfall and spreading as there is a likelihood that these patterns would repeat in the future. However, future production patterns and well use are likely to be very different than historical well utilization over the last 40 years. To develop meaningful future production patterns for individual wells, historical production information for individual wells was compiled and meetings were held with individual purveyors to discuss how individual wells would be used in the future. A more detailed description of this approach is presented below.

Assessment of Historical Pumping Rates and Well Utilization

The historical groundwater production data over the 1995-2004 period was analyzed to obtain the seasonal production statistics for individual wells including the average, minimum, and maximum monthly production rates. Historical data shows significant variations in the use of wells by individual water agencies and between wells owned by the same agency. Many wells are used fairly constantly throughout the year while others are either primarily peaking wells for summer use or used only during the winter months. To further complicate the evaluation, many wells have been used constantly for a number of years and as peaking wells to meet summer demands in others.

To develop the seasonal variations in production for individual wells, the monthly production was compared against the maximum monthly production for a given year and expressed as a percentage of maximum month. This method normalized the monthly production against the maximum month production for the year. This was used to determine the seasonal utilization rate for individual wells. The normalized utilization was then classified into three utilization categories: a) below average if a well was used less than 33 percent of the time, b) average when used between 33 and 66 percent, c) and above average when used over 66 percent of the time relative to the maximum month.

The analysis also considered the rated production capacity of wells as it was compared against monthly production for the same period to determine whether wells were being used to their maximum potential or if production could be increased to help mitigate rising water conditions without adding new wells. Using the historical well production data and well production and utilization analysis, an inventory of wells that were not fully utilized or had the capability to increase pumping production was developed.

To better understand and confirm the well operations within the Six Basins Area, meetings were conducted with most water purveyors. During these meetings, data regarding the purveyor well operations, seasonal use of wells, and capital improvement plans was discussed. In addition, agencies plans to restore existing wells or drill additional wells in the Six Basins Area were also considered. Production from additional wells considered in the model includes the Piedmont Well (GSGC) and Pomona wells No. 7 and No. 8, which have been recently equipped with nitrate removal facilities. In addition, the City of Upland plans to develop two new wells in the vicinity of Baseline Road and Benson Avenue and the WECWC plans to replace two of their existing wells in the next few years.

Development of Well Production Patterns for Model Simulations

Assumed well production patterns were developed as input for the groundwater model. The well production patterns were developed using three analysis methods. These methods include:

- Benchmarking to historical production data
- Estimating increased well production
- Developing monthly production pattern variations

Benchmarked Well Production Patterns. Benchmarking for the model input production patterns was based on a comparison with the historical three-year monthly and annual average production and 1999 well production. Both the three-year production trends and 1999 production patterns were considered the most representative historical production patterns to be used for benchmarking and developing the groundwater input model production patterns.

Calendar year 1999 was considered for benchmarking because the total basin production was very close to the long-term safe operating yield of 19,300 ac-ft. Although benchmarking against 1999 was used, some wells had no production data available for 1999; for these wells, the three-year (2002-04) monthly and annual average well production was considered to be the most representative of the recent well operation and pumping trends. The availability of three-year monthly and annual average production and 1999 production data varied for the each of the wells within the well inventory.

Estimates of Increased Well Production. To estimate the production increases for each well, the following assumptions were made. If the 1999 or historical three-year well production data was near the maximum historical production, it was assumed that the well could not increase production.

- For new and rehabilitated wells soon to come back on line with no recent production records, well production was assumed to be a percentage of the rated well pumping capacity. Seasonal distribution was based on monthly use from other wells of the same agency.
- When the 1999 or historical three-year well production data was significantly less than the maximum historical production, a comparison of the production difference between the 1999 and three-year average annual production was developed. The difference between the data sets was used as the basis for developing theoretical production increases for the wells. The assumed increase in production from the three-year average production was a percentage of the increase between 1999 and the three-year production data.
- If wells historically had small production capabilities and the ability to increase well production was unlikely for various reasons, it was assumed that the well produced similar to the three-year annual average production with no production increases.
- Unique assumptions were made for individual wells as required.

Developing Monthly Production Pattern Variations. To consider the typical monthly production variations when developing the groundwater model production input, it was assumed that monthly production variations would be similar to the benchmarked historical three-year monthly pattern and annual average and 1999 well production data. The following procedure was used to develop typical monthly and seasonal production variations for the model input data.

- If well production data was available for 1999, monthly production variations for the groundwater model input were based upon this distribution.
- If no well production data was available for 1999, monthly production variations for the groundwater model input were based upon the monthly distribution for historical three-year monthly and annual average production.
- When no data was available, the total annual production was considered to be the same as surrounding wells or wells owned by the same agency.

2.4.5 Use of the Model

With calibration and extension of its simulation period, the current groundwater model has become a valuable tool in assessing basin management practices. To aid in evaluating various operational conditions, a series of simulations can be run and the results compared.

With the model calibrated, the model can be applied to evaluate relative impacts to the Six Basins Area caused by changes in operational procedures. Some of the operations that can be tested are the implications of increased production and/or applied spreading. By changing inputs to the model (e.g. production, spreading) the model can be used to estimate changes in groundwater flow from these changes. The groundwater model can be used to simulate a suite of potential management actions and determine the relative benefits or disadvantages of each action prior to field application. This analysis involves evaluating changes in water levels, rising water conditions, basin outflows, and long term changes in basin storage. During this assessment, aquifer parameter data and other parameter files used to define stratigraphy remained unchanged.

With respect to the current study, various actions for controlling and/or preventing rising water and recharging and recovering imported water were simulated. These actions included:

- Changes to production patterns at existing wells
- Addition of new production wells
- Changes to spreading of natural (winter) recharge at SASG
- Spreading of imported water at SASG and recovery of the water through increased pumping.

To assess the specific impacts of these types of changes, a trial-and-error process of varying model input parameters was undertaken. For example, various combinations of production rates and spreading rates were simulated. The results of these simulations were directly compared to each other to judge relative benefits and disadvantages. The practicality of a given scenario was assessed based on hydraulic impacts and the practical/operational changes that the scenario would require.

To assess various operational scenarios, a common Baseline Scenario was developed to serve as the benchmark for comparison.

2.4.6 Preliminary Modeling Runs

Prior to simulation of Baseline and scenario conditions, a series of preliminary runs was conducted. The intent of the preliminary runs was to determine a range of management options that were both technically feasible and had a beneficial impact on the groundwater basins. Some of the preliminary model runs were made to determine basin response to:

Starting Water Level Conditions

- Various water level starting conditions from the calibrated model ranging from the dry period near 1978 to the wet period of 1996 (model calibration period was 1960-1996) were simulated to determine whether starting heads had an impact on overall rising water conditions.

Production Changes

- The overall level of groundwater pumping was adjusted in response to water levels by increasing and decreasing the total pumping in the modeled area in increments of 25 percent and as much as 50 percent.
- Adjusting pumping north of Indian Hill Fault due to water level changes (increasing production if levels are high, decreasing if levels are low). Water level triggers to adjust pumping ranged from 1,250 to 1,350 ft at the Mountain View Well No. 4 and at Monitoring Well No. 2.
- Adjusting pumping south of Indian Hill Fault due to water level changes (increasing production if levels are high, decreasing if levels are low). Water level triggers to adjust pumping ranged from 1,050 to 1,150 ft at the Berkeley well.
- Adding new production at the south end of SASG. Various production rates (e.g. seasonal; constant year-round) were assessed. The use of a "trigger" water level to increase production if water levels were too high was also assessed using trigger values from 1,300 to 1,375 ft. Increments of 25 feet were used to assess the sensitivity of the model.
- Adding new production within the Martin Cienegas. Various production rates (e.g. seasonal; constant year-round) were assessed. The use of a "trigger" water level to increase this production if water levels were too high was also assessed using trigger values from 1,100 to 1,150 ft. with 25 ft increments.

Spreading Changes

- Restricting natural spreading at SASG was assessed
- Importing from 5,000 to 15,000 ac-ft per year to SASG
- Increasing and decreasing spreading based on water levels (range 1,250 to 1,375 ft)

2.5 Baseline Scenario – Development

2.5.1 Development

The Baseline Scenario was developed as follows.

Aquifer Properties

Aquifer properties, such as stratrigraphic layering and hydraulic properties, remained as in the calibrated model.

Development Patterns

Levels of development remain as they are in the calibrated model. The level of development impacts the amount of deep percolation that results from surface activities in urban (e.g. pipe leakage) and agricultural (e.g. irrigation) areas. No major changes have occurred in recent years or are anticipated in the foreseeable future.

Basin Perimeter Inflow

In the Baseline Scenario, inflow to the basin along its perimeter (e.g. recharge at the foot of the mountains) remained the same as in the calibration simulation. The historical hydrology (e.g. rainfall) impacts the levels of subsurface recharge from the mountain front. For the Baseline (and calibration) simulation, the actual historical hydrology for 1960–2005 was applied. Any basin inflow that is calculated as a result of this hydrology was done so in the same manner as in the calibration simulation. Using historical inputs, such as rainfall, forces the model to cycle through different dry and wet periods, just as the basin has experienced historically.

Applied Spreading

As with rainfall, applied spreading of local surface water at the San Antonio, Thompson Creek, and Live Oak spreading grounds was applied using historical data from 1960-2005. Applied spreading at SASG ranged from 0 to over 31,300 ac-ft per year over the 45 year study period and averaged 6,061 ac-ft per year as illustrated in Figure 2-7.

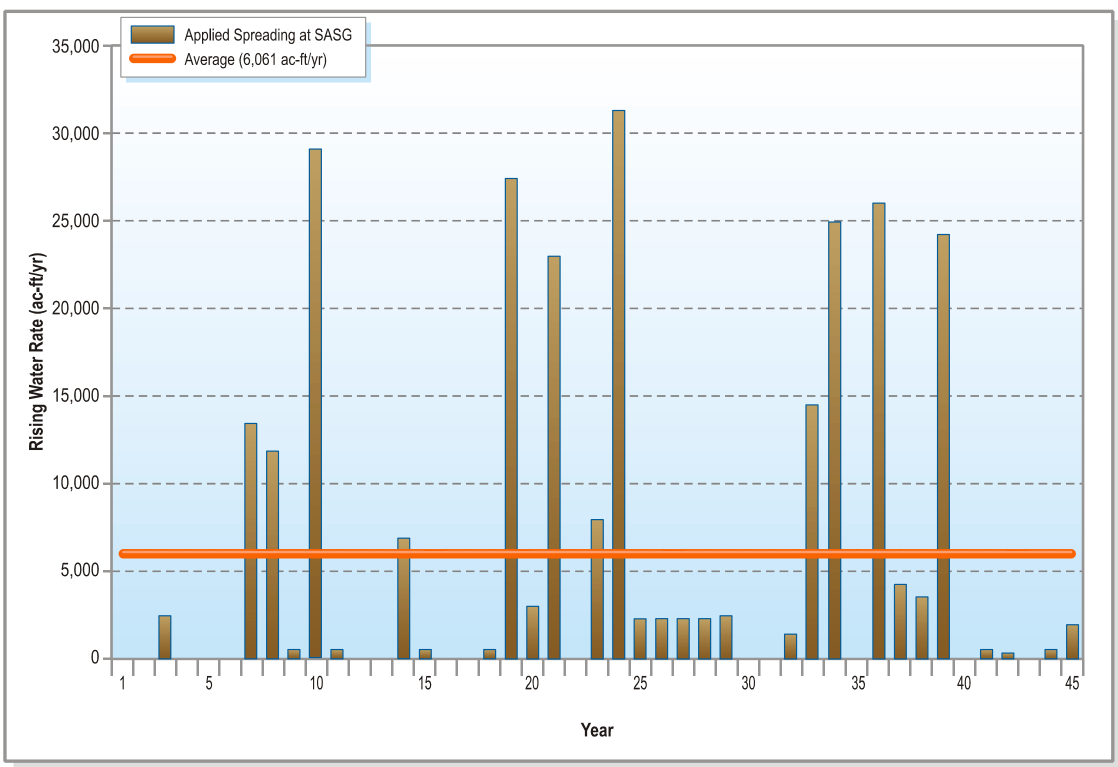


Figure 2-7
Annual Spreading of Local Surface Water at SASG – Baseline Scenario

Fluctuations in Groundwater Production

Production within the Six Basins Area varies significantly from year to year depending on water levels. In general, when water levels are high production rates increase. Similarly, when water levels are low production is typically decreased. In order to replicate this type of operation an algorithm to increase or decrease production was implemented in the model. Super-imposed on the annual production pattern described above is an algorithm in the model to vary production based on groundwater levels at specified locations.

In the Baseline Scenario, as in all subsequent scenarios described in Section 3, the variation of pumping was split into two regions with the Indian Hill Fault used as the divider. Production from wells on the north side of the fault in the Canyon, Upper Claremont Heights, Lower Claremont Heights, and Live Oak basins was regulated by water levels at Monitoring Well No. 2. This well, located in the vicinity of Padua Avenue and Baseline Road, was selected because water levels at this location are directly impacted by surface water spreading in the San Antonio Spreading Grounds.

Production from wells in the Pomona and Ganesha basins, south of the Indian Hill Fault, was regulated by water levels at the Berkeley No. 2 well. Table 2-2 summarizes the variations in production used in the model based on water levels at the Monitoring Well No. 2 and Berkeley No. 2.

Table 2-2
Pumping Parameters Based on Water Levels at Key Wells

Pumping Parameters		
Production North of Indian Hill Fault Water Levels at Monitoring Well No. 2	*Production South of Indian Hill Fault* Water Levels at Berkeley No. 2 Well	*% of Base Production Pattern Applied*
Greater than 1,350 feet	Greater than 1,150 feet	125%
1,300 feet to 1,350 feet	1,100 feet to 1,150 feet	Varied between 100% and 125%
1,300 feet	1,100 feet	Base Pattern (100%)
1,250 feet to 1,300 feet	1,050 feet to 1,100 feet	Varied between 75% and 100%
Less than 1,200 feet	Less than 1,050 feet	75%

2.5.2 Baseline Scenario - Evaluation

Using the inputs described in the preceding section, a Baseline Scenario was simulated in the groundwater flow model. Mass balance results from the Baseline Scenario were summarized as an average for the entire 45 years simulation period and into individual annual averages. Table 2-3 shows the annual mass balance results of the Baseline Scenario simulation. A description of each of the components listed in the table is presented below.

Table 2-3
Baseline Annual Mass Balance

Annual Summary: Baseline (ac-ft/yr)

Year	Aerial & Boundary Recharge	SASG Spreading: SASG, Natural	SASG Spreading: SASG, Imported	SASG Spreading: Other	Pumping: Baseline 2,3	Pumping: Proposed Near SASG	Pumping: Proposed Near Martin Cienegas	Rising Water: North of Indian Hill Fault	Rising Water: Pomona Basin Martin Cienega Area	Rising Water: Pomona Basin Del Monte Cienega Area	Rising Water: Pomona Basin Southern Portion	Rising Water: Pomona Basin Western Portion	Rising Water: Ganesha Basin	Rising Water: Southwest Portion of Model	Flow into Chino Basin	Change in Storage 4
1	12,538	0	0	1,580	22,876	0	0	0	0	0	0	0	0	0	1,581	-10,410
2	9,737	0	0	63	19,756	0	0	0	0	0	0	0	0	0	1,378	-11,304
3	11,663	2,473	0	93	17,323	0	0	0	0	0	0	0	0	0	1,291	-4,383
4	11,726	0	0	94	15,854	0	0	0	0	0	0	0	0	0	1,178	-5,205
5	10,426	0	0	81	14,881	0	0	0	0	0	0	0	0	0	1,102	-5,489
6	13,993	0	0	174	14,526	0	0	0	0	0	0	0	0	0	1,059	-1,430
7	12,689	13,352	0	913	14,487	0	0	0	0	0	0	0	0	0	1,114	11,337
8	16,095	11,868	0	1,696	15,763	0	0	0	0	0	0	0	0	10	1,187	12,688
9	11,543	500	0	61	17,817	0	0	0	0	0	0	0	21	20	1,211	-6,974
10	20,559	29,215	0	247	18,388	0	0	0	0	0	0	0	103	44	1,351	30,020
11	14,034	495	0	101	20,282	0	0	0	0	0	0	0	141	44	1,374	-7,452
12	13,586	0	0	103	21,075	0	0	0	0	0	0	0	169	38	1,331	-8,959
13	10,530	0	0	58	19,121	0	0	0	0	0	0	0	182	21	1,245	-9,978
14	14,618	6,923	0	904	17,076	0	0	0	0	0	0	0	238	32	1,266	3,826
15	14,796	495	0	112	16,583	0	0	0	0	0	0	0	233	47	1,273	-2,740
16	12,579	0	0	80	16,012	0	0	0	0	0	0	0	231	57	1,248	-4,889
17	12,896	0	0	101	15,073	0	0	0	0	0	0	0	231	60	1,208	-3,576
18	12,731	495	0	110	14,667	0	0	0	0	0	0	0	227	57	1,170	-2,789
19	21,100	27,387	0	228	14,578	0	0	0	0	0	0	0	299	81	1,327	32,397
20	15,002	2967	0	109	18,773	0	0	102	0	0	0	0	267	86	1,431	-2,644
21	20,093	22,981	0	978	21,096	0	0	0	0	0	0	0	332	106	1,550	20,751
22	12,726	0	0	76	21,810	0	0	0	0	0	0	0	282	96	1,529	-11,094
23	17,004	7,912	0	160	22,194	0	0	0	0	0	0	0	324	80	1,471	999
24	22,131	31,314	0	206	22,474	0	0	0	0	0	0	0	392	94	1,628	28,848
25	12,557	2,336	0	299	23,429	0	0	231	0	0	0	0	309	89	1,686	-10,827
26	13,209	2,296	0	304	24,323	0	0	0	0	0	0	0	342	66	1,627	-10,542
27	15,123	2,296	0	330	22,848	0	0	0	0	0	0	0	361	73	1,566	-7,117
28	13,276	2,296	0	329	20,048	0	0	0	0	0	0	0	320	109	1,445	-6,002
29	12,362	2,478	0	351	17,906	0	0	0	0	0	0	0	323	243	1,382	-4,648
30	11,651	100	0	164	16,835	0	0	0	0	0	0	0	353	366	1,361	-7,003
31	10,960	2	0	247	15,922	0	0	0	0	0	0	0	313	275	1,271	-6,564
32	13,930	1,484	0	828	15,087	0	0	0	0	0	0	0	352	306	1,231	-743
33	20,898	14,437	0	805	14,859	0	0	0	0	0	0	0	386	356	1,283	19,234
34	29,186	24,992	0	1364	19,273	0	0	0	0	0	0	0	504	538	1,612	33,185
35	16,829	11	0	251	22,521	0	0	141	0	0	0	0	427	428	1,724	-8,463
36	20,204	26,053	0	1,874	24,180	0	0	52	0	0	0	0	515	494	1,838	20,947
37	17,151	4,262	0	690	25,109	0	0	0	0	0	0	0	480	364	1,870	-5,747
38	14,988	3,621	0	1,776	25,261	0	0	0	0	0	0	0	479	409	1,841	-7,607
39	21,456	24,182	0	1,267	24,826	0	0	41	0	0	0	0	544	724	1,892	18,768
40	10,305	33	0	555	24,774	0	0	0	0	0	0	0	421	563	1,769	-16,781
41	12,686	600	0	685	24,402	0	0	0	0	0	0	0	465	629	1,645	-13,150
42	11,266	431	0	890	21,629	0	0	0	0	0	0	0	450	628	1,502	-11,619
43	10,020	0	0	300	18,415	0	0	0	0	0	0	0	411	635	1,338	-10,469
44	11,752	444	0	1,808	16,177	0	0	0	0	0	0	0	422	730	1,286	-4,609
45	10,724	2,020	0	992	15,317	0	0	0	0	0	0	0	393	636	1,245	-3,849
Avg	**14,563**	**6,061**	**0**	**543**	**19,236**	**0**	**0**	**13**	**0**	**0**	**0**	**0**	**272**	**214**	**1,420**	**-46**

Areal and Boundary Recharge

The average areal and boundary recharge in the Baseline Scenario is simulated to be 14,563 ac-ft per year. This value represents groundwater recharge from precipitation within the basins, recharge at the edge of the basin (i.e. "mountain front" recharge), and urban return flow. Recharge from precipitation and mountain-front recharge are driven entirely by rainfall records. Return flow from irrigation simulated in the model varied based on hydrologic conditions but was held constant between simulations. Therefore, the volumes listed as "Areal and Boundary Recharge" are essentially the same for all simulations including this Baseline Scenario. Annual Areal and Boundary recharge are illustrated in Figure 2-8.

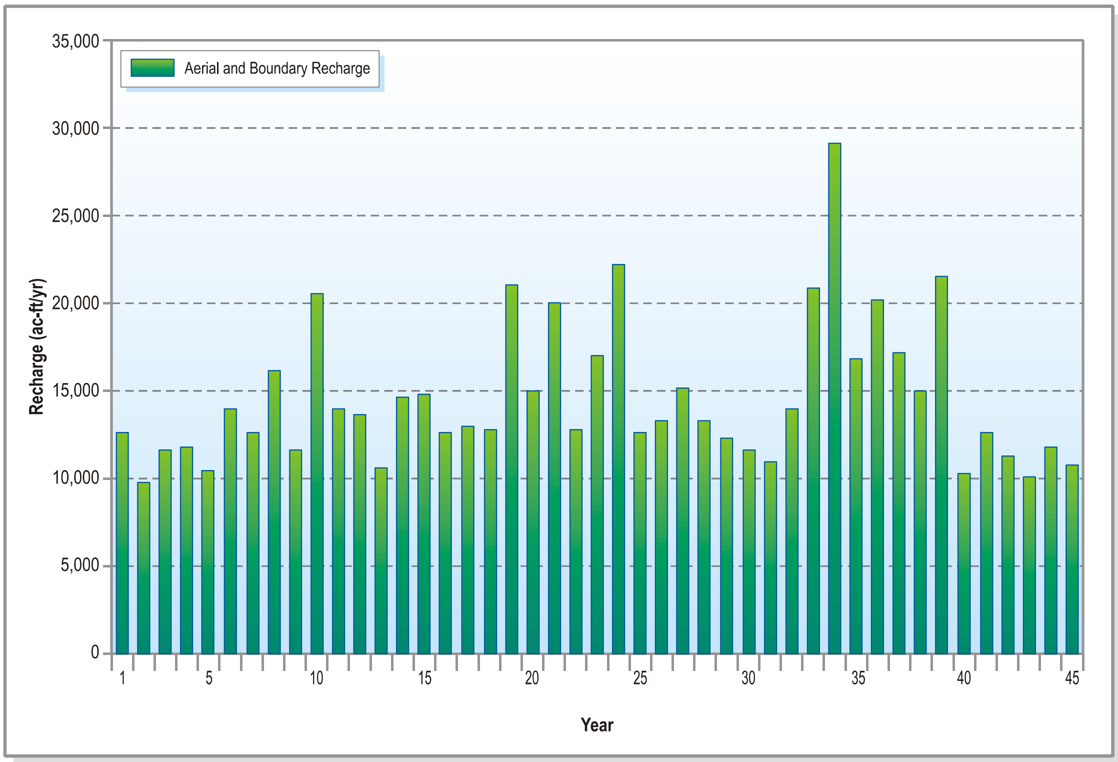


Figure 2-8
Annual Areal and Boundary Recharge – Baseline Scenario

Applied Spreading

The average "natural" spreading at SASG is simulated at 6,061 ac-ft per year as illustrated in Figure 2-7. Annual average values range from years with no applied spreading to over 31,000 ac-ft per year for Year 24. The simulated spreading pattern at SASG represents actual historical spreading volumes. This Baseline Scenario does not include any additional imported water applied at SASG. The average of 543 ac-ft per year of "other" spreading includes the Thompson Creek, Pedley, and Live Oak Spreading Grounds.

Production

The production simulated in the Baseline Scenario is based on the production patterns described in Section 2.3.4. The annual production input indicates a target total annual production of 20,500 ac-ft per year. This level of production, developed after many model simulations, is approximately 1,000 ac-ft per year higher than the long-term safe yield of the Six Basins Area; however, it results in an actual average annual pumping slightly below the safe yield value as illustrated in Figure 2-9. This difference in modeled values results from the inability of certain wells to pump when water levels fall below screen interval specified in the model. The additional production of 1,000 ac-ft per year was assigned to the lower portion of the Pomona Basin to augment the initial level of production assigned to this basin based on the pumping information provided by individual water agencies. Additional pumping from this portion of the basin would also minimize sub-surface flows out of the Pomona Basin into the Spadra Basin.

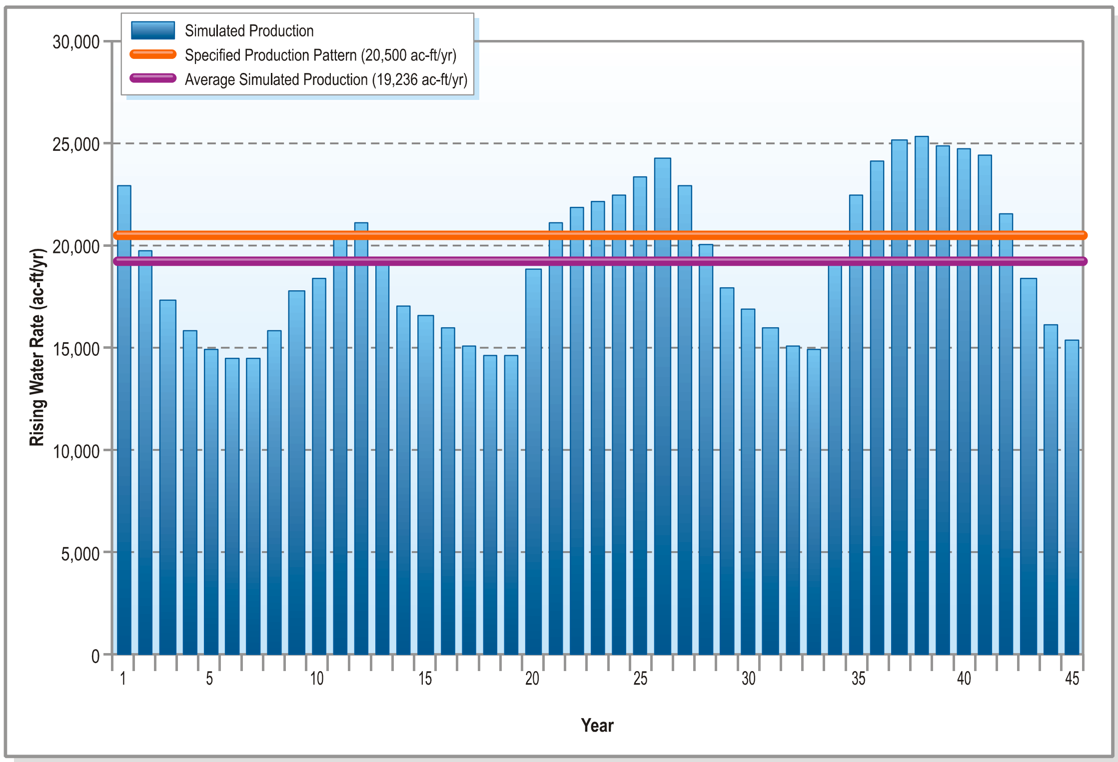


Figure 2-9
Annual Production in the Six Basins Area - Baseline Scenario

Figure 2-9 indicates the variations in production rates over the 45-year study period from just under 14,500 ac-ft per year to a high of over 25,000 ac-ft per year. These variations in production patterns reflect actual levels of production in the Six Basins Area under various hydrologic conditions. As previously indicated, the variations in production are related to increasing or declining water levels at the Monitoring Well No. 2 and at the Berkeley Well. Average production for the 45-year study period was calculated at 19,236 ac-ft per year.

Rising Water and Sub-Surface Flows

Simulation results were also analyzed to assess potential rising water conditions. Rising water summaries have been developed for different zones within the model domain. North of the Indian Hill Fault, the Baseline Scenario yields five rising water periods with durations of 1 to 2 years. The volume of rising water during these events ranges from 2 to 231 ac-ft per year and is illustrated in Figure 2-10. Rising water in the Pomona Basin was not reported under the Baseline Scenario as water levels did not reach the ground surface. However, it should be noted that modeled groundwater levels were close to the surface in the Martin Cienega area. Given that actual water levels in this area were within 30 feet of calibrated levels in the model, there is a probability that rising water would occur in this area during years with significantly above average spreading, like in 2005.

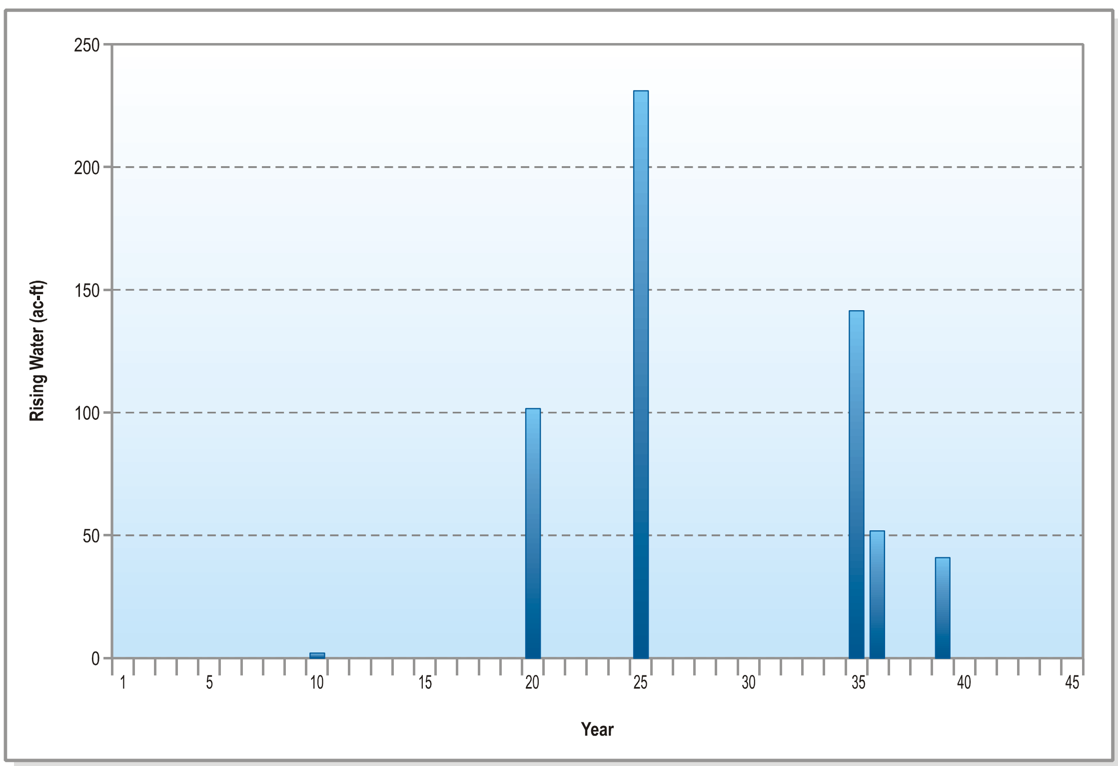


Figure 2-10
Rising Water in the Six Basins Area - Baseline Scenario

Sub-Surface Flows

Table 2-3 indicates a significant, annual discharge of rising water attributed to the Ganesha basin and in the southwest portion of the model domain (lower portion of the Pomona Basin). While these outflows are tabulated as sub-surface outflows since they leave the modeled area, there is ambiguity as to the actual outflow mechanism for this water in the basins. Due to lack of data, the relative development of these areas of the model is poor as compared to the rest of the model. CDM believes that some of this simulated rising water flow may actually be outflow from the model domain to other basins. This outflow may be over or through the San Jose Fault to the Chino Basin or flow into the Spadra Basin. Over the entire simulation, average outflows from the Ganesha basin and the southwest portion of the model are 272 and 214 ac-ft per year respectively. A comparison between sub-surface flows in these two areas to groundwater production and water levels indicates that sub-surface flows increase when water levels are high in the Six Basins Area. Figure 2-11 illustrates the relationship between subsurface outflows and annual production in the Six Basins Area.

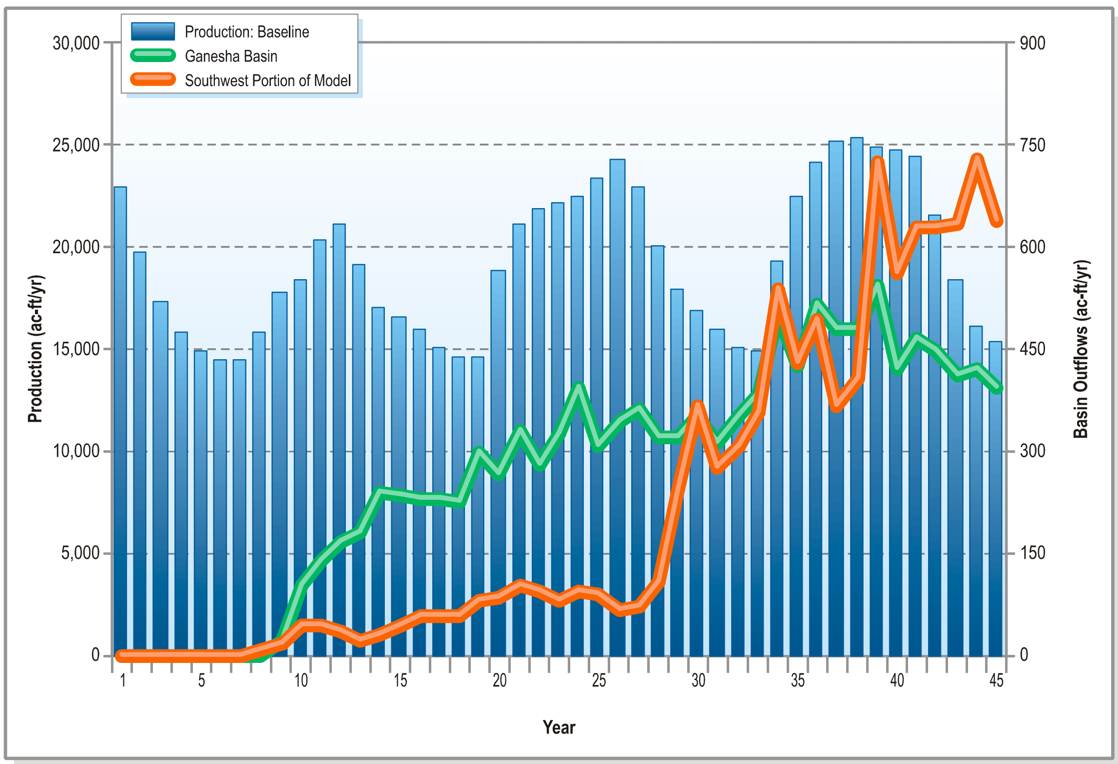


Figure 2-11
Sub-Surface Flows out of the Pomona and Ganesha Basins - Baseline Scenario

Flow into Chino Basin

These values represent flow over and through the San Jose Fault into the Chino Basin. In the Baseline Scenario, outflow to the Chino Basin is relatively constant and ranges from approximately 1,060 ac-ft per year to 1,890 ac-ft per year with an average of 1,420 ac-ft per year. Outflow to the Chino Basin are directly proportional to water levels as shown in Figure 2-12 below.

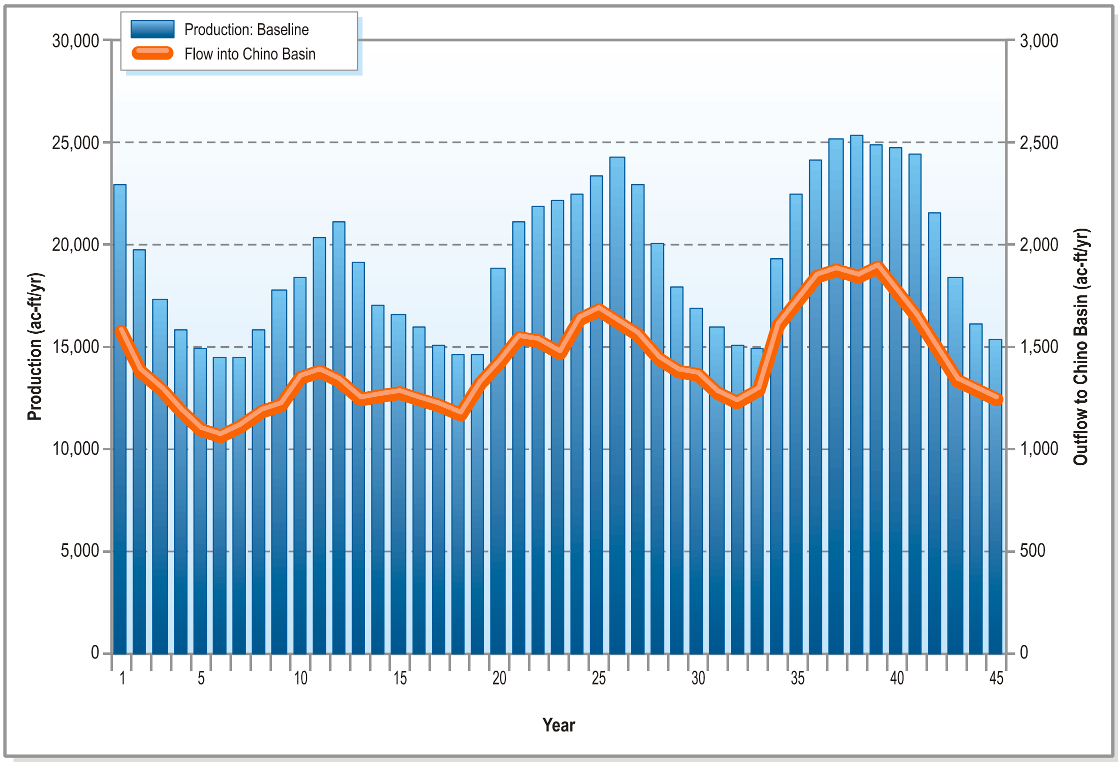


Figure 2-12
Sub-Surface Flows into Chino Basin-Baseline Scenario

Change in Basin Storage

Over the entire 45 year simulation, the average change in storage is a net decrease of 46 ac-ft per year in storage. During this simulation there are periods of increase and decrease in storage as shown in Figure 2-13. The range of storage changes from an increase of approximately 33,000 ac-ft per year in Years 19 and 34 to a loss of approximately 17,000 ac-ft per year in Year 40.

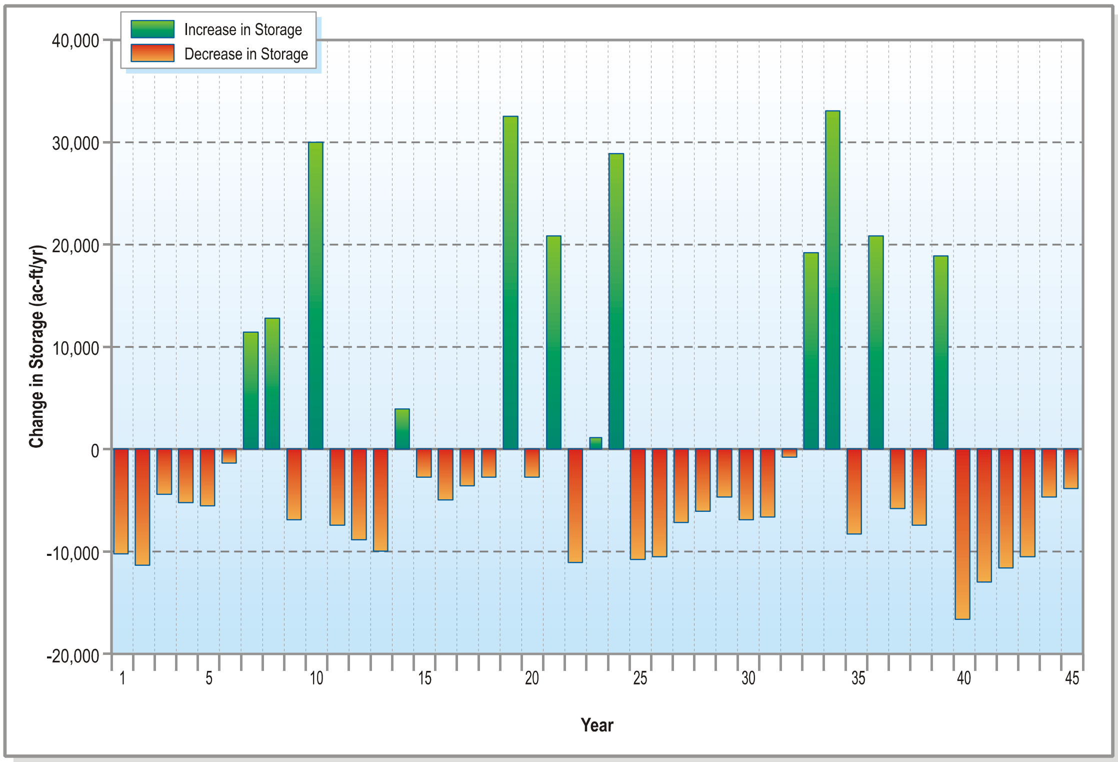


Figure 2-13
Change in Storage-Baseline Scenario

Section 3
Basin Management Scenarios

The purpose of this section is to describe the Four Basin Management Scenarios that were evaluated as part of this study. The first scenario focuses on additional facilities and operational changes that need to be implemented to reduce or eliminate the potential for rising water to occur as a result of spreading of local surface water during years of significantly above average precipitation. This scenario does not consider the use of imported water to recharge the SASG.

The other three scenarios consider different levels of imported water use for spreading at the SASG with corresponding increases in production to withdraw the water either for use within the Six Basins Area or for delivery to other portions of the TVMWD's service area. These scenarios focus on the additional extraction and transmission facilities that need to be constructed and the operational changes in basin operations that need to be implemented to take advantage of the ability to storea dn use imported water while still minimizing the potential for rising water to occur.

This section presents a description of the scenarios considered, the facilities identified to increase groundwater extractions, and the operational basin parameters to reduce or minimize the occurrence of rising water in the Six Basins Area.

3.1 No Imported Water Spreading Scenario

3.1.1 Description

Under this scenario, the historical pattern of local surface water spreading at the San Antonio and Thompson Creek spreading grounds was used over the 45 year simulation period. An average of approximately 5,900 ac-ft per year of imported water were spread under this scenario. Similar to the Baseline Scenario, production from individual wells above the Indian Hill Fault was increased or decreased based on water levels at the Monitoring Well No. 2; production south of the fault, was adjusted in similar fashion based on water levels at the Berkeley Well. This scenario also considered additional production in the southwestern portion of the Pomona Basin to lower water levels in that area and reduce the amount of water that exits the modeled area as described in the Baseline Scenario.

3.1.2 Facility Requirements

This scenario depends primarily on the use of existing production wells and changes on the operations of the SASG to reduce or eliminate the potential for rising water in the Six Basins Area. It is assumed that all additional production from local existing wells would be used by their respective water purveyors.

Under this scenario, a number of existing wells above the Indian Hill Fault have been identified as wells that could be used to increase production to reduce or eliminate the potential for rising water in the historical high rising water areas along Padua Avenue and at Greensboro Court in the Claremont Basins. These wells are listed below.

- West End No. 3
- West End No. 4
- Marlboro No. 1
- Mountain View No. 1
- Mountain View No. 4
- Tunnel Wells

To reduce the potential for rising water in the Martin Cienega in the northern portion of the Pomona Basin, the existing Berkeley Well and Harrison Home No. 2 have been identified as two wells whose production could be increased to lower water levels in the area.

The need for additional production from the southwestern portion of the Pomona Basin has also been identified in this scenario as significant amounts of water could leave this basin due the lack of pumping in the area. Three new wells have been identified in that area to extract an average of 1,000 ac-ft of groundwater per year. It is anticipated that extraction from these wells may exceed the current maximum contaminant levels of 45 mg/l for nitrate; however, it has been assumed that the production from these wells would be conveyed to the Pomona-Roland-Walnut feeder for in-line blending. This is highly attainable considering the low nitrate levels in the State Water Project water and minimum flows carried by this pipeline.

3.1.3 Basin Operating Parameters

This scenario is target at further control of rising water that would otherwise occur at the historical high rising water areas along Padua Avenue and at Greensboro Court in the Claremont Basins and at the Martin Cienegas in the Pomona Basin under normal operating conditions. A number of operational changes were investigated to reduce or eliminate rising water from these areas. Several operational parameters were identified under this scenario. They are as follows:

- Begin increasing groundwater production at the six wells listed above when water level elevation at MW-2 reach 1,300 ft. Augment production as water level elevation continues to increase up to 1,350 ft. At 1,350 ft elevation, pump the maximum possible from the identified wells.
- Increase production at the Berkeley and Harrison Home No. 2 in the Pomona Basin to the maximum possible if water levels at Berkeley No. 2 exceed 1,100 ft in elevation.
- Stop spreading of local surface water at the San Antonio Spreading Grounds when water level elevation at the MW-2 reach 1,375 ft.
- Maintain production at a rate of 1,000 ac-ft per year over current production amounts in the southwestern portion of the Pomona Basin.

It should be noted that the above recommendations need to take into consideration other parameters before they are implemented. For instance, if the trigger levels at MW-2 and Berkeley wells are reached in the beginning of the spreading season, increase in pumping would be more critical than if those levels are reached in late May or early June. At this time in the year, the decisions to increase production or stop spreading may be less critical.

3.2 Spreading of Imported Water Scenarios

3.2.1 Description

The use of imported water to supplement local surface water spreading at the SASG would substantially increase the availability of groundwater to the different agencies in the Six Basins Area and help reduce periods of significantly declining water levels during below average hydrologic cycles. Spreading imported water would allow the Watermaster to implement a conjunctive use program through which imported water is spread during periods of relative availability for extraction during the summer months or in subsequent years. Three different levels of imported water were considered and evaluated as part of this study.

Low Use of Imported Water Spreading. This scenario considers the annual spreading of 5,000 ac-ft of imported water in addition to the normal spreading of local surface water simulated under Baseline Conditions. Spreading of imported water is fixed at 5,000 ac-ft per year under this scenario. This scenario was conducted to simulate the anticipated level of spreading that TVMWD is currently considered and described in the San Antonio Spreading Grounds Conjunctive Use Project.

Mid Use of Imported Water Spreading. The amount of imported water spread under this scenario varies from year to year depending on water levels at MW-2. The operational parameters that regulate spreading are presented in Section 3.2.2. Under this scenario a long term average of 8,200 ac-ft per year of imported water were spread at the SASG. Annual spreading of imported water ranges from less than 1,000 ac-ft when water levels are high and as much as 12,000 ac-ft when water levels are low.

High Use of Imported Water Spreading. This scenario is very aggressive on the spreading of imported water at the SASG. Under this scenario an average of 11,600 ac-ft of imported water are spread every year with a maximum of 15,000 ac-ft in any given year.

3.2.2 Facility Requirements

The facility requirements to accommodate imported water recharge while still being able to reduce or eliminate the potential for rising water conditions in the Six Basins Area is basically the same for all scenarios. However, the scenarios differ on a) how the facilities are used to recover stored imported water and mitigate rising water and b) in the different basin operating parameters for pumping and spreading as described under Section 3.2.3.

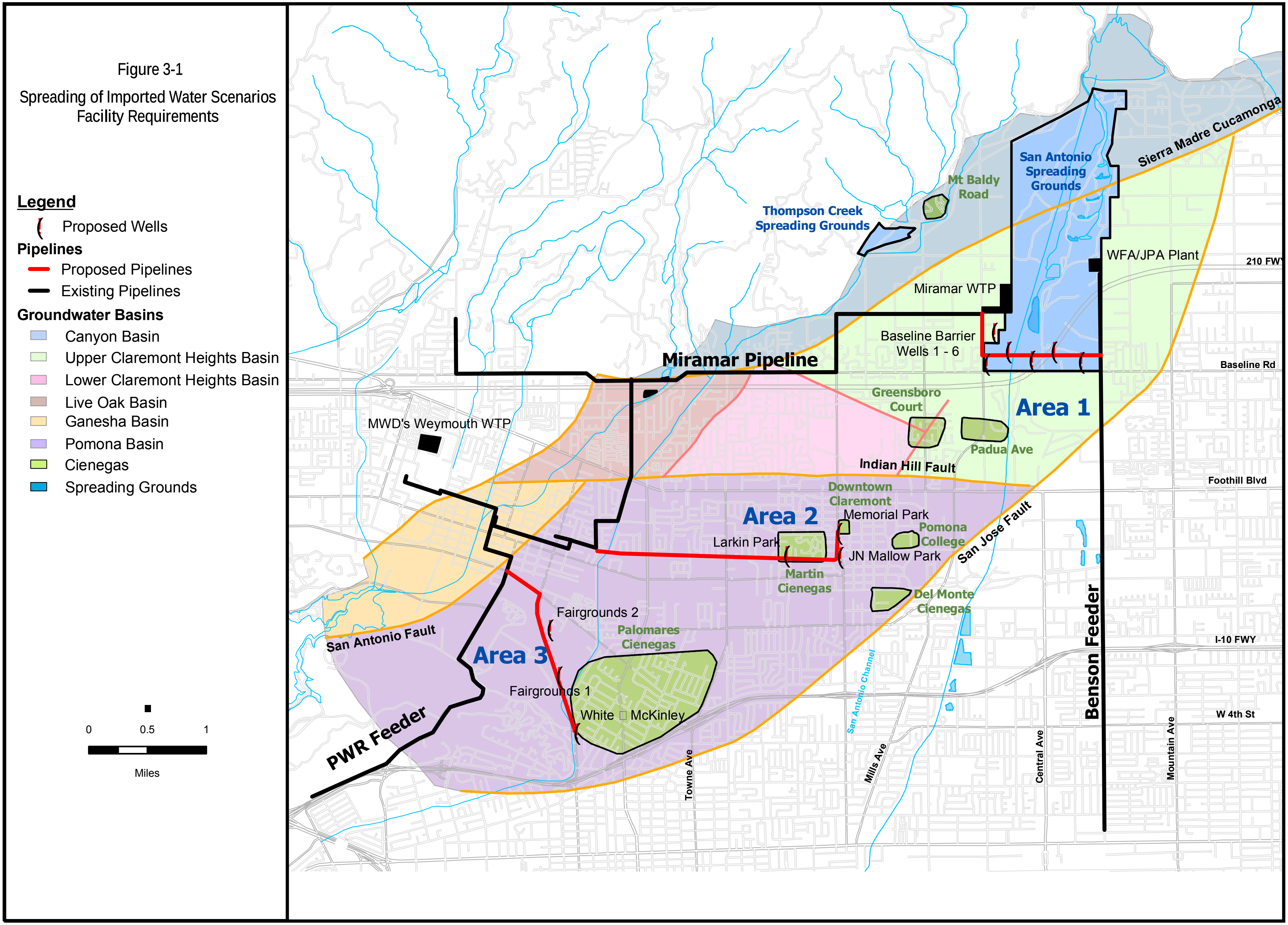
To recover stored water and reduce or eliminate the potential for rising water in the Six Basins Area, three areas of extraction have been identified as illustrated in Figure 3-1. Area 1 is identified as the area directly south of the SASG. In this area, the need for six new pumping wells in an east-west line along or north of Baseline Road has been identified. While these six wells represent new installations, it is assumed that three existing wells (College No. 1, West End No. 3 and West End No. 4) would be replaced with three of these new wells and be strategically located to maximize capture of spread water. The information on the replacement of the three existing wells was provided by their respective agencies as the City of Upland plans to replace the West End wells within the next five years, and a replacement for College No. 1 would be constructed as this well is in the middle of a proposed development. It has been assumed that each well will be capable of producing an average of 1,500 gpm and a maximum of 180 ac-ft a month. However, monthly production was varied at the Area 1 wells to approximate seasonal demands. Each of the Area 1 wells would pump 60 ac-ft per month from October through April; 120 ac-ft per month in May and September; and 180 ac-ft per month in June, July, and August for a total annual production of 1,200 ac-ft per well.

Additional facilities in this area include the construction of a 30 inch diameter line from the intersection of Baseline Road and Benson Avenue where it would tie to the Benson Feeder from the WFA/JPA water treatment plant, and along Baseline Road or parallel to it in the SASG, to Padua Avenue and then north to Miramar Avenue where it would tie to TVMWD's Miramar Pipeline. The construction of this pipeline would enable the Watermaster and TVMWD to use the extracted water for delivery to outside agencies if local agencies could not take the additional supplies. The approximate length of this pipeline is 11,000 ft.

Area 2 is defined as the vicinity of the Martin Cienega. To recover stored water and reduce or eliminate the potential for rising water in that area the need for three additional wells has been identified. It has been assumed that these wells would be capable of producing an average of 700 gpm each. It has been assumed that Golden State Water Company may not be able to take all the additional production from these wells; therefore, the need for additional transmission facilities to convey the pumped water to TVMWD's Miramar Pipeline has been identified as depicted in Figure 3-1. The transmission facilities to convey groundwater produced in the Martin Cienegas area to the Miramar Pipeline would consist of a combination of 8, 12, and 16 inch diameter pipeline totaling approximately 15,000 ft. Production from the three proposed wells would be manifold into a single line that could run along Harrison Avenue west to the vicinity of Thompson Creek channel where it would connect to the Miramar Pipeline.

Figure 3-1

Spreading of Imported Water Scenarios
Facility Requirements



It is anticipated that production from Area 2 would require treatment for the removal of volatile organic compounds. It has been assumed that granular activated carbon would be used to remove these compounds from the groundwater. High nitrate concentrations are also an issue of concern in this portion of the basin. It has been assumed that nitrate would be blended either locally or at the PWR Pipeline as discussed under the Baseline Scenario. Hence no nitrate removal facilities have been identified.

Area 3 is defined as the southern portion of the Pomona Basin in the vicinity of the Los Angeles County Fairgrounds. Similar to the No Imported Water Spreading Scenario, the imported water alternatives require additional extraction from this portion of the Pomona Basin. Production from these wells would be conveyed to the Pomona-Roland-Walnut regional pipeline as depicted in Figure 3-1. Transmission facilities would consist of a combination of 8, 12, and 16 inch diameter pipeline totaling approximately 10,000 ft. For purpose of this report, transmission facilities have been identified along White Avenue from McKinley Avenue to Arrow Highway and then to the PWR pipeline in the vicinity of Fairplex Drive.

Similar to Area 2, it has been assumed that production from Area 3 would require the construction of GAC facilities to remove volatile organic compounds from the groundwater. In line blending of nitrate has been assumed in the PWR Pipeline.

3.2.3 Basin Operating Parameters

The spreading of various amounts of imported water under the three imported water scenarios would increase the ability of Watermaster to conjunctively use the Six Basins Area; however, it must be coupled with the use of the additional facilities described in the previous sections to augment extractions and carefully managed basin operations to avoid increasing the potential of rising water. Rising water areas of concern include the historical high rising water areas along Padua Avenue and at Greensboro Court in the Claremont Basins and at the Martin and Palomares Cienegas in the Pomona Basin.

A number of operational changes to basin operations were investigated to spread imported water in the SASG, recover stored water, and reduce or eliminate rising water from the three areas identified in Figure 3-1.

Area 1 Wells

Low and Mid Use of Imported Water Spreading Scenarios

- Maintain the monthly production pattern in these wells when water levels at MW-2 are below 1,300 ft in elevation.

- Gradually increase monthly production in these wells up to 25 percent when water levels at MW-2 increase from 1,300 ft to 1,350 ft in elevation. The increase in monthly production is only applicable over the nine-month period between September and May as these wells would pump near their maximum capacity during the summer months.
- Operate Area 1 wells continuously when water levels at MW-2 exceed the 1,350 ft elevation until water levels recede below this elevation. At that time continue pumping activities as delineated in the two previous bullets.

High Use of Imported Water Spreading Scenario

- Operate these wells continuously to maintain water levels at MW-2 below the 1,350 ft elevation.

Area 2 Wells

All Imported Water Spreading Scenarios

- Increase production at the Berkeley and Harrison Home No. 2 wells when water level elevation at the Berkeley Well exceed 1,100 ft.
- Produce an average of 300 ac-ft from three new wells identified in this area when water level elevation at Berkeley Well exceed 1,100 ft.

It should be noted that stratigraphy of this area of the basin is not well understood at this time as some of the rising water conditions may be related to perched conditions. This should be taken into consideration during the design of proposed production facilities in the area.

Area 3 Wells

All Imported Water Spreading Scenarios

- Increase production from the southern portion of the Pomona Basin by 1,000 ac-ft per year to maintain adequate water levels in the area. This could be accomplished by existing wells or new wells as depicted in Figure 3-1.

Spreading of Local Surface Water at SASG

All Imported Water Spreading Scenarios

- Maximize spreading of local surface water as long as water level elevation at MW-2 is below 1,375 ft.

Spreading of Imported Water at SASG

Low Use of Imported Water Spreading Scenario

- Spread a maximum of 5,000 ac-ft per year at the SASG when water level elevation at MW-2 is below 1,375 ft.

Mid and High Use of Imported Water Spreading Scenarios

- Do not spread when water level elevation at MW-2 exceeds 1,375 ft.
- Increase spreading linearly up to 15,000 ac-ft per year proportionally to water level declines at MW-2 from 1,375 ft to 1,275 ft.
- Maintain spreading of 15,000 ac-ft per year when water level elevation at MW-2 is below 1,275 ft.

It should be noted that the above recommendations need to take into consideration other parameters before they are implemented. For instance, if the trigger levels at MW-2 and Berkeley wells are reached in the beginning of the spreading season, increase in pumping would be more critical than if those levels are reached in late May or early June. At this time in the year, the decisions to increase production or stop spreading may be less critical.

Section 4
Comparison of Basin Management Scenarios

4.1 Introduction

As presented in Section 2, future Baseline conditions within the Six Basins Area assumed to represent current purveyor water supply plans and application of the Six Basins Adjudication terms, coupled with local hydrologic conditions similar to long-term historical patterns would be expected to have the following overall results:

- Water levels and water in storage in the overall Six Basins Area would fluctuate significantly in response to local hydrology, but would ultimately not result in any long-term significant changes.
- Long-term production would average approximately 300 ac-ft per year, below the Judgment Safe Yield of 19,300 ac-ft per year, largely due to periods when water levels dropped so low that some wells could not produce water due to the low levels (or, conversely, some wells would be reduced in pumping capacity due to lower levels).
- There would still be the potential for significant rising water to occur in certain critical areas of the basin during a limited number of years following exceptionally high runoff and infiltration years.
- No advantage would be taken of the basin as a means to provide temporary storage of imported water during periods when excess imported water might be available and at lower rates in return for increasing production in peak periods to recover the water and reduce the need for direct delivery and treatment.

In Section 3, four Basin Management Scenarios were described that address one or more of these limitations through various operational changes and capital improvements. The four scenarios include one which focuses only on additional facilities and operations that could further reduce or eliminate the potential for rising water to occur and optimize basin operations without introducing imported water spreading; and three scenarios that incorporate both rising water control and various levels of imported water spreading and recovery.

In this Section, the following information is developed for each Scenario:

- An assessment of how the groundwater basins would respond under the proposed Scenario given the same long-term pattern of natural hydrology as examined for the baseline condition.
- Estimates of the capital costs for the facilities needed to implement the Scenario and typical annual operation and maintenance costs.

- A brief summary of potential environmental impacts of implementing the Scenario. A much more detailed assessment of the potential environmental impacts is presented in Appendix B.
- A discussion of potential institutional considerations related to implementing the Scenario
- A summary of any pertinent legal issues or potential constraints associated with implementing the Scenario

Each of the four basin management scenarios represents a different approach to managing water resources in the Six Basins Area. All four include an improved ability to manage and control groundwater during years of high local rainfall and available runoff so as to maximize the long term use of local surface and groundwater resources. The latter three scenarios also incorporate the use of the local groundwater basins to temporarily store imported State Project Water in the local groundwater basins during periods of higher availability and recover the water during periods of high local demand, thereby lowering the demand for direct delivery of State Project Water during peak periods.

Therefore, information is presented in this Section that allows the scenarios to be compared with each other and relative to the Baseline scenario and/or the No Imported Water Scenario on the basis of the following factors:

- Control of rising groundwater – the predicted annual quantities of rising groundwater when the basin is subject to the same 45-year pattern of local hydrology
- Average annual production – the predicted long-term average groundwater production
- Long term change in basin storage
- Capital cost investments in new infrastructure
- Operation and maintenance costs
- Environmental impacts related to facilities construction and operation
- Relative differences in institutional ability or constraints to implement the proposed facilities and operations
- Relative differences in legal challenges or constraints to implementing each of the scenarios

4.2 No Imported Water Scenario

4.2.1 Groundwater Basin Response

Under this scenario, imported water is not spread at the SASG. In order to minimize the rising water effects simulated in the Baseline scenario, additional localized pumping in the vicinity of the historical rising water areas in the Claremont Basins and northern portions of the Pomona Basin was simulated. Mass balance results for this scenario area summarized on a yearly basis and are presented in Table 4-1. Annual spreading, pumping, rising water, subsurface flows, flows into the Chino Basin and changes in storage are summarized in this table over the simulated 45-year hydrologic period. A description of each of the components listed in the table is presented below.

Rising Water

In the Baseline Scenario, there are five rising water events. These events have either a one or two year duration. Figure 4-1 indicates that the volume of rising water under the No Imported Water Scenario would be substantially less than Baseline. Lower rising water volumes result from additional pumping in the vicinity of the Claremont Cienegas and curtailed spreading at the SASG when water levels at MW-2 exceed 1,375 ft as described under Section 3.1.3. The average rising water volume decreases from 13 ac-ft in Baseline to 7 ac-ft per year above the Indian Hill Fault.

In the rising water event of years 35 and 36, there is a combined decrease in total volume from 193 ac-ft to 140 ac-ft as shown in Table 4-1 and illustrated in Figure 4-1. The decrease in rising water in Year 35 is significant and is due to additional pumping in the area; however, rising water conditions worsen in Year 36. Lower water levels in Year 35 result in lower pumping volumes in Year 36 as the amount of pumping in any given year is controlled by water levels at MW-2 in the model. As basin production decreases, simulated water levels rise, which results in an increase in rising water in Year 36. In actual operations, pumping could be further optimized to further minimize rising water.

Applied Spreading

Spreading of local surface water is on the average 147 ac-ft per year lower than in the Baseline Scenario. Most of this reduction occurs in years following significantly above average spreading. Spreading in these years result in water levels at MW-2 above the 1,375 ft elevation, at which level spreading is assumed to stop. For example, in Year 24 over 31,000 ac-ft of local surface water was spread while in Year 25 spreading was reduced from 2,336 ac-ft (Baseline) to Zero (No Imported Water). Similarly, spreading in Year 37 was reduced by over 98 percent from 4,262 ac-ft to 44 ac-ft.

Table 4-1
No Imported Water Spreading Scenario Annual Mass Balance

Annual Summary: Baseline Conditions (ac-ft/yr)														
		SASG Spreading					*Rising Water*					*Sub-Surface Flows*		
Year	Areal & Boundary Recharge	Local Surface Water at SASGI	Imported Water at SASG	Thompson Creek and Pomona Basin	Total Spreading	Total Pumping	North of Indian Hill Fault	Martin Cienega Area	Del Monte Cienega Area	Pomona Basin Southern Portion	Pomona Basin Western Portion	Ganesha Basin	Southwest Portion of Model	Flow into Chino Basin	Change in Storage
1	12,538	0	0	1,580	1,580	22,876	0	0	0	0	0	0	0	1,581	-10,410
2	9,737	0	0	63	63	19,756	0	0	0	0	0	0	0	1,378	-11,304
3	11,663	2,473	0	93	2,566	17,323	0	0	0	0	0	0	0	1,291	-4,383
4	11,726	0	0	94	94	15,854	0	0	0	0	0	0	0	1,178	-5,205
5	10,426	0	0	81	81	14,881	0	0	0	0	0	0	0	1,102	-5,489
6	13,993	0	0	174	174	14,526	0	0	0	0	0	0	0	1,059	-1,430
7	12,689	13,352	0	913	14,264	14,487	0	0	0	0	0	0	0	1,114	11,337
8	16,095	11,868	0	1,696	13,564	15,763	0	0	0	0	0	0	10	1,187	12,688
9	11,543	500	0	61	560	17,817	0	0	0	0	0	21	20	1,211	-6,974
10	20,559	29,215	0	247	29,462	18,388	2	0	0	0	0	103	44	1,351	30,020
11	14,034	495	0	101	596	20,282	0	0	0	0	0	141	44	1,374	-7,452
12	13,586	0	0	103	103	21,075	0	0	0	0	0	169	38	1,331	-8,959
13	10,530	0	0	58	58	19,121	0	0	0	0	0	182	21	1,245	-9,978
14	14,618	6,923	0	904	7,828	17,076	0	0	0	0	0	238	32	1,266	3,826
15	14,796	495	0	112	607	16,583	0	0	0	0	0	233	47	1,273	-2,740
16	12,579	0	0	80	80	16,012	0	0	0	0	0	231	57	1,248	-4,889
17	12,896	0	0	101	101	15,073	0	0	0	0	0	231	60	1,208	-3,576
18	12,731	495	0	110	605	14,667	0	0	0	0	0	227	57	1,170	-2,789
19	21,100	27,387	0	228	27,615	14,578	0	0	0	0	0	299	81	1,327	32,397
20	15,002	2967	0	109	3,076	18,773	102	0	0	0	0	267	86	1,431	-2,644
21	20,093	22,981	0	978	23,960	21,096	0	0	0	0	0	332	106	1,550	20,751
22	12,726	0	0	76	76	21,810	0	0	0	0	0	282	96	1,529	-11,094
23	17,004	7,912	0	160	8,073	22,194	0	0	0	0	0	324	80	1,471	999
24	22,131	31,314	0	206	31,520	22,474	0	0	0	0	0	392	94	1,628	28,848
25	12,557	2,336	0	299	2,635	23,429	231	0	0	0	0	309	89	1,686	-10,827
26	13,209	2,296	0	304	2,600	24,323	0	0	0	0	0	342	66	1,627	-10,542
27	15,123	2,296	0	330	2,626	22,848	0	0	0	0	0	361	73	1,566	-7,117
28	13,276	2,296	0	329	2,625	20,048	0	0	0	0	0	320	109	1,445	-6,002
29	12,362	2,478	0	351	2,829	17,906	0	0	0	0	0	323	243	1,382	-4,648
30	11,651	100	0	164	264	16,835	0	0	0	0	0	353	366	1,361	-7,003
31	10,960	2	0	247	249	15,922	0	0	0	0	0	313	275	1,271	-6,564
32	13,930	1,484	0	828	2,312	15,087	0	0	0	0	0	352	306	1,231	-743
33	20,898	14,437	0	805	15,242	14,859	0	0	0	0	0	386	356	1,283	19,234
34	29,186	24,992	0	1364	26,356	19,273	0	0	0	0	0	504	538	1,612	33,185
35	16,829	11	0	251	262	22,521	141	0	0	0	0	427	428	1,724	-8,463
36	20,204	26,053	0	1,874	27,926	24,180	52	0	0	0	0	515	494	1,838	20,947
37	17,151	4,262	0	690	4,952	25,109	0	0	0	0	0	480	364	1,870	-5,747
38	14,988	3,621	0	1,776	5,397	25,261	0	0	0	0	0	479	409	1,841	-7,607
39	21,456	24,182	0	1,267	25,449	24,826	41	0	0	0	0	544	724	1,892	18,768
40	10,305	33	0	555	588	24,774	0	0	0	0	0	421	563	1,769	-16,781
41	12,686	600	0	685	1,285	24,402	0	0	0	0	0	465	629	1,645	-13,150
42	11,266	431	0	890	1,321	21,629	0	0	0	0	0	450	628	1,502	-11,619
43	10,020	0	0	300	300	18,415	0	0	0	0	0	411	635	1,338	-10,469
44	11,752	444	0	1,808	2,252	16,177	0	0	0	0	0	422	730	1,286	-4,609
45	10,724	2,020	0	992	3,012	15,317	0	0	0	0	0	393	636	1,245	-3,849
Avg	**14,563**	**6,061**	**0**	**543**	**6,604**	**19,236**	**13**	**0**	**0**	**0**	**0**	**272**	**214**	**1,420**	**-46**

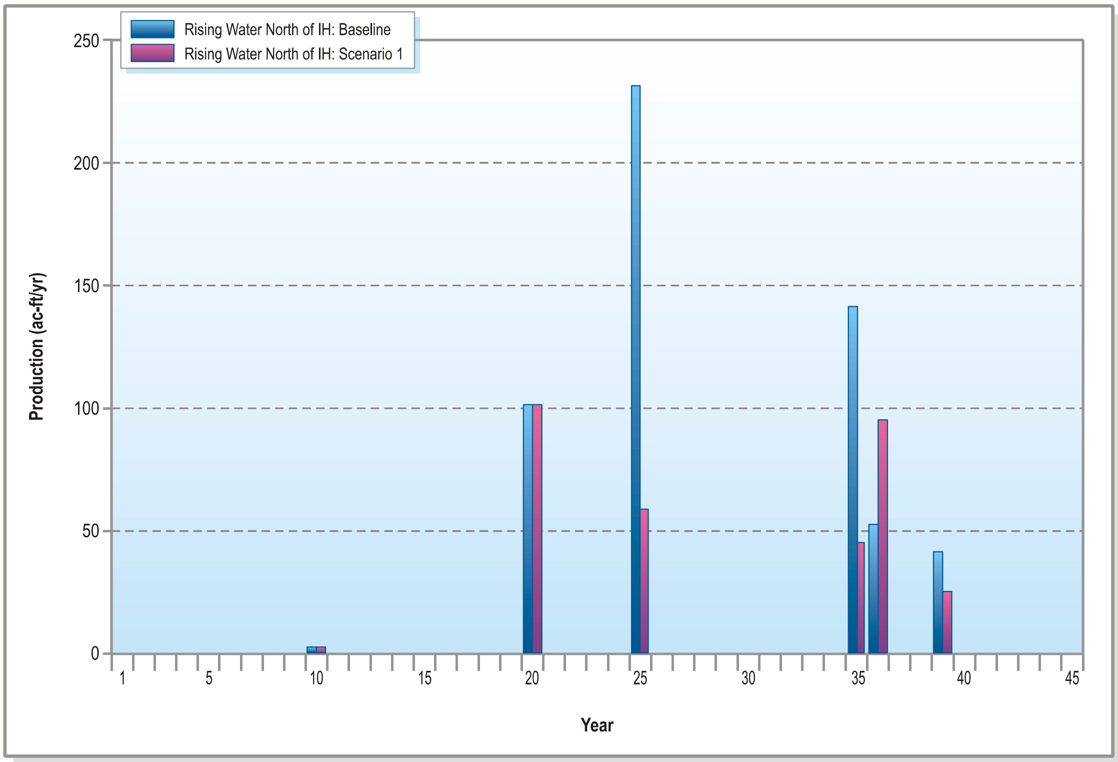


Figure 4-1
Rising Water – Baseline vs. No Imported Water Scenario

Groundwater Production

The reduction in local surface water spreading of 147 ac-ft per year under this scenario when compared to Baseline conditions does not impact groundwater production. There is virtually no change in production (19,236 ac-ft to 19,233 ac-ft per year) under this scenario as illustrated in Figure 4-2. The annual change in production varies between an increase of almost 700 ac-ft per year to a decrease of just over 1,000 ac-ft per year. Figure 4-3 shows the net change in production from Baseline to this scenario.

The increase in pumping is due to water levels at MW-2 rising above 1,300 ft in elevation. When this occurs, additional pumping from the wells in the vicinity of rising water areas results in an overall decrease in water levels at the trigger wells. When water levels fall, overall production levels decreases accordingly as production rates are linked to water levels at the two trigger wells as described in Section 3. Hence, each of the periods of increased production is followed by a period of decreased pumping. Over the entire 45 year simulation, production is essentially the same between both of these scenarios.

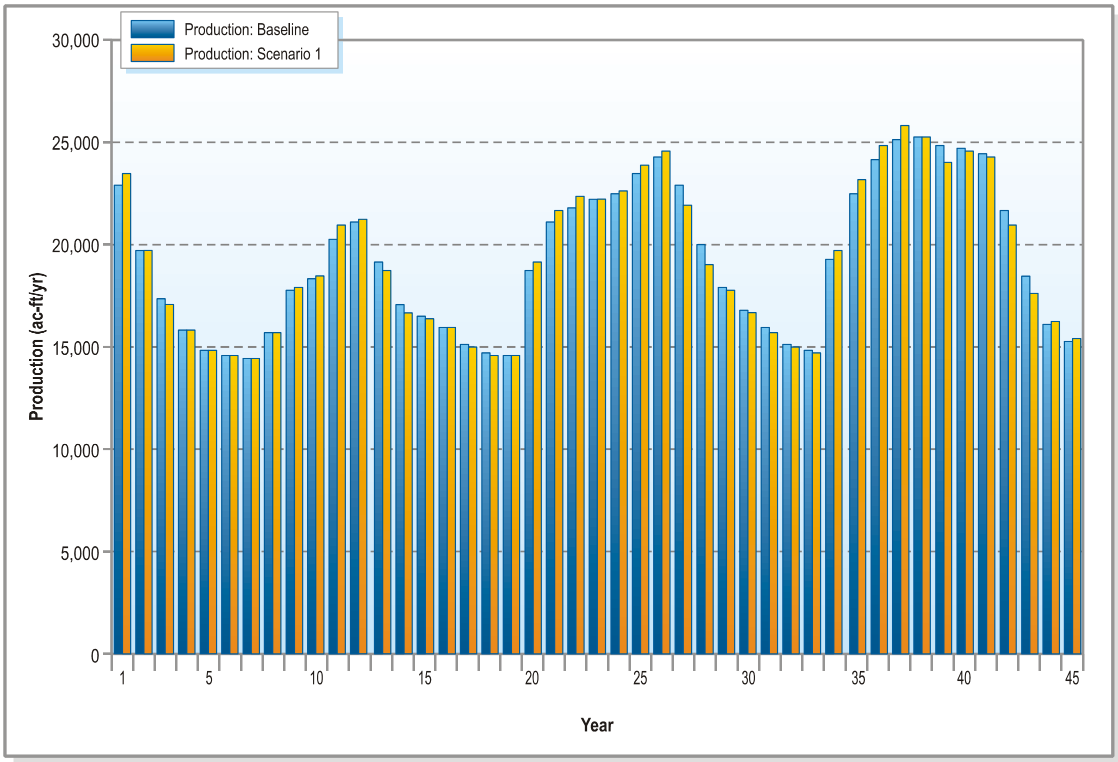


Figure 4-2
Annual Production Comparison – Baseline vs. No Imported Water Scenario

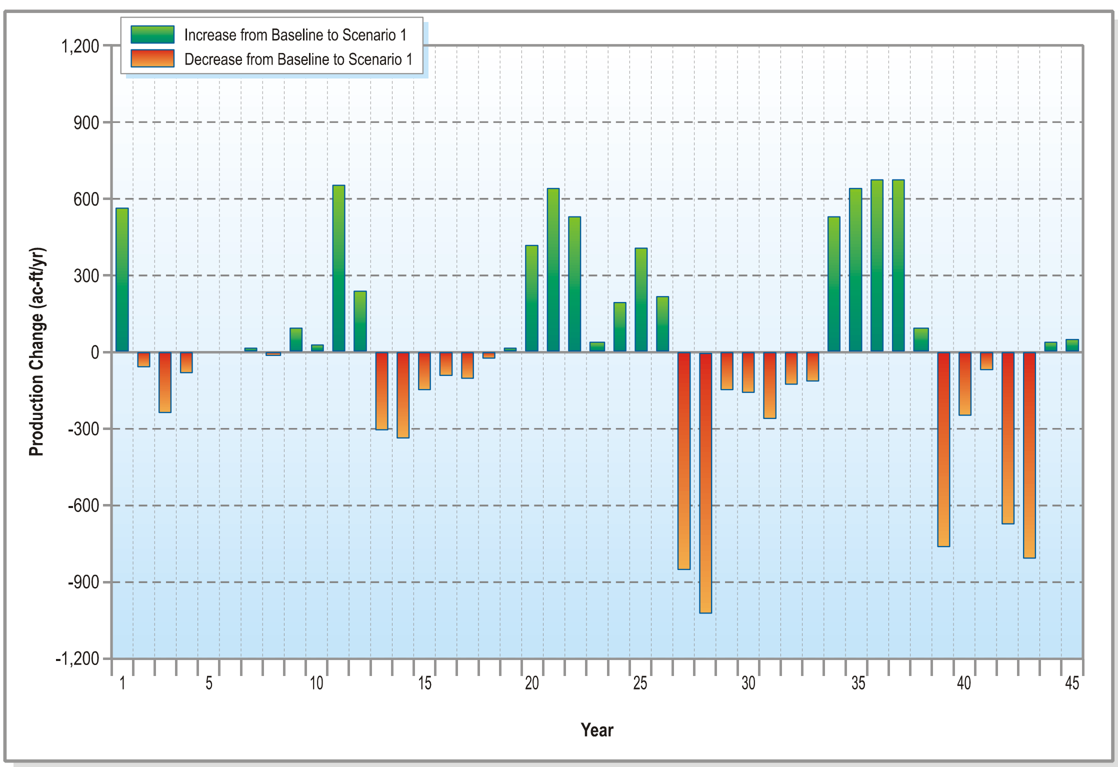


Figure 4-3
Net Production Increase/Decrease – Baseline vs. No Imported Water Scenario

Other Impacts

Significant reductions are observed in average outflows over the entire simulated period to the Chino Basin (from 1,420 ac-ft to 1,398 ac-ft per year), outflows in the southwestern portion of the Pomona Basin (from 214 ac-ft to 185 ac-ft per year), and in overall change in storage (from -46 ac-ft to -113 ac-ft per year) as illustrated in Table 4-1. Annual differences between Baseline conditions and this scenario can be observed by comparing this table against Table 2-3 in Section 2.

4.2.2 Capital Cost Requirements

Under this Scenario, there would be no new facilities constructed as additional production at localized areas would take place using existing facilities. Therefore, there is no new capital cost between this scenario compared to Baseline conditions.

4.2.3 Operational Cost

The primary economic difference between this Scenario and the Baseline condition is the difference in pumping energy cost. To assess this difference, the monthly production and water level for each well over the 45-year study period were used to calculate an overall weighted average production price per ac-ft over the entire Six Basins Area. The following generalized assumptions were made in calculating the average production cost:

- Cost of Energy: $0.10 per kwh
- Average drawdown during pumping: 50 ft
- Average discharge head above ground surface elevation: 200 ft
- Average pump efficiency: 70 percent

Using these parameters, the average production cost for this Scenario was calculated at $69.00 per ac-ft. This figure is virtually identical to the value calculated for the Baseline condition as water levels are very similar.

4.2.4 Summary of Environmental Impacts

Under this Scenario, there would be no new facilities constructed. The primary difference between this Scenario and the Baseline condition would be additional production from existing local wells both in the Claremont Heights Basin and the Pomona Basin. This would require further coordination between the Watermaster and local purveyors that own wells that could be used for additional production as discussed below. Because there are no new facilities proposed, and only limited modifications to existing pumping patterns, no potentially significant environmental impacts are anticipated.

4.2.5 Institutional Issues

The additional production contemplated under this Scenario relies on additional production at key wells by several water purveyors under certain specific conditions. These conditions would occur during and/or after periods when large quantities of local (replenishment) water have been spread and basin water levels reach or exceed trigger points as described in Section 3. The specific purveyors targeted for supplemental production include the following GSWC, the City of Pomona, and the City of Upland.

Since the plan envisions that water would be produced and utilized locally by the individual water purveyors, no new or significantly different institutional arrangements would be needed to allow the additional production. The primary concern for this Scenario is the mechanism under which the local purveyors would be encouraged or directed to increase pumping in those selected locations during the periods when such production is desired. To the extent that any additional production needed to control high groundwater levels can readily be accommodated by the individual purveyor without significantly increased costs, and without exceeding any purveyor's share of the annual Operating Safe Yield, it is expected that the needed production would be increased at the targeted wells voluntarily. However, it is possible under certain conditions, one or more of the purveyors with wells from which additional production is desired might have limitations on excess production for reasons such as:

- The additional production would cause the purveyor to exceed its share of annual Operating Safe Yield
- The additional target production from specific wells would create an abnormal cost burden compared to the purveyor's normal supply pattern to meet distribution of monthly demands

These issues are discussed further under Legal/Judgment Considerations.

4.2.6 Legal/Judgment Considerations

The simplest approach to encouraging additional production from targeted areas to control rising water without penalizing those purveyors who would be asked to produce additional water is for Watermaster to declare a Temporary Surplus of groundwater to be available for production under Section VI.B. 12 of the Judgment. Under this provision, Watermaster declares a total additional quantity that can be produced for a given period of time, to be divided among all of the parties in the same percentages as the Base Annual Production Right bears to the Operating Safe Yield. However, under this condition, a Party's rights to temporary surplus shall not be eligible for the accrual of Carryover Rights. Thus the temporary surplus applies only for a period established by Watermaster, and is only used to encourage additional production during that period. This condition was declared in 2005 following the exceptionally wet winter and high quantities of spreading and the rapid rise is groundwater levels below the SASG and that allowed producers to significantly increase production in the desired areas.

While this condition does not compel the key purveyors to maximize production in the selected areas, it was generally effective in assisting with encouraging additional production and lowering water levels over the past year. Further discussion at Watermaster may be warranted as to the effectiveness of coupling this essentially voluntary approach, with directed pumping to accomplish the necessary production. A corollary consideration would occur if the desired production would result in a significant disproportionate cost to any water purveyor as a result of directing pumping to specific wells during certain periods of the year. While possible, it is unlikely that the additional production desired from the indicated wells would significantly increase any individual producer's costs, provided the limitation and potential cost implications of exceeding the Operating Safe Yield is temporarily lifted as discussed above.

4.3 Imported Water Scenarios

In Section 3, three different levels of imported water use for spreading at the SASG an subsequent recovery through increased production were presented. These scenarios are briefly summarized as follows

- Low Use of Imported Water for Spreading. This scenario considered spreading 5,000 ac-ft of imported water per year every year.
- Moderate Use of Imported Water for Spreading. Spreading of imported water is varied in this scenario based on water levels at MW-2 up to a maximum of approximately 12,000 ac-ft per year.
- High Use of Imported Water for Spreading. Spreading of imported water is maximized under this scenario to spread a maximum of up to 15,000 ac-ft per year based on water levels at MW-2.

Section 3 also identified the need for additional extraction facilities at three different locations in the Six Basins Area as shown in Figure 3-1. The facilities identified to accommodate imported water recharge, while still being able to reduce or eliminate the potential for rising water conditions in the Six Basins Area, are basically the same for all scenarios. However, the scenarios differ on 1) how the facilities are used to recover stored imported water and mitigate rising water; and 2) in the different basin operating parameters for pumping and spreading as described under Section 3.2.3.

4.3.1 Groundwater Basin Response

Under these three scenarios, different levels of imported water were simulated at the SASG. Table 4-2 summarizes the basin response for each of these scenarios and compares them against the No Imported Water Scenario. Tables 4-3, 4-4, and 4-5 provide the annual details for the Low, Moderate, and High Use of Imported Water Spreading scenarios respectively. Annual spreading, pumping, rising water, subsurface flows, flows into the Chino Basin and changes in storage are summarized in these tables. A comparison of each of the components against the No Imported Water Spreading Scenario is presented below.

Table 4-2
Summary of Basin Response for All Scenarios

Summary of Basin Response for All Scenarios (ac-ft)				
Basin Response	*No Imported Water*	*Imported Water Spreading Scenarios*		
		Low	Moderate	High
Modeled Area Inflows				
Areal and Boundary Recharge	14,576	14,552	14,598	14,552
Surface Water Spreading				
SASG: Local	5,914	6,050	6,079	5,992
SASG: Imported	0	5,016	7,875	11,565
Thompson Creek/Pomona	543	543	540	540
Sub Total	6,457	11,609	14,495	18,097
Total: All Inflows	**21,033**	**26,161**	**29,093**	**32,649**
Modeled Area Outflows				
Total Pumping	19,233	24,213	26,478	30,001
Water Losses from Modeled Area				
Rising Water				
- Above Indian Hill	7	4	7	9
- Below Indian Hill	0	0	0	0
Subsurface Flows				
- Ganesha Basin	269	277	284	303
- Southwest Portion of Model	185	233	326	350
- Flow into Chino Basin	1,398	1,392	1,470	1,461
Sub Total	1,859	1,906 (103%)	2,087	2,124
Total: All Outflows	**21,092**	**26,119 (124%)**	**28,565**	**32,125**
Change in Storage	**-113**	**2**	**484**	**468**

Table 4-3
Low Use of Imported Water Spreading Scenario - Annual Mass Balance

Annual Summary: Low Use of Imported Water Spreading Scenario (ac-ft/yr)

		SASG Spreading					*Rising Water*					*Sub-Surface Flows*			
Year	Areal & Boundary Recharge	Local Surface Water at SASGI	Imported Water at SASG	Thompson Creek and Pomona Basin	Total Spreading	Total Pumping	North of Indian Hill Fault	Martin Cienega Area	Del Monte Cienega Area	Pomona Basin Southern Portion	Pomona Basin Western Portion	Ganesha Basin	Southwest Portion of Model	Flow into Chino Basin	Change in Storage
1	12,495	0	5,033	1,580	6,613	27,205	0	0	0	0	0	0	0	1,579	-9,742
2	9,657	0	5,006	63	5,069	22,882	0	0	0	0	0	0	0	1,387	-9,520
3	11,746	2,473	5,006	93	7,572	21,239	0	0	0	0	0	0	0	1,292	-3,222
4	11,741	0	5,006	94	5,100	20,579	0	0	0	0	0	0	0	1,175	-4,909
5	10,439	0	5,022	81	5,102	20,193	0	0	0	0	0	0	0	1,092	-5,745
6	14,030	0	4,974	174	5,148	20,070	0	0	0	0	0	0	0	1,035	-1,936
7	12,749	13,352	5,017	913	19,281	20,022	0	0	0	0	0	0	5	1,079	10,920
8	16,121	11,868	5,017	1,696	18,581	20,731	0	0	0	0	0	2	30	1,174	12,760
9	11,527	500	5,044	61	5,605	22,261	0	0	0	0	0	25	33	1,214	-6,404
10	20,541	28,327	5,017	247	33,591	23,808	6	0	0	0	0	115	55	1,358	28,703
11	13,982	495	5,017	101	5,613	26,594	0	0	0	0	0	155	53	1,364	-8,718
12	13,565	0	5,017	103	5,120	24,927	0	0	0	0	0	183	51	1,318	-7,832
13	10,496	0	5,033	58	5,091	22,812	0	0	0	0	0	194	39	1,239	-8,684
14	14,687	6,923	5,017	904	12,845	21,042	0	0	0	0	0	247	46	1,262	4,930
15	14,795	495	5,017	112	5,624	21,208	0	0	0	0	0	241	58	1,275	-2,377
16	12,550	0	5,006	80	5,086	20,793	0	0	0	0	0	239	66	1,250	-4,710
17	12,846	0	5,022	101	5,123	20,159	0	0	0	0	0	234	68	1,200	-3,691
18	12,670	495	4,995	110	5,600	20,088	0	0	0	0	0	233	65	1,148	-3,263
19	21,135	27,439	5,017	228	32,684	20,055	0	0	0	0	0	314	89	1,311	32,016
20	14,969	2,967	5,017	109	8,093	23,565	102	0	0	0	0	282	94	1,436	-2,481
21	20,072	22,981	5,044	978	29,004	28,142	0	0	0	0	0	347	114	1,558	18,693
22	12,685	0	5,017	76	5,092	27,832	0	0	0	0	0	301	112	1,513	-12,061
23	16,993	7,912	5,017	160	13,090	26,060	0	0	0	0	0	339	110	1,458	2,107
24	22,108	31,314	5,017	206	36,537	29,054	0	0	0	0	0	424	143	1,628	27,233
25	12,555	2,336	5,044	299	7,680	32,840	0	0	0	0	0	328	137	1,653	-14,872
26	13,192	2,296	5,017	304	7,617	27,471	0	0	0	0	0	364	163	1,564	-8,728
27	15,103	2,296	5,017	330	7,643	25,414	0	0	0	0	0	384	272	1,532	-4,844
28	13,278	2,296	5,017	329	7,642	23,548	0	0	0	0	0	337	251	1,431	-4,623
29	12,339	2,478	5,044	351	7,873	22,315	0	0	0	0	0	331	282	1,369	-4,074
30	11,672	100	5,006	164	5,270	21,288	0	0	0	0	0	360	289	1,339	-6,335
31	10,966	2	4,995	247	5,244	20,726	0	0	0	0	0	314	229	1,250	-6,308
32	13,958	1,484	4,985	828	7,296	20,406	0	0	0	0	0	352	263	1,200	-974
33	20,226	14,437	5,044	805	20,286	20,246	0	0	0	0	0	382	313	1,250	18,303
34	29,149	25,313	5,017	1,364	31,694	26,771	0	0	0	0	0	505	506	1,604	31,101
35	16,850	11	5,017	251	5,279	30,369	0	0	0	0	0	429	415	1,681	-10,934
36	20,112	26,053	5,017	1,874	32,943	31,342	52	0	0	0	0	519	557	1,759	18,697
37	17,234	4,262	5,044	690	9,997	32,765	0	0	0	0	0	486	517	1,757	-8,324
38	15,018	3,621	5,017	1,776	10,414	28,535	0	0	0	0	0	481	570	1,697	-5,829
39	21,352	24,182	5,017	1,267	30,466	29,531	26	0	0	0	0	545	848	1,781	18,983
40	10,462	33	5,017	555	5,605	31,042	0	0	0	0	0	417	653	1,677	-17,742
41	12,729	600	5,033	685	6,318	26,865	0	0	0	0	0	456	720	1,560	-10,548
42	11,344	431	5,006	890	6,327	23,826	0	0	0	0	0	433	672	1,457	-8,702
43	10,093	0	4,995	300	5,295	21,461	0	0	0	0	0	390	564	1,305	-8,309
44	11,796	444	4,963	1,808	7,215	20,793	0	0	0	0	0	395	570	1,250	-4,001
45	10,808	2,020	5,022	992	8,034	20,720	0	0	0	0	0	369	456	1,194	-3,893
Avg	**14,552**	**6,050**	**5,016**	**543**	**11,609**	**24,213**	**4**	**0**	**0**	**0**	**0**	**277**	**233**	**1,392**	**2**

Table 4-4
Moderate Use of Imported Water Spreading Scenario - Annual Mass Balance

Annual Summary: Moderate Use of Imported Water Spreading Scenario (ac-ft/yr)															
		SASG Spreading					*Rising Water*					*Sub-Surface Flows*			
Year	Areal & Boundary Recharge	Local Surface Water at SASGI	Imported Water at SASG	Thompson Creek and Pomona Basin	Total Spreading	Total Pumping	North of Indian Hill Fault	Martin Cienega Area	Del Monte Cienega Area	Pomona Basin Southern Portion	Pomona Basin Western Portion	Ganesha Basin	Southwest Portion of Model	Flow into Chino Basin	Change in Storage
1	12,475	0	7,863	1,580	9,442	27,340	0	0	0	0	0	0	0	1,584	-7,074
2	9,564	0	11,052	63	11,115	24,094	0	0	0	0	0	0	0	1,407	-4,794
3	11,727	2,473	11,382	93	13,948	23,686	0	0	0	0	0	0	0	1,338	651
4	11,598	0	10,131	94	10,225	23,570	0	0	0	0	0	0	0	1,242	-2,974
5	10,107	0	11,934	81	12,014	23,150	0	0	0	0	0	0	0	1,170	-2,194
6	13,787	0	12,019	174	12,193	22,693	0	0	0	0	0	0	0	1,137	2,142
7	13,043	13,352	11,101	913	25,365	23,311	0	0	0	0	0	0	5	1,220	13,854
8	16,463	11,868	4,846	1,696	18,410	25,613	0	0	0	0	0	1	33	1,323	7,692
9	11,465	500	4,434	61	4,994	25,996	0	0	0	0	0	22	33	1,311	-10,952
10	20,903	27,883	7,513	247	35,643	28,476	1	0	0	0	0	108	49	1,426	26,375
11	13,835	495	3,611	101	4,207	29,785	0	0	0	0	0	142	53	1,416	-13,404
12	13,503	0	7,194	103	7,297	25,970	0	0	0	0	0	171	50	1,357	-6,729
13	10,396	0	10,966	58	11,024	24,099	0	0	0	0	0	189	66	1,294	-4,201
14	14,895	6,923	10,818	904	18,646	24,092	0	0	0	0	0	242	81	1,336	7,783
15	14,762	495	7,664	112	8,271	24,634	0	0	0	0	0	241	89	1,353	-3,304
16	12,480	0	10,154	80	10,234	24,239	0	0	0	0	0	245	91	1,324	-3,173
17	12,743	0	11,082	101	11,182	23,577	0	0	0	0	0	239	88	1,284	-1,257
18	12,520	495	11,425	110	12,030	23,228	0	0	0	0	0	240	85	1,248	-245
19	21,551	29,215	9,378	228	38,821	27,000	15	0	0	0	0	325	116	1,441	31,359
20	14,892	2,967	3,573	109	6,649	29,264	118	0	0	0	0	292	121	1,520	-9,997
21	20,184	22,981	3,875	960	27,816	30,846	0	0	0	0	0	359	133	1,626	14,904
22	12,595	0	3,464	76	3,539	29,799	0	0	0	0	0	310	110	1,554	-15,632
23	17,012	7,912	7,565	160	15,638	26,387	0	0	0	0	0	355	175	1,494	4,237
24	22,159	31,314	4,862	206	36,382	29,830	0	0	0	0	0	445	409	1,677	25,992
25	12,490	2,336	1,856	299	4,491	32,129	0	0	0	0	0	345	288	1,686	-17,553
26	13,187	2,296	5,590	304	8,189	27,274	0	0	0	0	0	386	343	1,587	-8,196
27	15,078	2,296	9,013	330	11,639	25,385	0	0	0	0	0	410	490	1,568	-1,124
28	13,207	2,296	8,995	329	11,620	24,695	0	0	0	0	0	363	446	1,483	-2,137
29	12,281	2,478	9,855	351	12,684	24,160	0	0	0	0	0	352	450	1,433	-1,416
30	11,693	100	9,786	164	10,049	23,664	0	0	0	0	0	384	508	1,424	-4,238
31	10,840	2	10,955	247	11,204	23,611	0	0	0	0	0	332	423	1,346	-3,658
32	14,094	1,484	11,538	828	13,849	23,579	0	0	0	0	0	368	393	1,308	2,281
33	23,548	14,437	9,452	805	24,693	25,870	0	0	0	0	0	403	414	1,379	20,001
34	29,387	25,313	1,709	1,364	28,386	32,609	126	0	0	0	0	512	546	1,734	21,730
35	16,775	8	994	251	1,254	32,563	0	0	0	0	0	426	401	1,804	-17,190
36	20,176	26,053	5,453	1,874	33,379	31,465	53	0	0	0	0	518	653	1,891	18,916
37	17,101	4,262	3,573	690	8,525	31,613	0	0	0	0	0	488	750	1,872	-9,102
38	14,850	3,621	5,053	1,776	10,449	28,512	0	0	0	0	0	490	940	1,801	-6,438
39	21,165	24,182	6,675	1,157	32,014	29,836	0	0	0	13	0	563	1,279	1,870	19,551
40	10,271	33	3,542	555	4,130	31,141	0	0	0	0	0	421	904	1,746	-19,845
41	12,586	600	7,408	685	8,693	26,848	0	0	0	2	0	469	943	1,611	-8,586
42	11,180	431	10,727	890	12,048	24,797	0	0	0	1	0	448	868	1,516	-4,382
43	9,890	0	11,037	300	11,337	23,811	0	0	0	0	0	406	685	1,377	-5,028
44	11,732	444	12,119	1,808	14,372	23,647	0	0	0	0	0	406	657	1,332	53
45	10,716	2,020	11,163	992	14,176	23,630	0	0	0	0	0	380	514	1,297	-927
Avg	**14,598**	**6,079**	**7,875**	**540**	**14,495**	**26,478**	**7**	**0**	**0**	**0**	**0**	**284**	**326**	**1,470**	**484**

Table 4-5
High Use of Imported Water Spreading Scenario - Annual Mass Balance

Annual Summary: High Use of Imported Water Spreading Scenario (ac-ft/yr)															
		SASG Spreading					*Rising Water*					*Sub-Surface Flows*			
Year	Areal & Boundary Recharge	Local Surface Water at SASGI	Imported Water at SASG	Thompson Creek and Pomona Basin	Total Spreading	Total Pumping	North of Indian Hill Fault	Martin Cienega Area	Del Monte Cienega Area	Pomona Basin Southern Portion	Pomona Basin Western Portion	Ganesha Basin	Southwest Portion of Model	Flow into Chino Basin	Change in Storage
1	12,462	0	11,967	1,580	13,547	31,219	0	0	0	0	0	0	0	1,577	-6,859
2	9,575	0	15,051	63	15,114	28,117	0	0	0	0	0	0	0	1,393	-4,816
3	11,730	2,473	15,051	93	17,616	27,206	0	0	0	0	0	0	0	1,324	887
4	11,592	0	14,995	94	15,088	27,480	0	0	0	0	0	0	0	1,235	-2,035
5	10,106	0	15,132	81	15,212	27,151	0	0	0	0	0	0	0	1,160	-2,988
6	13,803	0	15,051	174	15,225	26,360	0	0	0	0	0	0	0	1,119	1,547
7	13,069	13,352	15,051	913	29,315	26,820	0	0	0	0	0	0	15	1,201	14,332
8	16,474	11,868	9,343	1,696	22,907	29,187	0	0	0	0	0	2	43	1,315	8,657
9	11,434	500	8,279	61	8,840	30,357	0	0	0	0	0	27	48	1,306	-11,503
10	20,812	27,883	13,014	247	41,144	30,816	13	0	0	0	0	126	65	1,422	29,410
11	13,759	495	2,457	101	3,053	32,369	0	0	0	0	0	166	52	1,424	-17,290
12	13,485	0	14,140	103	14,243	31,027	0	0	0	0	0	197	50	1,347	-4,875
13	10,370	0	15,126	58	15,184	28,466	0	0	0	0	0	212	48	1,275	-4,421
14	14,904	6,923	15,051	904	22,879	28,240	0	0	0	0	0	257	83	1,323	7,823
15	14,739	495	12,198	112	12,805	29,162	0	0	0	0	0	258	89	1,343	-3,335
16	12,442	0	15,010	80	15,090	28,629	0	0	0	0	0	256	94	1,311	-2,751
17	12,704	0	15,133	101	15,233	27,817	0	0	0	0	0	249	95	1,272	-1,486
18	12,487	495	15,051	110	15,656	27,390	0	0	0	0	0	254	90	1,232	-819
19	21,603	27,883	13,840	228	41,952	28,835	85	0	0	0	0	349	121	1,427	32,615
20	14,845	2,967	2,728	109	5,804	31,457	120	0	0	0	0	317	127	1,523	-13,178
21	20,153	22,981	8,976	963	32,920	32,080	0	0	0	0	0	393	212	1,613	18,665
22	12,540	0	3,483	76	3,558	33,055	0	0	0	0	0	343	215	1,565	-19,113
23	17,016	7,912	14,476	160	22,549	31,412	0	0	0	0	0	396	245	1,481	6,044
24	22,154	31,313	7,833	206	39,353	31,700	25	0	0	0	0	488	450	1,671	26,949
25	12,440	685	943	299	1,928	33,918	0	0	0	0	0	382	409	1,705	-22,189
26	13,151	2,296	12,724	304	15,324	31,349	0	0	0	0	0	419	505	1,585	-5,376
27	15,049	2,296	14,260	330	16,886	29,546	0	0	0	0	0	441	570	1,565	-189
28	13,158	2,296	13,772	329	16,397	29,439	0	0	0	0	0	387	488	1,479	-2,225
29	12,259	2,478	14,718	351	17,546	28,784	0	0	0	0	0	383	508	1,428	-1,287
30	11,682	100	14,685	164	14,949	28,738	0	0	0	0	0	409	533	1,415	-4,459
31	10,820	2	15,051	247	15,300	28,258	0	0	0	0	0	357	393	1,327	-4,206
32	14,109	1,484	15,051	828	17,362	27,569	0	0	0	0	0	392	395	1,286	1,816
33	22,873	14,437	14,511	805	29,753	28,551	0	0	0	0	0	433	424	1,361	21,706
34	28,667	24,366	1,687	1,364	27,417	32,547	108	0	0	0	0	535	575	1,733	19,957
35	16,708	11	1,043	251	1,305	34,856	0	0	0	0	0	449	421	1,797	-19,541
36	20,477	26,053	12,672	1,874	40,598	33,773	53	0	0	0	0	540	688	1,879	24,031
37	17,030	4,262	1,939	690	6,891	33,894	0	0	0	0	0	494	870	1,893	-13,328
38	14,807	3,621	10,445	1,776	15,842	32,880	0	0	0	1	0	509	1,026	1,799	-5,578
39	21,103	24,182	11,415	1,157	36,755	31,613	19	0	0	13	0	608	1,294	1,863	22,364
40	10,191	33	2,395	555	2,983	33,806	0	0	0	0	0	438	905	1,756	-23,828
41	12,558	600	14,534	685	15,819	32,096	0	0	0	2	0	485	899	1,595	-6,687
42	11,184	431	14,901	890	16,222	28,993	0	0	0	0	0	461	803	1,496	-4,339
43	9,867	0	15,050	300	15,350	28,042	0	0	0	0	0	422	707	1,358	-5,284
44	11,744	444	15,051	1,808	17,303	27,571	0	0	0	0	0	426	674	1,310	-945
45	10,696	2,020	15,132	992	18,145	27,492	0	0	0	0	0	391	521	1,268	-827
Avg	**14,552**	**5,992**	**11,565**	**540**	**18,097**	**30,001**	**9**	**0**	**0**	**0**	**0**	**303**	**350**	**1,461**	**468**

Rising Water

The proposed extraction facilities for the implementation of the imported water scenarios were identified in Section 3.2.2 for three distinct areas in the Six Basins Area. The use of the recommended extraction facilities, coupled with the water level triggers established for spreading and pumping, resulted in rising water volumes similar to those observed under the No Imported Water Spreading Scenario and lower than in the Baseline conditions. In addition, the magnitude of individual rising water periods in any given year was virtually the same for all three scenarios.

Water Levels at Trigger Wells

Monitoring Well No. 2 (MW-2) and GSWC's Berkeley Well were used in the model as the trigger wells to regulate spreading at the SASG and pumping above and below the Indian Hill Fault. Basin Operating Parameters under the different scenarios were derived from observations of water levels at these two wells. Water level fluctuations for these two wells are depicted in Figures 4-4 and 4-5 respectively.

Groundwater elevations at MW-2 remained primarily within the upper (1,350 ft) and lower (1,250 ft) bounds of the trigger levels for the Moderate and High Use of Imported Water scenarios. Spreading of imported water was increased in the model as water levels at MW-2 approached the 1,250 ft elevation while production above the Indian Hill Fault decreased towards 75 percent of normal; conversely, production increased (up to 125 percent of normal) and spreading decreased as water levels near the 1,350 ft elevation. Maintaining water levels within these ranges under these two scenarios resulted in a more uniform production pattern over the 45-Year analysis when compared to the other two scenarios; this is further discussed under Groundwater Production later in this section.

Water levels under the No Imported Water and Low Use scenarios, remained below the 1,250 ft elevation over significant periods. The prolonged and intuitively abnormal decline below the 1,250 ft elevation under the Low Use Scenario resulted from very low spreading of local water during those periods. For example, in Years 1 through 6, local surface water was spread in only one of those years in which less than 2,500 ac-ft were spread at the SASG. As water levels declined below the 1,250 ft elevation, production was maintained at 75 percent of normal in the model which resulted in further declines in water levels.

Additional groundwater production from Area 2 dewatering wells in the vicinity of the Martin Cienega, activated when water levels at the Berkeley Well reach 1,100 ft in elevation, have a significant impact on water levels at this well as illustrated in Figure 4-5 above. Water levels at this location are also impacted by fluctuations in production in the Pomona Basin as water levels fluctuate between the lower (1,050 ft) and upper (1,150 ft) trigger values at this well. While these rapid fluctuations in monthly levels may not actually occur, annualized trends represent long term water level trends in this portion of the Pomona Basin.

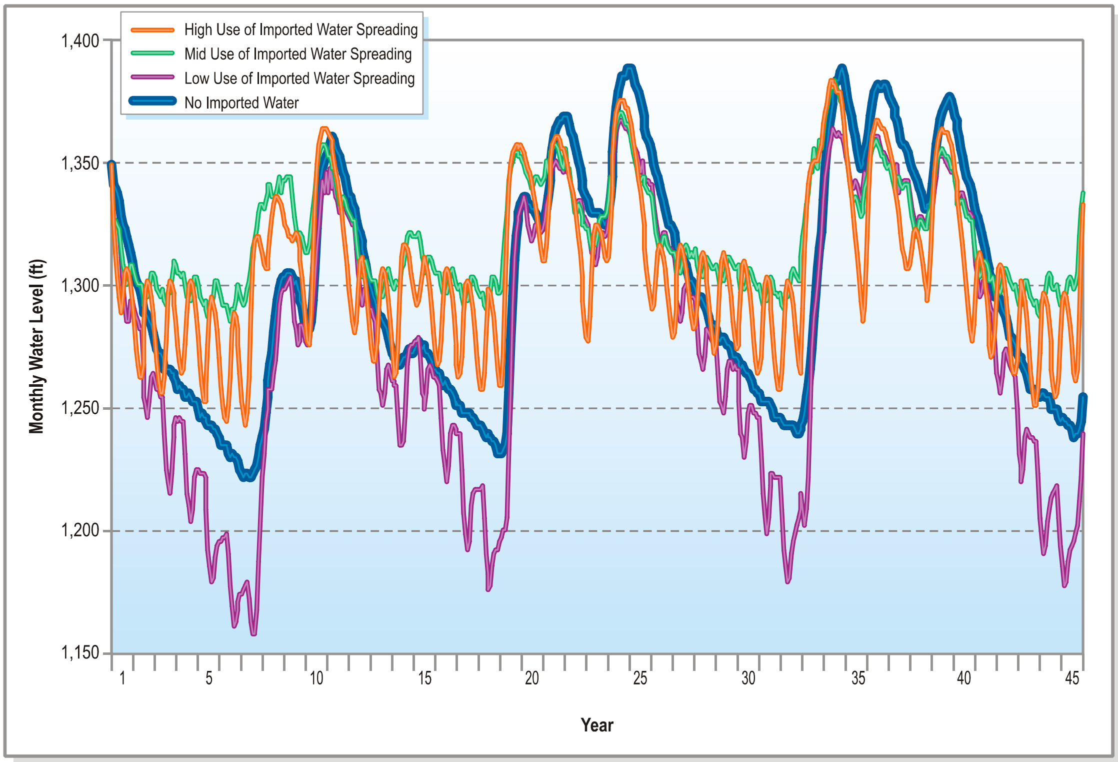


Figure 4-4
Groundwater Elevations at Monitoring Well No. 2 – All Scenarios

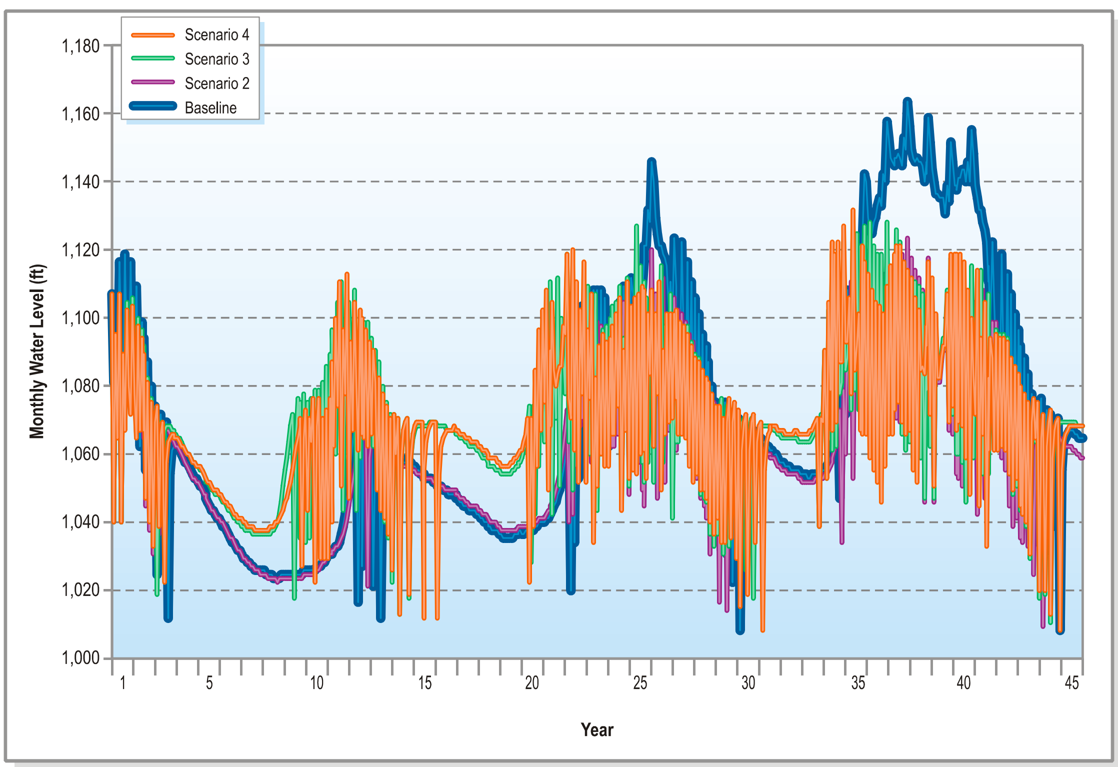


Figure 4-5
Groundwater Elevations at Berkeley Well – All Scenarios

Applied Spreading

Spreading of local surface water under the imported water scenarios was 78 ac-ft per year to 165 ac-ft per year higher than the No Imported Water Spreading Scenario and very close to that observed in the Baseline conditions. Additional pumping in the basin, resulting from added spreading of imported water when compared to the No Imported Water Spreading Scenario, allowed for additional spreading of local surface water.

Spreading of imported water varied significantly between the Imported Water Scenarios as illustrated in Figure 4-6. Under the Low Use Scenario, spreading of imported water was held constant at 5,000 ac-ft per year over the 45-year analysis as water levels were not taken into consideration. Conversely, spreading under the Moderate Use and High Use scenarios was linked to water levels at MW-2. Spreading of imported water was reduced as water levels rose and increased as water levels declined at MW-2.

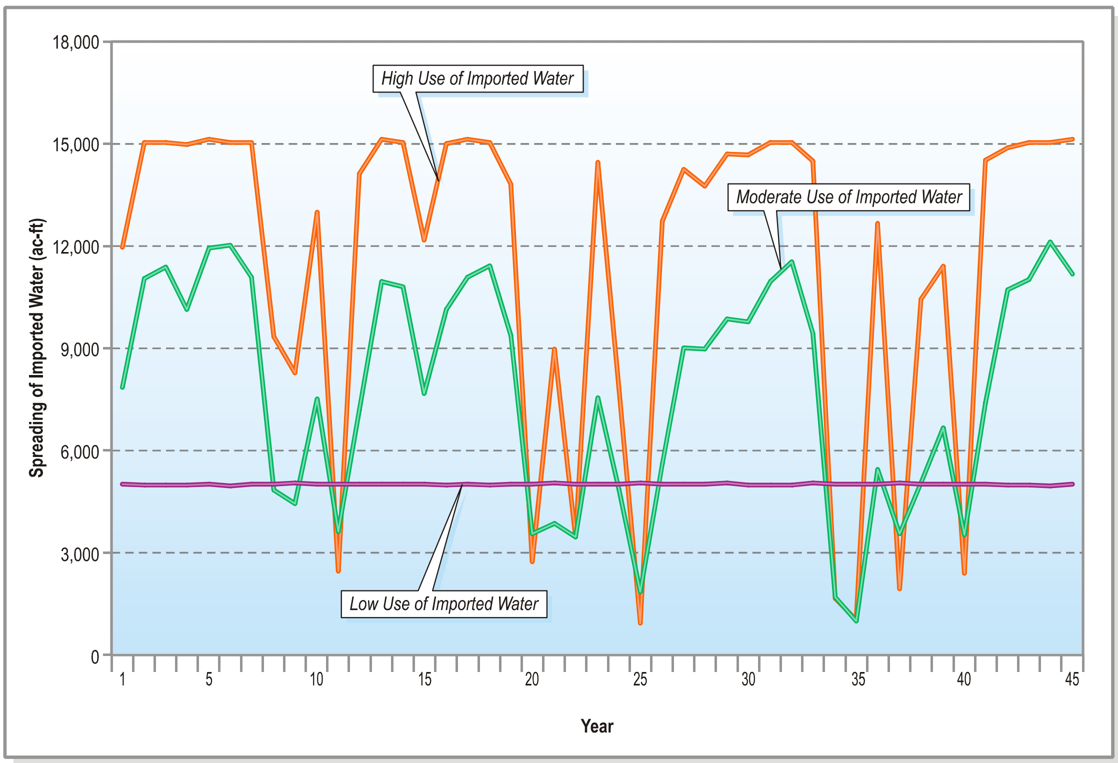


Figure 4-6
Annual Spreading of Imported Water - Low, Moderate, and High Use Scenarios

Under the Moderate Use Scenario, spreading of imported water ranged from less than 1,000 ac-ft in Year 35 to over 12,000 ac-ft in years 6 and 44. Spreading of imported water exceeded 10,000 ac-ft per year in 17 of the 45 years in the analysis and averaged 7,875 ac-ft per year. Average spreading of imported water was 57 percent higher under this scenario when compared to the Low Use Scenario.

Spreading of imported water under the High Use Scenario was significantly more aggressive than in the two other imported water scenarios. Average annual spreading was 230 percent higher than the Low Use Scenario at 11,565 ac-ft per year. Spreading ranged from less than 1,000 ac-ft per year in Year 35, as in the Moderate Use Scenario, and reached a maximum of 15,000 ac-ft per year during five periods over the 45-year simulation. Spreading of imported water exceeded 10,000 ac-ft per year in 33 of the 45 years or 73 percent of the time and over 14,000 ac-ft per year in 24 of the 45 years or 53 percent of the time.

Groundwater Production

Overall groundwater production from the Six Basins Area is significantly higher than under the No Imported Water Scenario as illustrated in Figure 4-7. Under the Low Use Scenario, total production ranges from just over 20,000 ac-ft per year to almost 33,000 ac-ft per year and averaged 24,213 ac-ft per year. This average is 4,980 ac-ft per year higher than under the No Imported Scenario. Production exceeds 25,000 ac-ft per year in 17 of the 45-Year analysis or 38 percent of the time and 30,000 ac-ft per year in five of those years.

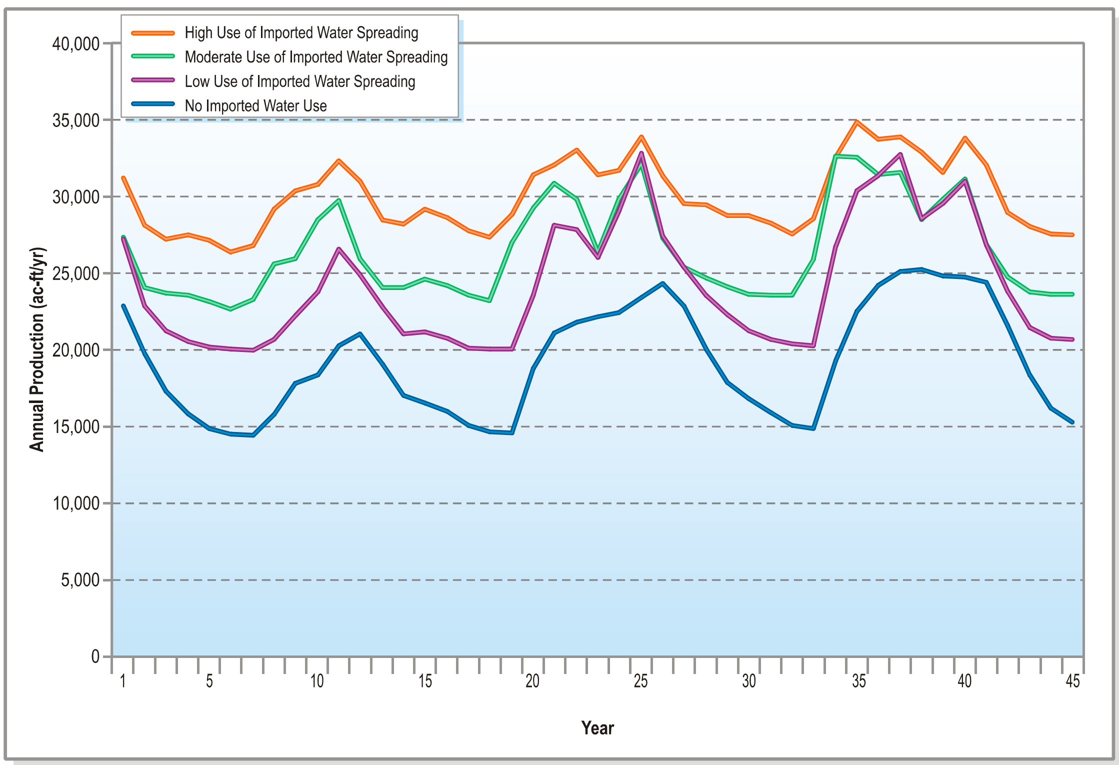


Figure 4-7
Total Production - All Scenarios

Under the Moderate Use Scenario, average production increases to 26,478 ac-ft per year reflecting additional spreading of imported water. Annual production ranges from approximately 22,700 ac-ft to over 32,600 ac-ft exceeding 25,000 ac-ft per year in 24 of the 45 years or 53 percent of the time and 30,000 ac-ft per year in seven of those years. In addition, production, as a percentage of average pumping, ranges from 86 to 123 percent of average. This range of production is smaller than under the Low Use Scenario indicating a more uniform production level over the 45-year analysis.

Under the High Use Scenario, average production increases to 30,001 ac-ft per year as a result of more aggressive spreading. Annual production ranges from over 26,300 ac-ft to approximately 35,000 ac-ft exceeding 30,000 ac-ft per year in 20 of the 45 years or 44 percent of the time. Production, as a percentage of average pumping, ranges from 88 to 116 percent of average indicating an even more uniform production level when compared to the other two imported water spreading scenarios.

However, to fully assess the impact of imported water spreading on production, they must both be compared while taking into consideration the differences in basin storage. Table 4-6 illustrates this comparison. Under the Low Use Scenario total production is higher than imported water spreading by 1.6 percent as losses from the modeled area were relatively slightly lower than under the No Spreading Scenario as illustrated in Table 4-2. It should be noted that while absolute losses from the modeled area were higher for this scenario; relative losses were lower.

Table 4-6
Comparison of Imported Water Spreading vs. Additional Pumping (ac-ft) – All Scenarios

Comparison of Imported Water Spreading vs. Additional Pumping for All Scenarios (ac-ft)				
	No Imported Water	*Imported Water Spreading Scenarios*		
Basin Response		Low	Moderate	High
Total Pumping	19,233	24,213	26,478	30,001
Change in Storage	-113	2	484	468
Sub Total	19,119	24,216	26,962	30,469
Additional Pumping from Spreading of Imported Water	, 0	5,096	7,843	11,350
Imported Water Spreading	0	5,016	7,875	11,565
Difference (Pumping - Spreading)	0	80	-33	-215
Difference as Percent of Spreading	N/A	1.6%	-0.4%	-1.9%

Pumping amounts under the Moderate and High Use scenarios are lower than the amount of imported water spreading by 0.4 and 1.9 percent respectively. Lower production levels result from slightly increased losses from the modeled area in the form of sub-surface losses in the Ganesha Basin, the Southern portion of the Pomona Basin, and across the San Jose Fault to the Chino Basin (See Table 4-2). Sub-surface flows to the Chino Basin for all three scenarios are illustrated in Figure 4-8.

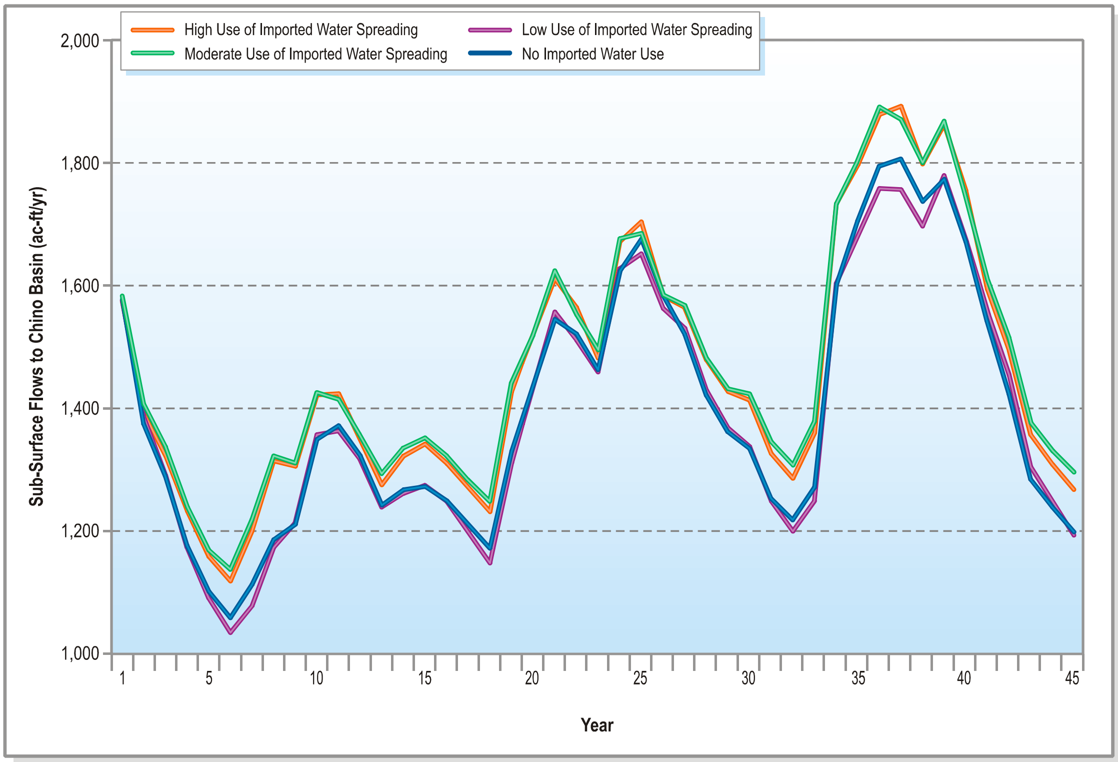


Figure 4-8
Sub-Surface Flows to the Chino Basin - All Scenarios

Change in Storage

Table 4-2 indicates that simulated storage in the basin would increase under the Moderate Use and High Use Scenarios to a maximum of approximately 484 ac-ft per year under the Moderate Use Scenario. Long-term storage increase is slightly less under the High Use Scenario due to higher water levels and slightly larger losses from the modeled area. Higher losses in the modeled area, as shown in Table 4-2, in the form of subsurface flows out of the modeled area in the Ganesha and Southwestern portion of the Pomona Basin; and flows across the San Jose Fault to the Chino Basin, are larger for these two scenarios when compared to the Low Use Scenario.

4.3.2 Capital Cost Requirements

Section 3 indicated that the facility requirements for all three imported water scenarios are esentially the same; however, the basin parameters governing their operation and the amount of water extracted are different. The facilities requirements are summarized as follows:

Area 1 Facilities

- Six Production Wells – 1,500 gpm each
- 11,500 ft of Pipelines

Area 2 Facilities

- Three Production Wells – 700 gpm each
- 15,500 ft of Pipelines
- 2,100 gpm Granular Activated Carbon Plant

Area 3 Facilities

- Three Production Wells – 700 gpm each
- 8,000 ft of Pipelines
- 2,100 gpm Granular Activated Carbon Plant

Unit Construction Cost

The following unit construction costs were used:

- Production Wells: $ 1,000,000 per well
- Pipelines: $ 12.00 per diameter-inch
- GAC Plant: $ 800 per gpm of treatment capacity

The above costs were based on current construction prices for similar facilities. A contingency of 25 percent was added to the unit cost to cover miscellaneous cost and unknown field design conditions. In addition, 15 percent was added to the cost for engineering services during design and construction. Table 4-7 summarizes the total construction cost and capital requirements for the required facilities. Total construction cost was estimated at 23.2 million dollars and total capital at 32.5 million dollars.

Capital Cost Funding and Amortization

The amortized annual cost to fund the recommended facilities was estimated based on a 30-year municipal bond earning an interest of six percent annually for half of the $32,500,000 project. TVMWD is currently seeking matching federal funds to implement the project that would provide up to half of the capital cost of the project, therefore, the amortized cost for the $16,250,000 portion of the cost that would be funded through the municipal bond was estimated at $1,180,000 per year.

Table 4-3 indicates that an additional 5,096 ac-ft of water would be able to be stored and recovered per year under the Low Use Scenario, 7,843 ac-ft per year for the Moderate Use Scenario, and 11,350 ac-ft per year for the High Use Scenario. Using these figures, the unit cost of additional production to recover the amortized capital cost for each of the scenarios was calculated as follows:

- Low Imported Water Use Scenario: $ 231.66
- Moderate Imported Water Use Scenario: $ 150.52
- High Imported Water Use Scenario: $ 104.01

Table 4-7
Estimated Construction Cost

Summary Capital Cost		
Basin Response	***Unit Price***	***Total Cost***
Area 1		
Six Wells	$1,000,000 per well	$6,000,000
Pipelines		
11,000 ft of 30" diameter	$12.00 per diameter-inch	$3,960,000
500 ft of 12"diameter	$12.00 per diameter-inch	$72,000
	Sub Total Area 1:	$10,032,000
Area 2		
Three Wells	$1,000,000 per well	$3,000,000
Pipelines		
10,500 ft of 16" diameter	$12.00 per diameter-inch	$2,016,000
3,000 ft of 12" diameter	$12.00 per diameter-inch	$432,000
2,000 ft of 8" diameter	$12.00 per diameter-inch	$192,000
2,100 gpm GAC Treatment Plant	$800 per gallon	$1,680,000
	Sub Total Area 2:	$7,320,000
Area 3		
Three Wells	$1,000,000 per well	$3,000,000
Pipelines		
3,000 ft of 16" diameter	$12.00 per diameter-inch	$576,000
2,500 ft of 12" diameter	$12.00 per diameter-inch	$360,000
2,500 ft of 8" diameter	$12.00 per diameter-inch	$240,000
2,100 gpm GAC Treatment Plant	$800 per gallon	$1,680,000
	Sub Total Area 3:	$5,856,000
	Total Construction Cost:	**$23,200,000**
	Contingency - 25%:	**$5,800,000**
	Engineering - 15%:	**$3,500,000**
	Overall Total:	**$32,500,000**

4.3.3 Operational Cost

The following operational costs were considered as part of this evaluation:

Cost of Imported Water for Spreading. This cost was based on purchasing replenishment water from MWD at $238 per ac-ft (effective 2006-07).

Pumping Energy Cost. To determine the average energy cost for each scenario, monthly simulated pumping heads and production amounts for all wells were used over the 45-year analysis. Initial simulated pumping heads were extracted from the model; additional heads were added to account for pumping drawdown (50 feet) and discharge head above ground surface (200 ft). In addition, an average pumping efficiency of 70 percent is used for all the wells. The unit price for energy varies significantly depending on the energy schedule chosen by water purveyors for individual wells and the time of the year pumping occurred. The cost of energy also includes provisions for base rates, time related charges, and additional penalties depending on the time of use. Energy price per kwh varies from $0.03 to over $0.15 depending on the above factors. An average price of $0.10 per kwh was used for this analysis. Based on the above considerations, the pumping energy cost for all imported water scenarios was as follows:

- Low Imported Water Use Scenario: $ 68.87 per ac-ft
- Moderate Imported Water Use Scenario: $ 69.14 per ac-ft
- High Imported Water Use Scenario: $ 70.09 per ac-ft

These prices are slightly higher than the cost of $67.29 calculated for the No Imported Water Scenario; this is due to lower average pumping levels under the Imported Water Scenarios. While this may seem counter-intuitive as higher water levels would be expected under the Imported Water Scenarios, additional pumping to recover the stored water was significantly higher and resulted in lower water levels overall.

Well Operations and Maintenance Cost. A cost of $20.00 per ac-ft of additional production has been assumed to cover operation and maintenance cost.

Spreading Operations Cost. The Feasibility Study of Imported Water Spreading at SASG, conducted in 2005 by Bookman Edmonston for TVMWD estimated the cost of spreading imported water at the southern portion of the spreading grounds at approximately $60,000 for a 5,000 ac-ft per year program or $12.00 per ac-ft. The estimated cost accounted for additional operations and maintenance of the spreading grounds and additional water level monitoring. This cost is anticipated to remain relatively constant regardless of the amount of imported water spread. Therefore, for the Moderate Use Scenario, this cost is estimated at $8.00 per ac-ft and for the High Use Scenario at $6.00 per ac-ft of additional production when compared to the No Imported Water Scenario as presented in Table 4-6.

Watermaster Administrative Cost. An administrative cost of $10.00 per ac-ft of additional production has been assumed.

Total Cost. Table 4-8 summarizes the total cost for each of the Imported Water Scenarios. Amortized costs are based on additional production from the Six Basins Area when compared to the No Imported Water Scenario.

Table 4-8
Imported Water Scenarios – Summary Cost per ac-ft

Summary Cost of Scenarios			
Cost	Use of Imported Water for Spreading Scenario		
	Low	Moderate	High
Capital Amortization (1)	$231.66	$150.52	$104.01
Cost of Imported Water	$238.00	$238.00	$238.00
Pumping Cost	$68.87	$69.14	$70.09
Well Operations and Maintenance	$20.00	$20.00	$20.00
Administrative	$10.00	$10.00	$10.00
Total Cost:	**$568.53**	**$487.66**	**$442.10**

(1) Assumes that 50 percent of capital cost funded by Federal Programs

The estimated cost for the Moderate and High Use Scenarios compares favorably to the use of imported water for direct delivery at $566 per ac-ft for Tier 2 Treated Water at the Miramar water treatment plant.

4.3.4 Summary of Environmental Impacts

For all of the Imported Water Scenarios, the same new facilities would be required. This includes new wells in the Lower Claremont Heights Basin, at the Martin Cienagas, and in the Southwest portion of the Pomona basin, pipelines that would connect the wells to regional distribution systems, and if necessary wellhead treatment (GAC) facilities at the latter two locations.

A detailed Preliminary Environmental Assessment was conducted for the construction and operation of the systems and is contained in Appendix A. In general, the impacts were assumed to be similar for all of the Imported Water Scenarios as the facilities would be the same, with the primary difference being the extent of use. A brief summary of the potential environmental impacts follows.

Aesthetics

The various elements of the Proposed Project would create short-term visual impacts that would be less than significant. The operation of the pipelines would be underground, thus no long-term visual impacts are anticipated. Careful siting of the well and treatment systems would be required to avoid potential significant impacts.

While measures to minimize the visibility, such as screening, locating facilities away from highly visible areas, or locating facilities in non-aesthetic settings such as parking lots or near existing infrastructure, would serve to reduce potential significant aesthetic impacts, undergrounding of wells may also be required at some locations. The locations of greatest sensitivity are the Claremont Historical District in Area 2 and the area near Ganesha Park in Area 3. Additionally, possible damage to scenic resources such as the street trees is potentially significant and avoidance is recommended. As the Proposed Project is not located in the vicinity of a state scenic highway, no impact on officially designated state scenic highways is anticipated.

Agricultural Resources

The Proposed Project would not result in any significant impacts on agricultural resources and no mitigation measures would be required.

Air Quality

The Proposed Project would not affect population, housing units, or employment, and would thus be consistent with SCAG's Growth Management Plan. In addition, the Project would not have an impact on the type, size, or location of transportation infrastructure in the long-term, and would thus be consistent with SCAG's Regional Mobility Plan. No CMP facilities are located within the Project site; hence, no impacts to local or regional air quality or congestion management plans would occur. However, the Project is located within a portion of the SCAB that is a non-attainment area for ozone, $PM_{2.5}$ and PM_{10}, CO and a maintenance area for NOx. Though temporary, construction of Project has the potential to impact local air quality if emissions exceed SCAQMD significance thresholds. With implementation of standard SCAQMD-approved construction procedures, compliance with the applicable provisions of the most recently-adopted SCAQMD Rule 403, and recommended mitigation measures, as applicable, construction impacts on air quality would be less than significant. The Project includes operation of above ground equipment that would potentially generate minimal air emissions. With compliance of SCAQMD rules and regulations, potential operational impacts are not anticipated to be significant. Additionally, any odors generated during construction would be short-term and controlled in accordance with SCAQMD Rule 402. No odor impacts are expected from operation of the Project.

Biological Resources

While the preliminary assessment in Appendix A presents potential significant impacts based on the assumed biological resources occurring in the Project site, biological survey(s) would be needed to determine what sensitive resources occur in the Project site and the extent to which they could be impacted by the Proposed Project.

The Project site consists primarily of developed land with few or no biological resources. However, the San Antonio Spreading Grounds in Area 1 is located in open space with the potential occurrence of sensitive plant and wildlife species and sensitive habitat. Disruption to sensitive biological resources is a potential significant impact. Disruption to street trees in Area 2 is a potential significant impact. Additionally, portions of Area 2 have been identified as having potential occurrences of sensitive plant species. Disturbance to sensitive plant species is a potential significant impact. A minimum of one waterway under federal and/or state jurisdiction traverses each Project site. Alteration of the waterways is a potential significant impact and may result in the need for a 404 permit and/or a Streambed Alteration Agreement. It is anticipated that the recommended mitigation measures, as well as avoidance, would reduce the potential significant impacts on biological resources to less than significant.

Cultural Resources

The Project site includes and is adjacent to historic and cultural resources. Whenever feasible, disturbance to these resources should be avoided. When avoidance is not feasible, the integrity of the resource should be protected to reduce potential significant impacts. This could include the siting of structures far from historic buildings or trees, undergrounding well equipment, or designing well equipment structures to be compatible with the existing structures. The area with the greatest historical significance is a portion of Area 2 in the City of Claremont Historic District, including Memorial and Mallows Park.

While unlikely that previously unknown cultural and scientific resources would be encountered, recommended mitigation would reduce the potential impact of such as discovery to less than significant.

Geology and Soils

The Proposed Project is not located within the boundaries of the state-designated Alquist-Priolo Earthquake Fault Zone. The Project site would not have a greater potential for seismic activity than most of the state. Furthermore, the Proposed Project's structures and elements would be constructed to meet all applicable Uniform Building Code and seismic safety standards, including the earthquake-resistant standards. The fact that most of the Proposed Project would be constructed and operated belowground minimizes the potential for aboveground impacts, and belowground impacts would be limited. Area 2 and Area 3 are located within a liquefaction hazard area. However, the Proposed Project's components would be constructed to meet all applicable Uniform Building Code and seismic safety standards. Additionally, all trenches (including well excavation) would be backfilled with engineered fill, which meets proper compaction and shear strength requirements, and therefore has little liquefiable potential. If the site-specific geotechnical investigation determines that a liquefaction hazard exists, mitigation measures may include ground improvement, removal, dewatering, and structural modifications, as appropriate. The specific mitigation measure to implement and the suitability of belowground structures would depend on the results of the site specific geotechnical investigation. Therefore, the Proposed Project is not expected to increase the risk of exposure of people or structures to substantial adverse effects from strong seismic ground shaking or seismic-related ground failure and no mitigation would be required. In addition, with implementation of an erosion control plan, substantial soil erosion impacts or loss of topsoil is not anticipated. Also, the construction and operation of the Proposed Project is not expected to cause the local geologic units or soils to become unstable, or result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse, and no impact is anticipated to soils capable of supporting the use of septic tanks or alternative wastewater disposal systems; hence, no mitigation would be required.

Hazards and Hazardous Materials

The construction and operation of the Proposed Project is not anticipated to create a significant hazard to the public or environment from the routine transport, use, or disposal of hazardous materials, or involve the release of hazardous materials. Neither is the Project anticipated to involve a hazardous materials site, nor itself emit hazardous materials. Though the Proposed Project would be constructed and operated within two miles of an airport, the Project does not involve activities that would expose people or workers to a safety hazard. The Proposed Project would temporarily interfere with local emergency response and evacuation plans during construction of the Proposed Project; however, on-street construction activities would conform to all traffic work plan and access standards, as well as include coordination with applicable public services, to allow adequate emergency access. In addition, the Proposed Project would not involve an area designated as a wildland fire zone. No significant hazard impacts are anticipated and no mitigation would be required.

Hydrology and Water Quality

The Proposed Project is a groundwater management project. The objectives of the Proposed Project include protecting and promoting the beneficial use of groundwater supplies in the Six Basins Area. The Proposed Project would extract non-contaminated and contaminated groundwater for the purpose of managing rising groundwater levels, possibly store and recover imported water, treat extracted contaminated groundwater to applicable water quality standards, and use the treated water as a supplement to the existing water purveyors' sources. The Proposed Project would not substantially deplete or interfere with groundwater supplies or recharge. In contrast, the Proposed Project would benefit groundwater supplies and recharge efforts by adding flexibility and additional resources (by treating contaminated groundwater) and limiting rising groundwater from creating a public safety issue (i.e., damage of infrastructure due to high groundwater). No adverse impacts to groundwater supply or recharge are expected and no mitigation would be required. Water generated during the construction and operation of the Proposed Project would meet all applicable permit requirements (for construction dewatering and runoff) and water quality rules, regulations and standards (during operation); therefore, impacts on water quality standards or waste discharge requirements would be less than significant and no mitigation would be required. Also, no natural stream or river would be altered within the Project site. No condition exists within the Project site that would involve impacts from inundation from seiche, tsunami and mudflows. Area 1 and Area 2 are within the San Antonio Dam Inundation Area; however, the Proposed Project would not expose people to significant risks associated with potential dam failure. In addition, structures associated with the Project would be minimal in size and quantity, and not placed within a 100-year flood area; hence, the Project would not impede or redirect flood flows.

Land Use and Planning

The Proposed Project would not physically divide any community. The Project is not anticipated to conflict with any land use plan, policy, or regulation, nor is it located within an area subject to a habitat conservation plan or natural community conservation plan. The Proposed Project is not anticipated to have any significant impact on land uses along or near the Project site, provided that aboveground structures located within parks do not disrupt recreational activities.

Mineral Resources

Much of the Project is located in developed areas where there is currently no potential for the establishment of surface mining. The Project portion located in the San Antonio Spreading Grounds, which is designated as an area with minerals of statewide significance, would not preclude existing and any future mining operations in the Spreading Grounds. Therefore the impact on mineral resources would be less than significant.

Noise

The various elements of the Proposed Project would create short-term noise impacts that would be less than significant with mitigation incorporated. The operation of the pipelines would be underground, thus no long-term noise impacts are anticipated. Careful siting of the well and treatment systems would be required to avoid potential significant operational noise impacts. Measures to minimize noise impacts, such as noise-dampening devices, locating facilities away from noise-sensitive areas, or undergrounding of well equipment would serve to reduce potential significant noise impacts. The locations of greatest sensitivity are within the Claremont Historic District, including Memorial, Mallows, and Larkin Parks in Area 2, and the area near Ganesha Park and the Los Angeles County Fairplex Fair Grounds in Area 3.

Population and Housing

The Proposed Project is not anticipated to have any impacts on population and housing in any of the three Project areas.

Public Services

The various elements of the Proposed Project would create short-term impacts to public services that are anticipated to be less than significant. Operation of the Project is also not anticipated to cause long-term impacts on public services. As the Proposed Project does not include development that would require substantial use of, or physical change to, fire and/or police protection services, nor use of schools or other public facilities (i.e., libraries or hospitals), no impact is expected such that construction of new, or the physical alteration of an existing, governmental facilities is required in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services.

Recreation

Construction of the various elements of the Proposed Project in and adjacent to recreation facilities would create temporary impacts on recreation that would be less than significant. The operation of the pipelines would be underground, and thus no long-term recreational impacts are anticipated. In Area 2 and Area 3 where structures could potentially be located in or adjacent to recreational areas, careful siting of the well and treatment systems would be required to avoid potential significant impacts. Locating the structures away from recreational amenities, in locations such as the park periphery or in the parking lots would minimize potential significant impacts. Further review would be required to determine if undergrounding of wells would be required at some locations. The parks with the greatest sensitivity due to the community significance and limited size are Memorial Park and Mallows Park in Area 2.

Transportation/Traffic

The Project would result in temporary minor alterations to the current traffic patterns and possible delays during the construction phase. Given that the changes to traffic patterns and service would be temporary, limited to the immediate area of the construction, and would be coordinated with local police and fire services, the impacts are anticipated to be less than significant. The Project would not generate a substantial amount of traffic during either construction or operation. Nor would it conflict with adopted policies supporting alternative transportation. The only potentially significant impact identified in this analysis pertaining to transportation and circulation patterns is a possible substantial reduction in parking spaces if treatment facilities and extraction wells are sited in parking lots. This impact can be reduced by locating any above ground facilities in such a manner that displaces the smallest number of parking spaces as feasible. This is anticipated to have the greatest potential impact in Area 2. Additionally, any aboveground facilities located with parking lots must be located in an area that would not create a traffic hazard.

Utilities and Service Systems

The Proposed Project is a groundwater extraction and treatment project. The Project would not result in changes to facilities or operations, including treatment requirements, at existing wastewater treatment facilities. Though the Area 1 alignment would terminate at the Miramar Water Treatment Plant, no expansion of the facility would be required because of the Project; therefore, no significant impacts are anticipated, and no mitigation would be required. Also during construction of the Project, measures would be implemented to control runoff to the stormwater drainage facilities such that no significant impact would occur. Operation of the Proposed Project is not expected to increase stormwater runoff in the Project site, since the Proposed Project would be placed beneath previously developed surfaces (e.g., street rights-of-way) or within designated off-street locations that would include a drainage plan. Excavation and construction debris associated with the Proposed Project would be minor and recycled or transported to the nearest landfill site and disposed of appropriately; therefore, no significant impacts to landfill capacity are anticipated and no mitigation would be required.

4.3.5 Institutional Issues

While the No Imported Water Scenario relies on additional directed use of existing wells and purveyor distribution systems and therefore no significant change in the normal institutional patterns, the Imported Water Scenarios introduce new types of facilities and operations that will require new arrangements. While the extent of the use of any of the new facilities differs between the Imported Water Scenarios, they all share similar considerations. The issues can generally be categorized as follows:

- Spreading of imported water
- Construction and operation of new wells and of new transmission systems for distribution of water
- Construction and operation of potential wellhead treatment facilities

Spreading of Imported Water

TVMWD is the local agency with access to imported State Project Water and has the ability to purchase imported water from Metropolitan for groundwater replenishment at Groundwater Replenishment rates whenever such water is available. TVMWD as one of the Parties to the Judgment has also entered a Storage and Recovery Agreement with Watermaster for spreading State Project Water in the San Antonio Spreading Grounds as described further under Section 4.3.5 and therefore has established the ability to store and recover water.

A separate Memorandum of Understanding (MOU) between the Watermaster and PVPA entered into at the time of the Judgment, provides for the spreading of "surplus water" under a Storage Agreement on behalf of qualified parties to the Judgment such as TVMWD. This agreement provides sufficient institutional authority both to allow spreading under a Storage and Recovery Agreement such as that executed between Watermaster and TVMWD, and limit spreading if necessary to prevent the supplemental spreading from contributing to rising water concerns.

A third key Memorandum of Agreement recently executed is between the TVMWD and PVPA. This agreement both allows and governs the use of the PVPA San Antonio Spreading Grounds for a conjunctive use project. This agreement spells out the technical and legal responsibilities for both TVMWD and PVPA when using the spreading facilities for imported water.

In summary, the basic institutional arrangements exist to allow TVMWD to store water although not to the extent contemplated under some of the scenarios as described further under Section 4.3.5.

Construction and Operation of New Wells and Pipelines

Construction and operation of the new wells in the Lower Claremont Heights and Pomona Basins proposed as part of the three Imported Water Scenarios could potentially be undertaken by individual purveyors to supplement their own system facilities with no unique institutional issues. In this case, TVMWD would transfer water from its storage account to other local parties under the Judgment to produce additional water.

However, recovered water could at times be delivered to other TVMWD member agencies outside of the local basin producers, particularly for the higher storage and recovery options. Therefore, it may be desirable for TVMWD to construct and operate some or all of the new wells. As a Municipal Water District, TVMWD has the authority to construct and operate water supply facilities including production wells so no new institutional arrangement would be needed for TVMWD to own and operate all or some of the recovery wells as well as the pipelines and appurtenances. Any water produced by TVMWD would be delivered into the proposed new transmission facilities and used for blending with water produced from the Miramar Plant to meet demands for agencies within TVMWD's service area.

Particularly in Area 1, where a large majority of the production recovery would take place, it is likely that the production required to recover the stored water and control rising groundwater would become significantly greater than local purveyors could use directly, especially under the Moderate and High Use Scenarios. Therefore, it is more probable in these areas that some or all of the wells would be owned by TVMWD.

Construction and Operation of Wellhead Treatment Facilities

Institutionally, any necessary wellhead treatment facilities could be constructed, owned and operated either by local purveyors or TVMWD.

4.3.6 Legal/Judgment Considerations

As briefly noted in Section 4.3.4, there are provisions within the Adjudication as well as the Rules and Regulations and Operating Plan that basically establish a basis to allow TVMWD to store and recover State Project Water in the Six Basins Area. The primary mechanism that currently exists is the TVMWD Storage Agreement, originally executed in May of 2001 and recently amended in December 2005 to clarify and expand the original Agreement to allow water to be spread in the SASG in the Upper Claremont Heights Basin and not just at TVMWD's property. The initial Agreement limits the spreading to a maximum of 1,000 ac-ft per year and a maximum in storage of 3,500 ac-ft without prior approval of Watermaster. Thus to execute any of the imported water scenarios described under this section, TVMWD would require an increase in the maximum amount allowed in storage at any one time, since even the Low Use of Imported Water Scenario contemplates up to 5,000 ac-ft per year of storage and recovery. The agreement does not have specific limitations with respect to maximum groundwater levels or rising water, but does have a provision that restrains TVMWD from undertaking any storage or recovery operation that may substantially injure the rights of any other Party. Furthermore, the Agreement specifies that TVMWD is responsible for satisfying all applicable requirements of CEQA in implementing any projects associated with the Agreement.

The initial Operating Plan for the Judgment speaks briefly about Storage Agreements, and has a much more extensive discussion about acquisition of Replacement Water. In general, the scenarios contemplated under this study are based on the concept of TVMWD putting water into a Storage Account to be either transferred to other parties for withdrawal or withdrawn for use outside the Six Basins Area. However, the principles under the Replacement Water Section of the Operating Plan should generally be followed in the development these scenarios.

The MOUs noted above between Watermaster and PVPA and between TVMWD and PVPA establish the Judgment and legal framework for allowing spreading of imported water in the PVPA spreading basins. The MOU between Watermaster and PVPA governs the relationship between PVPA and Watermaster, establishes PVPA's responsibilities for spreading water and its limitations. This includes the fact that PVPA bears no responsibility for water quality, high groundwater or rejected water as a result of spreading replenishment or replacement water. This MOU does not speak to any specific quantities of water to be spread. The MOU between TVMWD and PVPA specifically addresses the currently contemplated San Antonio Spreading Grounds Conjunctive Use Project which would allow spreading of up to 8,000 ac-ft per year. The MOU grants an easement for spreading, references groundwater models that would be used to coordinating PVPA's and TVMWD's spreading activities, spells out coordination activities and TVMWD's responsibilities for

Environmental Review, and spells out a procedure to determine responsibility in the event that high groundwater caused by spreading either local or imported water results in damages.

One area in the Judgment that needs further definition and clarification relates to the losses of stored water from the basin. Item B7 of Section III of the Judgment, Declaration of Rights and Responsibilities, indicates that if the Watermaster reasonably determines that Replenishment had to be terminated or curtailed in any year because of insufficient storage capacity, some or all of a Party's unproduced Carryover rights or Storage and Recovery rights may be deemed lost based on different priorities. Storage of imported water has the fourth priority and could be lost or reduced under these circumstances. This could result in substantial financial losses for TVMWD under the current Judgment, if PVPA had placed imported water in the basin under a storage agreement.

In summary, there is language in the Judgment and precedential agreements that establish the basis for implementing the Imported Water Scenarios. However, agreements would have to be modified to allow the levels of potential imported water storage contemplated under the Scenarios, subject to approval by all parties and following additional CEQA review to the extent that a program greater than that already covered under the current TVMWD plan is proposed.

4.4 Recommended Plan

Controlling rising water at various locations in the Six Basins Area, in the absence of introducing imported water, can be attained by managing more tightly spreading operations at the SASG and increasing pumping at certain locations to control water levels without incurring significant additional cost relative to Baseline. However, control of rising water can also be attained under the three imported water scenarios by operating the basin within the given parameters and by constructing a series of spreading, transmission, and pumping facilities. In addition, spreading of imported water offers the following benefits to the operations of Six Basins:

- Reduced imported water deliveries during peak demand conditions
- Increased reliability of local supply sources
- Increased groundwater availability and safe yield of the basin
- Maintained higher water levels during extended droughts
- Decreased fluctuations in water levels
- Lower overall cost per ac-ft when compared to direct delivery of imported water

As previously discussed in this section, the Low Use Scenario maintains spreading of imported water at 5,000 ac-ft per year regardless of water levels, while the other two scenarios consider variations in water levels as surrogates to increase or decrease spreading of imported water. Spreading of imported water under these scenarios varies from less than 1,000 ac-ft per year during high water level conditions to 15,000 ac-ft per year when levels are low. Long-term spreading under the Moderate Use Scenario averages approximately 7,900 ac-ft per year and 11,350 ac-ft per year under the High Use Scenario. These two scenarios represent a more realistic condition under which the basin could be operated.

Modeling results indicate that is feasible to spread up to 15,000 ac-ft per year under certain conditions while reducing or eliminating rising water. While, this level of spreading may be an ultimate goal, a phased approach is recommended. A phased approach will enable TVMWD and the Six Basins Watermaster to learn more about how the basin would respond to the additional spreading of imported water by evaluating data from a series of dedicated monitoring wells that are in place at various locations in the Six Basins Area.

Therefore, it is recommended that spreading of up to 8,000 ac-ft per year be considered in the initial phase with an overall average of approximately 5,000 ac-ft per year. Annual spreading should be limited when water levels are relatively high and further increased as water levels at MW-2 decreased. As additional knowledge is gained on how the basin responds to the imported water spreading, further increases in spreading should be considered to reflect those illustrated under the Moderate Use Scenario.

Section 5
Implementation Plan

5.1 Introduction

This section describes the recommended implementation plan that includes recharging imported water at the SASG to augment water supply availability in the Six Basins Area while reducing or eliminating the potential for rising water at historical cienegas.

Section 4 indicated that spreading of imported water similar to the levels presented under the Moderate Use Scenario is recommended. Under this scenario, spreading of imported water ranged from less than 1,000 ac-ft when water levels were high to over 12,000 ac-ft when water levels were low. Spreading of imported water exceeded 10,000 ac-ft per year in 17 of the 45 years in the analysis and averaged 7,875 ac-ft per year.

Similarly, groundwater production was increased significantly under the Moderate Use Scenario as it average production increased to 26,478 ac-ft per year reflecting additional spreading of imported water. Annual production ranged from approximately 22,700 ac-ft to over 32,600 ac-ft exceeding 25,000 ac-ft per year in 24 of the 45 years or 53 percent of the time and 30,000 ac-ft per year in seven of those years.

While modeling results indicate that is feasible to spread and pump these relatively large volumes under certain conditions while still reducing or eliminating rising water, a phased approach is recommended. A phased approach will enable TVMWD and the Six Basins Watermaster to learn more about how the basin would respond to the additional spreading of imported water given that a series of dedicated monitoring wells is in place at various locations in the Six Basins Area.

It should be noted that one of the underlying assumptions in the modeling of the Six Basins Area consist of spreading local surface water primarily in the northern portion of San Antonio Spreading Grounds. It was also assumed that spreading of imported water would normally occur evenly in the southern portion of the spreading grounds south of the Drabble Pit. CDM has identified numerous improvements in the SASG for PVPA. Improvements included the construction of well defined spreading basins and conveyance structures to control where spreading takes place. Improvements to the spreading grounds infrastructure, while not directly covered under this report, and closer control of native water and imported water spreading operations as recommended are an essential part of this plan.

5.2 Initial Phase

The initial phase considers the spreading of up to 8,000 ac-ft of imported water per year south of the Drabble Pit in the southern portion of the SASG with an average of 5,000 ac-ft per year. This level of spreading is commensurate with TVMWD's plans identified in the Feasibility Study of Imported Water Spreading at the San Antonio Spreading Grounds (B-E, April 2005). The implementation of this initial phase is based on the following assumptions:

- Imported water for spreading at replenishment water rates is available in the Foothill Feeder
- Improvements to the SASG have been implemented to concentrate spreading of native water in the northern portion of the grounds.

5.2.1 Facility Requirements

The improvements required to recover the imported water spread consist of a six wells located directly south of the SASG and parallel to Baseline Road, as identified in Figure 3-1 for Area 1. Improvements also include the construction of a 30 inch diameter regional pipeline from Benson and Baseline to the Miramar WTP to tie the Benson Feeder and the Miramar Pipeline and/or the WFA's Benson Feeder during times when local producers may not need the extra supply capacity.

It should be noted that the City of Upland, WECWC, GSWC, and Pomona College have indicated their plans to construct new wells in the area of interest over the next five years. The sitting of these wells should be coordinated with Watermaster and TVMWD so that they are strategically located to intercept a significant portion of the water spread at the SASG. Production capacity of individual wells has been estimated at 1,500 gpm in this area of the Upper Claremont Heights Basin.

It has been assumed for purpose of this study that all six wells would pump into the proposed regional pipeline. Additional facilities may be required to convey water from this pipeline to the individual agencies' systems depending on hydraulic grades. Connections to this pipeline should be metered to maintain proper accounting of production and deliveries.

Extraction facilities identified in the Pomona Basin in the Martin Cienega and the southern portion of the Pomona Basin are not recommended for the initial phase. They should be deferred until experience is gained on the basin response.

5.2.2 Construction Cost

The construction cost of the facilities identified for Area 1, presented in Table 4-7, are estimated $10,032,000. This cost includes six new wells, 11,000 ft of 30-inch diameter pipeline with connections to the Miramar and WFA's Benson Feeder, and 500 ft of 12-inch diameter pipeline. Construction contingency has been assumed at 25 percent while engineering services would add another 15 percent for an overall estimated total of $14,050,000.

The amortized annual cost to fund the recommended facilities was estimated based on a 30-year municipal bond earning an interest of six percent annually for half of the amount as TVMWD is currently seeking matching federal funds to implement the project. The amortized cost has been estimated at $510,000. The amortized cost per ac-ft, based on an additional pumping of approximately 5,000 ac-ft per year is estimated at $102.00.

5.2.3 Operational Cost

Section 4.3.3 identified the operational cost for the three imported water scenarios. Using the figures presented in that section, the operational cost for the initial phase of the recommended plan are as follows:

■ Capital Amortization	$ 102.00 per ac-ft
■ Cost of Imported Water	$ 238.00 per ac-ft
■ Pumping Cost	$ 69.00 per ac-ft
■ Well Operations and Maintenance	$ 20.00 per ac-ft
■ Administrative Cost	$ 10.00 per ac-ft
Total:	$ 439.00 per ac-ft

The estimated cost of $439 per ac-ft for the initial implementation phase compares very favorably to the use of imported water for direct delivery at $566 for Tier 2 Treated Water at the Miramar water treatment plant.

5.2.4 Basin Operating Parameters

The operation of the proposed facilities would be controlled by water levels at Monitoring Well No. 2, located in the southwest corner of the SASG. The recommended operations for the six proposed wells are as follows:

- Maintain average production (1,000 ac-ft per year) per well when water levels at MW-2 well are between 1,300 ft and 1,350 ft in elevation.
- Operate wells continuously when water levels at MW-2 are above the 1,350 elevation.
- Gradually reduce production to about half (500 ac-ft per year) per well when water levels at MW-2 decline from 1,300 ft to 1,250 ft in elevation.
- Further reduce production if water levels drop and stay below the 1,250 ft elevation at MW-2

With regards to spreading, the decision to spread or not should be based on the overall stage of the basin and it should be assessed at a minimum on a monthly basis depending on a number of factors. Factors that should be considered in assessing the stage of the basin include the time of the year, the presence or absence of water behind San Antonio Dam, the expected amount of surface water runoff from the San Antonio Creek watershed, water levels at MW-2 and other wells in the Six Basins Area, and the prior occurrence of rising water. Listed below are the general parameters to spread native and imported water at the SASG based on water levels at MW-2 Well in the UCHB.

- Depending on water levels at MW-2, spreading could begin as early as February of each year; however, in most years spreading should begin by late March or early April. Spreading should extend through the summer if imported water is available.
- Spread up to 8,000 ac-ft per year as long as water levels at MW-2 are below the 1,300 ft elevation.
- Gradually decrease spreading to approximately 4,000 ac-ft per year as water levels at MW-2 rise from 1,300 ft to 1,350 ft elevation
- Further decrease spreading if water levels continue to rise above the 1,350 ft elevation and stop spreading if they reach the 1,375 ft elevation at MW-2.

5.2.5 Environmental Impacts

TVMWD prepared an Initial Study and Mitigated Negative Declaration for the Spreading of Imported Water at the San Antonio Spreading Grounds. That study addressed the environmental impacts resulting from the construction of transmission facilities from the Foothill Feeder to the SASG, spreading at the SASG and the construction on one extraction well at TVMWD's Miramar facilities. A similar study would be required for the construction of additional wells (up to six) and associated transmission facilities to convey the extracted water to the different water purveyors in the area or into regional facilities. Section 4 presented a summary of potential environmental impacts that could result from the implementation of this project and Appendix A described the potential impacts and where applicable possible mitigation measured and refined project features. Please refer to Section 4 and Appendix A for further details.

5.2.6 Institutional Issues

Based on the discussion of institutional issues presented in Section 4, issues affecting the initial phase of implementation are limited to the spreading of imported water and the construction and operation of new wells and new transmission facilities.

Spreading of Imported Water

The basic institutional arrangements exist to allow TVMWD to store water in the Six Basins Area. However, the current Storage and Recovery Agreement with Watermaster limits the total amount of water in storage to 3,500 ac-ft. This agreement would have to be revised to increase the maximum amount that TVMWD could store to the amounts contemplated under this initial phase of implementation up to 8,000 ac-ft per year.

The agreement between Watermaster and PVPA, entered at the time of the Judgment, provides sufficient institutional authority to allow spreading under a Storage and

Recovery Account and limit spreading if necessary to prevent supplemental spreading from contributing to rising water concerns.

The agreement TVMWD and PVPA allows and governs the use of the PVPA San Antonio Spreading Grounds for a conjunctive use project. This agreement spells out the technical and legal responsibilities for both TVMWD and PVPA when using the spreading facilities for imported water.

Construction and Operation of New Wells and Pipelines

Construction and operation of the new wells in the Lower Claremont Heights proposed as part of the Initial Phase of Implementation could potentially be undertaken by individual purveyors to supplement their own system facilities with no unique institutional issues. In this case, TVMWD would transfer water from its storage account to other local parties under the Judgment to produce additional water.

However, since recovered water could at times be delivered to other TVMWD member agencies outside of the local basin producers, it may be desirable for TVMWD to construct and operate some or all of the new wells. As a Municipal Water District, TVMWD has the authority to construct and operate water supply facilities including production wells so no new institutional arrangement would be needed for TVMWD own and operate all or some of the recovery wells as well as the pipelines and appurtenances. Any water produced by TVMWD would be delivered into the proposed new transmission facilities and for blending with water produced from the Miramar Plant to meet demands for agencies within TVMWD's service area.

5.2.7 Legal/Judgment Considerations

There is language in the Judgment and preceding agreements that establish the basis for implementing the Initial Phase of Importing water for spreading at the SASG. However, agreements would have to be modified to allow the levels of potential imported water storage contemplated under the Scenarios, subject to approval by all parties and following additional CEQA review to the extent that a program greater than that already covered under the current TVMWD plan is proposed.

One area in the Judgment that needs further definition and clarification relates to the losses of stored water from the basin. Item B7 of Section III of the Judgment, Declaration of Rights and Responsibilities, indicates that if the Watermaster reasonably determines that Replenishment had to be terminated or curtailed in any year because of insufficient storage capacity, some or all of a Party's unproduced Carryover rights or Storage and Recovery rights may be deemed lost based on different priorities. Storage of imported water has the fourth priority and could be lost or reduced under these circumstances. This could result in substantial financial losses for TVMWD under the current Judgment, if PVPA had placed imported water in the basin under a storage agreement.

5.3 Subsequent Phases

The nature of subsequent phases of implementation would be highly depend on what is learned in the initial phase and could conceivably include the construction of additional extraction and transmission facilities in the Martin Cienega area (Area 2) and in the southern portion of the Pomona Basin as identified in Section 3. Details of how production should be increased or curtailed in this basin have been provided in that section. Section 3 also provides information on how the Martin Cienega wells should be operated to reduce and/or eliminate rising water in that area.

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A Division of GEI Consultants

Geotechnical
Environmental and
Water Resources
Engineering

Feasibility Study

Imported Water Spreading at San Antonio Spreading Grounds

Claremont, California

SUBMITTED TO

THREE VALLEYS MUNICIPAL WATER DISTRICT

April 2005
Project Number: 040740

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Executive Summary

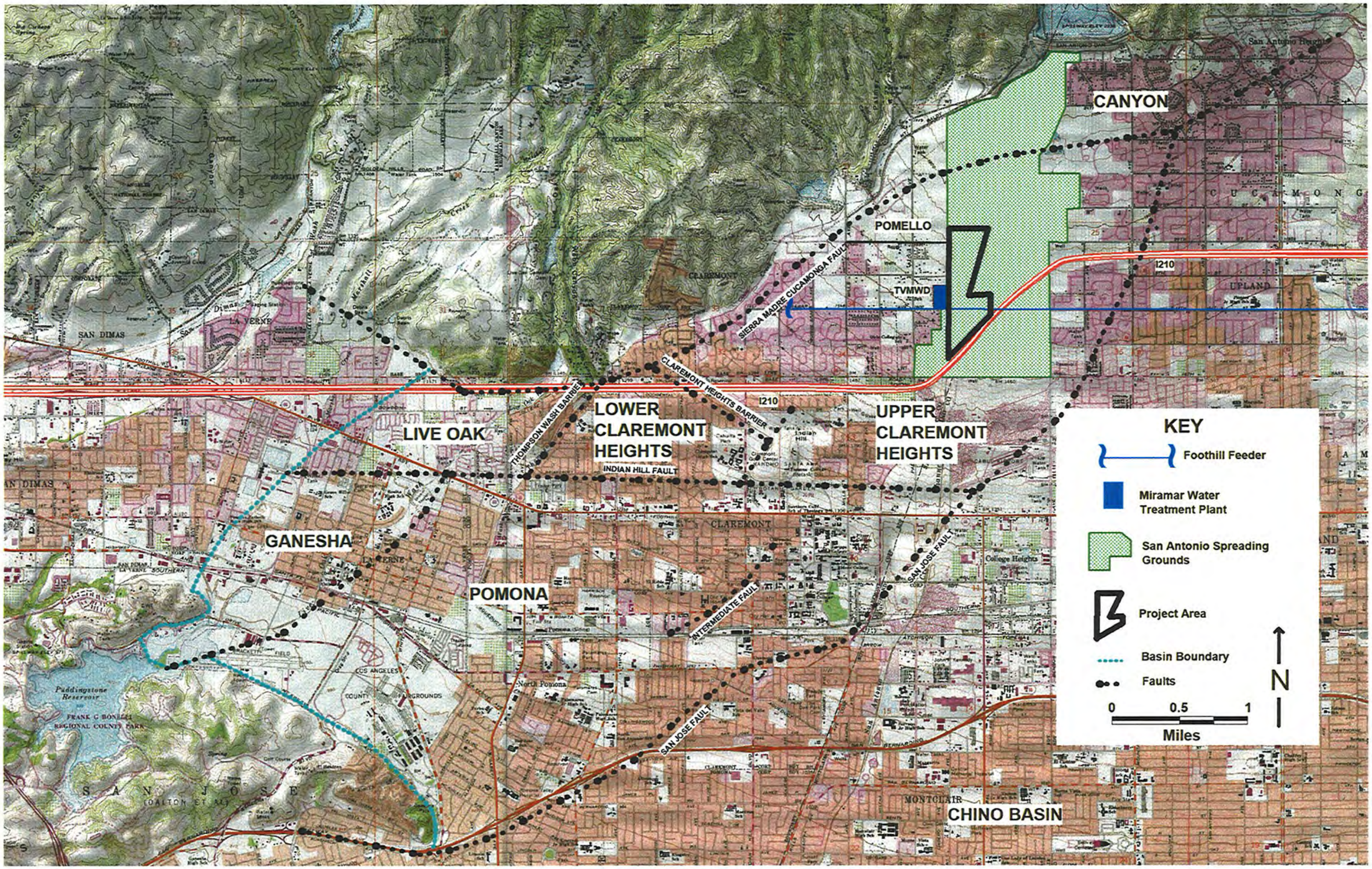
The proposed Imported Water Spreading at San Antonio Spreading Grounds Project (Proposed Project) would construct facilities to allow spreading of State Water Project (SWP) water delivered via Metropolitan Water District of Southern California's (Metropolitan) Foothill Feeder/Rialto Pipeline (Foothill Feeder) in the San Antonio Spreading Grounds (Spreading Grounds). The spread water would recharge the Upper Claremont Heights Basin, one of the six groundwater basins collectively adjudicated as the Six Basins. This report evaluates the technical, legal, institutional, political, environmental and economic issues associated with the Proposed Project. **Figure ES-1** shows the Project Vicinity. The Proposed Project will operate within the rules of the Six Basins Adjudication.

Objectives of the Proposed Project include:

- Improve the reliability of water supply in the Six Basins.
- Store imported water when available in order to provide supply in dry years.
- Reduce annual and seasonal peak demand on surface water treatment plants
- Increase operational flexibility in the SWP and Metropolitan's transmission facilities by allowing delivery for recharge rather than for direct use.
- Reduce the cost of purchased water.
- Store water for extraction during dry years.

By accomplishing these goals, the project would increase overall water supply reliability for purveyors within the service area of Three Valleys Municipal Water District, INLAND EMPIRE, Metropolitan and all State Water Contractors.

Grant Agreement No. 4600003165 between Three Valleys and the California Department of Water Resources (DWR) Groundwater Management Assistance Fund has funded this feasibility study. While Six Basins Watermaster (Watermaster) prepared and submitted the grant application that resulted in funding of this study, contractual issues prevented the Watermaster from receiving the funding. The grant and responsibility for the study was assigned to Three Valleys by DWR. While Three Valleys is managing this Feasibility Study, the Proposed Project will provide direct benefits to all Six Basins pumpers. At the time of the application for funding, the project title was the Six Basins Groundwater Recharge Feasibility Study.



Imported Water Spreading at San Antonio Spreading Grounds	Bookman-Edmonston A Division of GEI Consultants	Project Vicinity	
Three Valleys Municipal Water District Claremont, California	040740	April 2005	Figure ES-1

Water Service in Six Basins Area

Water purveyors in the Six Basins area serve a combination of groundwater, local surface water and imported water. Purveyors purchase imported water from either Three Valleys Municipal Water District (the majority) or Inland Empire Utilities Agency (Inland Empire). Those two agencies receive imported water from Metropolitan Water District of Southern California (Metropolitan). Due to the arrangement of Metropolitan's facilities, the imported water is from the State Water Project.

Three Valleys Municipal Water District (Three Valleys) incorporates portions of East San Gabriel Valley, Pomona Valley and Walnut Valley for a total area of approximately 133.3 square miles. Population as of 2000 was approximately 526,000. Three Valleys has 17 member agencies which generally receive water from a variety of sources including imported water (via Metropolitan), groundwater and surface. Four member agencies also receive recycled water. The Three Valleys service area is mostly urbanized and demand has been increasing at a rate of approximately one percent annually. Projected demand for 2005 is 143,000 acre-feet including 12,500 acre-feet of recycled water. Projecting to 2020, demand is anticipated to continue increasing at approximately one percent per year.

The Inland Empire's 242 square mile service area is located in the southwestern section of San Bernardino County. Population in 2000 was 620,000. The Agency serves the cities of Chino, Chino Hills, Fontana, Montclair, Ontario and Upland, as well as the Monte Vista Water District and the Cucamonga County Water District. Within the boundaries, there are eight retail water agencies that provide water to residents in the Agency's service area. Some of these water agencies provide water to areas outside of the Agency's service area. In addition, there is significant agricultural water use in the service area. The Inland Empire service area has recently experienced a higher rate of growth than Three Valleys and has more vacant land available for urbanized. Projected demand for 2005 is 264,500 acre-feet. Projecting to 2020, demand is anticipated to increase at approximately two percent per year.

Major treatment facilities include four surface water treatment plants: Metropolitan's Weymouth Filtration Plant (Weymouth), Three Valley's Miramar Water Treatment Facility (Miramar), the City of Pomona's Pedley Water Treatment Plant (Pedley) and the Water Facilities Authority's Agua de Lejos Water Treatment Plant (jointly owned by five Inland Empire members through the Water Facilities Authority). Weymouth, Miramar all treat imported water. Pedley treats water from San Antonio Canyon.

The proposed project would most directly affect the Four Basins (Canyon, Upper Claremont Heights, Lower Claremont Heights and Pomona). Since 1999 Operating Safe Yield for Four Basins has ranged from 22,000 acre-feet in 1999 down to 16,500 acre-feet in 2004. The trend has been constantly down for this five year period. Actual production has been less than the Operating Safe Yield due to a variety of operational and water quality challenges.

San Antonio Spreading Grounds

Spreading of imported water will occur in the San Antonio Spreading Grounds, owned and operated by the Pomona Valley Protective Association (PVPA). The San Antonio Spreading Grounds is located within the Los Angeles County and San Bernardino County. The Los Angeles County portion is within the City of Claremont, and the San Bernardino county portion is within the City of Upland. San Antonio Dam is located on the north end of the Spreading Grounds and San Antonio Channel flows from the dam through the Spreading Grounds. While the channel is located to the west of the County border, it is commonly used as the line to split the Spreading Grounds into a Los Angeles and a San Bernardino side.

San Antonio Dam was constructed in 1956 and is owned and operated by the Corps of Engineers. Although water conservation was not formally authorized as a project purpose at San Antonio Dam, it is the policy of the U.S. Army Corps of Engineers to assist local agencies in the conservation of water to the maximum extent possible without interfering with flood-control functions. (Corps of Engineers, 1991)

The main diversion gates located below the dam allow a maximum diversion of 800 cubic feet per second. The maximum diversion is split roughly one-third, two-thirds between the Los Angeles and San Bernardino sides respectively. While diversion of 800 cubic-feet per second (cfs) is possible, it is not possible to spread this flow for any period of time. As a practical matter, approximately 250 cfs can be diverted. While the majority of this flow will recharge the groundwater basins, some flows leaving the Spreading Grounds. Approximately 150 cfs can be diverted and spread without any losses.

Both the Los Angeles and the San Bernardino sides consist of a series of levees, check dams, spreading ponds and control structures which allow the water to be captured and controlled in such a manner as to allow the maximum underground recharge with the least interference with other operations and facilities. The control structures are operated manually.

The facilities on the two sides are very different; with the Los Angeles side being more fully developed and having more control facilities than does the San Bernardino side. The San Bernardino side, however, due to mining operations over a period of years that have produced several large pits, has a greater capacity and during wet periods more water is generally spread on the San Bernardino side. A series of maintenance roads on both sides allow the Spreading Grounds to be periodically checked and maintained. Only a portion of that land is actually used for spreading.

CDM is under contract to PVPA to prepare conceptual layouts of the Spreading Grounds to improve management of spreading. At present CDM envisions extending the existing Diversion Channel on the Los Angeles side of San Antonio Channel. This extended channel would allow directing all spreading on the Los Angeles side to selected basins.

Vulcan Materials Company-Western Division (Vulcan) and Holliday Rock Company, Inc. (Holliday Rock) lease portions of the Spreading Grounds. Each of these companies has proposed mining operations on the Los Angeles side of the Spreading Grounds. The project applications prepared by both companies propose reclamation plans that are consistent with spreading operations.

Imported Water Source

The Proposed Project would store imported water delivered via the Foothill Feeder and Miramar's Plant Intake Pipeline (Intake Pipeline). The Foothill Feeder has a rated capacity of 611 cfs in the vicinity of Miramar. It crosses through the Spreading Grounds in line with Miramar Avenue and within a 200-foot wide easement. Deliveries to the Miramar Treatment Plant are made at Service Connection PM-21 (PM-21) located along Miramar Avenue just west of the Spreading Grounds. PM-21 has a capacity of 80 cfs.

Geology and Hydrogeology

The Six Basins consist of six interconnected groundwater basins underlying portions of the cities of Claremont, La Verne, Pomona, Upland, and surrounding unincorporated areas of Los Angeles and San Bernardino counties. The Six Basins are shown on Figure ES-1 and include Canyon Basin, Upper Claremont Heights Basin (UCHB), Lower Claremont Heights Basin (LCHB), Pomona Basin, Live Oak Basin and Ganesha Basin.

Four of the six basins are affected by spreading in the Spreading Grounds: the Canyon Basin, UCHB, LCHB, and the Pomona Basin. Of particular concern in the planned recharging of natural runoff, or of the spreading of State Water Project water, are the potential effects to historical areas of rising water and to new constructions like State Route 210 and gravel operations.

A number of cienegas have historically produced rising water in the cities of Claremont and Pomona. Reports as early as 1888 record areas where flowing water occurred. Increased water use has generally lowered the groundwater levels in these areas, but following very wet years groundwater levels have risen high enough to be a serious problem.

To estimate how much spreading could occur in the Spreading Grounds without producing adverse high groundwater effects, recharge capacities were estimated for the UCHB and Pomona basins. By using hydrographs from thirteen wells and the historical spreading records for the Spreading Grounds the effect of recharge on groundwater levels were estimated and the available recharge capacities calculated.

The estimates of available recharge capacities for each well were then compared to determine which wells showed adverse high groundwater levels in response to recharge. The recharge capacities were then used to estimate the recharge volumes that produced adverse effects in each area. Finally, the probabilities of different recharge amounts were estimated from historical groundwater levels based on Mountain View 4 well, the well that responds most quickly to recharge. Using this methodology for Mountain View 4, the well most directly affected by the Spreading Grounds, it was found that the average rise in water level was 1 foot per 100 acre-feet of recharge over a period of a few months.

The recharge capacity is also dependent on the maximum allowable water level. The maximum elevation was assumed to be the surface minus 50 feet. This maximum was determined by using 40 feet to water for the liquefaction susceptibility zone (a) as determined in the Mount Baldy and Ontario seismic hazard evaluations (California Division of Mines and Geology (CDMG), 2000), and a margin of safety of 10 feet.

Calculation of the recharge capacities by this method yielded several conclusions regarding recharge and well groundwater elevations:

- Wells closest to the Spreading Grounds show a larger rise in groundwater level over a shorter period of time than do more distant wells.
- Well groundwater levels in the UCHB drop back to pre-recharge levels, where as groundwater levels in Pomona Basin wells tend to remain elevated.

For these reasons, estimates of recharge capacities in UCHB wells are more useful for determining spreading volumes at the Spreading Grounds. The amount of spreading that can be done each year can be determined from the plots of the well recharge capacities as described above. However, a comparison of the recharge capacities of wells indicates that the well Mountain View 4 and College 1 have the greatest changes in groundwater elevation per unit of spreading with 1 foot rise per 100 acre-feet of spreading. Both wells are close to the Spreading Grounds, and Mountain View 4 is the closest down gradient well.

The spreading of imported water in the Spreading Grounds will not produce any significant adverse groundwater quality affects, and any potential affects related to rising groundwater can be mitigated by groundwater level monitoring and limiting the amount of imported water spread. The maximum amount of imported water spread should be determined by the recharge capacity calculated at Mountain View 4, and for best management practices the imported water will need to be extracted from the UCHB before it is arrives at the Pomona Basin.

Environmental Documentation

Three Valleys is the lead agency for the Proposed Project with the principal responsibility for carrying out and approving the project and therefore the principal responsibility preparing CEQA documents.

A Notice of Preparation/Initial Study has been prepared. The Initial Study found that the project could potentially affect biological resources, mineral resources, hydrology/water quality, geology/soils and mandatory findings of significance.

The proposed project may have a significant effect on the environment, and an Environmental Impact Report is required. Three Valleys will accept written responses and comments on the Notice of Preparation/Initial Study between February 25, 2005 and March 28, 2005. The anticipated completion of environmental documentation is June 30, 2005.

Institutional Issues

Operation of the proposed project will be subject to a coordinated operating agreement between Three Valleys and the Pomona Valley Protective Association (PVPA) and will be overseen by the Six Basins Watermaster.

The Six Basins Operating Plan addresses use of the Spreading Grounds for Replenishment Water, and of Replacement Water.

A Memorandum of Agreement between the Pomona Valley Protective Association and Watermaster of the Six Basins relating to Water Spreading and Related Activities addresses use of the Spreading Grounds by PVPA and responsibilities of Watermaster.

PVPA and Watermaster will reach agreements covering construction and operations.

Vulcan leases property from PVPA for the purpose of mining aggregate. They have an ongoing operation on the San Bernardino side of the Spreading Grounds. Vulcan leases 214 acres on the north end of the Los Angeles side. The Los Angeles side is currently under review for a conditional use permit to allow mining. The Proposed Project does not include the land leased by Vulcan.

Holliday Rock leases property from PVPA for the purpose of mining aggregate. They have recently prepared a mining and reclamation plan to mine the southern portion of the Los Angeles side. Most of the Proposed Project is within the area that Holliday Rock proposes mining. Discussions between the District and Holliday Rock indicate that the two projects are compatible.

Metropolitan has a 200-foot wide easement near the southern end of the Spreading Grounds. The northern edge of this easement is approximately in line with the southern edge of the Miramar Treatment Plant. Metropolitan's Foothill Feeder and Service Connection OC-59 are within this easement.

A permit from the Los Angeles County Department of Public Works will be required for crossing San Antonio Channel. Public Works will coordinate the permit with the Los

Angeles District Army Corps of Engineers. Presuming that the initial Flood Permit Application meets all requirements, it will take two to four months for the permit process.

The Cities of Claremont and Upland will be provided an opportunity to review design drawings for portions of the construction located within their cities.

Proposed Facilities

The proposed facilities include a connection to the Foothill Feeder, two pipelines into the spreading grounds and turnouts into existing spreading basins or possible future basins to be developed by others. Allowance will be made for the possible future installation of a pump station. The facilities have been sized for maximum flexibility to allow opportunistic operation of the project. **Figure ES-2** shows schematically the proposed facilities.

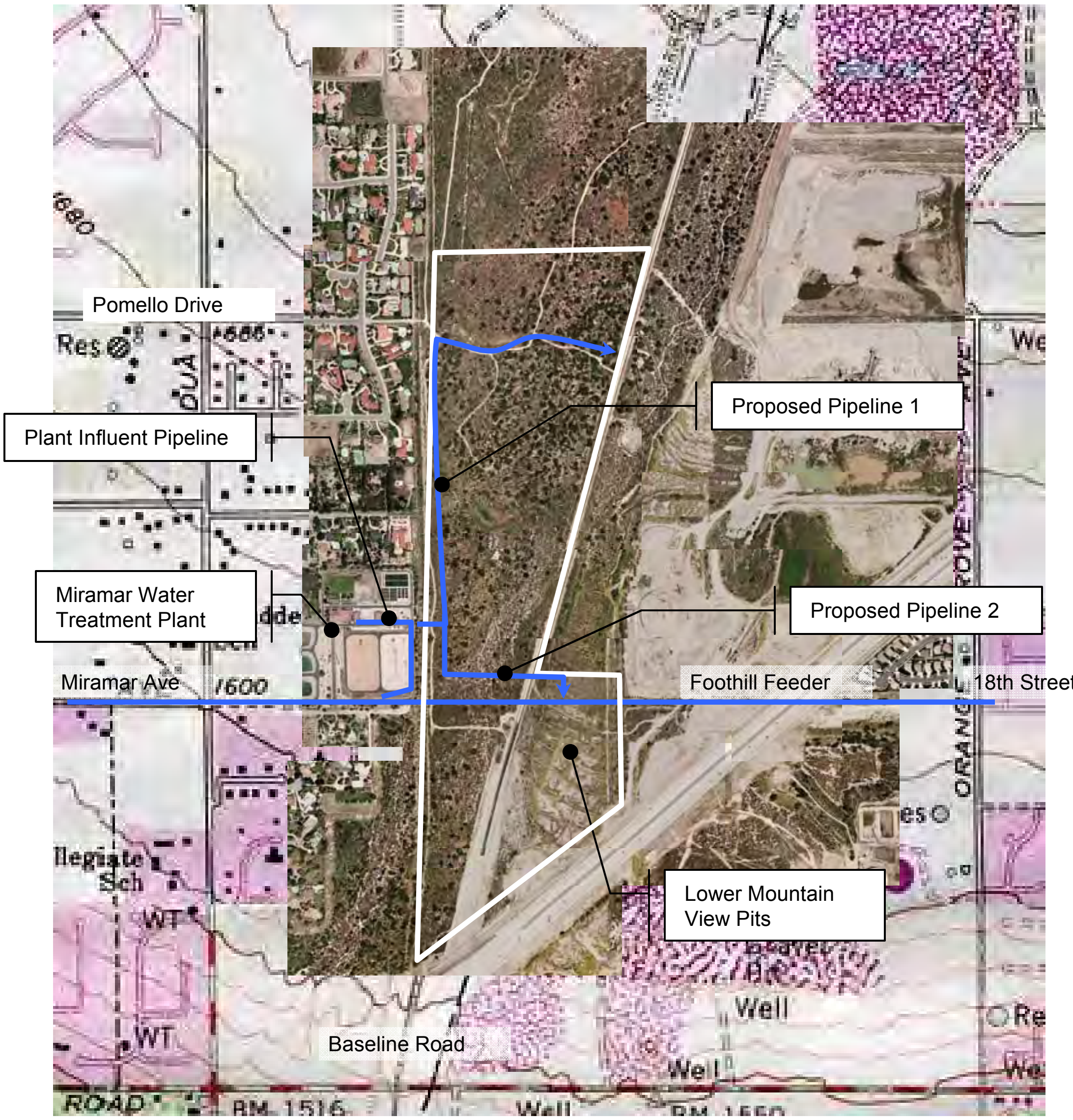
The connection to the Foothill Feeder will take advantage of Three Valley's existing 80 cfs connection that serves Miramar. Miramar has a design capacity of 40 cfs and generally operates at capacity. Sizing the connection for 40 cfs will allow use of the full capacity of the service connection while Miramar is operating at full capacity. In order to avoid – or at least defer – construction of a pump station while still allowing flexibility of operations, two pipelines are proposed.

Pipeline 1 is intended to maximize the area available for spreading imported water. It will extend north from Miramar along the west edge of the Spreading Grounds and then east along the extension of Pomello Drive to the Diversion Channel. This pipeline, sized to deliver 40 cfs, will allow spreading in the three of the basins proposed by PVPA. Three outlet structures, one for each basin, will be provided.

Pipeline 2 is intended to allow spreading operations during conditions of minimum pressure. This pipeline, sized for 20 cfs, will extend east across San Antonio Channel to the existing Lower Mountain View Pits. Spreading will be possible when the hydraulic grade line (HGL) in the Foothill Feeder is relatively low.

Outlet structures will be sized for the full capacity of their respective pipeline. The proposed outlet structures will be located consistent with the proposed improvements by PVPA. Watermaster will work with PVPA to complete this project.

This project does not include modifications to the basins within the Spreading Grounds. The proposed facilities can be modified to accommodate both PVPA's proposed improvements and Holliday Rock Company's proposed mining operations.



Imported Water Spreading at San Antonio Spreading Grounds	Bookman-Edmonston A Division of GEI Consultants	Proposed Project Facilities
Three Valleys Municipal Water District Claremont, California	040740 / April 2005	Figure ES-2

Table ES-1 shows the preliminary cost estimate of $2.1 million based on current costs and $2.2 million based on 2007 price level. This cost includes capital costs for constructing the connection to the District's Intake Pipeline, a 24-inch pipeline to the Lower Mountain View Pits and a 36-inch pipeline north to Pomello Drive and then east along the extension of Pomello Drive to the Diversion Channel. Costs for a pump station and a production well are not included. District administrative costs are not included. A 20-percent contingency is included in the construction cost.

Table ES-1
Capital Cost Estimate

Item	Total
Design	150000
Biological focused surveys □ mitigation plans (allowance)	50,000
Construction Contract Total	1,728,794
Construction Management	160,000
Project Capital Cost, May 2005 price level	**□ 2,088,794**
Adjust to midpoint of construction (2007)	106□
Project Capital Cost, 2007 price level	**□ 2,214,122**
Note: Does not include District administration costs.	

Metropolitan has committed $1.23 million to the Proposed Project. If funding is not available for the remaining $1.0 million, the length of the 36-inch pipeline can be reduced with little impact on project operations. Eliminating the portion that follows the extension of Pomello Drive to the Diversion Channel would reduce project costs to approximately $1.8 million.

Proposed Operations

This section covers the impact of operations on groundwater production by evaluating a possible operational scenario. It then reviews the monitoring that will both determine how much water can be spread and verify the impact of the spreading. Finally the physical operation of the Proposed Project is reviewed. As previously discussed, the Proposed Project will be operated in accordance with the Six Basins Adjudication. It will allow implementation of storage and recovery programs and provision of replacement water in accordance with the Adjudication.

A spreadsheet was developed to model the response of water levels in the Upper Claremont Heights Basin (UCHB) to spreading and recovery of imported water. Water levels in Mountain View 4 well are used as the surrogate for the water levels in the entire basin. A repeat of historic conditions from 1973 through 2003 is presumed – with native recharge limited to maintain water levels at no higher than 50 feet below ground surface (bgs). The spreadsheet was used to examine a hypothetical scenario for spreading imported water.

The scenario presumes that up to 8,000 acre-feet of imported water is available to spread each year. A maximum of 12,000 acre-feet is recovered in any year and up to 15,000 acre-feet of imported water is kept in storage to maintain water levels and dry-year supplies.

Additionally, the scenario allows up to 3,000 acre-feet of additional native water to be pumped if the water level is above 70 feet bgs.

Implicit in these scenarios is the assumption that pumpers could change their operations if the Proposed Project were in place. With the knowledge that imported water is available to supply replacement water, pumpers could increase their pumping. Naturally occurring high water levels could be pumped down faster making additional space for both native and imported water spreading.

This scenario demonstrates some of the options that are available and the some of the operational decisions that will be required. Actual operations will be developed by an operating committee. Operations will start at a low level and will increase over time as understanding of the response of the groundwater basin improves and the institutional relationships required to operate the proposed project develop.

Table ES-2 summarizes the results of this scenario over a thirty-one year history.

Table ES-2
Results of Hypothetical Operational Scenario
Presumes up to 8,000 acre-feet/year spread each year depending of basin capacity
(based on 1973 through 2003 historic hydrology)

	Results
Spreading and recovery over time period (acre-feet)	
Imported water stored	165,679 acre-feet
Imported water recovered	155,624 acre-feet
Imported water in storage at end of period	10,055 acre-feet
Increase in native water pumping	3,250 acre-feet
Total increase in recovery	158,874 acre-feet
Average annual increase in groundwater recovery	5,125 acre-feet/year
Water levels at Mountain View 4	
Average Water Surface Elevation (135 ft bgs without project)	129 feet bgs
Months water surface elevation 150 ft bgs or more (131 months without project)	114 months
Months water surface elevation 200 ft bgs or more (66 months without project)	0 months
Water level at end of period (225 feet bgs without project)	160 feet bgs

Table ES-2 shows that the Proposed Project can substantially increase the average groundwater yield in Six Basins. At the same time, it can reduce average pump lifts and increase the local water supply during drought.

Operations will not start at the levels used in making the above projections. Initially, only a portion of the available storage will be used. As the reaction of the basin to that storage is understood and as the institutional relationships develop, operations will be cautiously increased.

Scheduling of operations will have to be coordinated closely with Metropolitan and other agencies that depend on the Foothill Feeder. Some of the scheduling challenges in the San Gabriel River area are worked out in a long standing committee of the replenishing agencies, Metropolitan, County Sanitation District as a supplier of recycled water, the County as operator of the facilities and sometimes the Corps as owner and operator of some facilities. This group meets every six weeks to two months depending upon the issues. Three Valleys has attended these meetings.

Annual Operating Cost

Table ES-3 shows projections of the annual operating cost basis of an average of 5,000 acre-feet stored and recovered per year.

Table ES-3
Annual Operating Cost
(5,000 acre-foot/year storage and recovery.)

Item	Cost
Purchase of untreated replenishment water from Metropolitan at $238 per acre-foot (January 1, 2005 rates)	$ 1,175,000/year
Energy to deliver (Assume Feeder pressure is adequate for deliveries)	-
Gate operations, etc during deliveries (say 4hr/d □ 80 day/year, $70/hr)	22,400/year
Increased maintenance of Spreading Grounds (say 160 hr/year at $120/hr)	19,200/year
Additional groundwater monitoring (say 120 hr/year at $90/hr)	10,800/year
Pumping energy - recovery of 5,000 af from 150 ft bgs (e□70□; $0.12/kWh)	131,700/year
Annual operating cost	□ **1,359,100□year**
Acre-feet/year	5,000 acre-foot
Operating cost per acre-foot including purchase of water	□ **272□acre-foot**

A simplified approach to quantifying the benefits is to quantify the savings to the Six Basins pumpers from operating the project compare the purchase, storage and recovery of untreated replenishment water from Metropolitan to the purchase of full service treated water. **Table ES-4** shows this calculation based on an average storage and recovery of 5,000.

Table ES-4
Annual Operating Benefit
(5,000 acre-foot/year storage and recovery. Does not include capital costs)

Item	
Cost of full service treated water from Metropolitan (90% at Tier 1 rate of $443/acre-foot and 10% at Tier 2 rate of $524/acre-foot, January 1, 2005 rates)	$451/acre-foot
Cost of water spread and recovered by Imported Water Storage Project	$272/acre-foot
Reduced cost of purchased water per acre-foot	**$179/acre-foot**
Annual storage and recovery	5,000 acre-foot
Reduced annual water supply cost presuming 5,000 acre-feet/year storage and recovery	**$ 895,000/year**

The calculation does not include the capital cost of the project. Metropolitan has agreed to pay for a portion of the project's construction due to benefits to Metropolitan's operations and improved water supply reliability within Metropolitan's service area. Were the portion not funded by Metropolitan included in this calculation at a 5 percent interest rate over a 50 year life, the increase in project costs would be only $22 per acre-foot and the Proposed Project would reduce annual water supply cost by $ 785,000 per year rather than $ 895,000.

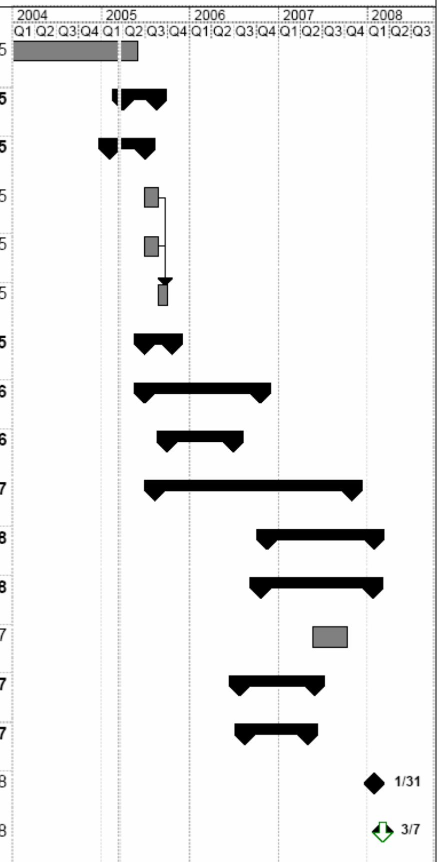
Project benefits to Six Basins pumpers are understated in the calculation as it does not address improved reliability, reducing the Six Basins pumpers dependency on imported supplies when there are shortages of imported supplies (either State Water Project or Colorado River), deferring the need to expand treatment capacity, and increasing operational flexibility of Metropolitan's system and the State Water Project.

Proposed Schedule

Three Valley's proposed Groundwater Storage Funding Agreement with Metropolitan provides supplemental funding for this project. That agreement requires the project to be operational by May 2008 including a production well. Completion of CEQA documentation in June 2005 is required for that agreement to be approved by the Metropolitan Board in August 2005. The most difficult scheduling challenge for construction of the project and operations will be the anticipated biological mitigation. A short version of the preliminary schedule is shown in **Figure ES-3**.

Figure ES-3
Proposed Project Schedule

ID	Task Name	Duration	Start	Finish
1	**Feasibility Study**	370 days	Thu 1/1/04	Tue 5/31/05
2	**Institutional Coordination**	**100 days**	**Fri 4/1/05**	**Thu 8/18/05**
5	**Environmental\CEQA**	**105 days**	**Sat 2/5/05**	**Thu 6/30/05**
19	**RFP Process - Spreading Connection**	40 days	Fri 7/1/05	Thu 8/25/05
20	**RFP Process - Production Well**	40 days	Fri 7/1/05	Thu 8/25/05
21	**MWD review of budget and schedule**	25 days	Fri 8/26/05	Thu 9/29/05
22	**DWSAP Program**	**80 days**	**Fri 7/1/05**	**Thu 10/20/05**
25	**Imported Water Connection Design**	**340 days**	**Fri 7/1/05**	**Thu 10/19/06**
40	**Production Well Design**	**195 days**	**Fri 9/30/05**	**Thu 6/29/06**
46	**Environmental Mitigation**	**580 days**	**Fri 8/12/05**	**Thu 11/1/07**
56	**Imported Connection Construction**	**315 days**	**Fri 11/17/06**	**Thu 1/31/08**
70	**Imported Connection CM**	**330 days**	**Fri 10/20/06**	**Thu 1/24/08**
76	**Operating committee & initial operati**	100 days	Fri 5/25/07	Thu 10/11/07
77	**Production Well Construction**	**220 days**	**Fri 7/28/06**	**Thu 5/31/07**
87	**Production Well CM**	**185 days**	**Fri 8/18/06**	**Thu 5/3/07**
94	Project completion	0 days	Thu 1/31/08	Thu 1/31/08
95	**Funding Deadline for Imported Conn**	0 days	Fri 3/7/08	Fri 3/7/08



The environmental mitigation requirements, while not costly compared to the basic construction costs, present a management challenge. There are choices available for the timing of various steps of the environmental mitigation. Those choices will have to be weighed and informed decisions made as the project moves forward.

Recommendation

The Proposed Project is physically feasible and will result in substantial direct benefits to Six Basins pumpers. Those benefits are both reduced cost of water supply and improved reliability of water supply. In addition the project benefits the other members of Three Valleys and Inland Empire, all Metropolitan member agencies and all State Water Contractors by improving water supply reliability during dry years.

Three Valleys should proceed forward with implementation. Completion of the environmental documentation is the next step.

Section 1 Introduction

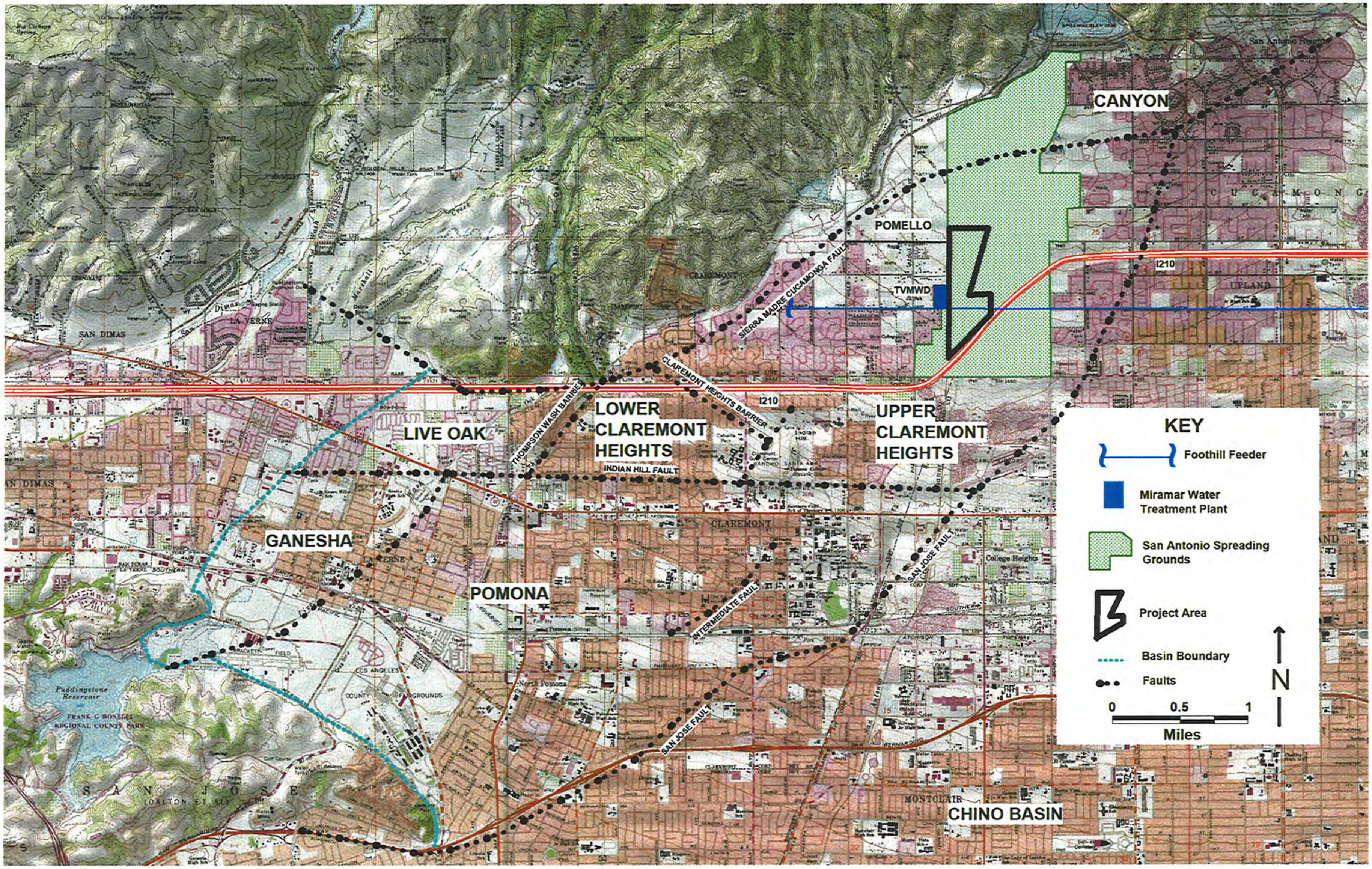
The Imported Water Spreading at San Antonio Spreading Grounds Project (Proposed Project) would construct facilities to allow spreading of State Water Project water delivered via Metropolitan Water District of Southern California's (Metropolitan) Foothill Feeder/Rialto Pipeline (Foothill Feeder) in the San Antonio Spreading Grounds (Spreading Grounds). The spread water would recharge the Upper Claremont Heights Basin, one of the Six Basins. This report evaluates the technical, legal, institutional, political, environmental and economic issues associated with the Proposed Project. **Figure 1-1** shows the Project Vicinity.

Groundwater management in the Six Basins is governed by the stipulated judgment entered in Los Angeles County Superior Court, Case No. KC029152, captioned Southern California Water Company vs. City of La Verne, et al (Six Basins Adjudication); entered December 18, 1998. The Six Basins Operating Plan dated July 1999 and the Rules and Regulations of the Six Basins Watermaster further define the management of the Six Basins. The Six Basins are further divided into the Four Basins and the Two Basins. The Four Basins includes the Upper Claremont Heights Basin. The Proposed Project will operate within the rules of the Six Basins Adjudication.

The Six Basins Adjudication allows for the storage and recovery of imported water and for the spreading of imported water as replacement water. Storage and recover is a program administered by an agreement between the Six Basins Watermaster (Watermaster) and a party to the Six Basins Adjudication to store water in the Four Basins, and subsequently recovering such water. Replacement water includes imported water acquired by the Watermaster or provided by a party to the Six Basins Adjudication to replace production by the party in excess of its share of operating safe yield, carry-over rights, and storage and recovery rights. The Proposed Project will allow implementation of storage and recovery programs and provision of replacement water.

Objectives of the Proposed Project include:

- Improve the reliability of water supply in the Six Basins.
- Store imported water when available in order to provide supply in dry years.
- Reduce annual and seasonal peak demand on surface water treatment plants
- Increase operational flexibility in the SWP and Metropolitan's transmission facilities by allowing delivery for recharge rather than for direct use.
- Reduce the cost of purchased water.
- Store water for extraction during dry years.



Imported Water Spreading at San Antonio Spreading Grounds	Bookman-Edmonston A Division of GEI Consultants	Project Vicinity	
Three Valleys Municipal Water District Claremont, California	040740	April 2005	Figure 1-1

By accomplishing these goals, the project would increase overall water supply reliability for purveyors within the service area of Three Valleys, Inland Empire, Metropolitan and all State Water Contractors.

Grant Agreement No. 4600003165 between Three Valleys and the California Department of Water Resources (DWR) Groundwater Management Assistance Fund has funded this feasibility study. While Six Basins Watermaster (Watermaster) prepared and submitted the grant application that resulted in funding of this study, contractual issues prevented the Watermaster from receiving the funding. The grant and responsibility for the study was assigned to Three Valleys by DWR. While Three Valleys is managing this Feasibility Study, the Proposed Project will provide direct benefits to all Six Basins pumpers. Some Six Basins pumpers rely on Inland Empire to provide supplemental water. At the time of the application for funding, the project title was the Six Basins Groundwater Recharge Feasibility Study.

This feasibility report first reviews water service in the Three Valleys Municipal Water District service area, the San Antonio Spreading Grounds, and the availability of imported water. The Geology and Hydrology of the Six Basins area – the capacity to store water in the aquifer without creating high groundwater conditions – is then evaluated in detail. Based on this understanding of existing conditions institutional issues including CEQA compliance and permitting are discussed. Finally the proposed facilities, their operation, and an implementation schedule are developed.

Section 2 Water Service in Six Basins Area

Introduction

Water purveyors in the Six Basins area serve a combination of groundwater, local surface water and imported water. Purveyors purchase imported water from either Three Valleys or Inland Empire. Those two agencies receive imported water from Metropolitan Water District of Southern California (Metropolitan). Due to the arrangement of Metropolitan's facilities, the imported water is from ultimately from the State Water Project.

Three Valleys incorporates portions of East San Gabriel Valley, Pomona Valley and Walnut Valley for a total area of approximately 133.3 square miles. Population as of 2000 was approximately 526,000. **Table 2-1** shows Three Valley's member agencies and their water sources.

The Inland Empire distributes water, provides industrial/municipal wastewater collection and treatment services and other related utility services for the western portion of San Bernardino County. The Agency's 242 square mile service area is located in the southwestern section of San Bernardino County. The Agency serves the cities of Chino, Chino Hills, Fontana, Montclair, Ontario and Upland, as well as the Monte Vista Water District and the Cucamonga County Water District. Within the boundaries, the eight retail water agencies that provide water to residents in the Agency's service area are shown in **Table 2-2**. Some of these water agencies provide water to areas outside of the Agency's service area. Population as of 2000 was approximately 620,000. Tree Six Basins pumpers either serve Inland Empire members or are Inland Empire members. The City of Upland is both a Six Basins pumper and an Inland Empire member agency. West End Consolidated Water Company is a Six Basins pumper whose majority owner (92 percent) is the City of Upland. Minor owners who receive water include Holliday Rock Company and Southern California Water Company. San Antonio Water Company is a Six Basin pumper and an Inland Empire member who delivers water to their own customers and to the cities of Upland and Ontario for use by their customers.

Table 2-1
Three Valleys Member Agencies

Category/Agency	Water Supply Source			
	Imported	Groundwater	Surface	Reclaimed
Municipalities				
Azusa	X (1)	X	X	
Covina	X	X	X	
Glendora	X	X	X	
Industry	X (1)	X		X
La Verne	X	X		
Pomona	X	X	X	X
West Covina	X (2)	X	X	
Water Companies				
Covina Irrigating Company		X	X	
Southern California Water Company Claremont District	X	X	X	
Southern California Water Company San Dimas District	X	X	X	
Suburban Water Systems	X (1)	X	X	
Valencia Heights Water Company	X (1)	X	X	
Water Districts				
Rowland Water District	X	X(3)		X
Walnut Valley Water District	X	X(3)		X
Institutions				
California State Polytechnic University, Pomona		X	X	
Mt. San Antonio College		X	X	
Private				
Boy Scouts of America	X			

Data Source: Urban Water Management Plan 2000
(1) Imported water not supplied directly by Three Valleys Municipal Water District
(2) City of West Covina is no longer a retail water purveyor. Their retail system was sold to Suburban Water Systems. West Covina is still a Three Valleys member agency.
(3) Groundwater available to these agencies is of very poor quality due to high salt concentrations and is used for non-potable purposes. A small amount of groundwater is purchased from La Verne, with the cooperation of Three Valleys.

Table 2-2
Inland Empire Local Retail Agencies

Category/Agency	Water Supply Source			
	Imported	Groundwater	Surface	Reclaimed
Municipalities				
Chino	X	X		X
Chino Hills	X	X		X
Ontario	X	X	X	X
Upland	X	X(1)		X
Water Companies				
Fontana Water Company	X	X	X	X
San Antonio Water Company	X	X(1)	X	
Water Districts				
Cucamonga County Water District	X	X	X	X
Monte Vista Water District	X	X		

Data source: Inland Empire Utilities Agency, Urban Water Management Plan Year 2000 Update
(1) In addition to directly owning Six Basins rights, Upland owns portions of San Antonio Water Company and West End Consolidated Water Company, both Six Basins pumpers.

Surface Water Treatment Facilities

Major treatment facilities include four surface water treatment plants: Metropolitan's Weymouth Filtration Plant, Three Valley's Miramar Water Treatment Facility and Pomona's Pedley Water Treatment Plant, and the Water Facilities Authority's Agua De Lejos Water Treatment Plant

Weymouth Filtration Plant (Weymouth), owned and operated by Metropolitan, receives imported water from both the Colorado River and the State Water Project. Metropolitan's Upper Feeder, Yorba Linda Feeder and Foothill Feeder all can deliver imported water to Weymouth. Weymouth treats up to 520 million gallons per day. Treated water is delivered to the Central Pool portion of Metropolitan's distribution system.

Miramar Water Treatment Plant (Miramar) receives water from Metropolitan's Foothill Feeder at Service Connection PM-21. Miramar's maximum capacity is 25 million gallons per day. Treated water is delivered to the communities of Claremont and La Verne. Water in excess of the demands of these two agencies is available to Southern California Water Company's San Dimas Service Area and the agencies comprising the Pomona-Walnut-Rowland Joint Water Line.

Pedley Water Treatment Plant (Pedley) treats surface water from San Antonio Canyon and Evey Canyon. The plant has a rated capacity of 4.0 million gallons per day. San Antonio Water Company also receives surface water from San Antonio Canyon.

Agua de Lejos Treatment Plant receives water from Metropolitan's Foothill Feeder. The plant has a capacity of 81 million gallons per day. Treated water is delivered to the Water Facilities Authority owners: the cities of Chino, Chino Hills, Upland, Ontario and the Monte Vista Water District.

Water Supply

Historic water supply within Three Valley's and Inland Empire's service areas are shown in **Tables 2-3 and 2-4** respectively and **Figures 2-1 and 2-2** respectively.

Table 2-3

Historic Water Demand in Three Valleys Service Area

Fiscal Year	Imported Water	Groundwater/ Surface Diversions	Recycled Water	Total Use
1990/91	67,744	42,046	10,644	120,434
1991/92	56,274	36,175	10,846	103,295
1992/93	58,803	44,573	8,388	111,764
1993/94	61,494	49,265	10,601	121,360
1994/95	61,146	48,984	11,222	121,352
1995/96	58,996	61,150	13,019	133,165
1996/97	62,998	57,205	9,048	129,251
1997/98	56,279	56,871	7,946	121,096
1998/99	58,589	58,782	9,018	126,389
1999/00	72,195	58,024	10,377	140,596
2000/01	68,564	57,311	8,540	134,415
2001/02	80,415	58,474	10,987	149,876
2002/03	83,187	47,836	8,463	139,486
2003/04	89,562	49,144	8,110	146,816
Data source: Water Management Plan 2000 for data through 1999/00. Three Valleys staff for more recent data.				

Table 2-4

Historic Water Demand by Inland Empire Local Retail Agencies

Fiscal Year	Imported Water	Groundwater/ Surface Diversions	Total Use
1990/91	62,251	109,575	171,826
1991/92	45,951	119,611	165,562
1992/93	49,828	109,777	159,605
1993/94	55,661	105,460	161,121
1994/95	43,866	124,643	168,509
1995/96	45,635	144,781	190,416
1996/97	48,311	146,479	194,790
1997/98	45,459	124,824	170,283
1998/99	42,719	127,702	170,421
Data source: Urban Water Management Plan, Year 2000 update			

Figure 2-1
Historic Water Supply in Three Valleys Service Area

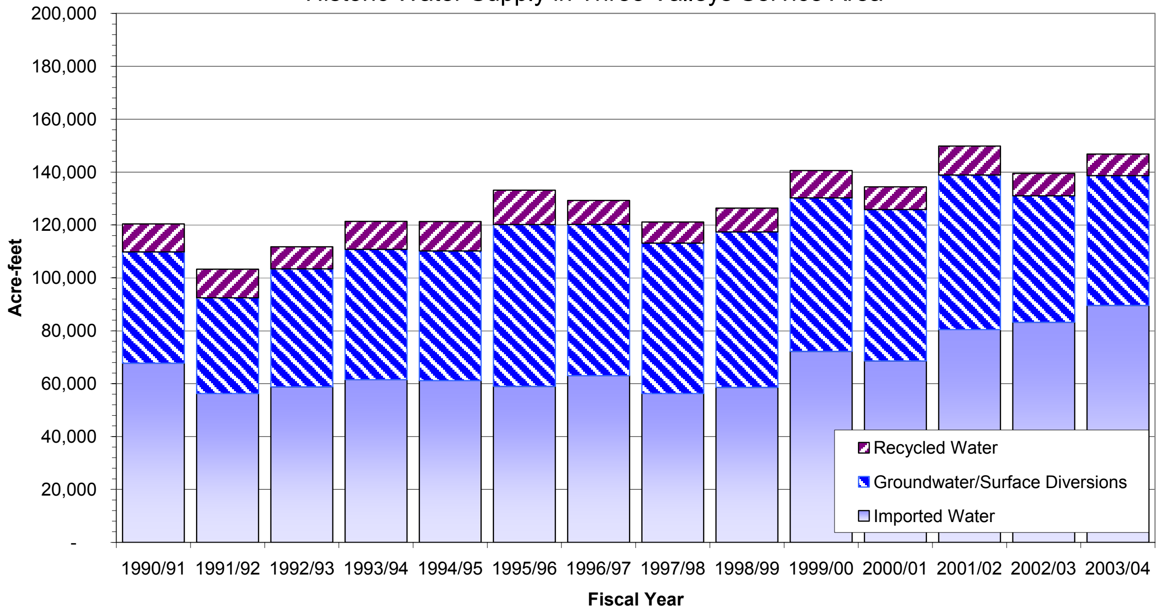
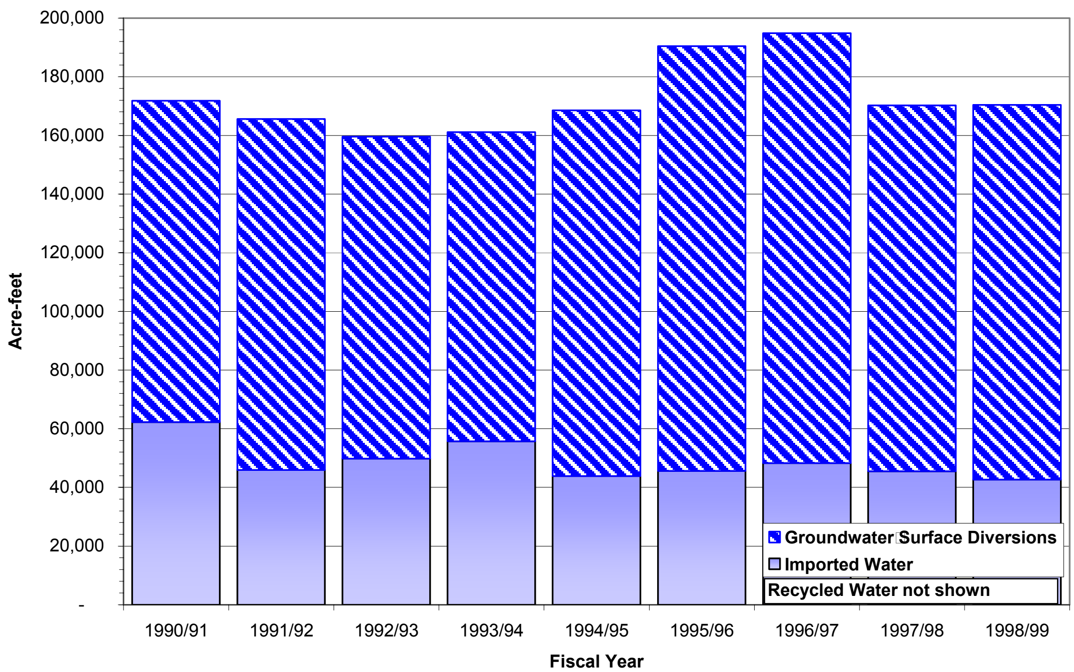


Figure 2-2
Historic Water Supply in Inland Empire Service Area



Projected Demand

Projected water demand in the Three Valleys and Inland Empire service areas are shown in **Tables 2-5 and 2-6**. These projections show an annual increase in water demand of approximately 1 percent.

Table 2-5
Projected Demand in Three Valleys Service Area

Fiscal Year	Agriculture	Residential	Commercial □ Industrial	Recycled [1]	Total Use
2005	1,500	101,820	27,800	12,500	143,620
2010	1,300	105,064	30,300	15,600	152,264
2015	1,200	108,234	32,200	15,800	157,434
2020	1,000	114,538	33,700	16,000	165,238

Data source: Water Management Plan 2000.
(1) Recycled does not include recycling for groundwater replenishment.

Table 2-6
Projected Demand in Inland Empire Service Area

Fiscal Year	Municipal and Industrial	Agriculture	Total Use
2005	234,500	30,000	264,500
2010	257,600	28,900	286,500
2015	280,900	19,700	300,600
2020	305,700	10,000	315,700

Data source: Urban Water Management Plan, Year 2000 Update.

Groundwater Supplies

The Proposed Project would most directly affect the Four Basins Area (Canyon, Upper Claremont Heights, Lower Claremont Heights and Pomona basins). **Table 2-7** shows pumping in the Four Basins Area.

Table 2-7
Production by Pumpers in Four Basins
(acre-feet)

	1999	2000	2001	2002	2003	2004
Operating Safe Yield	22,000	22,000	19,500	18,000	17,000	16,500
Production						
La Verne, City of	845	1,086	787	1,306	1,400	1,412
Pomona, City of	3,104	2,305	2,201	1,271	1,200	1,476
Pomona College	2,168	2,670	2,445	1,166	1,905	2,149
San Antonio Water Co.	964	885	1,303	1,339	1,285	1,355
Southern California Water Co.	7,538	5,120	4,678	5,102	4,430	4,358
Upland, City of	2,682	1,795	2,397	1,300	2,159	1,625
West End Consolidated Water Co.	4,515	2,630	1,983	2,145	1,903	1,756
Total	21,816	16,492	15,794	13,628	14,280	14,131

Note: The City of La Verne is the only pumper from the Two Basins area and production is small compared to Six Basins production. In 2003, production from Two Basins was 265 acre-feet.

A variety of operational and water quality challenges have limited groundwater production in the Four Basins. In particular, production by the City of Pomona has been limited due to water quality challenges in the Pomona Basin. Pomona has recently completed permitting a plant to treat VOC contaminated water from two wells (P-7 and P-8) and, in a future phase will treat water from a third well (P-32). With these wells in operation, Pomona's production will increase substantially. Water quality in the Four Basins area will be discussed further in Section 5.

Section 3 San Antonio Spreading Grounds

Spreading of imported water will occur in the San Antonio Spreading Grounds, owned and operated by the Pomona Valley Protective Association (PVPA). This section reviews the existing facilities and the anticipated improvements to the Spreading Grounds.

Existing Facilities

The San Antonio Spreading Grounds is located within the Los Angeles County and San Bernardino County. The Los Angeles County portion is within the City of Claremont, and the San Bernardino County portion is within the City of Upland. San Antonio Dam is located on the north end of the Spreading Grounds and San Antonio Channel flows from the dam through the Spreading Grounds. While this channel is located to the west of the County border, it is commonly used as the line to split the Spreading Grounds into a Los Angeles and a San Bernardino side. State Route 210 marks the south end of the spreading grounds. Portions of the Spreading Grounds extend south of State Route 210. The portions south of State Route 210 are not used for spreading.

San Antonio Dam was constructed in 1956 and is owned and operated by the Corps of Engineers. It not only provides flood control on San Antonio Channel, but also is part of the flood control facilities of the Santa Ana River Main Stem. Thus its operations are coordinated with the Main Stem dams: Prado Dam and Seven Oaks Dam. The rate of discharge from the Dam is calculated based on water levels and gate settings. Although water conservation was not formally authorized as a project purpose at San Antonio Dam, it is the policy of the U.S. Army Corps of Engineers to assist local agencies in the conservation of water to the maximum extent possible without interfering with flood-control functions. (Corps of Engineers, 1991)

The Main Diversion Gates located below the dam allows water diversions from the channel to the Spreading Grounds. Two 4-foot by 4-foot gates allow diversion to the west side of the Spreading Grounds and four similar gates allow diversion to the east side. These gates allow a maximum diversion of 800 cubic feet per second (cfs). The maximum diversion is split roughly one-third, two-thirds between the Los Angeles and San Bernardino sides respectively. These gates are controlled by PVPA and are locally operated locally. While there are flow meters at this structure, they are not currently calibrated.

Both the Los Angeles and the San Bernardino sides consist of a series of levees, check dams, spreading ponds and control structures which allow the water to be captured and controlled in such a manner as to allow the maximum underground recharge with the least interference with other operations and facilities. The control structures are operated manually.

The facilities on the two sides are very different; with the Los Angeles side being more fully developed and having more control facilities than does the San Bernardino side. The San Bernardino side, however, due to mining operations over a period of years that have produced several large pits, has a greater capacity and during wet periods more water is generally spread on the San Bernardino side. A series of maintenance roads on both sides allow the Spreading Grounds to be periodically checked and maintained. Only a portion of the land is actually used for spreading.

The Los Angeles side facilities include a Diversion Channel that parallels San Antonio Channel. Diversion Structures #2 through # 6 divert water to channels and basins for spreading. The only named basin is Drabble Pit which receives water diverted at Diversion #4. The majority of the spreading occurs along grassy and rocky channels that in some cases are not well defined, and in the form of sheet flow as these channels overflow.

On the San Bernardino side water can be diverted into Calmat Pit No 5, the Upper Mountain View Pits and the Lower Mountain View Pits.

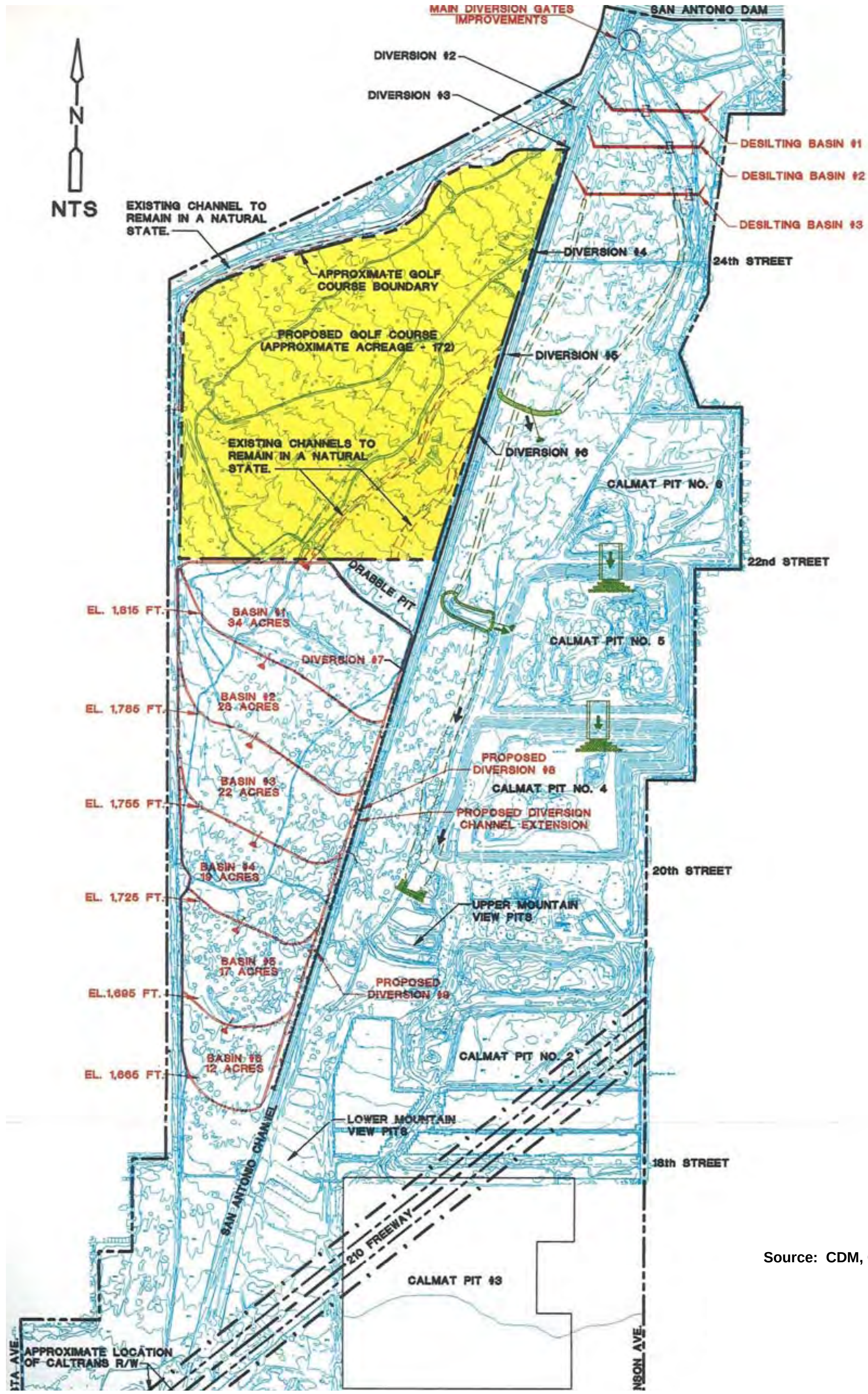
While diversion of 800 cfs is possible, it is not possible to spread this flow for any period of time. As a practical matter, approximately 250 cfs can be diverted. While the majority of this flow will recharge the groundwater basins, some flows leave the Spreading Grounds. Approximately 150 cfs can be diverted and spread without any losses.

Maximum spreading is also limited by the capacity of the groundwater basin. PVPA in the past has limited spreading to 6,000 acre-feet in any 30-day period for two consecutive periods. Watermaster and PVPA also evaluate operations with a spreadsheet model that calculates the impact of spreading on key wells to produce an index water level. During the current year it is anticipated that spreading will exceed that amount. Section 5 addresses the capacity of the groundwater basin.

Anticipated Improvements

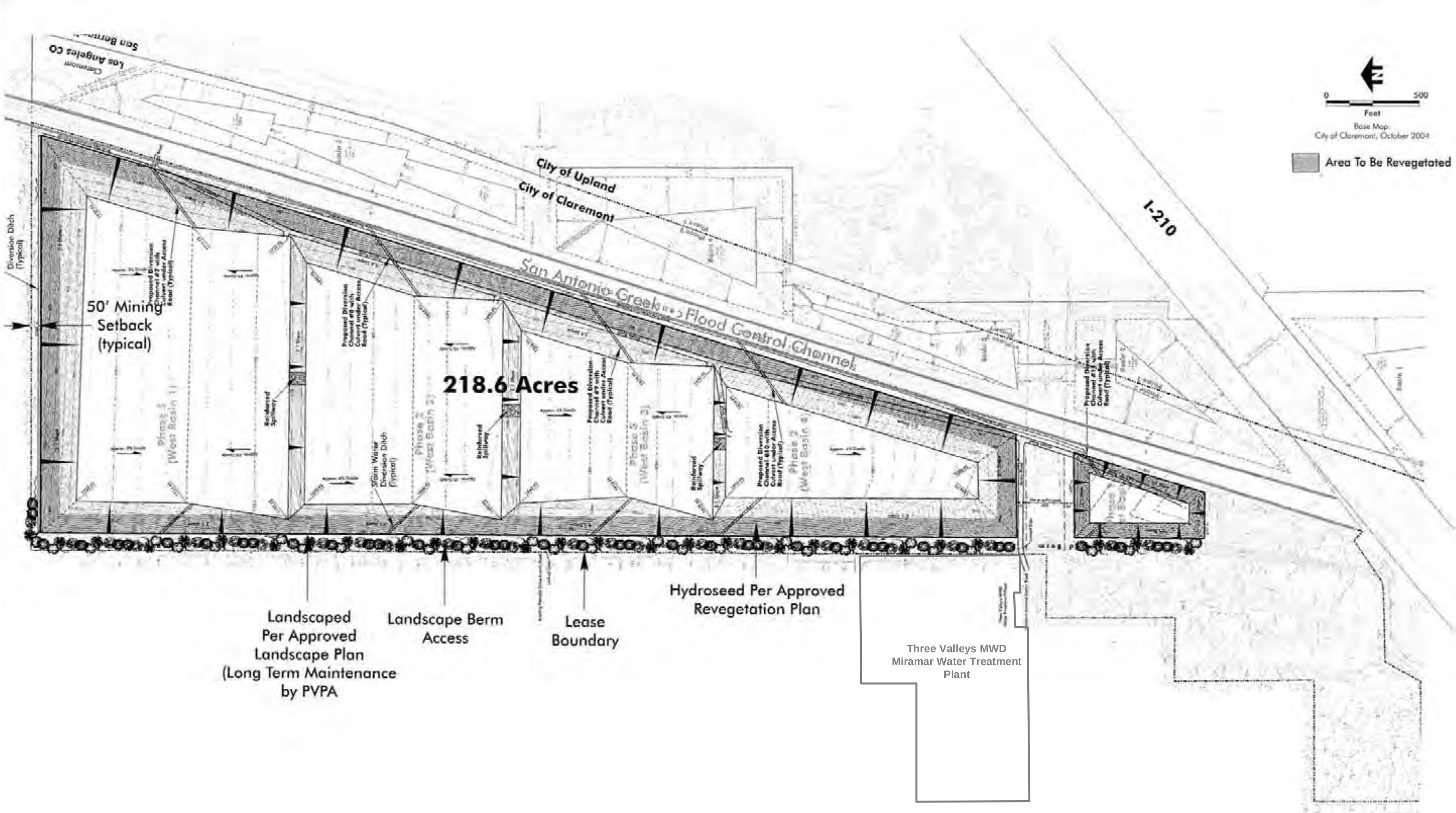
Camp Dresser McKee (CDM) is currently under contract to PVPA to prepare conceptual layouts of the Spreading Grounds to improve management of spreading. At present CDM envisions extending the existing Diversion Channel on the Los Angeles side of San Antonio Channel. This extended channel would allow directing all spreading on the Los Angeles side to selected basins. These proposed improvements are shown in **Figure 3-1**.

Vulcan Materials Company-Western Division (Vulcan) and Holliday Rock Company, Inc. (Holliday Rock) lease portions of the Spreading Grounds. Each of these companies has proposed mining operations on the Los Angeles side of the Spreading Grounds. The project applications prepared by both companies propose mining plans and reclamation plans that are consistent with spreading operations. Vulcan's proposed operations are located generally in the area shown as a proposed golf course in Figure 3-1 and are north of the area under consideration for spreading of imported water. Holliday Rock's proposed mining operations are within the area under consideration for spreading of imported water and are shown on **Figure 3-2**. Holliday Rock and Three Valleys staff have met and discussed the proposed gravel operations and proposed spreading. The projects are not incompatible.



Source: CDM, October 2001

Imported Water Spreading at San Antonio Spreading Grounds **Three Valleys Municipal Water District** **Claremont, California**	Bookman-Edmonston A Division of GEI Consultants	**San Antonio Spreading Grounds Improvements Proposed by Pomona Valley Improvements Association**	
	040740	**April 2005**	**Figure 3-1**



Source: Lilburn Corporation. December 2004

Imported Water Spreading at San Antonio Spreading Grounds Three Valleys Municipal Water District Claremont, California	Bookman-Edmonston A Division of GEI Consultants	Holiday Rock Company Proposed Reclamation Plan
040740	April 2005	Figure 3-2

Section 4 Imported Water Source

The proposed project would store imported water delivered via the Foothill Feeder and Miramar's Plant Intake Pipeline (Intake Pipeline). This section addresses those facilities.

Foothill Feeder

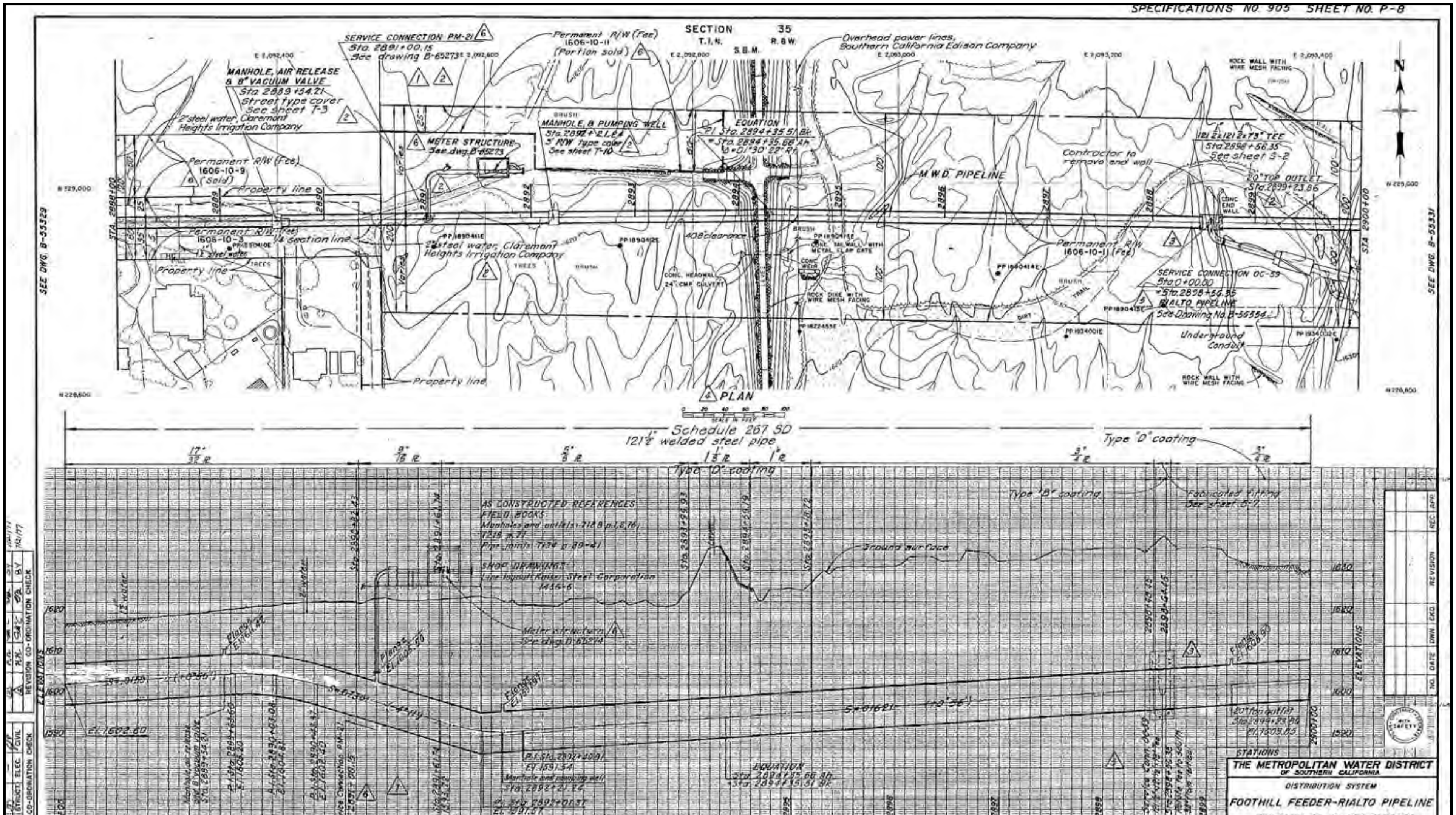
The Foothill Feeder begins at the Devils Canyon Power Plant of the State Water Project and runs westerly to Metropolitan's Live Oak Reservoir. From Live Oak Reservoir it continues to Weymouth. The Foothill Feeder is a 121.5-inch diameter, concrete-lined and coated steel pipe with a rated capacity of 611 cfs in the vicinity of Miramar. It crosses through the Spreading Grounds in line with Miramar Avenue and within a 200-foot wide easement. **Figure 4-1** shows the Foothill Feeder in the vicinity of Miramar.

Deliveries to the Miramar Treatment Plant are made at Service Connection PM-21 (PM-21) located along Miramar Avenue just west of the Spreading Grounds. PM-21 has a capacity of 80 cfs.

The maximum water surface elevation at the Devil Canyon Power Plant Afterbay of 1930 feet establishes the maximum possible pressure in the Foothill Feeder. Actual flow and pressure available for the project depends on flow in the pipeline for other purposes including supply to Metropolitan's Weymouth Water Treatment Plant and other spreading operations.

Predicting the availability of water is a challenge for a spreading project. By its nature, spreading operates opportunistically – water is available for spreading after direct deliveries are met. This section will review the hydraulics to develop an understanding of the range of possible deliveries. It will then review the operational history of the Foothill Feeder and recent trends to evaluate probabilities of delivery rates and pressures.

Located very near to the Spreading Grounds is a topographic high in the Foothill Feeder, which controls the maximum flow in the Reach. This topographic high is at an elevation of 1640 feet above sea level. Thus, the hydraulic grade line at PM-21 can vary from a high of 1930 feet to a low elevation of 1640 feet above sea level.



Imported Water Spreading at San Antonio Spreading Grounds

Three Valleys Municipal Water District
Claremont, California

Bookman-Edmonston
A Division of GEI Consultants

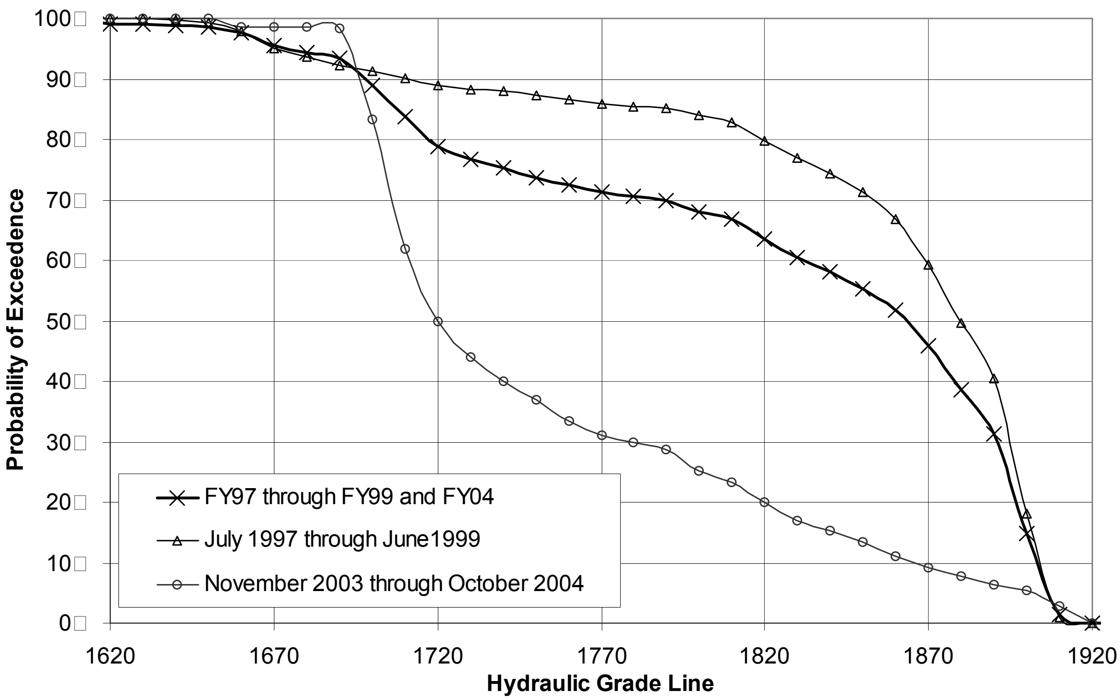
Foothill Feeder

040740	**April 2005**	**Figure 4-1**

Figure 4-2 is a probability of exceedence curve showing the hydraulic grade line at PM-21 for a three-year period ending with June 1999 and for a one-year period ending with October 2004 and for the four years combined. The figure shows the result of recent increased use of the Foothill Feeder. Reduced availability of Colorado River Water to supply the Weymouth Treatment Plant and increased demand for imported water have resulted in increased flows and reduced pressures in the Foothill Feeder. While this trend will vary from year to year, Metropolitan will be relying more on the State Water Project and less on the Colorado River than in the past. This shift in supply also shifts flows to the Foothill Feeder. The historical data provided by this figure does not predict future pressure availability. Metropolitan recognizes these challenges and is committed to work with member agencies to accomplish recharge.

Figure 4-2

Hydraulic Grade Line at PM-21 Probability of Exceedence (all seasons)



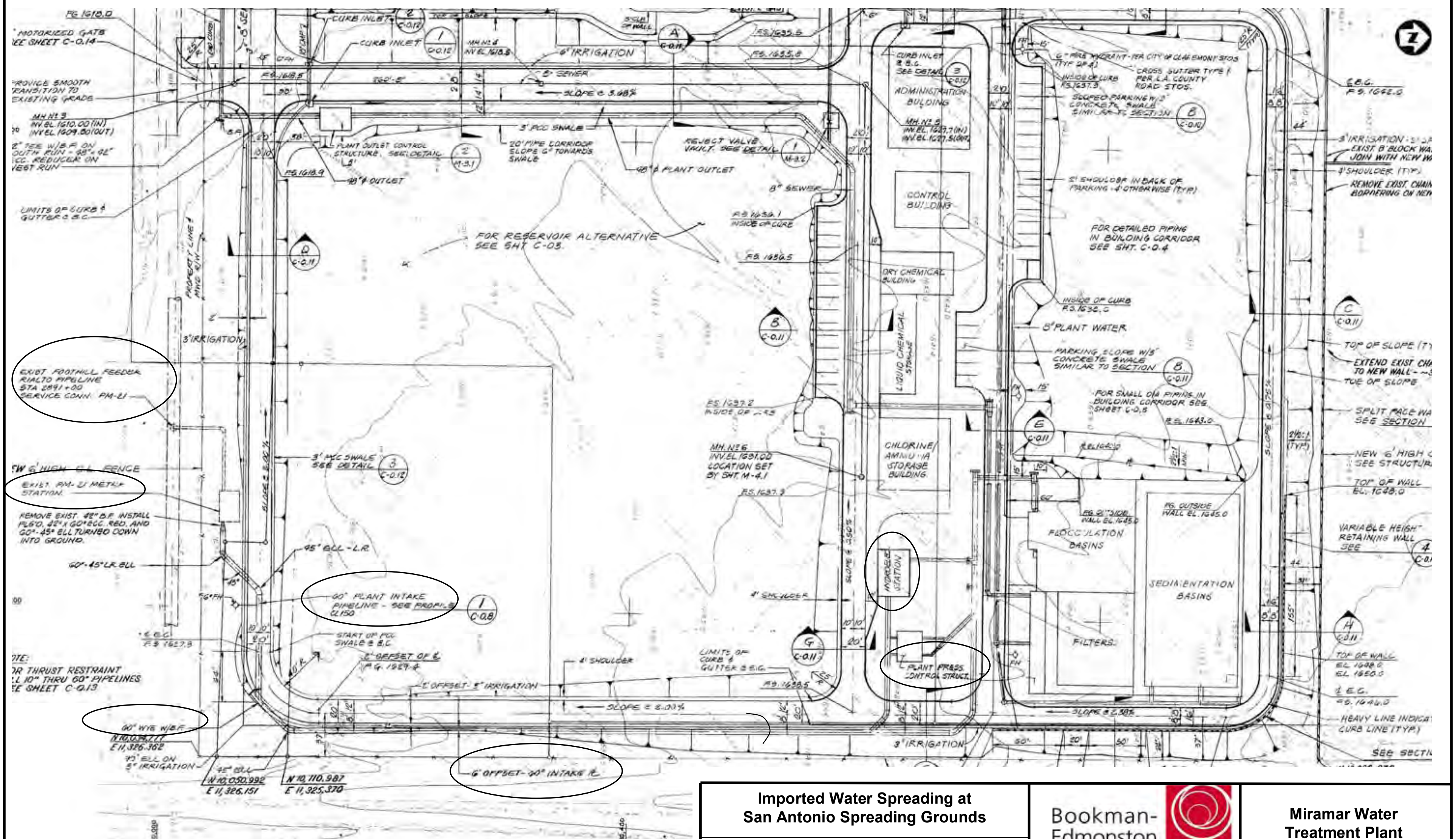
Miramar Water Treatment Plant Intake Pipeline

The 60-inch diameter Intake Pipeline is at an elevation of 1620-feet above sea level. The Intake Pipeline has a hydroelectric plant to take advantage of the high pressure (up to 1930 feet above sea level) and a bypass to use in low-pressure situations.

PM-21 is located on the Miramar site just west of the Spreading Grounds as shown on **Figure 4-3**. The connection was installed in 1986 and has a capacity of 80 cfs. In addition to the existing MWD meter there is a "Y" connection that is equipped with a 24-inch diameter flange, which could be activated with the installation of a meter and valves. The existing meter is more than adequate as Miramar has a maximum capacity of 25 million-gallon per day or 40 cfs.

From the PM-21 water is conveyed in the Intake Pipeline that extends east to the east property line of Miramar and then north along the property line. The water can be delivered by gravity into the plant or when there is adequate pressure can be delivered to the plant through a hydroelectric plant. At the southeast corner of the treatment plant site where the 60-inch pipe makes a 90-degree turn there is a “Y” outlet. Unfortunately the “Y” is pointing in the wrong direction and its use during high flow conditions will undoubtedly result in cavitation. This connection can possibly be reversed or a simple "T" connection installed.

The capacity of PM-21 is adequate to provide 40 cfs to the plant (maximum plant capacity) and concurrently provide up to 40 cfs (3,380 acre-feet in one month) for spreading. As Metropolitan charges its customers at 10% of the meter capacity when flow is less than 10%, every effort is made to maintain a flow greater than 8 cfs. The use of PM-21 would not require a change in the MWD metering or the addition of another MWD connection. As the expense of an additional MWD meter and connection is high this addition will not be considered for economic reasons.



Source: Engineering Sciences. 1984

Imported Water Spreading at San Antonio Spreading Grounds

Three Valleys Municipal Water District
Claremont, California

Bookman-Edmonston
A Division of GEI Consultants

Miramar Water Treatment Plant 60 Plant Intake

040740	**April 2005**	**Figure 4-3**

Section 5 Geology and Hydrogeology

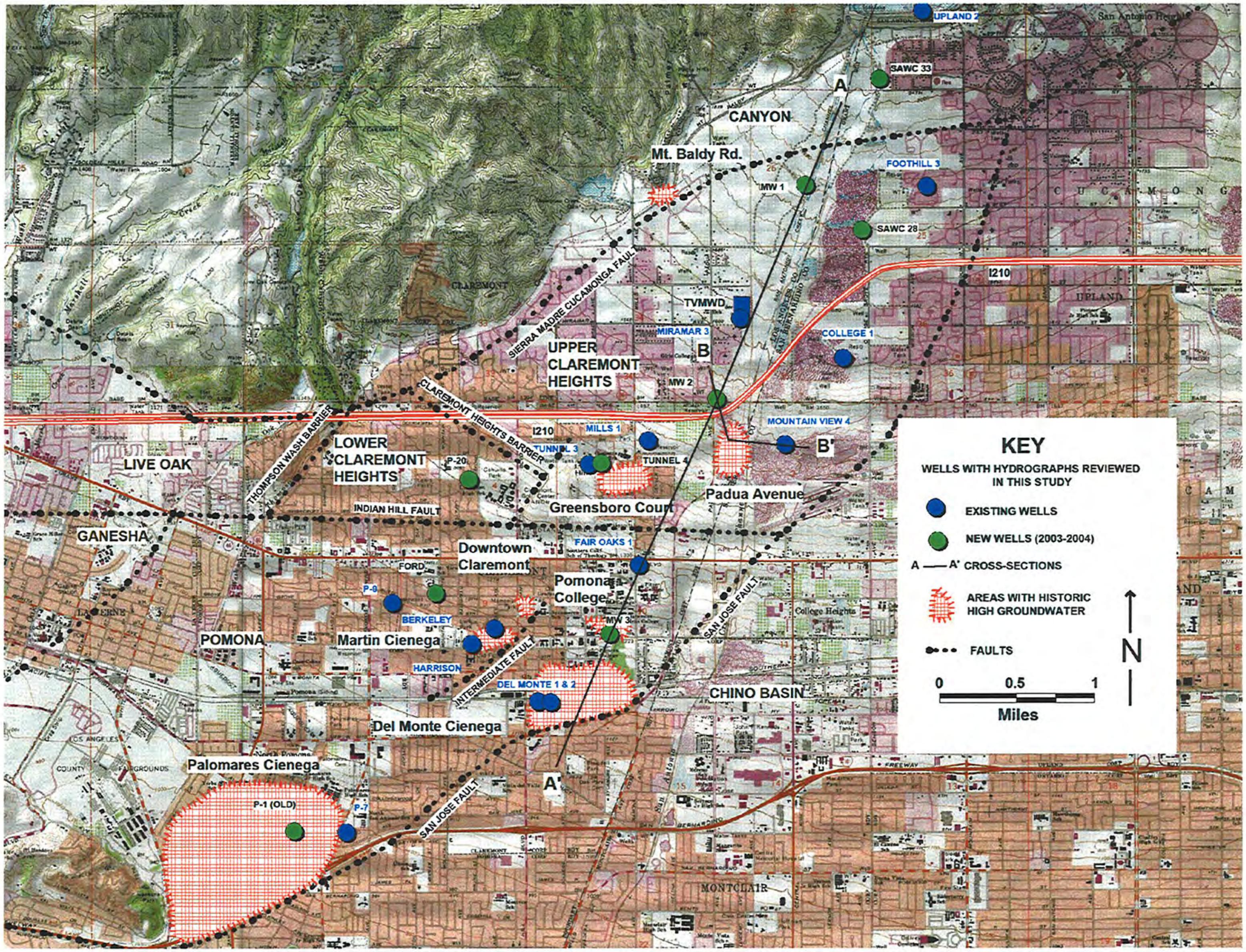
Introduction

This section provides information on the capacity of the Six Basins to store imported water spread at the San Antonio Spreading Grounds. It also discusses the potential risks associated with the spreading of State Water Project water, or of natural runoff water, in the San Antonio Spreading Grounds, and offers possible solutions to these risks. It starts by discussing the general geologic and hydrologic characteristics of the Six Basins to establish background information and then addresses critical issues of utilizing the Spreading Grounds for groundwater recharge. The issue of potential rising groundwater, a historical problem in the Six Basins, is described and the relationship of Spreading Grounds recharge to rising groundwater emphasized. Short discussions of current groundwater level monitoring programs are presented, followed by a detailed discussion on how monitoring can be used to determine recharge capacities in various parts of the basin and to estimate acceptable spreading amounts. State Water Project water and local groundwater chemical constituents are compared to determine if potential water quality problems associated with spreading State Water Project water exist. Finally, conclusions on the overall affects to the critical issues in the report are summarized.

General Geology

The Six Basins consist of six interconnected groundwater basins underlying portions of the cities of Claremont, La Verne, Pomona, Upland, and surrounding unincorporated areas of Los Angeles and San Bernardino counties. The Six Basins are shown on **Figure 5-1** and include Canyon Basin, Upper Claremont Heights Basin (UCHB), Lower Claremont Heights Basin (LCHB), Pomona Basin, Live Oak Basin and Ganesha Basin. The San Gabriel Mountains on the north, the San Jose Hills on the southwest, the Main San Gabriel Basin on the west, and the Chino Basin on the east bound the Six Basins.

The area is a gentle southwesterly-sloping alluvial fan along the southern base of the San Gabriel Mountains. Extensive folding and faulting, which began in Pleistocene time and has continued with decreasing intensity to the present, produced the San Gabriel Mountains part of the Transverse Ranges Geomorphic Provinces of Southern California. The Transverse Ranges Geomorphic Provinces extend from the Eagle Mountains westerly to the Channel Islands.



Six Basins Recharge Feasibility Study Six Basins Watermaster	Bookman-Edmonston A Division of GEI Consultants	Location Map Six Basins	
Three Valleys Municipal Water District Claremont, California	040740	April 2005	Figure 5-1

Individual basins are defined by faults and physical boundaries many of which do not have surface expression. The precise locations of these boundaries are difficult to determine. Because the number and locations of these faults and boundaries were estimated from groundwater level changes in hydrographs, their number and location are inconsistent in the literature. For the purposes of this report, the basins are in general accordance with the stipulated judgment entered in Los Angles County Superior Court, Case No. KC029152, captioned Southern California Water Company vs. City of La Verne, et al. (Six Basins Adjudication). The basins are as follows: The Indian Hill Fault separates the Live Oak, Upper and Lower Claremont Heights, and Canyon basins to the north from the Pomona and Ganesha basins to the south (Figure 5-1). The Sierra Madre – Cucamonga Fault separates the Canyon Basin to the north from the Live Oak Basin, UCHB, and LCHB to the south. The San Antonio Fault separates the Ganesha Basin from the Pomona Basin to the east. The LCHB is separated from the Live Oak Basin to the west and the UCHB to the east by the Thompson Wash and Claremont Heights barriers, respectively. The San Jose Fault separates the Six Basins from the Chino Basin.

Mapping by the California Geological Survey shows seven alluvial units in the Six Basins area: very old alluvial fan deposits, older alluvial fan deposits, and five generations of younger alluvial fan deposits. These alluvial units were developed by the Southern California Areal Mapping Project and can be distinguished by their environment of deposition. Each unit has assigned liquefaction susceptibility (California Division of Mines and Geology (CDMG), 2000). However, most of these units are indistinguishable in well logs and in driller's reports, and the historical literature generally recognizes only two alluvial units: older alluvium and younger alluvium. The latter two-unit subdivision will be used in this report.

Basement rocks to the alluvium consist of a heterogeneous mass of igneous and metamorphic rocks identical to the San Gabriel Mountains. The basement rocks are principally granite, gneiss, and schist, but include sandstone and shale units found in the San Jose Hills to the south. Basement rocks are generally considered to be non-water bearing, except where water occurs in fractures within the rock mass.

Alluvial units consist of unconsolidated, well-graded boulders, cobbles, gravels, sands, silts, and clays eroded from the San Gabriel Mountains and carried into the valley by major mountain drainages. The younger alluvium unit ranges from a thin veneer on older formations to a thickness of approximately 200 feet. The thickness of the older alluvium is also variable and ranges from a few feet near the margins of the basin to as much as 1,000 feet in some areas. A period of erosion and weathering occurred before deposition of the younger alluvium. This erosion event produced an uneven surface, a darker color (yellow or red), a higher clay percentage, more consolidation, and locally an upper portion with a residual clay cap.

Hydrology

Groundwater recharge to the Six Basins occurs by infiltration from man-made water spreading and control structures, subsurface inflow, and by direct recharge from precipitation and applied water. San Antonio Channel is the principal tributary stream with a drainage area of approximately 28 square miles (Bookman-Edmonston (B-E), 1987). Headwaters to San Antonio Channel originate in the eastern end of the San Gabriel Mountains, which are characterized by steep rugged terrain and elevations of 8,000 feet above sea level and greater. San Antonio Dam is operated as a flood control structure by the US Army Corp of Engineers and, in agreement with the Pomona Valley Protection Agency (PVPA), is used to enhance the conservation of water on San Antonio Channel by controlled groundwater spreading in the Spreading Grounds creating direct recharge to the UCHB. Live Oak Canyon is the second largest tributary with a watershed of approximately 1,850 acres (Civiltec, 2003). Water from Live Oak Canyon enters the Six Basins at the Live Oak Spreading Grounds, which is operated by the Los Angeles County Flood Control District, and supplies water to the Live Oak Basin. Captured stream flow at the Thompson Spreading Grounds is retained for percolation into the Canyon Basin by the PVPA. The City of Pomona operates the Pomona Spreading Grounds and recharges groundwater to the UCHB from the City's surface-water allocation on San Antonio Channel during periods of peak runoff. **Table 5-1** gives the total and average groundwater spread in the San Antonio, Thompson, and Pomona spreading grounds. The average recharge by spreading to the Six Basins as estimated at 6,894 acre-feet/year. Montgomery (1993) estimated the spreading recharge amount to be 7,850 acre-feet/year. Subsurface outflow from Canyon Basin, UCHB and, to a lesser extent, Live Oak Basin replenishes the remaining basins.

Table 5-1
Groundwater Recharge By Spreading Grounds

`	Years	Water Spread (acre-feet)	Average (acre-feet/year)
San Antonio(1)	1930 to 2000	428,991	6,042
Thompson(1)	1939 to 2000	5,333	87
Pomona(1)	1949 to 2000	26,311	516
Live Oak(2)	1964 to 1986	5,729	249
		Total	6,894

(1) Data from PVPA
(2) Bookman-Edmonston (1987, Appendix A)

Subsurface inflow into the Six Basins occurs as a result of the release of stored water from fractured rock of the mountainous watersheds to the north. B-E (1987) estimated the subsurface inflow to average 6,800 acre-feet/year. Calibration of the Upper Santa Ana Basin groundwater model suggests a subsurface inflow of 3,400 acre-feet/year (Montgomery, 1993).

Direct recharge to the Six Basins occurs by precipitation and percolation of applied water. Annual rainfall in the Live Oak watershed was estimated by Civiltec (2003) to be approximately 18-inches, however, the average annual precipitation as measured at the San Antonio Dam (Station 1115) from 1956 to 2002 is 23.22 inches. Montgomery (1993) estimated the average direct recharge to the Six Basins to be 6,910 acre-feet/year. B-E (1987) estimates the total recharge from direct precipitation, domestic, agricultural, and wastewater return flows to be about 11,200 acre-feet/year.
Groundwater is lost from the Six Basins by subsurface outflow, extraction, and by surface flow and evapotranspiration related to rising water in areas of historical cienegas or marshes. Subsurface outflow from the Six Basins recharges the Main San Gabriel Basin to the west and, to a minor extent, the Chino Basin to the south. Subsurface outflow to the Chino Basin has not been estimated, and is considered to be very low (B-E, 1987). Montgomery (1993) estimated a net subsurface flow from model calibration of about 4,260 acre-feet/year, and Camp Dresser & McKee (CDM, 1997) uses an estimate of 4,000 acre-feet/year in their model.

Cienegas (Spanish for marshes) have historically existed in the Six Basins area and flowing water has occurred during several periods. The cienegas are shown on Figure 5-1. Each of these areas are discussed in greater detail below under Rising Water Impacts. No annual groundwater loss from cienegas has been estimated.

Groundwater loss is principally by extraction. Extraction rates from 1999 to 2003 have ranged from 13,628 acre-feet in 2002 to 21,816 acre-feet in 1999 with an average of 16,411 acre-feet/year. Producers in the Six Basins include the City of La Verne, City of Pomona, Pomona College, San Antonio Water Company, Southern California Water Company, City of Upland, and the West End Consolidated Water Company.

Hydrogeology

Groundwater occurs both as unconfined and confined. In the upper basins where material is generally coarser and mostly younger alluvium the groundwater is unconfined, but where fine grained silts and clays overlie more permeable materials the groundwater can be confined beneath the finer layers. The general direction of groundwater flow is south to southwest, but is affected locally by pumping wells, faults, and recharge, which occurs mainly in the spreading basins of San Antonio, Thompson Creek, Pomona, and Live Oak. The groundwater flow direction and gradient are about south 23° west and 0.04 ft/ft in the UCHB.

Four of the six basins are potentially affected by spreading in the Spreading Grounds. These are: the Canyon Basin, UCHB, LCHB, and the Pomona Basin. A brief discussion on the hydrogeology of each basin and their relationship to spreading in the Spreading Grounds follows.

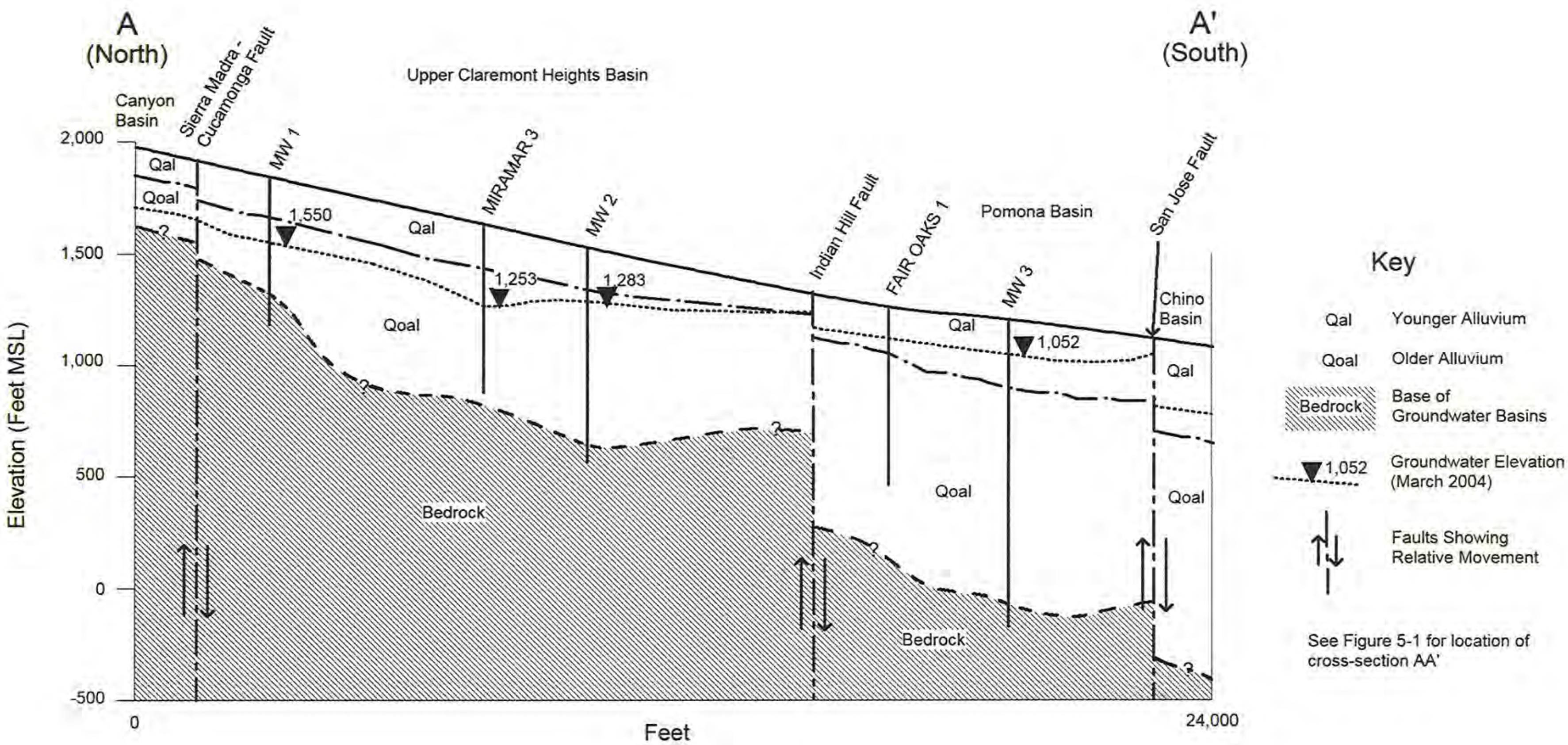
The Canyon Basin underlies an area of approximately 1,500 acres located at the mouth of San Antonio Canyon, and is estimated to be about 200 feet thick with a storage capacity of about 15,000 acre-feet and an average specific yield of 0.10 (Montgomery, 1993). The basin fills rapidly and groundwater discharges across the Sierra Madre – Cucamonga Fault zone, which separates the Canyon Basin from the UCHB and LCHB. About one-third of the Spreading Grounds is located on the Canyon Basin, and due to the historical procedure of spreading natural runoff water from north to south in the Spreading Grounds, the Canyon Basin is first to fill during spreading operations. There is no information on the hydrologic conductivity of the Sierra Madre – Cucamonga Fault zone, neither Montgomery (1993) nor CDM (2002) model the fault zone as a barrier to groundwater flow with a lower hydrologic conductivity.

The UCHB underlies an area of about 3,000 acres and consists of Recent and Pleistocene age sediments up to about 1,000 feet thick, with a storage capacity estimated to be about 100,000 acre-feet and an average specific yield of 0.10 (Montgomery, 1993). The UCHB represents the major source of recharge to the Six Basins due to spreading in the Spreading Grounds. The UCHB is separated from the Pomona Basin by the Indian Hill Fault, which from hydrographic data is a significant barrier to groundwater flow and was modeled accordingly by both Montgomery (1993) and CDM (2002).

The LCHB consists of approximately 1,400 acres with a sedimentary thickness of about 700 feet, and contains some 20,000 acre-feet of storage with a specific yield of 0.09 (Montgomery, 1993). The principal source of recharge to the basin is by subsurface groundwater flow from the Canyon and UCHB. No areas of historical high groundwater occur in the LCHB.

The Pomona Basin consist of alluvial sediments up to 1,200 feet thick and Montgomery (1993) has estimated the area to be about 5,800 acres and contain approximately 200,000 acre-feet of storage with an average saturated thickness of 400 feet and a specific yield of about 0.081. The Pomona Basin consists of at least two aquifers: an unconfined and a confined aquifer. The confined aquifer represents most of the basin's storage and occurs beneath clay layers generally with overlying perched or unconfined aquifers. Most of the historical rising groundwater problems discussed below occur in the Pomona Basin and are associated with the unconfined aquifers and adjacent faults.

Figure 5-2 is a geologic cross-section through the UCHB and the Pomona Basin. The location of cross-section AA' is shown on Figure 5-1. The relationships between faults and groundwater flow are discussed further below.



Six Basins Recharge Feasibility Study Six Basins Watermaster	Bookman-Edmonston A Division of GEI Consultants	Geologic Cross-Section AA' Looking East
Three Valleys Municipal Water District Claremont, California	040740	April 2005 — Figure 5-2

Effects of Faults on Groundwater

The size and number of the basins composing the Six Basins are not consistent in the literature. The effects of the faults and barriers on groundwater flow and elevations are also not well established. However, it is generally accepted that the Sierra Madre – Cucamonga, Indian Hill, and San Jose faults are major basin bounding faults and play a significant role in groundwater flow and elevation. Well hydrographs on opposite sides of these faults indicate that these faults are significant barriers to groundwater flow. The importance of the San Antonio Fault and the Thompson Wash and Claremont Heights barriers as groundwater barriers are less clear. The Intermediate Fault of Bean (1980) and Montgomery (1993) acts as a barrier to groundwater flow from west to east in the Pomona Basin. Bean (1980, 1982), B-E (1987), Montgomery (1993), and CDM (1996, 2002) indicate the importance of faults to the location of historical high groundwater. The areas of Downtown Claremont and the Martin Cienaga (Figure 5-1) appear to be related to the Intermediate Fault. The Greensboro Court and Padua Avenue high groundwater areas are probably related to the Indian Hill Fault, and the Palomares and Del Monte cienegas are located along the San Jose Fault. The Mount Baldy Road high groundwater area occurs near the Sierra Madre – Cucamonga Fault and a projection of the San Gabriel Mountains. The relationship of the Pomona College high groundwater area to basin faults is less clear.

Rising Water Impacts

Of particular concern in the planned recharging of natural runoff, or of the spreading of State Water Project water, are the potential effects to historical areas of rising water and to new constructions like State Route 210 and gravel operations. Presented below are discussions of the history of rising water in the Six Basins, and the potential new impacts that could be related to spreading in the Spreading Grounds. Further in this report, rising water controls, such as the recently completed groundwater monitoring well system and methods for determining the recharge capacities of the aquifer are discussed.

History of High Groundwater

A number of cienegas have historically produced rising water in the cities of Claremont and Pomona. Reports as early as 1888 record areas where flowing water occurred (B-E, 1987). Increased water use has generally lowered the groundwater levels in these areas, but following very wet years groundwater levels rose high enough to be a serious problem. In addition to historical cienegas, prior investigations have identified several other areas where historical high groundwater has occurred. A total of eight areas have been identified. From north to south on Figure 5-1 these are: Mount Baldy Road, Padua Avenue, Greensboro Court, Downtown Claremont, Pomona College, and the Martin, Del Monte, and Palomares cienegas. The discussion below is not intended to be an in-depth history of rising water in the area or of its impacts, but is intended to discuss areas of concern with the potential spreading of State Water Project water or with the recharging of natural runoff in the Spreading Grounds. For a more detailed history of rising water the reader is referred to Bean (1980 & 1982), B-E (1987), and CDM (2002).

The Mount Baldy Road area is located in the Canyon Basin near the intersections of Mt. Baldy Road and Mills Road where the Canyon Basin narrows between the San Gabriel Mountains and the Sierra Madre – Cucamonga Fault. There is little reported information on this area. Montgomery (1985) suggests that the rising water probably returns to the lower basins as recharge. The Mount Baldy Road area is located between the Thompson Creek and Spreading Grounds. High periods of spreading in the two spreading grounds combined with natural recharge from smaller streams draining the San Gabriel Mountains probably result in rising groundwater on the north side of the Sierra Madre – Cucamonga Fault.

The Padua Avenue area is located at the southern end of the Spreading Grounds in the UCHB in the vicinity of Padua Avenue and Shenandoah Drive. The occurrence of rising water in this area is probably related to spreading activity at the Spreading Grounds. Hydrographs for the Mountain View 4 and Mills 1 wells show a correlation between high groundwater levels and spreading amounts greater than 20,000 acre-feet. This correlation is discussed in more detail below. Historical high groundwater impacts have been limited to local flooding of gravel operations. The Mountain View 4 well can be used to determine at what recharge amounts rising water impacts would occur.

The Greensboro Court area is located in the UCHB a few hundred feet south of Pomona Tunnel Well 3 well and the Pomona Spreading Grounds. The hydrograph for Pomona Tunnel Well 3 does not show groundwater above than 70 feet (1969) below ground surface (bgs) from 1958 to 2004 despite spreading amounts in San Antonio Spreading Grounds as high as 30,152 acre-feet (1977-1978). This is significant in that both the Mountain View 4 and Mills 1 wells show groundwater levels above 50 feet bgs up to six times during this period, and the Martin Cienega had flowing artesian or near flowing conditions during nine years of this time period (see Martin Cienega). This could be a result of groundwater production by the City of Pomona in the Pomona Tunnel Wells area during periods of rising groundwater or, as is more likely the case, the result of local perched water conditions in the upper part of the aquifer as suggested by CDM (2002). CDM (2002) recommended keeping groundwater elevations in the Pomona Tunnel Well area below 1,300 feet.

The Downtown Claremont area represents a small area in the upper part of the Pomona Basin. There is little information on the area, but two hydrographs used by B-E (1987, Figure IV-4) illustrate that a shallow perched aquifer occurs over a deeper aquifer in this area. Well 4489B (B-E, 1987 Figure IV-4) shows groundwater elevations consistently at about 1,150 feet, where as well 4489 shows groundwater elevations below 1,150 feet. This demonstrates that the local high groundwater conditions are probably the result of local perched groundwater. Spreading in the Spreading Grounds will not cause high groundwater conditions in the Downtown Claremont area unless the aquifer becomes saturated above the perched layer. Groundwater conditions in the Downtown Claremont area appear to be similar to that of the Greensboro Court area. The Intermediate Fault probably acts as a barrier to groundwater flow in the Downtown Claremont area and to the Martin Cienega. This would cause higher groundwater levels on the north side of the fault.

The Pomona College high water area is located north of the Del Monte Cienega and some historical reports have combined the two (B-E, 1987). Others combined the area with the Downtown Claremont area and the Del Monte Cienega (Bean, 1980). The cause of the historical high groundwater in this area is unknown. Bean (1980) suggests that groundwater flowed laterally from blocked artesian wells until it was able to escape to the surface. Until recently the only well in the area was College Well 2 and no hydrographs exist for this well. Monitoring Well 3 (MW 3) was drilled by the Three Valleys in December of 2003. The depth to bedrock in MW 3 is about 1,270 feet, and no clay layer was encountered to produce a confining layer which would cause artesian or perched groundwater conditions. MW 3 was installed with a submersible pressure transducer to provide continuous groundwater elevation monitoring. This will assist in understanding the cause of high groundwater in the area.

The Martin Cienega, also called Pilgrim Place in the literature, is located in the center of the Pomona Basin on the north side of the Intermediate Fault. Groundwater discharge to the surface has occurred numerous times in this area. The hydrograph for the Berkley well shows that groundwater was discharged the surface in 1959, from 1969 to 1971, from 1979 to 1981, and again in 1983. The Harrison 1 well also shows significant periods of high groundwater. These wells are shallow at approximately 160 feet in depth and groundwater levels are probably indicative of perched conditions in the upper Pomona Basin similar to that found in the Downtown Claremont area. CDM (2002) reports groundwater depths from 200 and 250 feet in deeper wells north and west of the Martin Cienega during the same time as high groundwater in the Berkley and Harrison 1 wells.

Berkley and Harrison 1 hydrographs clearly show a correlation with spreading in the Spreading Grounds, but with a lag time of about 12 to15 months. The most likely cause of the high groundwater in the Martin Cienega is that high recharge in the UCHB becomes trapped against the Intermediate Fault and produces a rise in the perched groundwater due to the Pomona Basin becoming saturated next to the fault. A second explanation could be that the perched groundwater in the Martin Cienega extends to the Indian Hill Fault and high recharge in the Spreading Grounds produces a rise in the groundwater level of the perched groundwater that is then prevented from flowing south by the Intermediate Fault or by a reduction in the thickness of the perched aquifer.

High groundwater in the Del Monte and Palomares Cienegas is caused by groundwater being trapped against the San Jose Fault. Groundwater level differences between the Six Basins and the Chino Basin clearly show that the San Jose Fault is a barrier to groundwater flow, and that without groundwater extraction at the southern end of the Six Basins groundwater elevations will rise if high recharge is applied. The hydrograph for Pomona well P-7 shows groundwater elevations less than 50 feet from the surface since about 1995. Groundwater depths in the P-1 Old well have ranged from 30 to 35 feet during the first half of 2004. Increased pumping in these areas will mitigate high groundwater impacts.

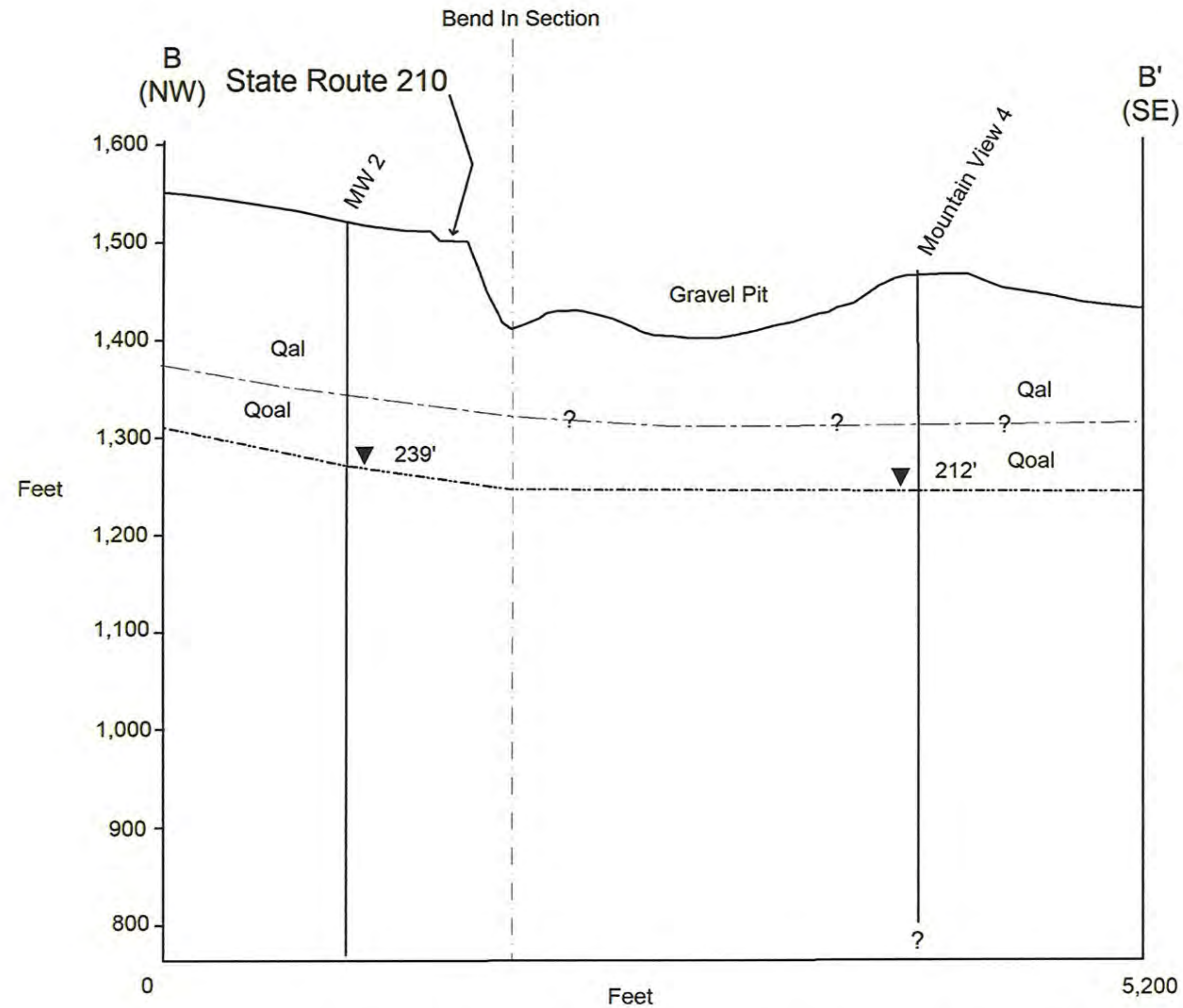
Physical Changes Since Last High Groundwater

High groundwater last occurred in the UCHB in 1993. Physical changes that have occurred to the Basin since then that could potentially be impacted by spreading in the Spreading Grounds include the State Route 210 highway and current gravel operations in the Spreading Grounds. Each of these is discussed below.

The construction of State Route 210 through the Six Basins and near the southern end of the Spreading Grounds presents new potential impact to high groundwater effects. To determine the effect of spreading State Water Project water, or natural recharge water, in the Spreading Grounds on State Route 210, as-built drawings were obtained from the San Bernardino Associated Governments for portion of the San Bernardino County side, and from the California Department of Transportation Division 7 for portions of the Los Angeles County side. These As Built diagrams show the excavated depths of State Route 210 from about Indian Hill Boulevard on the west to Mountain Avenue on the east. In general, the base of State Route 210 starts at an elevation of about 1,366.22 feet above sea level near Indian Hill Boulevard and increases to 1,426.54 feet at the Mills Avenue overpass, to 1,492.47 feet at the Monte Vista Avenue overpass, to 1,689.63 feet at the Benson Avenue overpass, and finally to 1,710.96 feet at the Mountain View overpass.

The Spreading Grounds extends from Monte Vista Avenue to Benson Avenue. The lowest portion of State Route 210 in the Spreading Grounds is at the Monte Vista overpass (1492.47) very close to Six Basins Well 2 (MW 2) at the northeast corner of Baseline and Monte Vista (Figure 5-1). MW 2 was completed in April of 2004.

The Padua Avenue historical high groundwater area is located just to the south of State Route 210 and MW 2 (Figure 5-1). As part of the construction of State Route 210, the gravel pit, (actual site where the historical high groundwater occurred) was partially regraded and the lowest point (elevation 1,399.97 feet) near State Route 210 was filled in. The lowest point in the gravel pit is now at 1,409.58 feet or 82.89 feet below the base of the lowest point on State Route 210 in the Spreading Grounds (1,492.47 feet at the Monte Vista overpass). The surface elevation of Mountain View 4 is about 1,470 feet and the estimated elevation of MW 2 is about 1,522 feet. This would suggest that for rising water to impact State Route 210 the groundwater elevation in Mountain View 4 would have to rise to near surface, flooding the gravel pit by about 83 feet of water and the depth to groundwater in MW 2 would need to be less than 30 feet below surface. **Figure 5-3** is a cross-section BB' showing the relationships between MW 2, Mountain View 4, State Route 210, and the Padua Avenue historical high groundwater area. Because of the conservative methodology used to prepare the recharge capacity calculations discussed below, no impacts to State Route 210 should occur due to spreading in Spreading Grounds provided the recharge capacities are not exceeded.



Key

Qal Younger Alluvium

Qoal Older Alluvium

Water Table With Feet Below Surface (March 2004)

See Figure 5-1 for location of cross-section BB'

Six Basins Recharge Feasibility Study Six Basins Watermaster	Bookman-Edmonston A Division of GEI Consultants	Geologic Cross-Section BB' Looking North
Three Valleys Municipal Water District Claremont, California	040740	April 2005 / Figure 5-3

High groundwater levels could affect current and proposed gravel mining operations in the Spreading Grounds. The Padua Avenue historical high groundwater area, which consists of the gravel pit south of State Route 210, was originally excavated to a depth of about 1,399.97 feet according to maps provided by the California Department of Transportation Division 7. The pre-mining surface elevation in this area was about 1,500 feet suggesting that about 100 feet of material was removed by the gravel mining operation. In a Project Application submitted to the City of Claremont Community Development Department on behalf of Vulcan Materials Company, a proposed gravel mining operation would remove up to 100 feet of material on the Los Angeles side of the Spreading Grounds (Vulcan, 2004). Because gravel operations are likely to occur at depths to 100 feet below current surface elevations, spreading of State Water Project water or natural runoff water could raise groundwater levels to a point that would adversely affect gravel mining operations.

A map provided by Vulcan in the Project Application (Miscellaneous Map No. 010) suggests that aggregate sources could be depleted on current gravel mining operations in 2006. The time period of the proposed operations is not specified. In addition to Vulcan, Holliday Rock also holds leases with the PVPA that could create future mining operation in the Spreading Grounds.

The PVPA currently spreads natural runoff water in gravel pits on the east side of San Antonio Diversion Channel on the San Bernardino side of the Spreading Grounds. Details of the agreement(s) between the PVPA and the gravel operations for using the gravel operation to spreading natural runoff are unknown.

Rising Water Well Monitoring Program

This report utilized twenty-three well hydrographs to estimate groundwater levels created by spreading in the Spreading Grounds. The wells are shown on Figure 5-1 and are listed in **Table 5-2**. Of the twenty-three wells, thirteen wells have hydrographs that can be used to estimate recharge capacities in the UCHB and Pomona Basin; five are currently used to estimate recharge availability by the PVPA; six are used by CDM (2002) for their groundwater model calibration; and all but four of the wells have hydrographs maintained by Bookman-Edmonston for the Six Basins Watermaster or for Three Valleys. Well hydrograph users are listed in Table 5.1. Using all of these wells to continuously monitor groundwater levels would provide significant information on the details of rising groundwater due to spreading in the Spreading Grounds. The information will yield a better understanding of groundwater flow patterns and rates and be used to fine-tune spreading procedures and amounts to more effectively utilize groundwater storage resources without producing significant effects related to rising groundwater.

For purposes of implementing a water spreading operation in the Spreading Grounds a groundwater monitoring program will be implemented to insure that rising groundwater does not cause adverse effects to the Six Basins, and to estimate the amounts of imported water that can be spread each year. If the operational goals were a simple yearly put and take spreading operation with only imported water and no natural runoff recharge, and the groundwater was limited to the UCHB, then a monitoring program could be as simple as maintaining hydrographs from a few key wells in the UCHB. However, if the goal is to fully utilize runoff from San Antonio Canyon, spread the maximum amount of imported water, and operating a complex multiyear put and take operation that could affect both the UCHB, Pomona Basin, and possibly the LCHB, a larger number of hydrographs will need to be maintained. Because the latter goal is the most effective way to utilize the Six Basins' resources, maintaining most or all of the twenty-three hydrographs listed in Table 5.1 is recommended.

Using the five PVPA well hydrographs (see Table 5.2) to estimate the available recharge capacity of the UCHB should be continued and both the Montgomery (1993) spreadsheet model and the B-E method (described below) should be used to estimate the recharge capacity. If the spreading of imported water is done on a multi-year put and take operation, then increased groundwater production will probably be required in the UCHB and possibly the Pomona Basin to prevent possible high groundwater effects due to spreading. Monitoring all twenty-three well hydrographs will help determine the amount and location of groundwater pumping.

Table 5-2

Rising Water Monitoring Program Wells

Name	State Well Number	Sub Basin	Well Owner	Hydrographs Users	Years
Berkley	01S/08W-09G03 S	Pomona	SCWC	CDM	1958-2004
College 1	01N/08W-35Q01 S	UCH	Pomona College	PVPA, B-E	1921-2004
Del Monte 1	01S/08W-10N01 S	Pomona	SCWC	CDM	1958-2004
Del Monte 2	01S/08W-10N02 S	Pomona	SCWC	CDM	1958-2004
Fair Oaks	01S/08W-10B01 S	Pomona	SCWC	B-E	1931-2003
Foothill 3	01S/08W-25L01,02 S	UCH	West End CWC	PVPA, B-E	1990-2004
Ford 1	01S/08W-09E02 S	Pomona	SCWC	B-E	2002-2004
Harrison 1 (Home)	01S/08W-09L03 S	Pomona	SCWC	CDM	1958-1996
Mills 1	01S/08W-03G02 S	UCH	SCWC	CDM, B-E	1921-2004
Miramar 3	01N/08W-35E01 S	UCH	SCWC	PVPA, B-E	1929-2004
Mountain View 4	01S/08W-02F01 S	UCH	West End CWC	PVPA, B-E	1948-2004
MW 1	N/A	UCH	Six Basins	B-E, Three Valleys □ Six Basins	2004
MW 2	N/A	UCH	Six Basins	B-E, Three Valleys □ Six Basins	2004
MW 3	N/A	Pomona	Six Basins	B-E, Three Valleys and Six Basins	2004
Old P-1	01S/08W-17P01 S	Pomona	City of Pomona	B-E	2002-2004
P-20	01S/08W-04L01 S	LCH	City of Pomona	B-E	2002-2004
P-7	01S/08W-17K02 S	Pomona	City of Pomona	B-E	1957-2004
P-9	01S/08W-08H02 S	Pomona	City of Pomona	B-E	1931-2002
SAWC 28	01N/08W-36D01 S	UCH	SAWC	B-E	2003-2204
SAWC 33	N/A	Canyon	SAWC	B-E	2003-2004
Tunnel Well 3	01S/08W-03F03 S	UCH	City of Pomona	PVPA, B-E	1957-2004
Tunnel Well 4	01S/08W-03F05 S	UCH	City of Pomona	B-E	2002-2004
Upland 2	01N/08W-24E01	Canyon	City of Upland	B-E	1931-2004

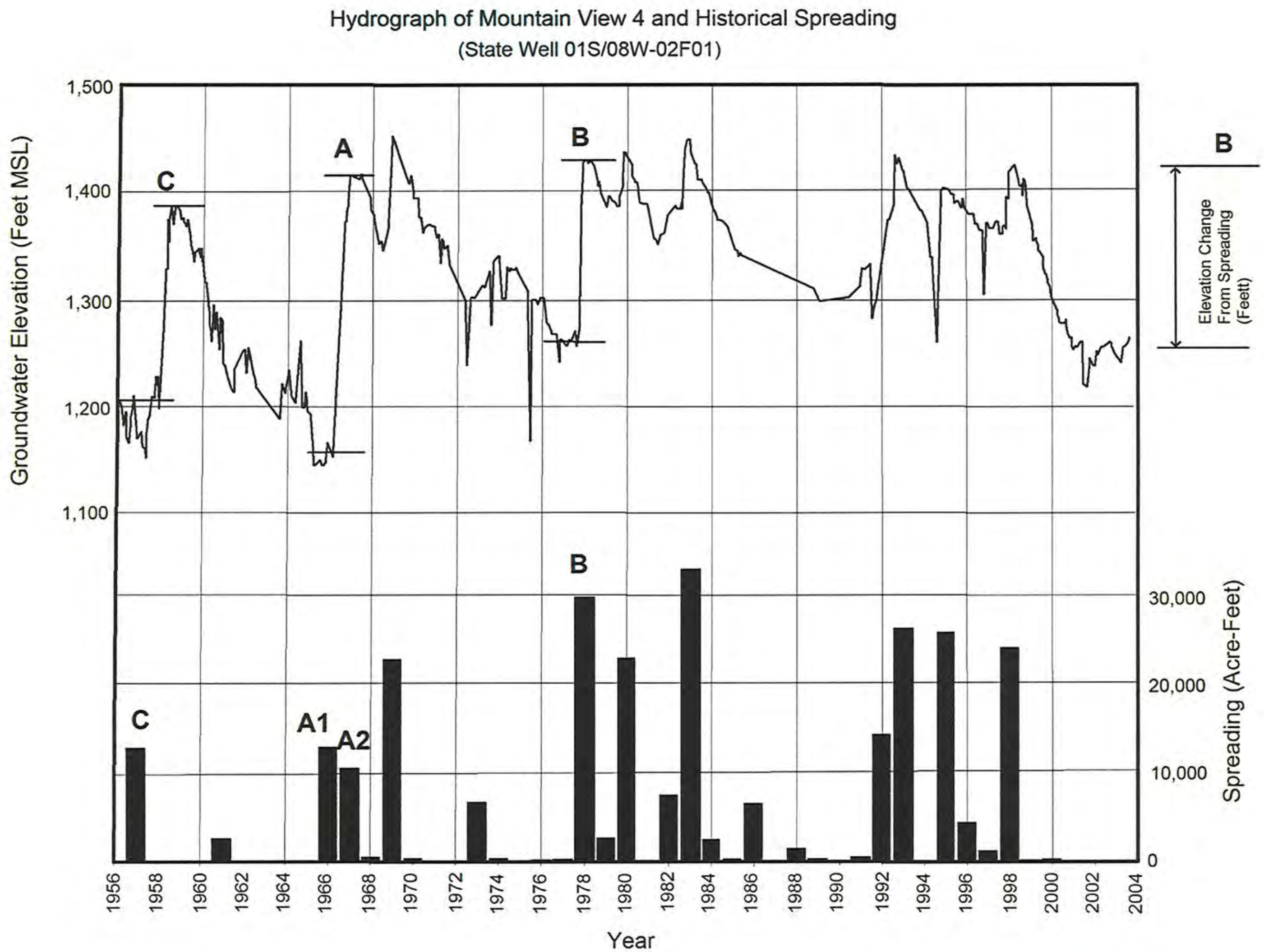
Recharge Capacity

To estimate how much spreading could occur in the Spreading Grounds without producing adverse high groundwater effects, recharge capacities were estimated for the UCHB and Pomona basins. By using hydrographs from thirteen wells and the historical spreading records for the Spreading Grounds the effect of recharge on groundwater levels were estimated and the available recharge capacities calculated. The wells are shown on Figure 5-2.

The estimates of available recharge capacities for each well were then compared to determine which wells showed adverse high groundwater levels in response to recharge. The recharge capacities were then used to estimate the recharge volumes that produced adverse effects in each area. Recharge capacity results were also compared to available storage estimated calculated by using the Montgomery (1993) spreadsheet model. Finally, the probabilities of different recharge amounts were estimated from historical groundwater levels based on the most responsive well to recharge.

Recharge Capacity Calculations

Figure 5-4 shows the first step of calculating recharge capacities from key well hydrographs. The hydrograph for the Mountain View 4 is shown along with the historical spreading data for Spreading Grounds. The groundwater elevation is shown on the left scale and the amount of spreading in thousands of acre-feet is shown on the right scale. The time interval is shown on the bottom scale. Two charts were made for each well hydrograph when data was available: one from 1936 to 1955 and one from 1956 to 2004. From these charts, estimates of the increase in groundwater level as a function of spreading was estimated. Two assumptions were required to make this estimate: 1) the increase in groundwater level was a result of only the spreading (direct precipitation was not included), and 2) the increase in groundwater elevation could be estimated from the hydrograph by a change from a low elevation point before spreading to a high elevation point after spreading. For the second assumption, only data showing a relatively flat groundwater elevation before significant spreading was considered. In some cases two periods of spreading were combined to yield the estimated change in groundwater elevation (i.e. A1A2 on Figure 5-2).



Six Basins Recharge Feasibility Study Six Basins Watermaster	Bookman-Edmonston A Division of GEI Consultants	Hydrograph of Mountain View 4 and Histrocial Spreading	
Three Valleys Municipal Water District Claremont, California	040740	April 2005	Figure 5-4

The following three calculations show how the change in elevation was determined from the spreading volumes in Figure 5-4:

A = (1,420 ft – 1,160 ft) / (13,056 + 10,727) acre-feet = 0.011 ft / acre-ft

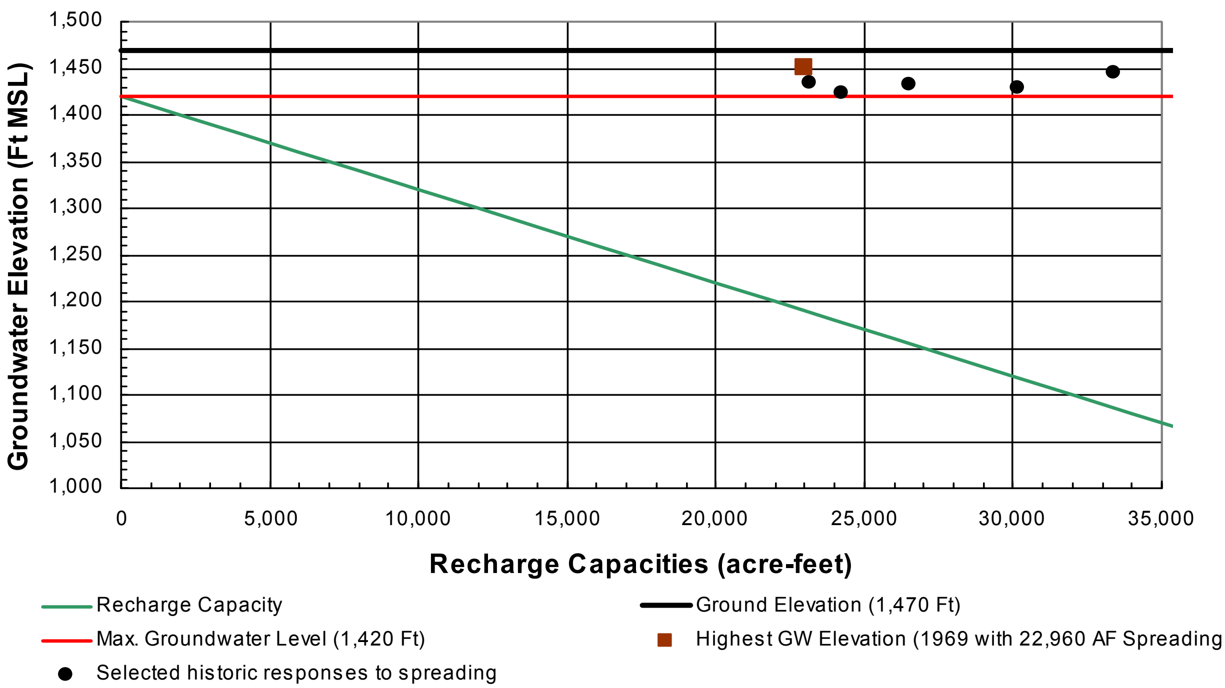
B = (1,430 ft – 1,260 ft) / 30,152 acre-feet = 0.006 ft / acre-feet

C = (1,390 ft – 1,210 ft) / 12,881 acre-feet = 0.014 ft / acre-feet

Average 0.010 ft /acre-feet

Figure 5-5 shows the second step in the calculation of the recharge capacities. For this step, the amount of spreading as a function of groundwater elevation is plotted using the average change in elevation per acre-feet of spreading calculated above. The maximum elevation was assumed to be the surface minus 50 feet. This maximum was determined by using 40 feet to water for the liquefaction susceptibility zone (a) as determined in the Mount Baldy and Ontario seismic hazard evaluations (CDMG, 2000), and a margin of safety of 10 feet. The CDMG (2000) states that for areas of limited or no geotechnical data, susceptibility zones may be identified by geologic criteria. The geologic criteria for (a) is areas containing soil deposits of late Holocene age (current river channels and their historic floodplains, marshes and estuaries), where the M7.5-weighted peak acceleration that has a 10% probability of being exceeded in 50 years is greater than or equal to 0.10 g and the water table is less than 40 feet below the ground surface. To avoid the need for detailed geologic analysis this case is assumed for the entire Six Basins area.

Figure 5-5
Recharge Capacity based on groundwater elevation
at Mountain View 4 (01S/08W-02F01)



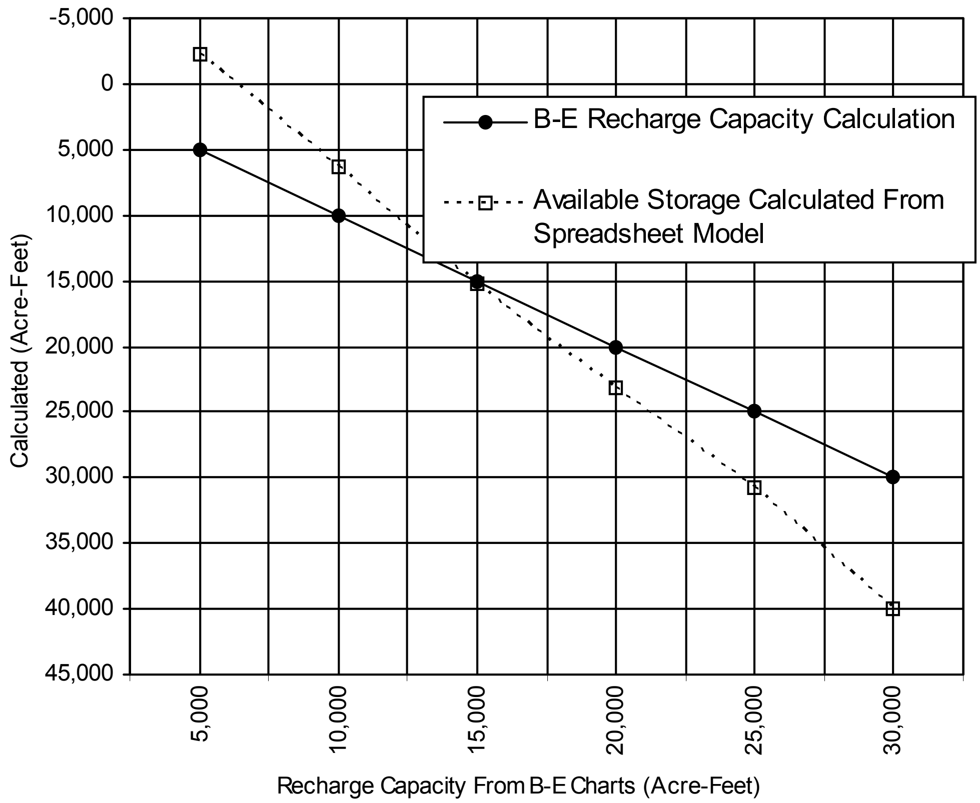
Based on the estimate of the change in elevation per acre-feet of spreading (green line on Figure 5-5) and the groundwater elevation (right scale), the amount of spreading can be estimated (bottom scale). This amount of spreading for different groundwater elevations is the recharge capacity. For example, if the groundwater elevation in Mountain View 4 is 1,300 feet mean sea level (MSL), then spreading should be about 12,000 acre-feet, and obtain a new groundwater elevation of about 1,420 feet MSL. From this the recharge capacity would be 12,000 acre-feet at 1,300 ft. **Appendix B** contains recharge capacity charts for the Mountain View 4, Miramar 3, College 1, Mills 1, and Tunnel 3 wells.

Also shown on Figure 5-5, are high groundwater events (depth to water less than 50 feet below surface), and the amount of spreading associated with those events. The highest groundwater elevation for each well is indicated by a square and the year and the spreading amount are given.

Calculation of Recharge Capacity Compared To Spreadsheet Model of Recharge Capacity

To help determine the validity of the recharge capacities calculated in this section, recharge capacities were compared to available storage values calculated from the spreadsheet model developed by Montgomery (1993) for the PVPA Groundwater Management Study. The spreadsheet model is used to determine groundwater recharge and storage values, and is based on the groundwater elevations of five key wells. The keys wells are: Foothill 3, Miramar 3, College 1, Mountain View 4, and Tunnel Well 3. From plots of spreading as a function of groundwater elevation (Figure 5-5) the elevations were determined for each of the five key wells for annual spreading rates of 5,000, 10,000, 15,000, 20,000, 25,000, and 30,000 acre-feet. These groundwater elevations were then entered into the spreadsheet model and an available storage number calculated. **Figure 5-6** shows the results of the comparison. Based on these five key wells, the storage availability calculated from the spreadsheet model and the recharge capacity calculated from the spreading verses groundwater elevation plots are equivalent at about 15,000 acre-feet of recharge capacity. Calculations of storage availability from the spreadsheet model are lower than recharge capacities for values under 15,000 acre-feet, and higher for values over 15,000 acre-feet. For the purposes of this investigation, calculations of available storage by the two methods generally agree at storage availabilities between 13,000 and 18,000 acre-feet.

Figure 5-6
Comparisons of Methods for Calculating Storage Available



Results

Calculation of the recharge capacities by this method yielded several conclusions regarding recharge and well groundwater elevations. These conclusions are:

- Wells closest to the Spreading Grounds show a larger rise in groundwater level over a shorter period of time than do more distant wells. For example, the rise in groundwater elevation at Mountain View 4 occurs over a period of months where as changes in the groundwater elevations of Del Monte wells takes about a year. This is because recharged groundwater moves as a groundwater mound, and the amplitude of the mound decreases with increasing distance, but the period increases with distance.

- Well groundwater levels in the UCHB drop back to pre-recharge levels, where as groundwater levels in Pomona Basin wells tend to remain elevated. This is probably due to relatively good groundwater flow from the UCHB to the Pomona Basin, but poor or limited groundwater flow out of the Pomona Basin into the Chino Basin.

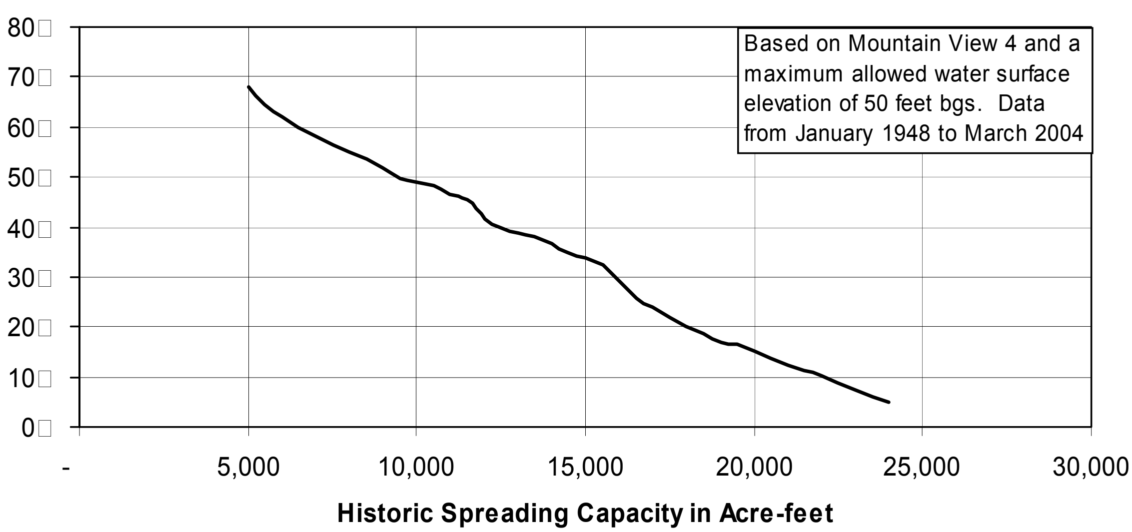
For these reasons, estimates of recharge capacities in UCHB wells are more useful for determining spreading volumes at the Spreading Grounds. The amount of spreading that can be done each year can be determined from the plots of the well recharge capacities as described above. However, a comparison of the recharge capacities of wells indicates that the well Mountain View 4 and College 1 have the greatest changes in groundwater elevation per unit of spreading with 0.010 ft/acre-feet. Both wells are close to the Spreading Grounds, and Mountain View 4 is the closest down gradient well.

For the UCHB, the Mountain View 4 well shows the greatest number of high groundwater elevations (six) related to periods of spreading. The Mills 1 well is second with four. In each case, the high water levels occurred after spreading of 20,000 acre-feet of natural runoff or greater. Flowing water in Del Monte and Martin cienegas appear to be related to spreading that occurred up to 1.5 years earlier then when the effect became apparent.

Recharge Probabilities

From the calculations of recharge capacities it is possible to estimate the probability of recharging different amounts of imported water or natural runoff. Based on historical groundwater elevation data of Mountain View 4 and the well's recharge capacity, a chart was constructed showing the percentage of times different spreading amounts were available. **Figure 5-7** shows the probability of spreading from 5,000 to 20,000 acre-feet/year of imported water using Mountain View 4 as the key well. Groundwater elevations from January 1948 to March 2004 were used to calculate the recharge capacities.

Figure 5-7
Historic Storage Capacity
Percent of Years Spreading Capacity has Exceed



Water Quality

To determine potential water quality effects to local groundwater caused by recharging with State Water Project water the chemical constituents of the two waters were compared. Chemical constituent data for State Water Project water at Silverwood Lake for the period January 1998 through May 2004 was obtained from the California Department of Water Resources and compared to local groundwater data collected from the California Department of Health Services for 17 groundwater wells in the UCHB for the period January 1994 through October 2003. **Table 5-3** lists the wells used to determine local groundwater quality. Table 5-3 summarizes chemical constituent comparisons between State Water Project water and local groundwater. Results for most Volatile Organic Chemicals (VOCs) and Non-Volatile Synthetic Organic Chemicals (SOCs) were less than detectable. Constituents with detectable results are summarized in **Table 5-4**. Well locations are shown on **Figure 5-8**.

Table 5-3

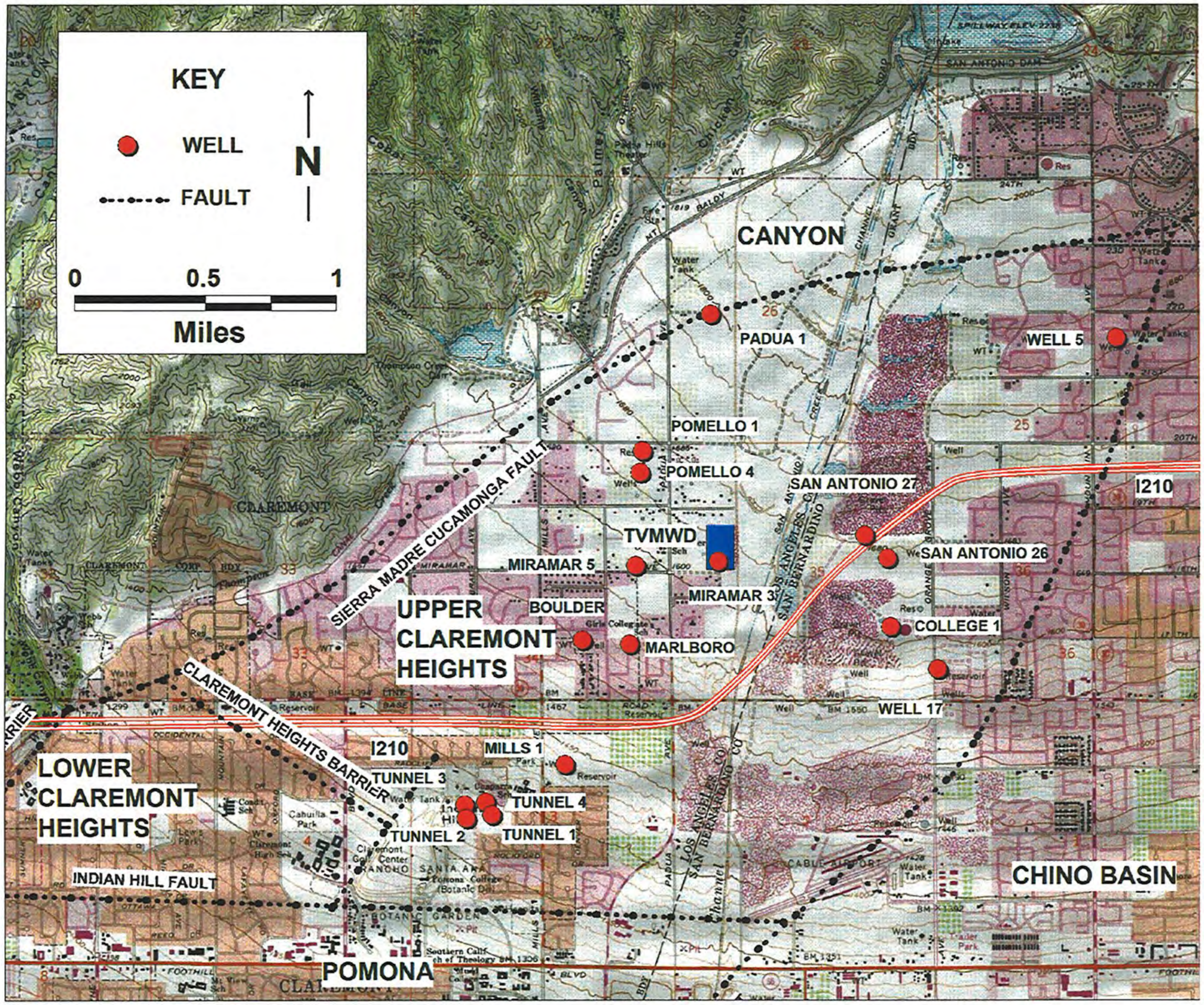
Groundwater Wells Used For Local Water Quality Determination

Well Name	State Well Number	Well Owner	Number of Constituent Results
Boulder 1	01N/08W-34Q01 S	Southern California Water Company	877
College Well 1	01N/08W-35Q01 S	Pomona College	1889
Marlboro	01N/08W-34R01 S	Southern California Water Company	939
Mills 1	01S/08W-03G02 S	Southern California Water Company	1756
Miramar 3	01N/08W-35E01 S	Southern California Water Company	1105
Miramar 5	01N/08W-34H01 S	Southern California Water Company	1049
Padua 1	01N/08W-26E01 S	Southern California Water Company	75
Pomello 1	01N/08W-34A01 S	Southern California Water Company	964
Pomello 4	01N/08W-34A02 S	Southern California Water Company	567
San Antonio 26	01N/08W-35J03 S	San Antonio Water Company	1090
San Antonio 27	01N/08W-35K02 S	San Antonio Water Company	427
Tunnel Well 1	01S/08W-03F02 S	City of Pomona	823
Tunnel Well 2	01S/08W-03F04 S	City of Pomona	821
Tunnel Well 3	01S/08W-03F03 S	City of Pomona	854
Tunnel Well 4	01S/08W-03F05 S	City of Pomona	888
Well 17	01N/08W-36N01 S	City of Upland	1534
Well 5	01N/08W-25K03 S	City of Upland	907

Table 5-4 Summary of State Water Project Water and Local Groundwater Chemical Constituents

Constituents	Units	MCL (b)	Groundwater (Jan. 1994 to Jan. 2004)				Silverwood (Jan.1998 to May 2004)			
			Range (a)	Mean	Standard Deviation	Number of Results	Range	Mean	Standard Deviation	Number of Results
Total Dissolved Solids (TDS)	mg/L (c)	500 (g)	165 - 290	229	22	73	196 - 353	264	45	19
Specific Conductance	umhos/cm (d)	900 (g)	300 - 520	382	29	233	351 - 615	471	78	19
Calcium (Ca)	mg/L		35 - 75	55	8.5	73	16 - 25	20	2.6	19
Magnesium (Mg)	mg/L		2.4 - 22	10.6	3.9	73	10 - 16	12	1.7	19
Sodium (Na)	mg/L		5.1 - 41	14	6.8	73	34 - 72	50	11	19
Potassium (K)	mg/L		*0.0* - 3	1.7	0.5	73				0
Bicarbonate (HCO3)	mg/L		71 - 281	195	29.8	73				0
Sulfate (SO_4)	mg/L	250 (g)	17.1 - 39.2	26.7	3.7	73	*0.0* - 58	32	16	22
Chloride (Cl)	mg/L	250 (g)	1.8 - 12	6.6	1.7	73	45 - 114	71	21	19
Hardness (as $CaCO_3$)	mg/L		120 - 256	183	29.1	73	81 - 107	95	12	4
Alkalinity (as CaCO3)	mg/L		132 - 230	161	21.4	73	72 - 91	79	6.1	19
Fluoride (F)	mg/L	2	*0.0* - 0.79	0.31	0.15	87	0 - 0.1	0.03	0.05	22
Nitrate (as NO_3)	mg/L	45	*0.0* - 79	15.9	8.3	262	0.9 - 5.4	2.6	1.30	19
Nitrate □ Nitrite (N)	mg/L	10	*0.0* 7.2	2.7	1.9	60	0.2 1.6	0.6	0.31	60
Nitrite (as N)	mg/L	1	*0.0* - *□0.4*	*0.191*	*0.201*	86				0
Dissolved Ammonia (as N)	mg/L						*0.0* - 0.08	0.03	0.02	60
Iron (Fe)	mg/L	0.3 (g)	*0.0* - 1.1	0.072	0.133	71	*0.0* - 0.032	0.004	0.008	20
Manganese (Mn)	mg/L	0.05 (g)	*0.0* - 0.121	0.016	0.018	77	*0.0* - 0.009	0.002	0.003	20
pH (Lab)	std units	6.5-8.5 (i)	6.9 - 8.5	7.7	0.26	202	6.0 - 8.1	7.4	0.65	16
Apparent Color	units	15 (g)	*0.0* - 50	3	6	61				0
Odor	TON	3 (g)	1 - 2	1.0	0.13	61				0
Turbidity	NTU (e)	5 (g)	*0.0* - 15.2	0.3	1.2	222	*0.0* - 4	2	1	21
Aluminum (Al)	mg/L	1	*0.0* - 0.130	0.025	0.030	63	*0.0* - 0.011	0.001	0.003	19
Antimony (Sb)	mg/L	0.006	*0.0* - *□0.006*	*0.003*	*0.003*	60	*0.0* - *□0.005*	*0.000*	*0.000*	3
Arsenic (As)	mg/L	0.01	*0.0* - 0.003	0.001	0.001	71	0.002 - 0.004	0.002	0.001	21
Barium (Ba)	mg/L	1	*0.0* - *□0.1*	*0.038*	*0.049*	63	*0.0* - *□0.05*	*0.000*	*0.000*	20
Beryllium (Be)	mg/L	0.004	*0.0* - *□.001*	*0.000*	*0.001*	63	*0.0* - *□0.001*	*0.000*	*0.000*	17
Boron (B)	mg/L	1 (h)	*0.0* - 0.170	0.036	0.052	59	0.1 - 0.2	0.17	0.05	19
Cadmium (Cd)	mg/L	0.005	*0.0* - *□0.001*	*0.0004*	*0.0005*	63	*0.0* - *□0.001*	*0.000*	*0.000*	20
Total Chromium (Cr)	mg/L	0.05	*0.0* - *□0.01*	*0.004*	*0.005*	77	*0.0* - 0.008	0.003	0.002	20
Chormium Hexavalent	mg/L	0.0002 (f)	*0.0* 0.033	0.002	0.007	22				0
Copper (Cu)	mg/L	1 (g)	*0.0* - *□0.05*	*0.028*	*0.025*	75	0.002 - 0.005	0.003	0.001	20
Lead (Pb)	mg/L	0.015	*0.0* - *□0.005*	*0.002*	*0.002*	61	*0.0* - *□0.001*	*0.000*	*0.000*	20
Mercury (Hg)	mg/L	0.002	*0.0* - 0.001	0.000	0.001	63	*0.0* - *□0.0002*	*0.000*	*0.000*	18
Nickel (Ni)	mg/L	0.1	*0.0* - 0.012	0.004	0.005	63	0.001 - 0.002	0.002	0.000	17
Selenium (Se)	mg/L	0.05	*0.0* - 0.006	0.002	0.003	63	*0.0* - 0.001	0.000	0.000	6
Silver (Ag)	mg/L	0.1 (g)	*0.0* - *□.01*	*0.004*	*0.005*	59	*0.0* - *□0.001*	*0.000*	*0.000*	22
Zinc (Zn)	mg/L	5 (g)	*0.0* - *□0.05*	*0.03*	*0.03*	74	*0.0* - 0.008	0.001	0.002	20
Total Trihalomethanes (TTHM)(j)	mg/L	0.1	*0.0* - 0.021	0.001	0.003	168	*0.0* - *□0.05*	*0.000*	*0.000*	24
Dibromochloropropane (DBCP)	□g/L	0.2	*0.0* - 0.23	0.02	0.04	489				
Fluorobenzene(k)	□g/L						8.2 - 10.8	9.51	0.759	23
Total Phosphorus	mg/L as P						0.02 - 0.15	0.070	0.022	57
Bromide	mg/L						*0.0* - 0.38	0.213	0.090	42
Methyl-*tert*-butyl ether (MTBE)	□g/L	13	*0.0* - *□5*	*0.5*	*1.5*	136	*0.0* - 2.8	1.7	0.8	24

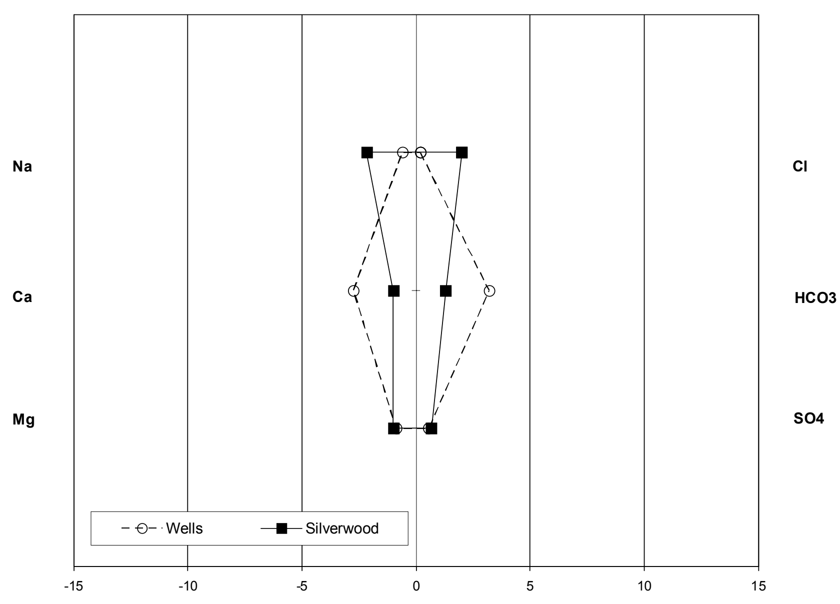
Notes:
(a) Italicized numbers represent nondetected levels
(b) California Department of Health Services Drinking Water Maximum Contaminant Level
(c) milligrams per liter
(d) micromhos per cubic centimeter
(e) Nephelometric turbidity unit
(f) California Public Health Goal
(g) California Department of Health Services Drinking Water Secondary I
(h) California Department of Health Services Action Level
(i) US Envirnomental Protection Agency Secondary Drinking Water MCL
(j) Total of Chloroform □ Bromoform □ Dibromochloromethane for Silverwood
(k) results are from September 17, 2000 to October 16, 2000



Six Basins Recharge Feasibility Study Six Basins Watermaster	Bookman-Edmonston A Division of GEI Consultants	Well Locations for Groundwater Quality
Three Valleys Municipal Water District Claremont, California	040740	April 2005 — Figure 5-8

No significant water quality changes will occur to the local groundwater as a result of recharging with State Water Project water. The most significant water quality effect could be an increase in total dissolved solid (TDS) from about 220 mg/L to a maximum of about 264 mg/L, and a basic water chemistry change from calcium bicarbonate dominant water to sodium chloride dominant water. The basic water chemistry is shown on the Stiff Diagram in **Figure 5-9**. State Water Project water generally has an average concentration of 50 mg/L sodium and 71 mg/L chloride where the groundwater has an average concentration of about 14 and 7 mg/L, respectively. The groundwater could decrease in calcium bicarbonate with a corresponding decrease in hardness and alkalinity. However, it is most likely that State Water Project water will mix with local groundwater and natural recharged water to form constituent concentration between the water's sources. One beneficial result to groundwater quality should be the decrease in nitrate levels. Nitrate could decrease from about 15.9 mg/L (as NO_3) to as low as 2.6 mg/L. Other benefits could include decreases in levels of cadmium, total chromium, chromium six, and Dibromochloropropane (DBCP), although these constituents are currently low. Possible adverse effect to groundwater could include a slight increase in Methyl-tert-butyl ether (MTBE), bromide, total phosphorus, and Fluorobenzene. However, the concentrations of these constituents are very low in State Water Project water, and except for MTBE, which has a detection limit of 5 µg/L in groundwater analysis relative to 1 µg/L in State Water Project water, no analysis exists for these constituents in Six Basins groundwater. The higher detection limits in groundwater analysis relative to State Water Project water generally yield larger numbers of results with less than detection values and this tends to reduce the constituents average value. A Fluorobenzene analysis of State Water Project water from August 17, 2000 to October 16, 2000 appears to represent a singular event in State Water Project water chemistry.

Figure 5-9 Water Quality Summary Stiff Diagram



Conclusions

Based on the findings summarized in this report, the spreading of imported water in the Spreading Grounds will not produce any significant adverse groundwater quality effects, and any potential affects related to rising groundwater can be mitigated by groundwater level monitoring and limiting the amount of imported water spread. The maximum amount of imported water spread can be determined by the recharge capacity calculated at Mountain View 4, and for best management practices the imported water should be extracted from the UCHB before it arrives in to the Pomona Basin.

This analysis was completed prior to the winter of 2004-2005 which has been one of the wettest winters on record. Approximately 16,000 acre-feet of native water has been recharged as of the end of March. There are now more monitoring wells available than in the past. Analysis of this years spreading will provide additional understanding of the basin.

CDM's concerns focused on the Pomona Tunnel Wells area. They recommended keeping groundwater elevations in the Pomona Tunnel Wells area below 1,300 feet. When the groundwater elevations at Tunnel Well 3 and Mountain View 4 from July 1993 to April 2004 (available data from PVPA Spreadsheet Model) were compared, groundwater elevations at Tunnel Well 3 were 1,300 feet or greater only twice: in September 1993 (1,301 ft) and December 1993 (1,302 ft). During these times, the groundwater elevations at Mountain View 4 were 1,421 feet and 1,401 feet, respectively. These groundwater elevations at Mountain View and the requirement to keep the water surface to 50 feet bgs at Mountain View 4 limit the spreading of imported water to zero and 1,200 acre-feet, respectively. Additionally, from April 1995 to September 1995, and from July 1998 to April 1999, the calculated recharge capacities at Mountain View 4 were between zero and 1,200 acre-feet, and the groundwater elevations at Tunnel Well 3 averaged 1,227 feet and 1,271 feet, respectively. From this historical data, if the recharge capacity at Mountain View 4 is note exceeded only minor amounts (less than 1,200 acre-feet) of imported water would be spread when the groundwater elevation at Tunnel Well 3 is higher than about 1,227 to 1,271 feet.

Because of the safeties built into the recharge capacity calculations, no impacts to State Route 210 will occur due to spreading in Spreading Grounds provided the recharge capacity of Mountain View 4 is not exceeded.

Section 6 Environmental Documentation, Institutional Issues Permitting

This section covers the environmental documentation, institutional issues and permitting requirements required to implement the project.

Environmental Documentation

Three Valleys is the lead agency for the Proposed Project with the principal responsibility for carrying out and approving the project and therefore the principal responsibility preparing CEQA documents.

A Notice of Preparation/Initial Study has been prepared. The Initial Study found that the project could potentially affect biological resources, mineral resources, hydrology/water quality, geology/soils and mandatory findings of significance.

The proposed project may have a significant effect on the environment, and an Environmental Impact Report is required. Three Valleys accepted written responses and comments on the Notice of Preparation/Initial Study between February 25, 2005 and March 28, 2005. The anticipated completion of environmental documentation is June 30, 2005.

It is anticipated that the final Environmental Impact Report will require mitigation measures that will affect the design, construction and operation of the proposed project. Mitigation will be required to reduce potential impacts to Biological Resources and to Geology and Soils to less than significant. The Biological Resources mitigation measures will require careful coordination during design and construction. The Geology and Soils mitigation measures will address operation of the project.

Jurisdictional Areas (USACECDFG)

United States Army Corps of Engineers

Under Section 404 of the *Clean Water Act* (CWA) the U.S. Army Corps of Engineers (Corps) is charged with regulating the discharge of dredge and fill materials into jurisdictional waters of the United States. The term “waters of the United States,” or “jurisdictional waters,” has a broad meaning that includes special aquatic sites, such as wetlands. Waters of the United States, as defined by regulation and refined by case law, include (1) the territorial seas; (2) coastal and inland waters, lakes, rivers, and streams that are navigable waters of the United States, including their adjacent wetlands; (3) tributaries to navigable waters of the United States, including adjacent wetlands; (4) interstate waters and their tributaries, including adjacent wetlands; and (5) all other waters of the United States not identified above, such as some isolated wetlands and lakes, intermittent and ephemeral streams, prairie potholes, and other waters that are not a part of a tributary system to interstate waters or navigable waters of the United States, the degradation or destruction of which could affect interstate commerce.

San Antonio Creek runs though the southern portion of the project site and outflows from San Antonio Dam normally flow down the San Antonio Creek Channel into the Chino Creek Channel and into Prado Reservoir. As the San Antonio Dam is operated as a component of the Santa Ana River reservoir system, San Antonio Creek would be considered waters of the United States by the Corps under the jurisdictional authority given to them by the *Clean Water Act*. Alterations to the channel would need to be in compliance with the CWA and may require a Section 404 permit. The spreading basins located outside of the channel, within the alluvial fan are artificial structures that are designed to hold and dissipate water into the alluvium for groundwater recharge. As the inflow and outflow are not connected to the channel, and are artificially maintained on a regular basis (i.e., flows can be turned on and turned off), it is unlikely that these spreading basins would be considered other waters of the U.S. as the normal circumstances of the area would be outside of the jurisdictional boundaries of the CWA. Lastly, the small drainage ditch located along the eastern boarder of the proposed project area connects to the Caltrans stormwater collection system. This channel could be considered other waters of the US under recent court rulings (e.g., *Headwaters, Inc. v. Talent Irrigation District*, 243 F.3d 526 [9th Cir. 2001]).
Although the spreading basins within the proposed project area do not appear to be subject to Corps jurisdiction, the Corps reserves the right, on a case-by-case basis and as supported by applicable laws and regulations, to determine whether or not potential jurisdictional areas lie within their regulatory boundaries.

California Department of Fish and Game

When any alteration of a lake, stream, or river could adversely affect fish and wildlife resources within the State, the CDFG is empowered under Section 1600 of the Fish and Game Code to issue a Streambed Alteration Agreement, which is designed to ensure protections of said resources. Typical activities that require a Streambed Alteration Agreement include excavation or fill placed within a channel, vegetation clearing, structures for diversion of water, installation of culverts and bridge supports, cofferdams for construction dewatering, and bank reinforcement.
The CDFG reserve the right, on a case by case basis to determine whether or not potential jurisdictional waters lie within their regulatory boundaries.

Pomona Valley Protective Association

Pomona Valley Protective Association (PVPA) is a non-profit corporation created in 1910 to protect the water producers in the Claremont, Pomona, Upland and La Verne areas from outside interests developing and exporting local water from the area.

Watermaster has the authority under the Six Basins Adjudication to direct spreading by PVPA. This process is evolving toward greater management by Watermaster. The Memorandum of Agreement between the Pomona Valley Protective Association and Watermaster of the Six Basins relating to Water Spreading and Related Activities addresses use of the Spreading Grounds by PVPA and responsibilities of Watermaster.

PVPA and Watermaster will reach agreements covering construction.

Leaseholds within San Antonio Spreading Grounds

Vulcan Materials Company- Western Division

Vulcan leases property from PVPA for the purpose of mining aggregate. They have an ongoing operation on the San Bernardino side of the Spreading Grounds. Vulcan leases 214 acres on the north end of the Los Angeles side. The Los Angeles side is currently under review for a conditional use permit to allow mining. The Proposed Project does not include the land leased by Vulcan. (Vulcan, 2004)

Holliday Rock Company Inc.

Holliday Rock Company (Holliday Rock) leases property from PVPA for the purpose of mining aggregate. While they currently are not actively mining, they have recently prepared a mining and reclamation plan to mine the southern portion of the Los Angeles side. Most of the Proposed Project is within the area that Holliday Rock proposes mining. Discussions between the District and Holliday Rock indicate that the two projects are compatible. This report has been prepared based on the assumption that the Proposed Project will precede mining operations.

Metropolitan Water District of Southern California

Metropolitan has a 200-foot wide easement near the southern end of the Spreading Grounds. The northern edge of this easement is approximately in line with the southern edge of the Miramar Treatment Plant. Metropolitan’s Foothill Feeder and Service Connection OC-59 are within this easement. Figure 4-1 shows Foothill Feeder in this vicinity.

Permitting requirements

A permit from the Los Angeles County Department of Public Works (Public Works) will be required for crossing San Antonio Channel. Public Works will coordinate the permit with the Los Angeles District Army Corps of Engineers. Presuming that the initial Flood Permit Application meets all requirements, it will take two to four months for the permit process. There will be a plan check fee on the order of $500 and an inspection fee on the order of $400 (fees are currently under review). Telephone contact with Public Works Permitting Office is 626/458-3129. Telephone contact can be made at the Corps of Engineers at 213/452 3393 (Ted Masigat). A copy of Public Works Flood Permit Application, permit instruction and Guidelines for Overbuilding and Air Rights is in Appendix C.

A Stormwater Pollution Prevention Plan (SWPPP) prepared in compliance with an NPDES Phase I Permit will be required. The SWPPP describes the project site, erosion and sediment controls, runoff water quality monitoring, means of waste disposal, implementation of approved local plans, control of post-construction sediment and erosion control measures and maintenance responsibilities, and nonstormwater management controls. Dischargers are also required to inspect construction sites before and after storms to identify stormwater discharge from construction activity, and to identify and implement controls where necessary.

The Cities of Claremont and Upland will be provided an opportunity to review design drawings for portions of the construction located within their cities.

Section 7 Proposed Facilities

The operation of a water spreading project is inherently opportunistic, available supply is used first to meet immediate demand, remaining supply may be available for spreading. Furthermore, this project will compete with the spreading operations of other agencies for available water. Both Inland Empire and Orange County Water District take water deliveries for spreading from the Foothill Feeder at the OC-59 service connection within the Spreading Grounds.

While Figure 4-1 provides some guidance on the availability of spreading water, several factors suggest that future demands on the Foothill Feeder will be higher than past demands. The most recent year's data shows lower pressures (and thus higher flows and demands) than the fiscal year 1997-1999 data. This trend can be expected to continue. Reduced availability of Colorado River Water increases demand for the State Water Project water carried by the Foothill Feeder. Inland Empire's ability to spread water has recently been increased substantially by improvements to spreading grounds within their service area. Additional spreading projects are contemplated.

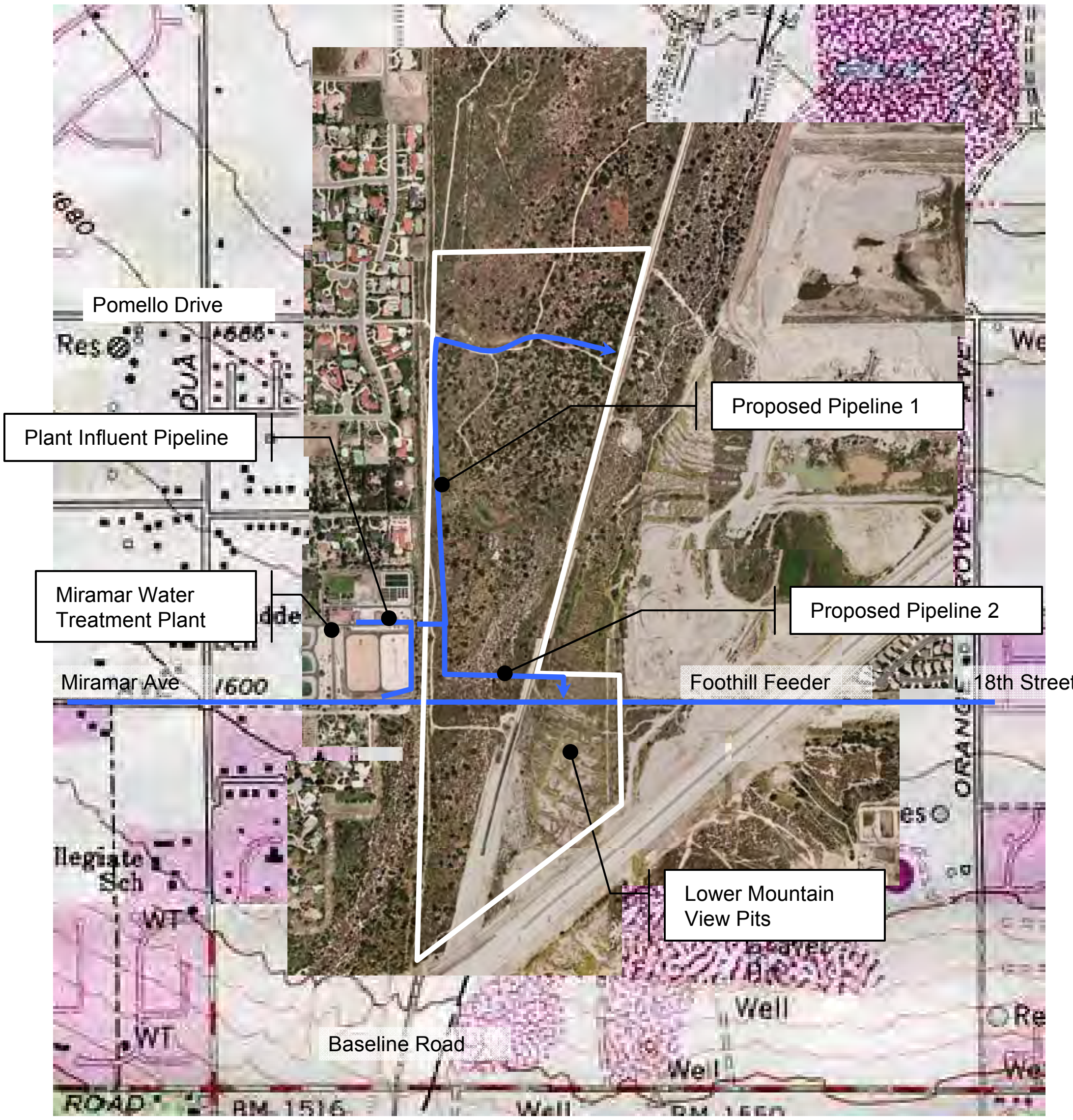
Figure 7-1 shows schematically the proposed imported water spreading facilities. **Appendix D** includes design drawings showing the proposed alignment of the pipelines.

Imported Water Connection

Metropolitan's PM-21 has a design capacity of 80 cfs. Miramar has a design capacity of 40 cfs and generally operates at capacity. Sizing the connection for 40 cfs will allow use of the full capacity of PM-21 while Miramar is operating at full capacity. A 36-inch connection will be made to the Influent Pipeline after it turns west to the hydroelectric station. Space will be available for a pump station. The pump station will not be built unless operation of the project shows that it is needed.

Pipelines

PVPA's intent for improvements to the Spreading Grounds includes extending the existing Diversion Channel along the Los Angeles side of San Antonio Channel. This channel would be used to route native water to various basins. Delivering imported water to the north end of the Diversion Channel would provide for the simplest operations. But, this option would be costly. During 2004 available pressure in the Foothill Feeder would allow deliveries to elevation 1720 (the approximate elevation of the extension of Pomello Drive approximately 50 percent of the time (see Figure 4-2), although close coordination with Metropolitan will facilitate deliveries.



Imported Water Spreading at San Antonio Spreading Grounds	Bookman-Edmonston A Division of GEI Consultants	Proposed Project Facilities
Three Valleys Municipal Water District Claremont, California	040740 April 2005	Figure 7-1

In order to avoid – or at least defer – construction of a pump station while still allowing flexibility of operations, two pipelines are proposed. Pipelines will be PVC pressure pipe for water distribution (AWWA C-905).

Pipeline 1 is intended to provide flexibility in operations. It will extend north from Miramar along the west edge of the Spreading Grounds to the extension of Pomello Drive and from there east along the extension to the Diversion Channel. This 36-inch pipeline, sized to deliver a maximum of 40 cfs at a velocity of 5.7 feet per second, will allow spreading in the three of the basins proposed by PVPA (Figure 2-1). In the future, it could be extended to connect to the Diversion Channel and north along the channel. Three outlet structures, one for each basin, will be provided. These outlet structures will consist of a concrete structure with a manually operated butterfly valve.

Pipeline 2 is intended to allow spreading operations during conditions of minimum pressure. This 24-inch pipeline, sized for a maximum of 20 cfs at a velocity of 6.4 feet per second, will extend east across San Antonio Channel to the existing Lower Mountain View Pits. Spreading will be possible when the hydraulic grade line (HGL) in the Foothill Feeder is approximately 1680 feet or less. Historically an HGL of 1680 feet has been available more than 90 percent of the time.

Outlet structures will be sized for the full capacity of their respective pipeline. Each structure will include a manually operated butterfly valve. The proposed outlet structures will be located consistent with the proposed improvements by PVPA (Figure 2-1). Watermaster will work with PVPA to complete this project.

Production Well

Three Valleys will be installing a groundwater production well at Miramar that will pump from the Upper Claremont Heights Basin. While construction of that well is not part of the Imported Water Project and is not included in the cost estimate, it will enhance operation of the project. The well will be used to produce both imported water stored as part of this project. The produced water will be delivered to the Miramar discharge line. In addition, the well could be used to produce native water for Six Basins purveyors and deliver that water to the purveyors. The well will provide an additional method of managing the groundwater basin.

Pumping Plant

If a pumping station is determined necessary in the future, it would be located within Miramar, south of the Plant Pressure Control Structure. The layout of the Imported Water Connection will be to facilitate future construction of a pumping plant.

An engineering review report was prepared to evaluate the electrical supply requirements for the project and the adequacy of existing electrical supply at Miramar. The electrical requirements for a production well at Miramar were included in the report. The well is mentioned here only from the standpoint that the eventual conjunctive use project would include a well to extract a portion of the spread water. The report is included in Appendix D.

Basin Modifications

This project does not include modifications to the basins within the Spreading Grounds. The proposed facilities can be modified to accommodate either PVPA's proposed improvements (Figure 3-1) or Holliday Rock Company's proposed mining operations (Figure 3-2) or both.

Biological Mitigation

Environmental documentation is scheduled for completion in June 2005. Based on the Biological Technical Report, mitigation will be required. For the most part, the mitigation starts with focused surveys for specific species. If those species are found, then additional mitigation measures will be developed and implemented. Given the range of possible species it is reasonable to assume that some species will be found during the surveys and mitigation will be required to mitigate construction impacts.

Capital Cost

Table 7-1 shows the preliminary cost estimate of $2.1 million based on current costs and $2.2 million based on 2007 price level. This cost includes capital costs for constructing the connection to the District's Intake Pipeline, a 24-inch pipeline to the Lower Mountain View Pits and a 36-inch pipeline north to Pomello Drive and then east along the extension of Pomello Drive to the Diversion Channel. Costs for a pump station and a production well are not included. District administrative costs are not included. A 20-percent contingency is included in the construction cost.

Table 7-1
Capital Cost Estimate

Item	Total
Design	150000
Biological focused surveys □ mitigation plans (allowance)	50,000
Construction Contract Total	1,728,794
Construction Management	160,000
Project Capital Cost, May 2005 price level	**□ 2,088,794**
Adjust to midpoint of construction (2007)	106□
Project Capital Cost, 2007 price level	**□ 2,214,122**
Note: Does not include District administration costs.	

Metropolitan has committed $1.23 million to the Proposed Project. If funding is not available for the remaining $1.0 million, the length of the 36-inch pipeline can be reduced with little impact on project operations. Eliminating the portion that follows the extension of Pomello Drive to the Diversion Channel would reduce project costs to approximately $1.8 million.

Section 8 □ Proposed Operations

This section covers the impact of operations on groundwater production by evaluating a possible operational scenario. It then reviews the monitoring that will both determine how much water can be spread and verify the impact of the spreading. Finally the physical operation of the Proposed Project is reviewed. As previously discussed, the Proposed Project will be operated in accordance with the Six Basins Adjudication. It will allow implementation of storage and recovery programs and provision of replacement water in accordance with the Adjudication.

Impact of Operations on Groundwater Production

Using the analysis of geology and hydrogeology presented in Section 5, a spreadsheet was developed to model the response of water levels in the Upper Claremont Heights Basin (UCHB) to spreading and recovery of imported water. Water levels in Mountain View 4 well are used as the surrogate for the water levels in the entire basin. A repeat of historic conditions from 1973 through 2003 is presumed – with native recharge limited to maintain water levels at no higher than 50 feet below ground surface (bgs). The spreadsheet was used to examine a hypothetical scenario for spreading imported water. That scenario is discussed below and the key operational parameters are presented in **Table 8-1**. Detailed calculations and graphical presentations of the results are in **Appendix E**.

The scenario presumes that up to 8,000 acre-feet of imported water is available to spread each year. Spreading of imported water would only occur as long as the spread water would not raise the groundwater level above 100 feet below ground surface (bgs) from November through February or above 50 feet bgs from March through October. Limited by the ability to look ahead, additional storage space is reserved during a wet year for native recharge.

Recovery of imported water occurs if the water level is above 110 feet bgs from January through July. Starting in August the recovery elevation drops monthly to 150 feet bgs in November and December. A maximum of 12,000 acre-feet is recovered in any year and up to 15,000 acre-feet of imported water is kept in storage to maintain water levels and dry-year supplies.

Additionally, the scenario allows up to 3,000 acre-feet of additional native water to be pumped if the water level is above 70 feet bgs.

Implicit in these scenarios is the assumption that pumpers could change their operations if the Proposed Project were in place. With the knowledge that imported water is available to supply replacement water, pumpers could increase their pumping. Naturally occurring high water levels could be pumped down faster making additional space for both native and imported water spreading.

This scenario demonstrates some of the options that are available and the some of the operational decisions that will be required. Actual operations will be developed by an operating committee. Operations will start at a low level and will increase over time as understanding of the response of the groundwater basin improves and the institutional relationships required to operate the proposed project develop.

Table 8-1

Key Operational Scenario — Imported Water Storage and Recovery Parameters

Spreading of Imported water			Recovery		
Month	Spread if water level above (feet bgs)	Maximum available for spreading	Recover if water level above (feet bgs)	Maximum monthly recovery (acre-feet)	Maximum recovery as percent of storage
January	100	1,733	110	500	0□
February	100	1,733	110	500	0□
March	50	1,733	110	500	0□
April	50	1,733	110	500	0□
May	50	333	110	1,500	0□
June	50	-	110	1,500	10□
July	50	400	110	1,500	33□
August	50	-	120	1,500	50□
September	50	0	140	1,500	100□
October	50	0	140	1,500	100□
November	100	0	150	500	100□
December	100	0	150	500	100□
	Annual maximum	8,000	Annual maximum	12,000	

Table 8-2 summarizes the results of this scenario over a thirty-one year history.

Table 8-2

Results of Hypothetical Operational Scenario

Presumes up to 8,000 acre-feet spread each year depending of basin capacity

(based on 1973 through 2003 historic hydrology)

	Results
Spreading and recovery over time period (acre-feet)	
Imported water stored	165,679 acre-feet
Imported water recovered	155,624 acre-feet
Imported water in storage at end of period	10,055 acre-feet
Increase in native water pumping	3,250 acre-feet
Total increase in recovery	158,874 acre-feet
Average annual increase in groundwater recovery	5,125 acre-feet/year
Water levels at Mountain View 4	
Average Water Surface Elevation (135 ft bgs without project)	129 feet bgs
Months water surface elevation 150 ft bgs or more (131 months without project)	114 months
Months water surface elevation 200 ft bgs or more (66 months without project)	0 months
Water level at end of period (225 feet bgs without project)	160 feet bgs

Geological Limits on Spreading

The recharge capacity of the Upper Claremont Heights Basin can be estimated by the method described in Section 5 using Mountain View 4 (01S/08W-02F01 S). The calculation of the recharge capacity should use a maximum groundwater elevation of surface elevation minus 50 feet. This maximum groundwater elevation was determined by using the 40 feet to water for the liquefaction susceptibility zone (a) and a margin of safety of 10 feet. Stored water could be extracted from the Upper Claremont Heights Basin before additional storage is allowed. Alternatively stored water not removed from the Upper Claremont Heights Basin can be allowed to migrate to the Pomona Basin to allow for storage in the Upper Claremont Heights Basin provided the migration of the stored water does not increase the Pomona Basin groundwater levels that would create a problem in the Pomona Basin (i.e. to elevations within 50-feet of the surface).

During the first three years of the proposed project no more than 50 percent of the calculated recharge capacity of Upper Claremont Heights Basin should be used to insure that the proposed calculation methods are correct. During the following two years, no more than 80 percent of the calculated recharge capacity should be used. During the life of the project, the observed groundwater level changes from spreading should be compared to the calculated groundwater level changes by the recharge capacity charts for Mountain View 4, Miramar 3, College 1, Mills 1, and Tunnel #3. Recharge capacity charts for these wells are located in Appendix B. Any correction to the estimated recharge capacity of the Upper Claremont Heights Basin based on the observed verses calculated groundwater level changes should be made.

A groundwater monitoring program should be implemented to insure that rising groundwater does not cause adverse effects to the Six Basins. The groundwater monitoring program should consist of the monthly monitoring and hydrograph updating of groundwater elevations for the nineteen wells listed in **Table 8-3**.

Table 8-3
Groundwater Monitoring Wells

Name	State Well Number	Sub Basin	Well Owner
College 1	01N/08W-35Q01 S	UCH	Pomona College
Fair Oaks	01S/08W-10B01 S	Pomona	SCWC
Foothill 3	01S/08W-25L01,02 S	UCH	West End CWC
Ford 1	01S/08W-09E02 S	Pomona	So California WC
Mills 1	01S/08W-03G02 S	UCH	So California WC
Miramar 3	01N/08W-35E01 S	UCH	So California WC
Mountain View 4	01S/08W-02F01 S	UCH	West End CWC
MW 1	N/A	UCH	Six Basins
MW 2	N/A	UCH	Six Basins
MW 3	N/A	Pomona	Six Basins
Old P-1	01S/08W-17P01 S	Pomona	City of Pomona
P-20	01S/08W-04L01 S	LCH	City of Pomona
P-7	01S/08W-17K02 S	Pomona	City of Pomona
P-9	01S/08W-08H02 S	Pomona	City of Pomona
SAWC 28	01N/08W-36D01 S	UCH	San Antonio WC
SAWC 33	N/A	Canyon	San Antonio WC
Tunnel Well 3	01S/08W-03F03 S	UCH	City of Pomona
Tunnel Well 4	01S/08W-03F05 S	UCH	City of Pomona
Upland 2	01N/08W-24E01	Canyon	City of Upland

As operation of the project proceeds and a better understanding of the response of the groundwater basin developed, these rules may be modified.

Physical operation of facilities

Coordinating deliveries with Metropolitan

Metropolitan makes deliveries for spreading only after meeting all direct municipal delivery demand. Thus, spreading water (Metropolitan uses the term “replenishment water”) is generally available during the winter months of October through April with some exceptions. During dry periods, spreading water may not be available and during wet periods spreading water may be available during the summer.

State Water Project deliveries are curtailed when the supply is insufficient to meet all demands. While allocations of entitlement are projected to average about 70 percent of the annual entitlement, they vary in any given year. In recent years the State has set an initial allocation of 20 to 40 percent of entitlement for the fall for following year. This amount is usually increased as the year develops and water supply becomes known. Increases have occurred as late as August. Allocations for recent years are shown in **Table 8-4**.

Table 8-4
Historic State Water Project Allocations

Water Year	Date	Allocation as a Percent of Entitlement
2001	December 1, 2000	40
	January 31, 2001	20
	March 6, 2001	25
	March 15, 2001	30
	May 4, 2001	33
	May 17, 2001	35
	August 16, 2001	39
2002	November 30, 2001	20
	January 11, 2002	45
	March 22, 2002	55
	March 28, 2002	60
	May 14, 2002	65
	August 23, 2002	70
2003	December 3, 2002	20
	January 16, 2003	45
	March 26, 2003	50
	April 24, 2003	70
	May 16, 2003	90
2004	December 1, 2003	35
	January 15, 2004	50
	March 1, 2004	65
2005	November 30, 2005	40
	January 14, 2005	60

Recent drought conditions on the Colorado River further challenge Metropolitan's flexibility. Metropolitan's deliveries from the Colorado have reduced by approximately half. As Metropolitan has a limited right to Colorado River water it has been operating largely on surplus water. Demand for Colorado River water from other agencies can also affect Metropolitan's deliveries. In 2004 Metropolitan's allocation was increased in November as the higher priority agricultural users in California had not used their full allocation. This increase was about 150,000 acre-feet.

Capacity of the Foothill Feeder can also affect the availability of replenishment water. There are four other major areas which use the Foothill Feeder for spreading water. These are, the Inland Empire, Orange County Water District, Upper San Gabriel Valley MWD and Central Basin. While some of these agencies have other connections for replenishment deliveries, the Foothill Feeder is the only one serving just State Project water. State Project water is preferred over Colorado River water for replenishment because of its lower salinity. Also, Metropolitan generally prefers to deliver State Project water for spreading in order to maintain the proper water quality mix at surface water treatment plants. These challenges puts pressure on the Foothill Feeder and Metropolitan may be in the position of having to allocate between agencies.

While Metropolitan faces challenges in determining the presence of surplus water and thus the availability of water for spreading, Metropolitan staff is very interested in supplying spreading water while working within a limited supply situation. The proposed project benefits Metropolitan as well as the Six Basins area.

Replenishing agencies also have scheduling challenges with spreading operations. Examples include spreading ground availability, channels not available because of construction activities, flood operations, insect control, channel cleaning operations (the timing of which is controlled by nesting habits of endangered birds).

While spreading water will be available, Three Valleys will need to be flexible and willing to take the water when it is available. Some of the agencies are inflexible and order water for delivery in certain time periods. Three Valleys does have an advantage over other agencies in that flood operations will not affect the ability to take deliveries.

Some of the scheduling problems in the San Gabriel River area are worked out in a long standing committee of the replenishing agencies, Metropolitan, County Sanitation District as supplier of recycled water, the County as operator of the facilities and sometimes the Corps as owner and operator of some facilities. This group meets every six weeks to two months depending upon the issues. Three Valleys has attended these meetings.

Coordinating deliveries with PVPA

Watermaster has the authority under the Six Basins Adjudication to direct spreading by PVPA. This process is evolving toward greater management by Watermaster.

Annual Operating Cost

Table 8-5 shows projections of the annual operating cost basis of an average of 5,000 acre-feet stored and recovered per year.

Table 8-5
Annual Operating Cost
(5,000 acre-foot/year storage and recovery.)

Item	Cost
Purchase of untreated replenishment water from Metropolitan at $238 per acre-foot (January 1, 2005 rates)	$ 1,175,000/year
Energy to deliver (Depend on Feeder pressure. Assume Feeder pressure is adequate for deliveries)	-
Gate operations, etc during deliveries (say 4hr/d □ 80 day/year, $70/hr)	22,400/year
Increased maintenance of Spreading Grounds (say 160 hr/year at $120/hr)	19,200/year
Additional groundwater monitoring (say 120 hr/year at $90/hr)	10,800/year
Pumping energy - recovery of 5,000 af from 150 ft bgs (e□70□; $0.12/kWh)	131,700/year
Annual operating cost	**□ 1,359,100□year**
Acre-feet/year	5,000 acre-foot
Operating cost per acre-foot including purchase of water	**□ 272□acre-foot**

Project Benefits to Three Valleys and member agencies

As previously discussed, the objectives of the Proposed Project include:

- Improve the reliability of water supply in the Six Basins.
- Store imported water when available in order to provide supply in dry years.
- Reduce annual and seasonal peak demand on surface water treatment plants
- Increase operational flexibility in the SWP and Metropolitan's transmission facilities by allowing delivery for recharge rather than for direct use.
- Reduce the cost of purchased water.
- Store water for extraction during dry years.

A simplified approach to quantifying the benefits is to quantify the savings to the Six Basins pumpers from operating the project compare the purchase, storage and recovery of untreated replenishment water from Metropolitan to the purchase of full service treated water. **Table 8-6** shows this calculation based on an average storage and recovery of 5,000.

Table 8-6
Annual Operating Benefit
(5,000 acre-foot/year storage and recovery. Does not include capital costs)

Item	
Cost of full service treated water from Metropolitan (90 □ at Tier 1 rate of $443/acre-foot and 10□ at Tier 2 rate of $524/acre-foot, January 1, 2005 rates)	$451/acre-foot
Cost of water spread and recovered by Imported Water Storage Project	$272/acre-foot
Reduced cost of purchased water per acre-foot	**□179□acre-foot**
Annual storage and recovery	5,000 acre-foot
Reduced annual water supply cost presuming 5,000 acre-feet□year storage and recovery	**□ 895,000□year**

The calculation does not include the capital cost of the project. Metropolitan has agreed to pay for a portion of the project's construction due to benefits to Metropolitan's operations and improved water supply reliability within Metropolitan's service area. Were the portion not funded by Metropolitan included in this calculation at a 5 percent interest rate over a 50 year life, the increase in project costs would be only $22 per acre-foot and the Proposed Project would reduce annual water supply cost by $ 785,000 per year.

This calculation understates project benefits to Six Basins pumpers as it does not address improved reliability, reducing the Six Basins pumpers dependency on imported supplies when there are shortages of imported supplies (either State Water Project or Colorado River), deferring the need to expand treatment capacity, and increasing operational flexibility of Metropolitan's system and the State Water Project.

Section 9 □ Proposed Schedule

Three Valley's proposed Groundwater Storage Funding Agreement with Metropolitan provides supplemental funding for this project. That agreement requires the project to be operational by May 2008 including a production well. Completion of CEQA documentation in June 2005 is required for that agreement to be approved by the Metropolitan Board in August 2005.

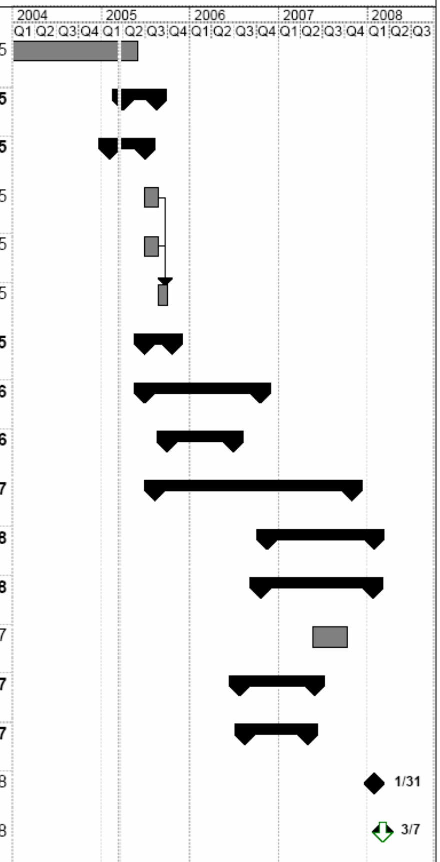
The most difficult scheduling challenge for construction of the project and operations will be the anticipated biological mitigation. The mitigation is generally a multi-step process:

- Surveys are done for specific species in accordance with established protocols. There are tradeoffs between doing surveys promptly, doing them at specific times of the year, and doing them close to the start of construction.
- If the species are found, mitigation plans are developed in coordination with regulatory agencies. Depending on the species involved, those plans could take months to develop.
- Mitigation plans are then implemented.

A preliminary schedule has been prepared. An abbreviated form of the schedule is shown in **Figure 9-1**. A more complete schedule, showing interdependency between each task is shown in **Appendix F**.

Figure 9-1
Proposed Project Schedule

ID	Task Name	Duration	Start	Finish
1	**Feasibility Study**	370 days	Thu 1/1/04	Tue 5/31/05
2	**Institutional Coordination**	**100 days**	**Fri 4/1/05**	**Thu 8/18/05**
5	**Environmental\CEQA**	**105 days**	**Sat 2/5/05**	**Thu 6/30/05**
19	**RFP Process - Spreading Connectior**	40 days	Fri 7/1/05	Thu 8/25/05
20	**RFP Process - Production Well**	40 days	Fri 7/1/05	Thu 8/25/05
21	**MWD review of budget and schedule**	25 days	Fri 8/26/05	Thu 9/29/05
22	**DWSAP Program**	**80 days**	**Fri 7/1/05**	**Thu 10/20/05**
25	**Imported Water Connection Design**	**340 days**	**Fri 7/1/05**	**Thu 10/19/06**
40	**Production Well Design**	**195 days**	**Fri 9/30/05**	**Thu 6/29/06**
46	**Environmental Mitigation**	**580 days**	**Fri 8/12/05**	**Thu 11/1/07**
56	**Imported Connection Construction**	**315 days**	**Fri 11/17/06**	**Thu 1/31/08**
70	**Imported Connection CM**	**330 days**	**Fri 10/20/06**	**Thu 1/24/08**
76	**Operating committee & initial operati**	100 days	Fri 5/25/07	Thu 10/11/07
77	**Production Well Construction**	**220 days**	**Fri 7/28/06**	**Thu 5/31/07**
87	**Production Well CM**	**185 days**	**Fri 8/18/06**	**Thu 5/3/07**
94	Project completion	0 days	Thu 1/31/08	Thu 1/31/08
95	**Funding Deadline for Imported Conn**	0 days	Fri 3/7/08	Fri 3/7/08



The environmental mitigation requirements, while not costly compared to the basic construction costs, present a management challenge. There are choices available for the timing of various steps of the environmental mitigation. Those choices will have to be weighed and informed decisions made as the project moves forward.

Appendix A
Bibliography

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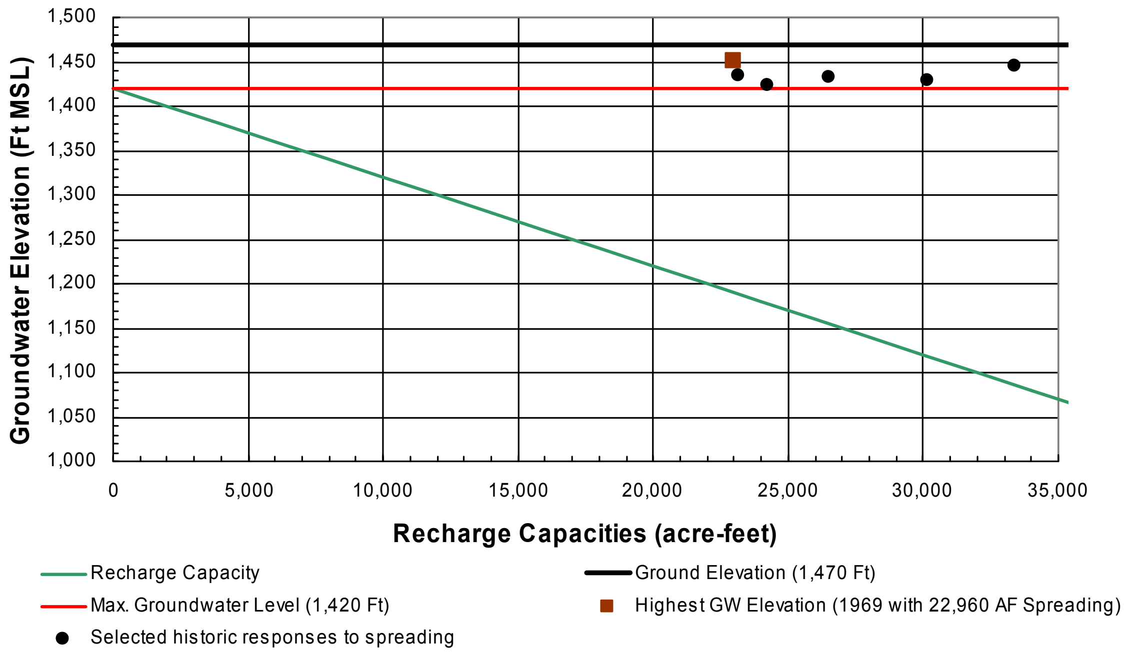
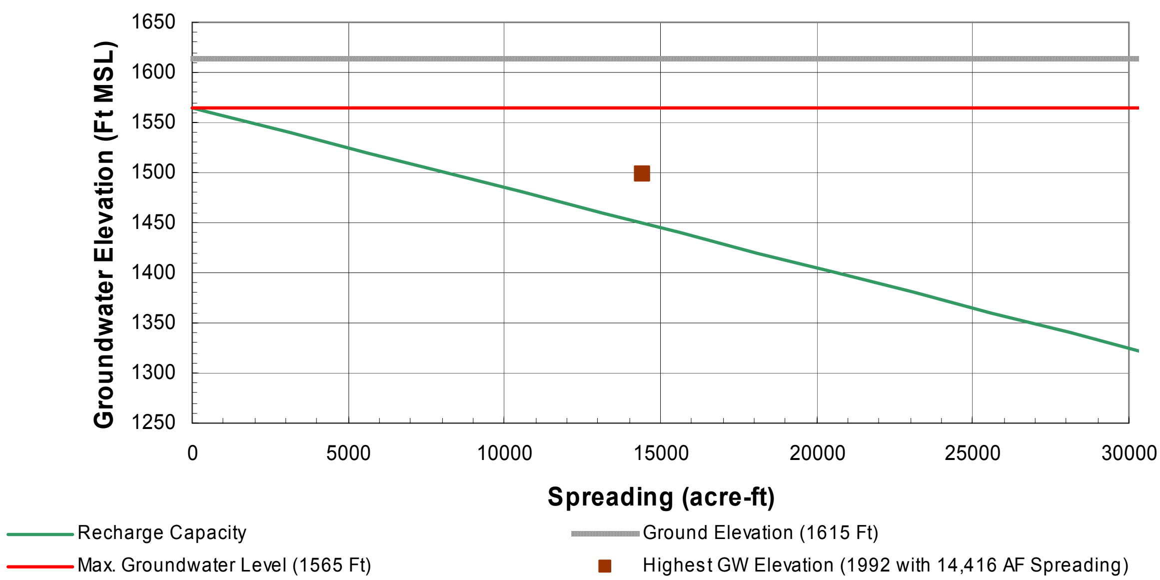
Appendix B
Geology

- Recharge Capacity Charts

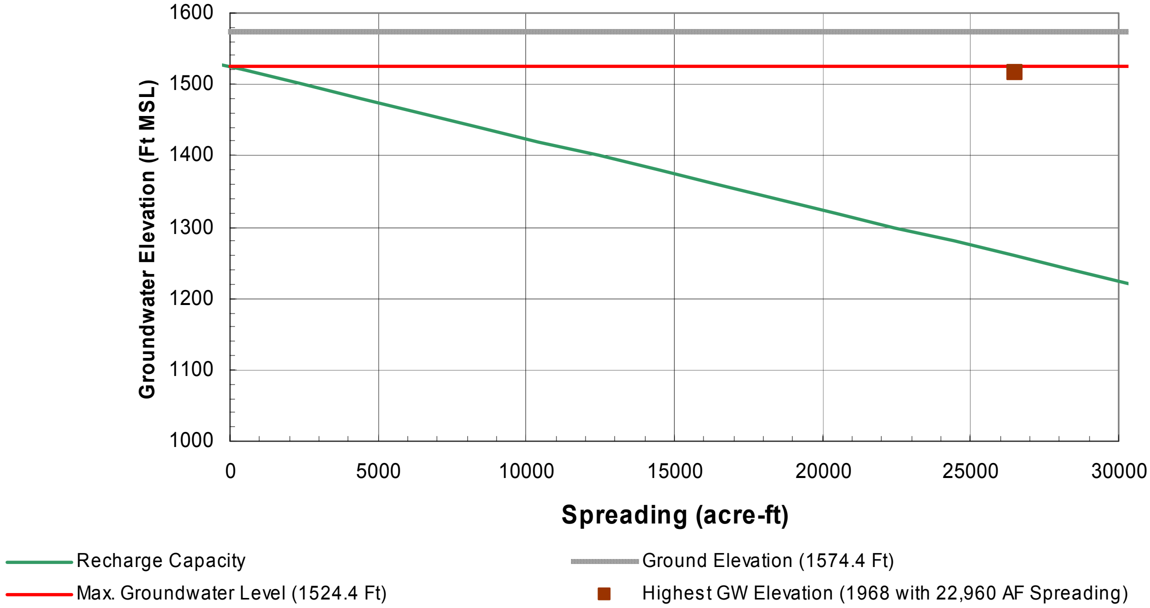
Recharge Capacity based on groundwater elevation at Mountain View 4 (01S□08W-02F01)



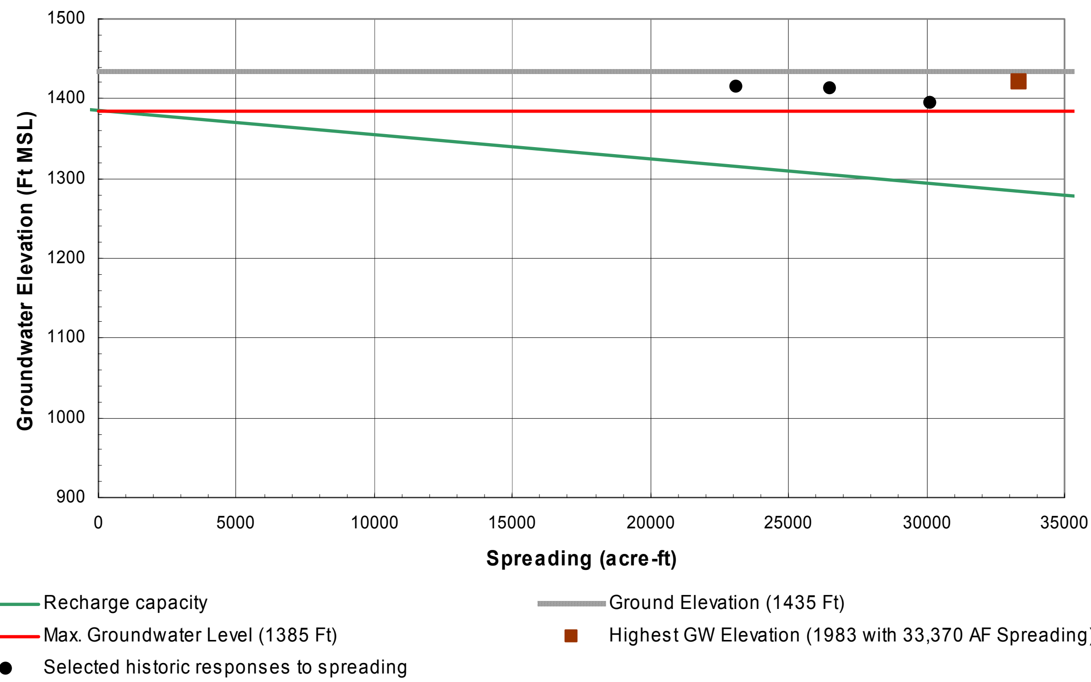
Recharge Capacity based on groundwater elevation at Miramar □3 (01N□08W-35E01)

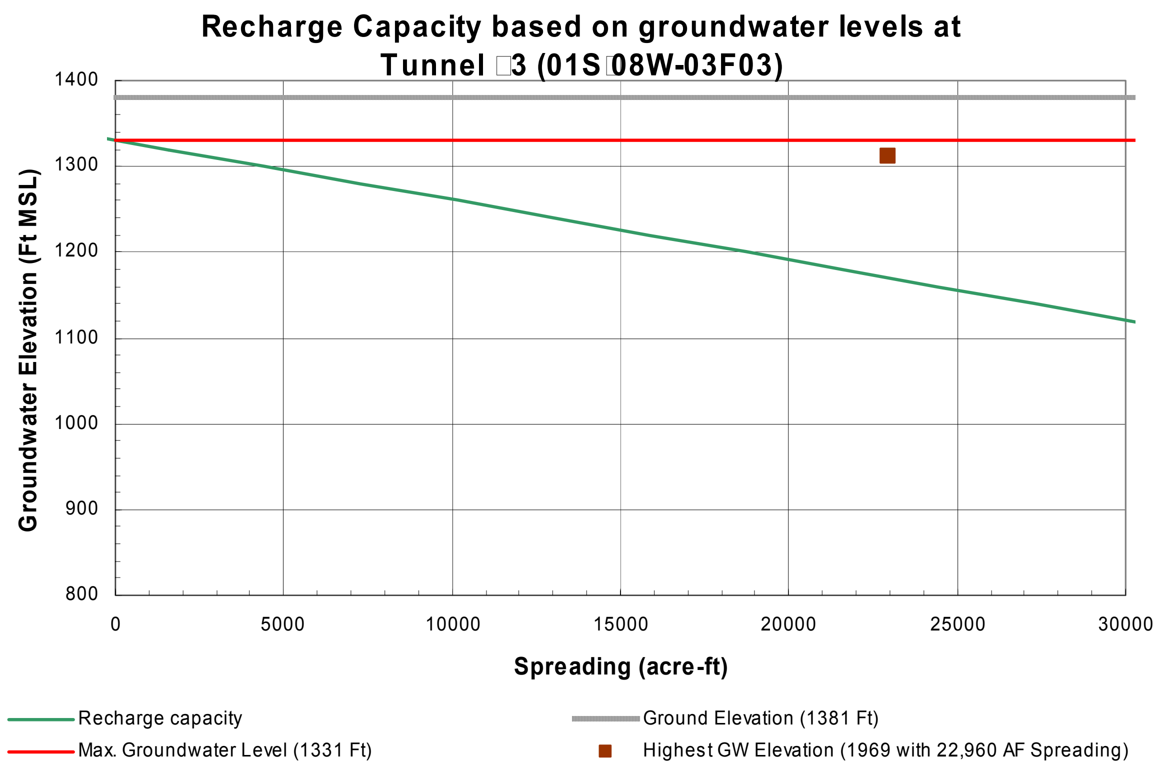


Recharge Capacity based on groundwater elevations at College □1 (01S□08W-35Q01)



Recharge Capacity based on groundwater elevations at Mills □1 (01S□08W-03G02)




Recharge Capacity based on groundwater levels at
Tunnel 3 (01S 08W-03F03)
1400
1300
1200
1100
1000
900
800
Groundwater Elevation (Ft MSL)
0
5000
10000
15000
20000
25000
30000
Spreading (acre-ft)
Recharge capacity
Ground Elevation (1381 Ft)
Max. Groundwater Level (1331 Ft)
Highest GW Elevation (1969 with 22,960 AF Spreading)

Appendix C
Coordination Permits

- Los Angeles County Department of Public Works (County Flood Control District)
  - Flood Permit Application
  - Permit Application Instructions
  - Guidelines for Overbuilding and Air Rights

LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS
FOR LOS ANGELES COUNTY FLOOD CONTROL DISTRICT
900 SOUTH FREMONT AVENUE
ALHAMBRA, CALIFORNIA 91803-1331

FLOOD PERMIT APPLICATION

REQUEST NO. ____________
DATE RECEIVED: ____________

The applicant must show that the proposed work will not adversely affect the District's interests; i.e., (1) Hydraulic and Hydrology Design; (2) Structural integrity; (3) Maintenance standards; (4) District's property rights, etc.

A. TO BE FILLED OUT BY OWNER/AGENT

OWNER/ APPLICANT:____________________ TELEPHONE:(____)____________

ADDRESS:____________________
Street City Zip Code

AGENT/ CONTACT:____________________ TELEPHONE:(____)____________

ADDRESS:____________________
Street City Zip Code

E-MAIL ____________________

SITE ADDRESS:____________________
Street City Zip Code

NEAREST INTERSECTION:____________________ THOMAS GUIDE:____________

PERSON/AGENCY RESPONSIBLE FOR THE
MAINTENANCE OF THE PROPOSED FACILITY:____________________ PHONE: (____)____________

The undersigned certifies that the applicant for this permit is familiar with the requirements of the County Lobbyist Ordinance (Los Angeles County Code Chapter 2.160), and that all persons acting on behalf of the applicant have complied with and will continue to comply with this ordinance throughout the application process.

____________________ ____________________ ____________
Print Name of Owner/Agent Signature of Owner/Agent Date

B. SCOPE OF WORK (USE SEPARATE SHEET IF REQUIRED) ____________________

Please submit the following with your application:

1. Four sets of final construction plans (seven if Army Corps Facility involved) with structural details and profiles of the existing and proposed facilities.
2. Two sets of letter size structural and/or hydraulic and hydrology calculations. The plans and calculations must be stamped and signed by a registered civil/structural engineer licensed to practice in the State of California.
3. Copy of the As-Built drawing of the DISTRICT's facility impacted by the proposed work.
4. Fee will be charged according to current ordinance established by the Board of Supervisors.
5. For storm drain connection complete **EXHIBIT "A"** when applicable.
6. Certificate of Liability Insurance ($1,000,000 min.cov) along with the additional insured endorsement naming the County of Los Angeles, the Los Angeles County Flood Control District, and (when applicable) the U.S. Army Corps of Engr. as co-insured.

FOR DISTRICT USE ONLY

*RECEIVED BY:*______ *ASSIGNED TO:*______

PAYMENT

Fees Paid Yes ☐ No ☐ Waived (☐Reciprocate Services, ☐Qualified Inspectors Provided, ☐ Other____________)

Plan Check PCA No.____________ Plan Check Fee____________ Revenue Source Code B07-____________
Inspection PCA No.____________ Inspection Fee____________ Revenue Source Code B07-____________
Keyword ____________ Total Amount____________ Receipt No.____________
☐ SP8-7700 (Deposit ________) Deposit Amount____________ Receipt No.____________

TYPE

☐ Storm Drain Connection	☐ Landscaping	☐ Over Build	☐ Access
☐ Catch Basin Relocation	☐ Major Modifications	☐ Bridge	☐ LNO
☐ Catch Basin Modification	☐ Minor Modifications	☐ Utility Crossing	☐ Other____________

INFO

Stream/Project ____________ File Code ____________ App Lead________

PD/MTD (To be Transferred) ____________ Tract/P.M. No. ____________

FOR DISTRICT USE ONLY

(Preliminary Check)

General

- ❑ Permit application completely filled out
- ❑ Plan Check and Inspection fees included
- ❑ Vicinity Map
- ❑ Affected facility (i.e. MTD, RDD, & etc.) has been transferred to the District for maintenance

General Engineering Requirements

- ❑ Two sets of calculations and/or reports stamped and signed by Civil/Structural/Geotechnical Engineer
- ❑ Four sets of plans (seven for Army Corp facilities) signed and stamped by Civil/Structural/Geotechnical Engineer
- ❑ Copy of District's facility "As-Built" drawings that are affected by proposed work
- ❑ Name of affected District facility shown on the plans for the proposed work
- ❑ Plan, Profiles, Elevations, Sections, and Details for the proposed work

Storm Drain Connections

- ❑ Existing hydraulic and hydrology data of the District's facility impacted by the proposed connection
- ❑ Revised Hydraulic calculations taking into account proposed connection
- ❑ Water quality agreement signed and notarized (Not always required)
- ❑ Stationing along LACFCD's storm drain centerline were proposed connection is located

Catch basin relocation

- ❑ Existing catch basin hydrology and design data included.
- ❑ Revised catch basin hydrology and design data included.
- ❑ Connector pipe hydraulics.
- ❑ Street Capacity calculations

Crossings over channels

- ❑ Water surface and pier loss calculations
- ❑ Structural calculations for the bridge/ utility crossing including surcharges on the District facility
- ❑ Plan and profile plans

Overbuilds

- ❑ Right-of-way letter of approval from the underlying fee owner
- ❑ Structural calculations for added surcharges on District facility
- ❑ Copy of right-of-way map

Utility Crossings

Under-crossing

- ❑ Plan and profile of proposed utility showing District storm drain
- ❑ Method of support and structural calculations
- ❑ Copy of right-of-way map and " as built"

Over-crossing

- ❑ Plan and profile of proposed utility showing District storm drain
- ❑ Copy of right-of-way map and "as built"
- ❑ Structural calculations for added surcharges on District facility

Temporary Use

Short Term (less than a year)

- ❑ Liability Insurance ($1 million dollars) including LACDPW as additionally insured
- ❑ Plot plan with north arrow and limits of affected areas

Long Term Use (more than a year)

- ❑ Copy of Use Agreement, Recreation Agreement
- ❑ SDF Plot plan with north arrow and limits of affected areas

LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS
CONSTRUCTION DIVISION

Office Location:
900 S. Fremont Avenue, 8th Floor
Alhambra, CA 91803-1331
Phone (626) 458-3129

Mailing Address:
P. O. Box 1460
Alhambra, CA 91802-1460
Fax (626) 576-7739

PERMIT APPLICATION INSTRUCTIONS

1. Submit a complete permit application or letter of request containing the following information:
   - **a. Applicant's name, address and telephone number.**
   - **b. Job site address and Thomas Guide location.**
   - **c. Owner's name, address and telephone number (if different from applicant).**
   - **d. Contact person and daytime telephone number.**
   - **e. Description of the work for which the permit is requested along with relevant background information.**
   - **f. Estimated start and completion dates.**
   - **g. Estimated plan check and inspection fees.**

2. Submit six collated and stapled sets of final construction including the following information:
   - **a. Facility/channel name.**
   - **b. Vicinity map.**
   - **c. Distances to the nearest cross streets, street names and channel stationing.**
   - **d. Dimensioned property and right of way lines, all appropriately labeled.**
   - **e. Existing facility, fencing, roadways, gates, etc.**
   - **f. Full details and dimensions of proposed structures.**
   - **g. Connection or crossing details (profile and/or section details and L.A.C.F.C.D station).**
   - **h. Cross sections or call out the standard plan (APWA Standard)**
   - **i. As built plans with the sketch of correct location for the proposed connection.**
   - **j. Include North Arrow, scale used and elevations. Plans should be wet stamped and signed by a California Registered Civil/Structural Engineer.**
   - **k. Show existing HGL on plan at the proposed connection point.**
   - **l. Submit all pertinent hydraulic and hydrology data for existing system related to the proposed connection. Highlight the existing relevant data used in the submittal calculations.**

3. Submit two sets of hydraulic/hydrology calculations, structural calculations and geotechnical reports, if applicable. All calculations must bear the wet stamp and signature of a Civil/Structural Engineer licensed by the State of California.

The preceding information is provided as a convenience to help expedite the permit process.
INCOMPLETE AND/OR INADEQUATE SUBMITTALS SHALL INCREASE PROCESSING TIME.
You will be notified by the Permit Section if additional information, calculations, plan revisions or fees are required, or if your proposal is found by the District to be unacceptable. Insurance, including liability and Workers Compensation, is required in accordance with the latest edition of Standard Specifications for Public Works Construction. Permits required by other interested agencies and consent of underlying fee owners of District easement lands are the responsibility of the permittee. PERMANENT RIGHTS ARE REQUIRED FOR THE LONG-TERM USE OF DISTRICT FEE-OWNED PROPERTY. THESE PERMANENT RIGHTS MUST BE SECURED PRIOR TO PERMIT ISSUANCE.

LOS ANGELES COUNTY
DEPARTMENT OF PUBLIC WORKS

LOS ANGELES COUNTY FLOOD CONTROL DISTRICT

GUIDELINES

FOR

OVERBUILDING AND AIR RIGHTS

CONSTRUCTION DIVISION - PERMITS AND SUBDIVISIONS SECTION

REVISED JUNE 2004

CONTENTS

GUIDELINES
FOR
OVERBUILDING AND AIR RIGHTS

A. INTRODUCTION

The purpose of these guidelines is to provide information relative to the various possible uses by other parties of the District's rights of way for overbuilding open channels and covered storm drains to create surface areas, to identify and resolve areas of incompatibility, and to provide the basic requirements for specific proposals that will maximize the long-range benefits to the public and the District.

The guidelines recognize that channels and their rights of way, in addition to providing flood protection, have the potential as transportation, utility, and recreational corridors, for overbuilding for public housing development, and are also desired by some communities as open space areas. Requirements are included to protect the District's interest to ensure that proper operation and maintenance of the channels and other uses can be accomplished.

Private parties are encouraged to use District's rights whenever a proposal is found to be compatible with District's needs and authorized or planned uses by others. To this end, the District's goal is to allow utilization of its rights of way to the most efficient degree possible.

B. GENERAL REQUIREMENTS

1. Joint Use Right of Way

   Interested public agencies and developers should consult the District at an early stage regarding joint use, the extent of the rights held by the District, and the areas that may be reserved for other public uses. In some instances, competitive bidding for use of the right of way and air rights may be required. In those instances where District's holding is not of sufficient size to be useful in itself and a proposal is received to utilize District's open channel in conjunction with adjoining ownership, a bidding proposal will not be undertaken.

   For operating right of way, overbuilding by others will be allowed provided District needs for flood control and all existing foreign uses authorized by the District are protected or provided for as further described in Item 3 below. Proposed uses must accommodate recreational, utility, transportation, public housing, and open space requirements that are programmed for the channel in question.

2. Master Planning

   District is developing a Property Use Plan (PUP) for each major flood control channel to ensure that the channel rights of way are developed in a manner compatible with the adjoining properties and yield the maximum benefit to the local community. Proposals should be in conformance with the plan; however, if a desired use is different, the applicant will be required to submit a change (amendment) to the plan for approval. An amendment may be acceptable, provided the change for a particular reach of channel is between successive streets and approved by the local planning agency. Also, all environmental requirements will have to be fulfilled to the satisfaction of the lead agency.

3. Compatibility

a. Joint use will have to provide for District's paramount right to use its right of way for flood control purposes and shall not adversely affect design, construction, operation, maintenance, or integrity of District's existing or proposed facilities.

b. A facility that may affect any non-District installations shall be designed, constructed, operated, and maintained to be compatible with them. All approvals required of other agencies and parties shall be the responsibility of the applicant. District will make its records available regarding other permittees and users of its right of way.

c. Public agencies needs, including, but not limited to, recreation, transportation, overbuilding for public housing, and open space, either authorized or proposed, will have to be accounted for by joint use. Recreation and transportation standards will be provided by the District for each proposal.

d. Joint uses will have to comply with all State, County, and local zoning and building regulations. The District wishes to remain a "good neighbor" to the surrounding area and will not allow a use that it or the local community would find objectionable. Therefore, proposals should be aesthetically pleasing, compatible with surrounding areas, conducive to long-term use, and reflect good planning.

4. Indemnifications and Insurance

Unless otherwise waived by the District, upon a showing of adequate ability to indemnify the District, all users shall furnish the District a policy of insurance coverage naming the District (and the U.S. Army Corps of Engineers, when applicable) as coinsured. The coverage shall indemnify the District against any loss or damage as may be required by the District but not less than $250,000/$1,000,000 for liability and $250,000 for property damage, all as further described in the lease document to be entered into by applicant. Applicant will also be required to provide a policy of fire and extended coverage insurance. The amount of the insurance will be dependent on the full replacement value of the channel cover and appurtenant structures.

C. CONSTRUCTION REQUIREMENTS

1. Types of Overbuilding

The methods introduce here serve as a general guidelines only. Each case is different and will have to be considered case by case. There are three basic methods of overbuilding (see pages 11, 12, and 13 of Section I). Method "A" is to keep the cover above the channel as low as possible and do away with District access roads and fences. Method "B" is to keep the structure well above the top of the channel so as to allow continuous access to the channel for cleaning and maintenance of the channel, recreational trails, and transportation or utility corridors. In general, Method "A" can be used for channels less than 25 feet wide. Method "B" can be used for channels over 60 feet wide. Method "A" may be used for channels between 25 feet and 60 feet wide if it can be shown to the District's satisfaction that no special side drainage, channel maintenance, recreation, or corridor use problems exist. Method "C" is for building over underground conduits.

2. Criteria for Design and Analysis of Overbuilding

Plans and calculations submitted for overbuilding must be signed by a civil or structural engineer licensed to practice in the State of California.

Cover systems, protective devices, and conduits shall be designed and/or analyzed based on loads and criteria consistent with the intended use of the area, but shall result in a system not less than one meeting the following requirements:

a. Dead Loads:

Earth Loads:

Vertical and lateral loads are to be in accordance with the District's Structural Design Manual. Overburden must be shown on the drawings.

Structure Loads:

The loads to be used are the actual direct loads or as transmitted through earth fill as determined by a recognized method (e.g. Bousinesq).

b. Live Loads:

Railroad Bridges or Crossings:

Cooper E Loads are to be determined by servicing or franchised railroad. Distribution of loads and impact is to be as shown in District's Structural Design Manual.

Highway Bridges, Street Crossing, and Ingress and Egress Routes:

HS-20 truck loading with impact in accordance with ASSHTO Standard Specifications for Highway Bridges is to be used.

Parking or Exterior Storage:

A uniform load consistent with type of storage or parking is to be used, 100 psf minimum, plus one HS-20 truck with impact, placed at locations to provide maximum stresses. The uniform load does not have to occupy the area of the truck. Minimum truck impact shall be 10 percent of the live load.

Interior Storage and Other Structures:

The load shall be consistent with use as accepted by the jurisdictional Building Department.

Other Areas not Normally Accessible by Vehicles or Covered by a Structure:

H-15 truck with impact of at least 10 percent is to be used.

c. Wide and Seismic Loads:

The loads are to be as accepted by the jurisdictional Building Department.

d. Design Methods and Stresses:

Railroad Bridges or Crossing:

Design is to be in accordance with the AREA Manual for Railroad Engineering.

Highway Bridges, Street Crossings, and Ingress and Egress Routes:

Design is to be in accordance with the AASHTO Standard Specifications for Highway Bridges. Concrete design may be either working stress or strength in accordance with American Concrete ACI 318 except that load factors for strength design shall be per AASHTO. Concrete structures maintained by the District are to be analyzed using the working stress method only.

All Others:

Design is to be in accordance with the AISC Manual of Steel Construction, Nation Design Specification for stress-grade lumber or ACI 318, as appropriated, nothing that concrete structures maintained by the District are to be analyzed using the working stress method.

e. Foundations:

Directly on drain:

1) Structure must be removable if not required for stability of the drain.

2) The storm drain must not be over-stressed by the structure. An engineering analysis of all elements of the storm drain structure must be submitted. The analysis is to be based on methods and loads shown in the District's Structural Design Manual in addition to surcharge loads due to permit work.

3) Where appropriate, a soil investigation and report will be required.

Independent but Surcharge Drain (including surcharge fill):

1) Same as No. 2 above.

2) The structure must provide a minimum of 6-inches horizontal clearance from any element of the drain, including subdrain pipes and at least 18-inches vertical clearance from a box or pipe conduit, and 6-inches vertical clearance from an open channel.

3) A soils engineer must analyze the foundation. Analysis is to include a soil investigation and report. Exploratory excavations must extend below foundation. Analysis must also include uplift pressures on the invert where appropriate.

No Effect on Drain:

1) Same as No. 2 and 3, above (independent but surcharge drain). Piles must be sleeved, as necessary; to prevent drag forces on the drain and bearing areas must be sufficiently deep so as not to produce uplift pressures.

2) The hydraulic capacity of flood control facility will have to be maintained. Normally, no construction will be allowed below the top of the channel walls if it encroaches within the design freeboard area. Types of structure for the covering will be specified to allow for standardizing the types of construction whenever possible.

3) The U.S. Army Corps of Engineers is conducting a hydrologic study of various drainage areas (LACDA project). Therefore, any proposed development may have to provide for existing channels to be widened or for channel walls to be heightened. The District will provide information relative to the status and/or requirements of this study or other controls that must be met.

4) Any proposed development should provide a means for local run-off to enter the channel after said channel has been covered. Side drainage problems also should be investigated where a channel is below the surrounding ground level and existing side drains are inadequate or designed to a lesser frequency than the main channel. In these cases, interested parties will be required to do one or all of the following: (1) construct additional drainage inlets, (2) leave a section of channel uncovered, or (3) use Method "B" for overbuilding (see page 13). Channel covering usually requires that access facilities to the channel invert be constructed also. See Section D, Operational Requirements, for more information.

3. Aesthetic Requirements

Surface structures shall be constructed to be aesthetically compatible with the area and District's facilities based on current standards and economic feasibility. Landscaping or other aesthetic measures may be required to mitigate the impact of structures on its environs.

D. OPERATIONAL REQUIREMENTS

To optimize safety and ensure the hydraulic and structural integrity of a particular flood control channel, the District and the U.S. Army Corps of Engineers have a number of operational requirements that must be met by every joint use proposal. The following is a list of the major requirements. Please note that this list should not be considered complete or absolute. The requirements are:

1. Access into a covered channel is required every 500 feet. This access is usually of a pedestrian nature and could be in the form of manholes, ladders, etc.

2. Adequate clearances inside the channel (a minimum height of channel wall) must be maintained throughout the channel for the transportation of heavy equipment used in channel repair, bridge, and bridge abutment repair, etc.

3. In the event the channel is to be covered, adequate ventilation must be provided to prevent the build-up of noxious or volatile fumes. A short reach of the channel, 30 feet or so, to remain uncovered, thereby aiding channel maintenance and repair in that equipment and material could be lowered into or removed from the channel.

E. RIGHT OF WAY AVAILABILITY

1. Operating Right of Way

   a. Fee Title

      Generally, joint uses may be authorized on rights of way held in fee by the District. However, there may be legal encumbrances in the form of prior easements, leases, and rental agreements, which may have to be cured prior to the proposed joint use. Also, "paper streets" or unused easements for public street purposes may exist. There also may be other conditions, covenants, and restrictions to the District's title. Since perfecting title is very time-consuming, all proposals for joint use should be submitted as early as possible for right of way clearance.

   b. Much of the District's right of way is in the form of flood control easements. Where long reaches of fee are interspersed with short reaches of easements, it may be economically feasible to acquire the underlying fee.

   c. All costs attendant to perfecting title or acquiring the underlying fee will be borne by the proposed developer or public agency.

2. Excess Right of Way

   District has, in addition to its operating right of way, excess property holdings, both in fee and easement. In most instances, the fee property can be incorporated into the joint use proposal. For an easement area, approval of the underlying fee owner will be required.

F. OTHER REQUIREMENTS

1. Where the applicant is a private organization, after approval of the concept by the District, for fee-owned rights of way, an agreement to lease (option) will be entered into between District and applicant. This will give the applicant assurance that the right of way is available for consideration by the applicant as to duration and terms.

2. In addition to the General Provisions of District's standard permit to be issued for construction, special provisions my be required because of the nature, design, or location of proposed installation.

3. Construction must commence within six months of date of permit unless otherwise approved by Chief Engineer and be completed in accordance with an approved schedule.

4. Construction work within the channel rights of way involving removal and restoration of the channel structure, excavation, and backfill shall be accomplished during the period of April 15 to October 15.

5. As-built drawings and installation of identification markers for subsurface structures will be required by the District. Markers must not be placed so as to interfere with use of District's vehicular service roads.

6. Any relocation of survey monuments defining District's right of way boundaries will be performed by District's surveyors with the permittee underwriting the costs of such relocation.

G. DOCUMENTS

The District will allow overbuilding and use of air rights by a long-term lease over fee-owned property. These lease documents will provide for protection of the District's interest if nonpayment occurs, liability, etc.

The leave will contain requirements that will protect the District's interest and provide for rental income. The District will monitor the lease throughout its term to ensure compliance with provisions. The term of the lease will be for a period long enough for a developer to amortize the cost of covering the channel and his construction loan, plus an additional time period (usually ten years) to obtain a return on his investment.

The amortization of the cost to cover the channel may be reflected in the rent. The rent will be based on Fair Rental Value (FRV) of the property. If the appraisal approach considers channel cover as an on-site improvement, there will not be an amortization period for the cost of cover. Periodically, increases in rent based on fixed step increases or changes in the Wholesale Price Index (WPI) or periodic review of FRV, as the situation calls for, will be assessed.

The lease will contain an option period to provide a developer time to complete the environmental considerations, complete the permit process, and obtain a lender.

Where District has easement rights, overbuilding by the underlying fee owner can most likely be handled by permit with some type of mutually agreed upon maintenance agreement. In addition, because the District's easement for flood control purposes is, in some instances, tantamount to having the fee ownership, compensation will be required from the permittee because of the reduction in the District's use of its right of way to that of an easement for a covered drain; i.e., loss of surface use. Should the permittee be someone other than the underlying fee owner, evidence of approval of the fee owner would also be required.

H. PROCEDURE TO BE FOLLOWED FOR USE OF DISTRICT'S FACILITIES BY OTHERS

1. Prospective users must submit a written application for overbuilding or covering of open channels for proposed surface use and/or air rights use. This application should be addressed to:

Los Angeles County Department of Public Works
Construction Division
Permits and Subdivisions Section - 8th Floor
900 South Fremont Avenue
Alhambra, CA 91803-1331

Early application, particularly for a major installation, is recommended. The following information is required:

a. Six sets of preliminary drawings showing the location of the proposed covering, the desired surface use, the existing flood control facilities and stationing, and the District's right of way.
b. Owner of proposed improvement.
c. Preliminary construction program.
d. Required time of land use.

District's review will be to determine the overall acceptability of the proposal and, if readily available, the approximate annual cost for leasing should the District's property be fee owned. If the District responds favorable to this application, a meeting will be arranged with the applicant and representatives of the District's Mapping and Property Management Division to discuss the criteria to be used for submittal of preliminary plans and general terms for leasing the District's properties and/or maintenance responsibilities.

2. Applicant shall submit six sets of preliminary plans and design calculations, structural and hydraulic, if necessary for approval, and two copies of the Draft Environmental Impact Report (if required by an appropriate authority) when available. At this time, a deposit for the plan review will be required. The fees for checking of plans for covering of channels, including structural or hydraulic or other review as deemed necessary by the District are based on the current fee schedule adopted by the Board of Supervisors. Presently the fees are: Case I; clear span, actual cost to the District ($500 min.) and Case II; all others, actual cost to the District ($600 min.). After preliminary plans have been approved, a final submittal must be made prior to issuance of construction permit. This final submittal should contain the following:

    a. Four sets of final construction plans signed by a civil or structural engineer licensed to practice in California, showing proposed covering of channel. Plans should show existing improvements (both District and foreign in the construction area) and proposed improvements over proposed covering, District right of way limits, working areas, existing utilities, etc. In connection therewith, applicant will be responsible for inspecting the right of way, searching all available records, and ascertaining all foreign users of the rights of way. The District will aid in providing all its information regarding permits issued by the District.

    b. Inspection fees\deposits are based upon estimated actual cost determined by District; should the cost be less, the District will refund the difference. If the cost is more, applicant will submit additional amount.

3. Upon review and approval of the final submittal, and payment of all fees, including deposit for first year's rental for leases, District will issue a construction permit. Approval of construction will be valid only to the extent of District jurisdiction. Also, the District may require a performance bond and liability insurance to protect the District's interest.

4. After the District responds favorably to this application, an Agreement to Lease (option) can be entered into between District and applicant. This commitment will be honored by the District for a period of one full year or longer, if so specified in the Agreement. At this time, the applicant will be required to deposit funds for preparation of the Agreement and the appraisal to determine the annual lease cost. These costs will be credited to applicant in the first year's rent should lease be finalized, otherwise the fees deposited will be waived. Note: In the event the applicant needs to know the cost prior to preparation of preliminary plans and finalization of the lease arrangement, applicant will be required to deposit funds for the District's cost for the work. Cost will be credited for first year's rent as stated above.

5. Applicant may proceed with construction under terms and conditions of the permit. Construction must be initiated within one year of the date of issuance of permit unless otherwise approved by the Chief Engineer.

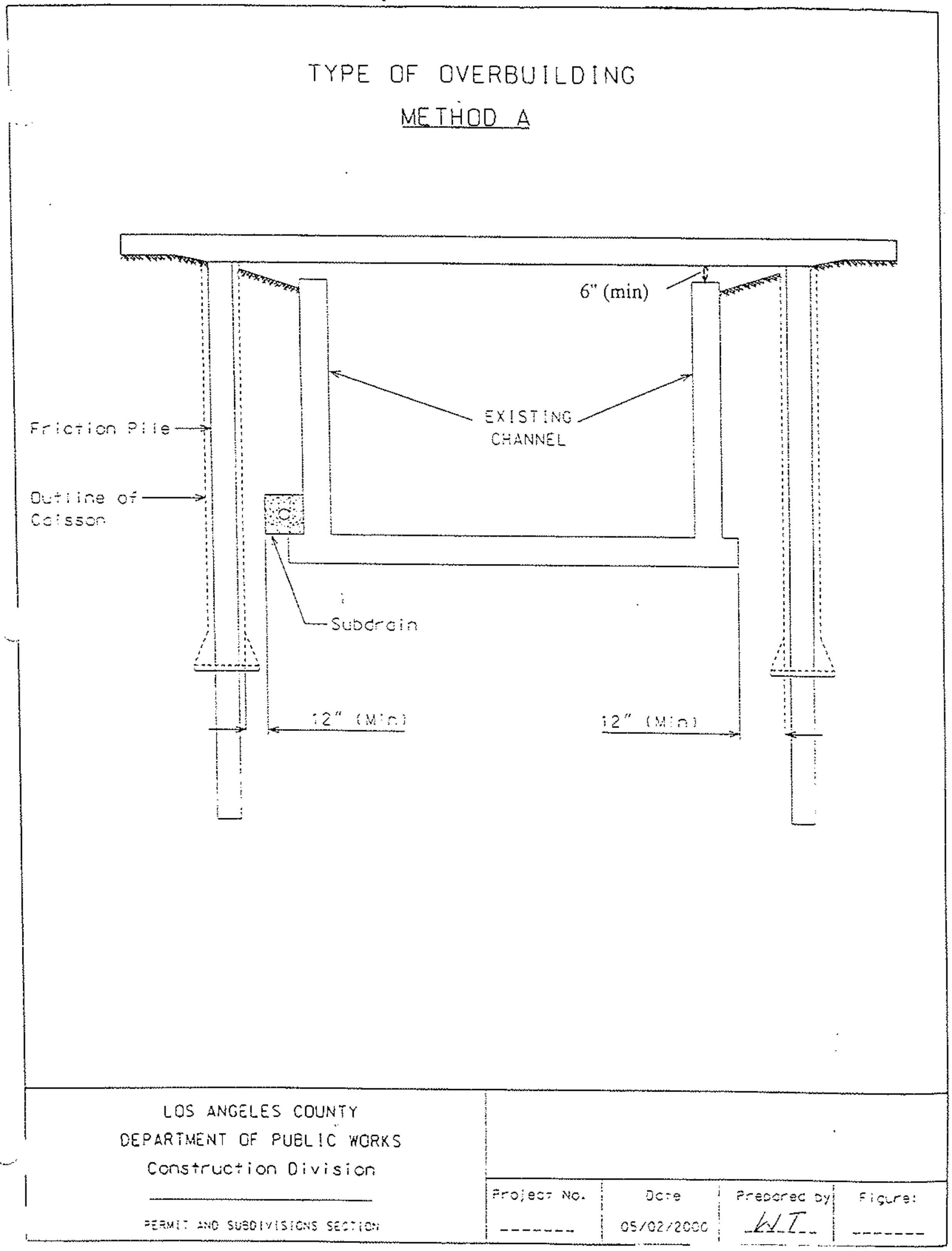
6. The District will prepare the appropriate document or lease, in accordance with the terms of the Agreement previously entered into.

7. Upon completion of construction, one set of reproducible as-built drawings shall be submitted to the District within 180 days.

8. In the event time warrants, one document only (lease) may be sued for the right of way negotiations. The document should be fully executed (signed by both parties) prior to submittal of final plans and before a construction permit is issued. Execution of the lease first is satisfactory with District provided applicant understands and accepts the fact that the plan review and issuance of the permit takes 30 to 60 days to complete. If there is a deadline for the applicant, the plans should include this time period.

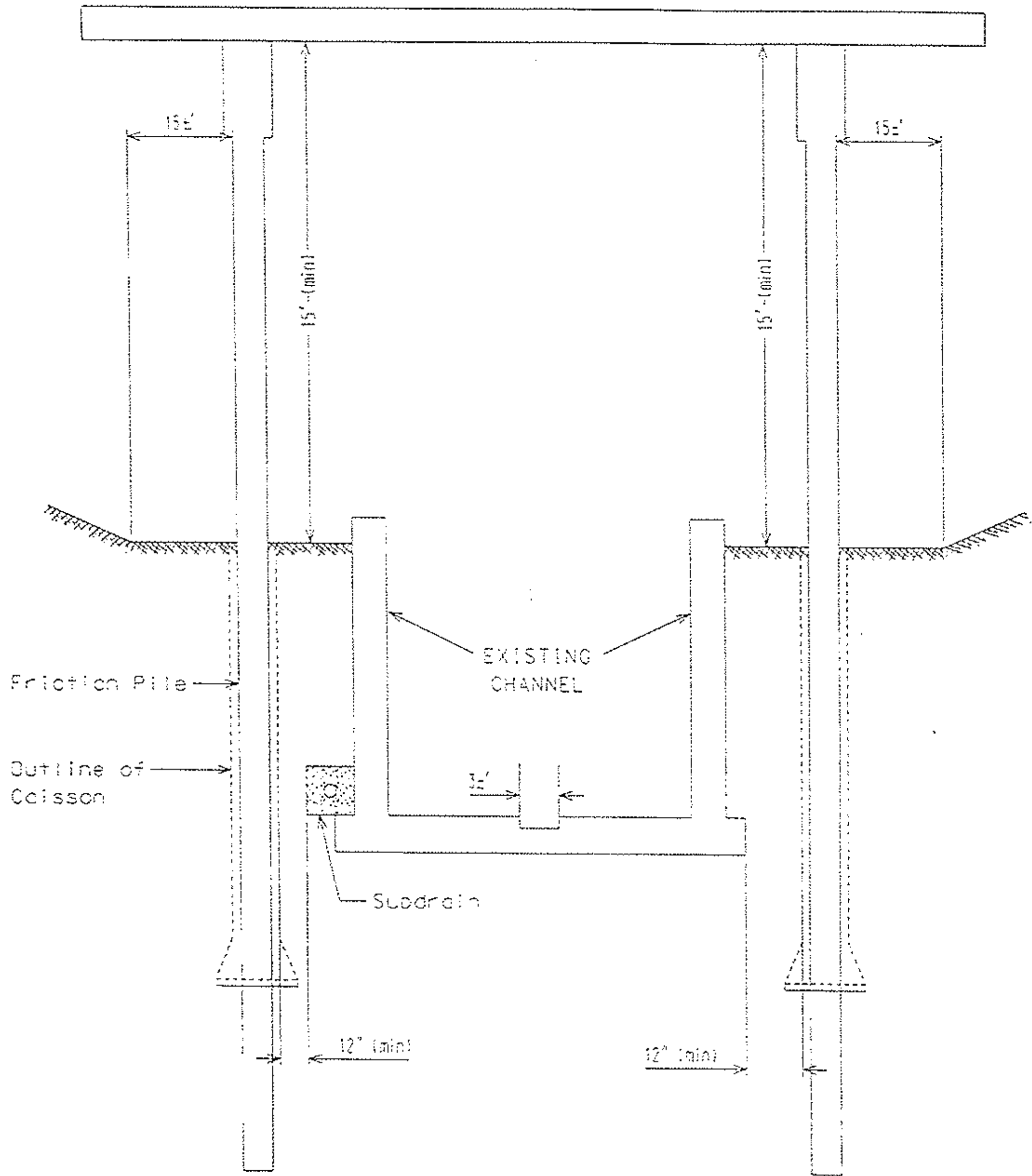
O:\Section\Permits\Flood\Master\GUIDELINES-OVER-AIRIGHTS.doc

I. EXAMPLES OF OVERBUILDING



TYPE OF OVERBUILDING

METHOD B



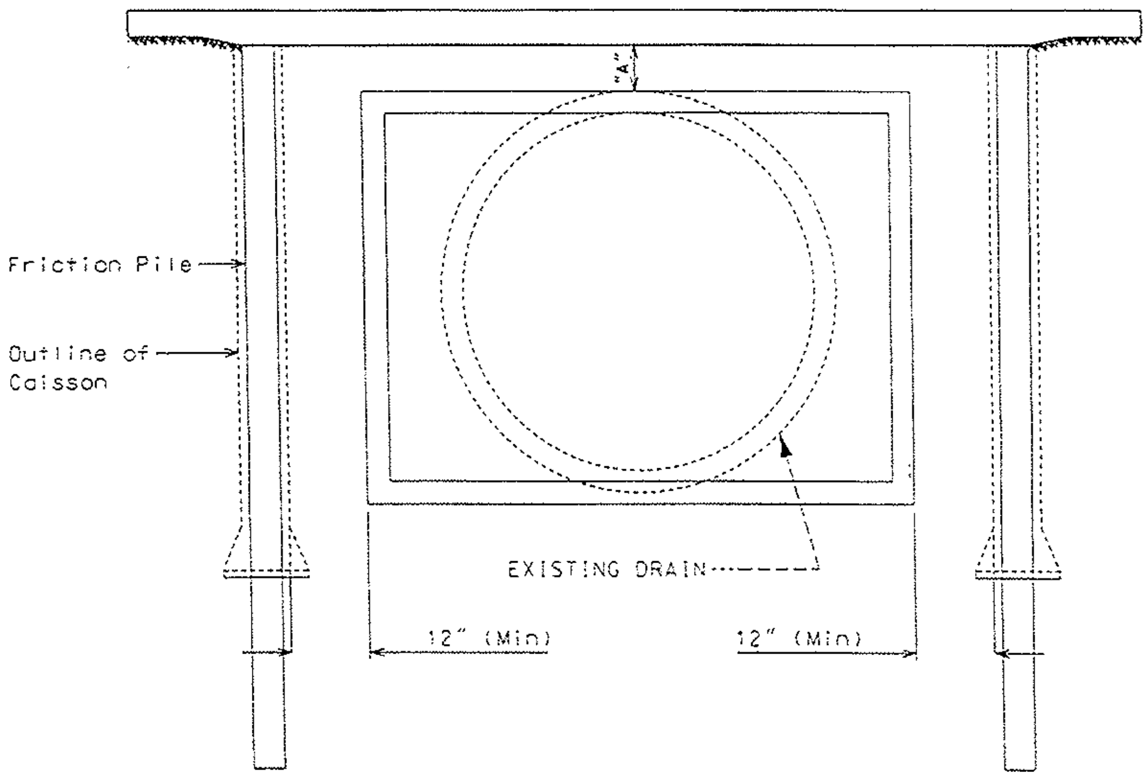
LOS ANGELES COUNTY
DEPARTMENT OF PUBLIC WORKS
Construction Division

PERMIT AND SUBDIVISIONS SECTION

Project No.	Date	Prepared by	Figure:
_______	05/02/2000	_______	_______

TYPE OF OVERBUILDING

METHOD C



"A" 18" Min

LOS ANGELES COUNTY
DEPARTMENT OF PUBLIC WORKS
Construction Division

PERMIT AND SUBDIVISIONS SECTION

Project No.	Date	Prepared by	Figure:
-------	05/02/2000	-------	-------

Appendix D
Proposed Facilities

- Drawings and Sketches
- Cost Estimate
- Electrical Report

THREE VALLEYS MUNICIPAL WATER DISTRICT

THREE VALLEYS MUNICIPAL WATER DISTRICT

PLANS FOR THE CONSTRUCTION OF

SAN ANTONIO SG FEASIBILITY

FEBRUARY 2005

Bookman-Edmonston
A Division of GEI Consultants

PLANS FOR THE CONSTRUCTION OF

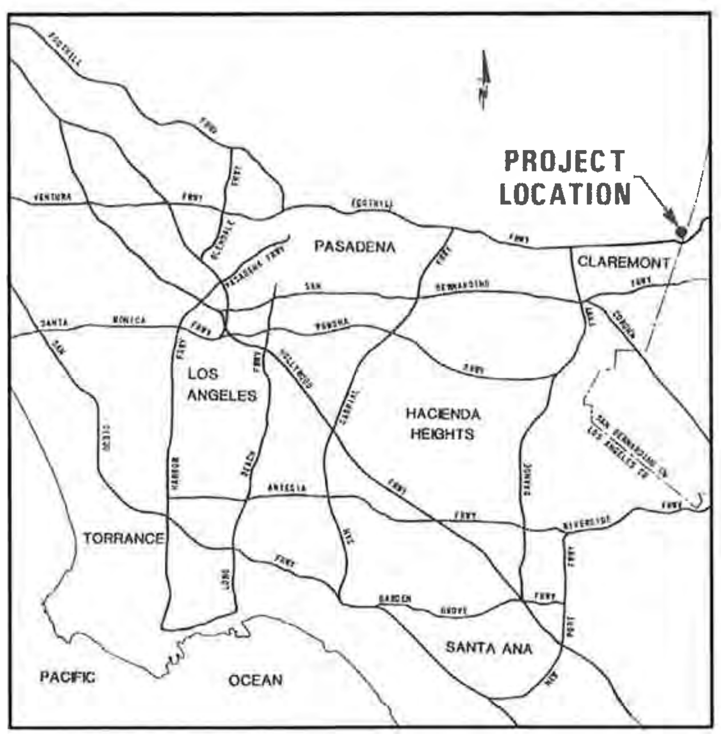
X

X

THREE VALLEYS MUNICIPAL WATER DISTRICT

BOARD OF DIRECTORS

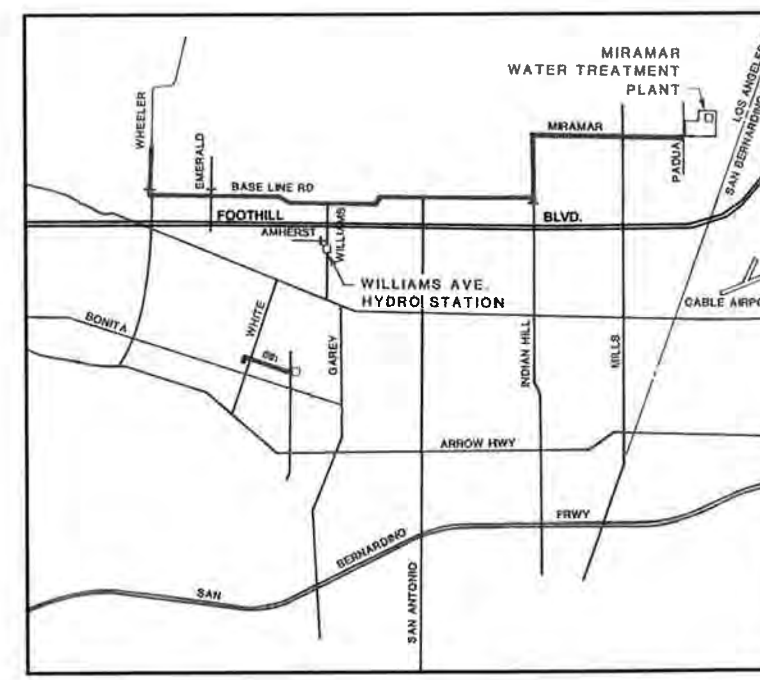
LUIS M. JUAREZ	DIVISION I
DAVID D. DE JESUS	DIVISION II
BRIAN BOWCOCK	DIVISION III
BOB G. KUHN	DIVISION IV
JOSEPH T. RUZICKA	DIVISION V
FRED LANTZ	DIVISION VI
DAN HORAN	DIVISION VII



LOCATION MAP
NO SCALE

THREE VALLEYS MUNICIPAL WATER DISTRICT

RICHARD W. HANSEN
GENERAL MANAGER/CHIEF ENGINEER



VICINITY MAP
SCALE 1" = 4400

APPROVED ______ RICHARD W. HANSEN, GENERAL MANAGER/CHIEF ENGINEER	DATE	
DESIGNED M. ROZMAN	CHECKED	
DRAWN K. CHUNG	APPROVED M. ROZMAN	

WARNING: 0 1/2 1 — THIS BAR SHOULD MEASURE 1" OR DRAWING IS NOT TO SCALE

REV	DATE	DESCRIPTION	SUB	APP'D

REGISTERED PROFESSIONAL ENGINEER — MARC J. ROZMAN — No. C042862 — Exp. 03/31/06 — CIVIL — STATE OF CALIFORNIA

Bookman-Edmonston
A Division of GEI Consultants

THREE VALLEYS MUNICIPAL WATER DISTRICT
1021 MIRAMAR AVE.
CLAREMONT, CA 91711
(909) 621-5568

MIRAMAR WATER TREATMENT PLANT
X

TITLE SHEET, LOCATION MAP AND VICINITY MAP

PROJ NO:	CONTRACT NO
X	---
ISSUE DATE	SUBMITTAL
X	X
DRAWING	
G-2	

LIST OF DRAWINGS

ABBREVIATIONS

AC	ASPHALT CONCRETE
BM	BENCH MARK
CB	CATCH BASIN
CON	CONCRETE
ELEV	ELEVATION
EP	EDGE OF PAVEMENT
EUC	EUCALYPTUS
EV	ELECTRIC VAULT
FH	FIRE HYDRANT
FL	FLOWLINE
FS	FINISH SURFACE
GB	GRADE BREAK
GP	GUARDPOST
HB	HOSEBIB
IE	INVERT ELEVATION
LIP	EDGE OF GUTTER
MH	MANHOLE
NTS	NOT TO SCALE
RB	RECLAIMED BACKWASH
SB	SPENT BACKWASH
SPK	SPIKE
TC	TOP OF CURB
TOE	TOE OF SLOPE
TOP	TOP OF SLOPE
TV	TELEPHONE VAULT
WV	WATER VALVE

LEGEND

- EXISTING FENCE
- FLOWLINE
- 1.1% — % SLOPE
- SLOPE CUT OR FILL
- WALL
- FH — FIRE HYDRANT
- TREE
- VALVE
- CB — CATCH BASIN
- SURVEY (C-NAIL & TIN
- SURVEY (BENCH MARK LEAD & TAG
- 1"X2" HUB
- BUTTERFLY VALVE
- STORMDRAIN MANHOLE
- SURVEY CONTROL POINT

DETAIL NUMBER

1
C-6

DETAIL CALLOUT

DRAWING WHERE
DETAIL IS CALLED OUT

GENERAL NOTES

1. PRIOR TO START OF CONSTRUCTION, THE CONTRACTOR SHALL LOCATE ALL EXISTING UTILITIES IN AND AROUND THE AREAS OF NEW CONSTRUCTION.
2. THE CONTRACTOR SHALL PROTECT ALL EXISTING UTILITIES TO REMAIN.
3. LOCATIONS OF UNDERGROUND UTILITIES SHOWN ON THE DRAWINGS WERE OBTAINED FROM AVAILABLE RECORDS. NEITHER THE OWNER NOR ENGINEER ASSUMES ANY RESPONSIBILITY FOR UTILITIES NOT SHOWN OR NOT IN THE LOCATION SHOWN. THE CONTRACTOR SHALL VERIFY ALL LOCATIONS AND ELEVATIONS AND SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT UTILITY LINES WHETHER SHOWN OR NOT SHOWN.
4. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT EXISTING IMPROVEMENTS, WHICH ARE TO REMAIN IN PLACE, FROM DAMAGE. ALL IMPROVEMENTS DAMAGED BY THE CONTRACTOR SHALL BE EXPEDITIOUSLY REPAIRED OR RECONSTRUCTED AT THE CONTRACTORS EXPENSE WITHOUT ADDITIONAL COMPENSATION.
5. THE CONTRACTOR SHALL PROVIDE A MINIMUM OF 36 INCHES COVER ON ALL PIPELINES 12 INCHES OR LARGER UNLESS OTHERWISE DIRECTED.
6. STRAIGHT SLOPES SHALL BE MAINTAINED BETWEEN INVERTS SHOWN.
7. CONNECTION DETAILS TO EXISTING PIPING SHALL BE SUBMITTED FOR APPROVAL.
8. LOCATION OF ELECTRICAL MANHOLES AND PULL BOXES ARE APPROXIMATE. CONTRACTORS SHALL COORDINATE EXACT LOCATION OF MANHOLES AND PULL BOXES WITH ELECTRICAL AND CIVIL WORK.
9. PRIOR TO ANY CONNECTION TO AN EXISTING UTILITY, THE CONTRACTOR SHALL COORDINATE WITH THE OWNER OR THE CORRESPONDING AGENCIES.
10. THE CONTRACTOR IS RESPONSIBLE FOR FIELD VERIFICATION OF ALL EXISTING SURFACE FEATURES, WHETHER SHOWN OR NOT HEREIN.

APPROVED
RICHARD W. HANSEN — DATE
GENERAL MANAGER/CHIEF ENGINEER

WARNING:
0 1/2 1
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DESIGNED M. ROZMAN — CHECKED
DRAWN K.CHUNG — APPROVED M. ROZMAN

REV	DATE	DESCRIPTION	SUB	APP'D

REGISTERED PROFESSIONAL ENGINEER — MARC J. ROZMAN — No. C042862 — Exp. 03/31/06 — CIVIL — STATE OF CALIFORNIA

Bookman-Edmonston
A Division of GEI Consultants

THREE VALLEYS MUNICIPAL WATER DISTRICT

THREE VALLEYS MUNICIPAL WATER DISTRICT
1021 MIRAMAR AVE.
CLAREMONT, CA 91711
(909) 621-5568

MIRAMAR WATER TREATMENT PLANT
X

INDEX TO DRAWINGS, GENERAL NOTES AND SYMBOLS

PROJ. NO X — CONTRACT NO. ---
ISSUE DATE X — SUBMITTAL X
DRAWING

G-3

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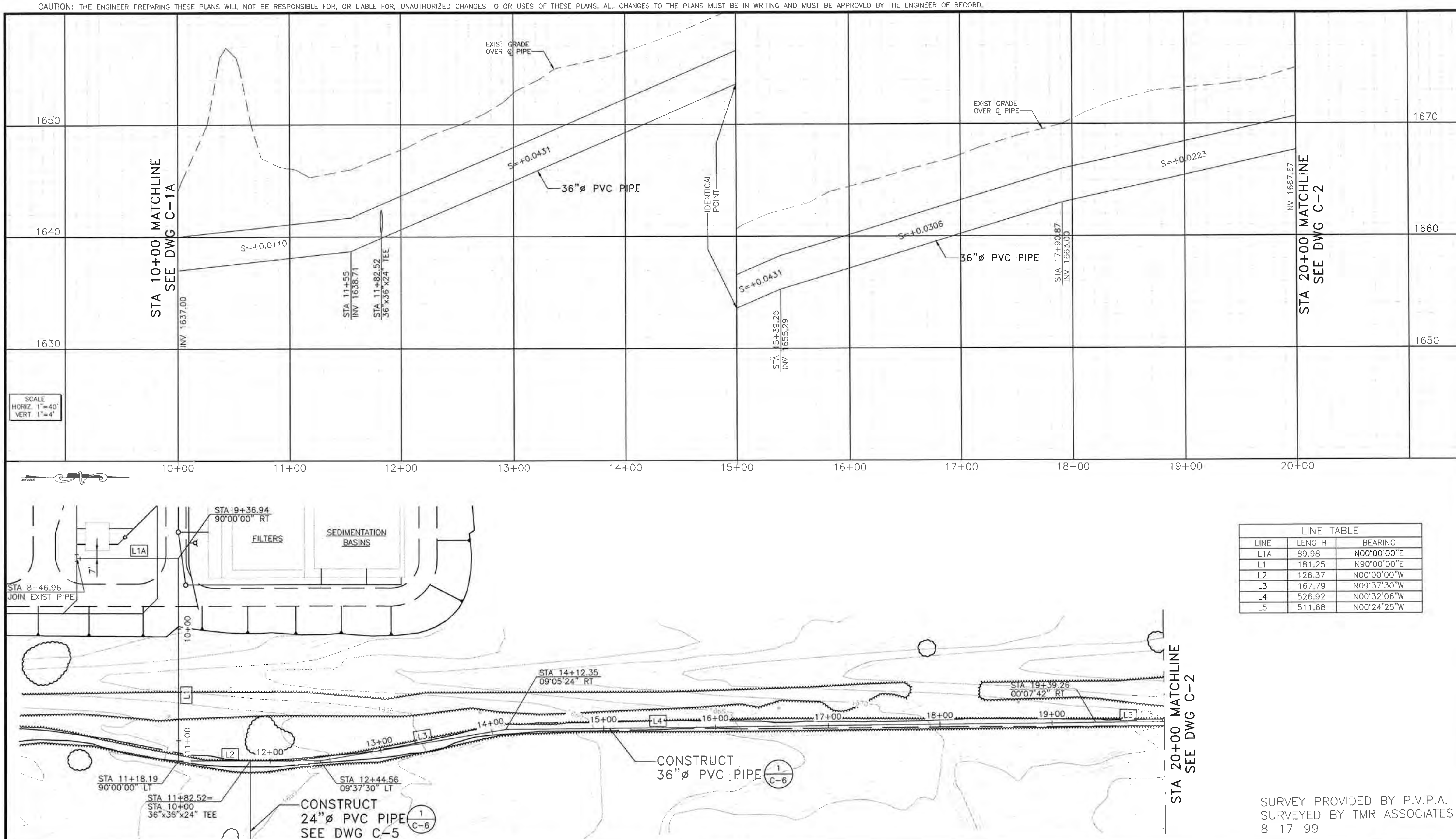

LINE TABLE

LINE	LENGTH	BEARING
L1A	89.98	N00°00'00"E
L1	181.25	N90°00'00"E
L2	126.37	N00°00'00"W
L3	167.79	N09°37'30"W
L4	526.92	N00°32'06"W
L5	511.68	N00°24'25"W

SURVEY PROVIDED BY P.V.P.A.
SURVEYED BY TMR ASSOCIATES
8-17-99

APPROVED ____ RICHARD W. HANSEN GENERAL MANAGER/CHIEF ENGINEER DATE

WARNING: 0 1/2 1 THIS BAR SHOULD MEASURE 1" OR DRAWING IS NOT TO SCALE

DESIGNED M. ROZMAN CHECKED ____
DRAWN K. CHUNG APPROVED M. ROZMAN

REV	DATE	DESCRIPTION	SUB	APP'D

REGISTERED PROFESSIONAL ENGINEER MARC J. ROZMAN No. C042862 Exp. 03/31/06 CIVIL STATE OF CALIFORNIA

Bookman-Edmonston
A Division of GEI Consultants

THREE VALLEYS MUNICIPAL WATER DISTRICT

THREE VALLEYS MUNICIPAL WATER DISTRICT
1021 MIRAMAR AVE.
CLAREMONT, CA 91711
(909) 621-5568

MIRAMAR WATER TREATMENT PLANT
X

PLAN AND PROFILE (36"ø PVC)
STA 10+00 TO STA 20+00

PROJ. NO. X CONTRACT NO. ---
ISSUE DATE X SUBMITTAL X
DRAWING C-1

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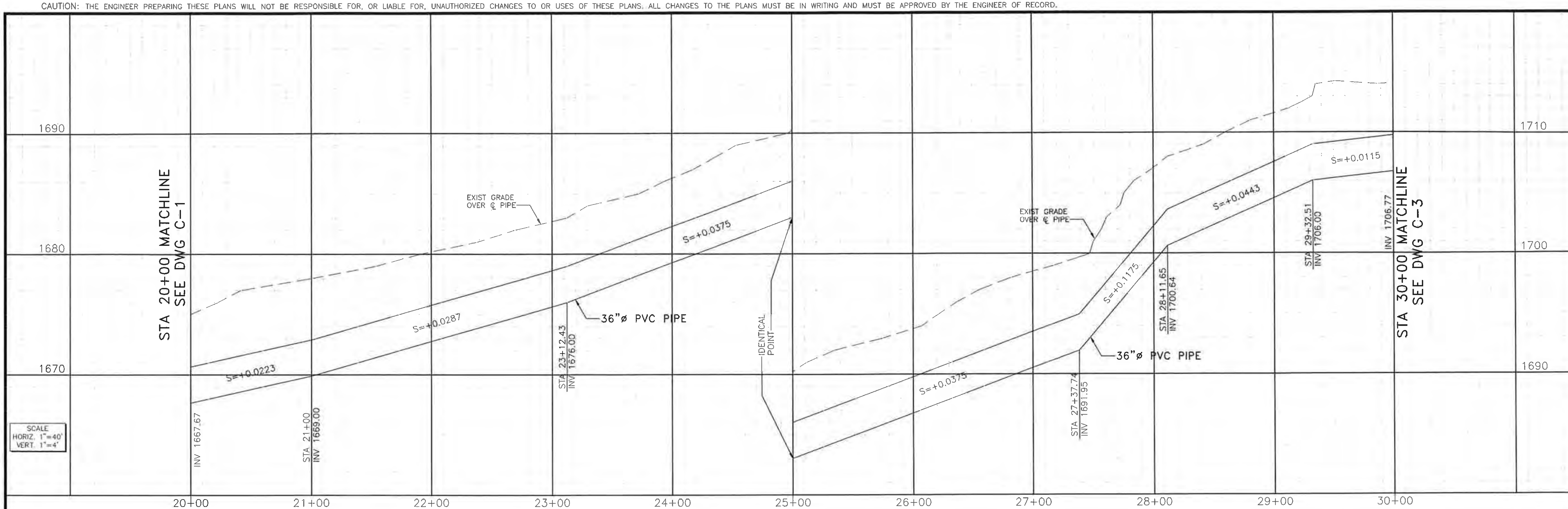

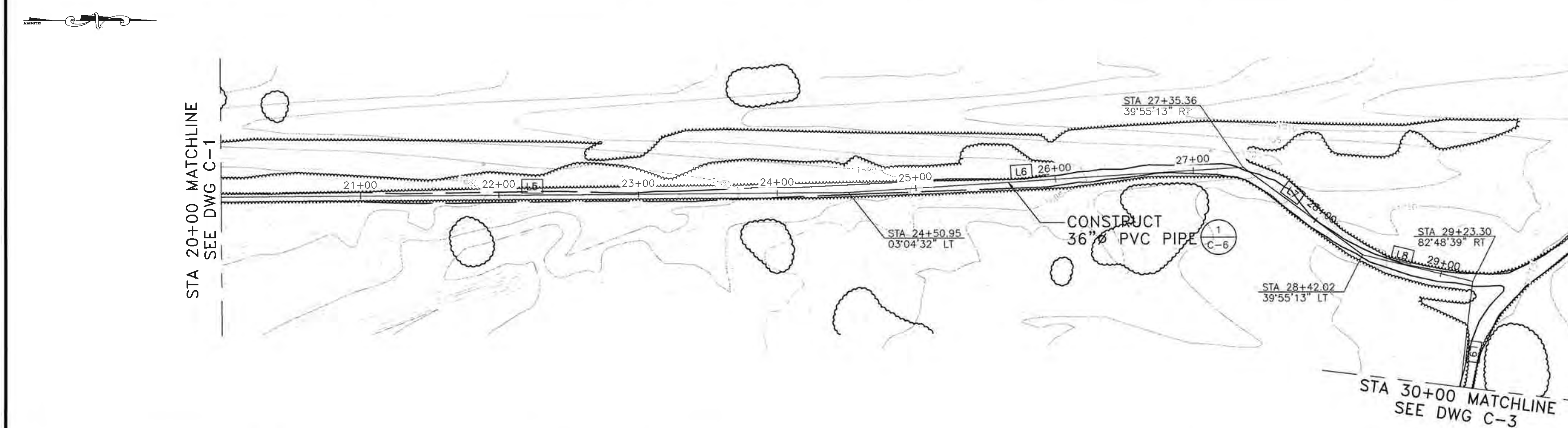

LINE TABLE

LINE	LENGTH	BEARING
L5	511.68	N00°24'25"W
L6	284.41	N03°28'57"W
L7	106.66	N36°26'16"E
L8	81.28	N13°56'50"E
L9	114.37	S83°14'31"E

APPROVED ______ RICHARD W. HANSEN, GENERAL MANAGER/CHIEF ENGINEER DATE

WARNING:
0 1/2 1
THIS BAR SHOULD MEASURE 1" OR DRAWING IS NOT TO SCALE

DESIGNED M. ROZMAN
DRAWN K. CHUNG
CHECKED
APPROVED M. ROZMAN

REV	DATE	DESCRIPTION	SUB	APP'D

REGISTERED PROFESSIONAL ENGINEER
MARC J. ROZMAN
No. C042862
Exp. 03/31/06
CIVIL
STATE OF CALIFORNIA

Bookman-Edmonston
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THREE VALLEYS MUNICIPAL WATER DISTRICT

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1021 MIRAMAR AVE.
CLAREMONT, CA 91711
(909) 621-5568

MIRAMAR WATER TREATMENT PLANT
X

PLAN AND PROFILE (36"ø PVC)
STA 20+00 TO STA 30+00

PROJ. NO: X
CONTRACT NO: ---
ISSUE DATE: X
SUBMITTAL: X
DRAWING
C-2

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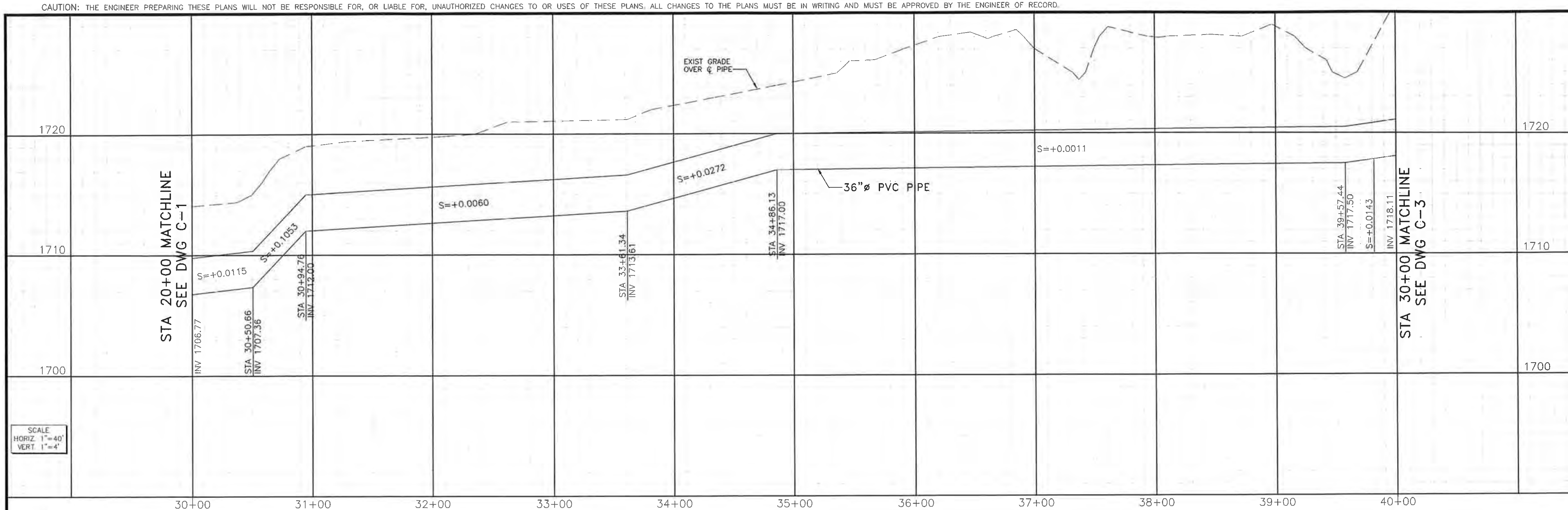

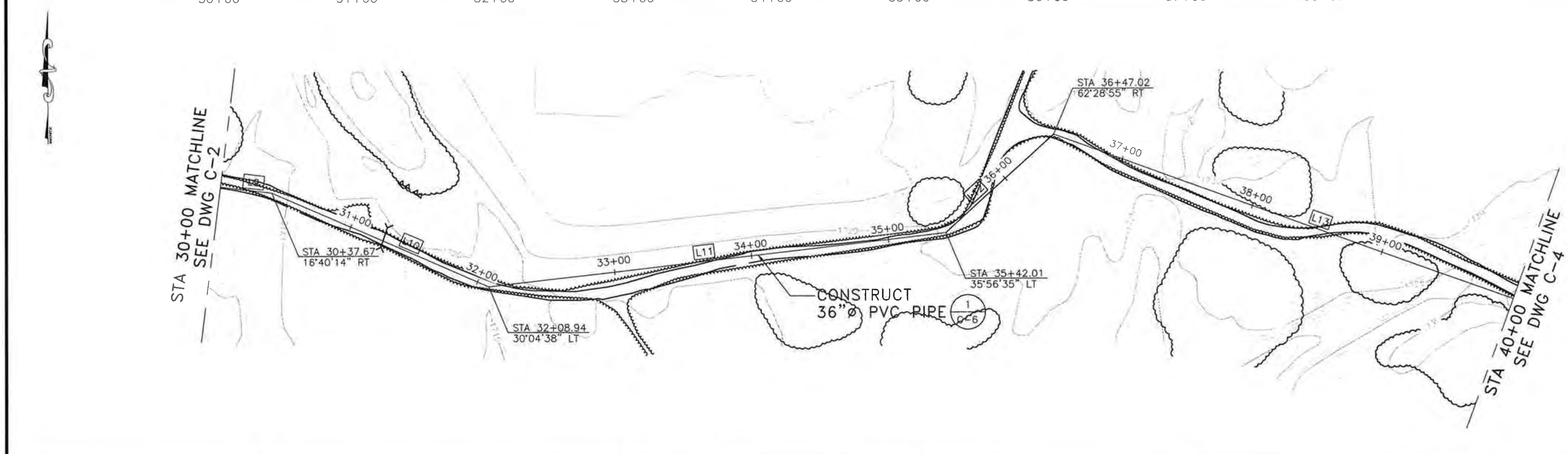

LINE TABLE

LINE	LENGTH	BEARING
L9	114.37	S83°14'31"E
L10	171.27	S66°34'17"E
L11	333.07	N83°21'06"E
L12	105.01	N47°24'31"E
L13	434.27	S70°06'34"E

APPROVED RICHARD W. HANSEN GENERAL MANAGER/CHIEF ENGINEER DATE

WARNING: 0 1/2 1 THIS BAR SHOULD MEASURE 1" OR DRAWING IS NOT TO SCALE

DESIGNED M. ROZMAN CHECKED
DRAWN K. CHUNG APPROVED M. ROZMAN

REV	DATE	DESCRIPTION	SUB	APP'D

REGISTERED PROFESSIONAL ENGINEER MARC J. ROZMAN No. C042862 Exp. 03/31/06 CIVIL STATE OF CALIFORNIA

Bookman-Edmonston
A Division of GEI Consultants

THREE VALLEYS MUNICIPAL WATER DISTRICT

THREE VALLEYS MUNICIPAL WATER DISTRICT
1021 MIRAMAR AVE.
CLAREMONT, CA 91711
(909) 621-5568

MIRAMAR WATER TREATMENT PLANT
X

PLAN AND PROFILE (36"ø PVC)
STA 30+00 TO STA 40+00

PROJ NO: X CONTRACT NO: ---
ISSUE DATE X SUBMITTAL X
DRAWING C-3

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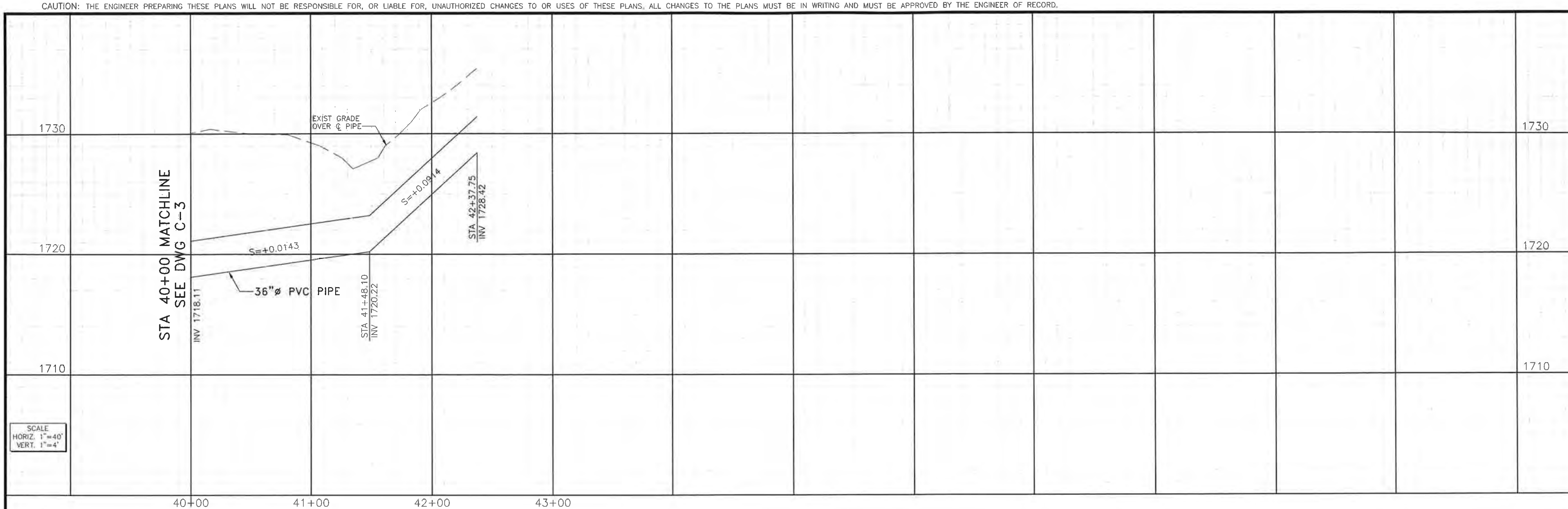

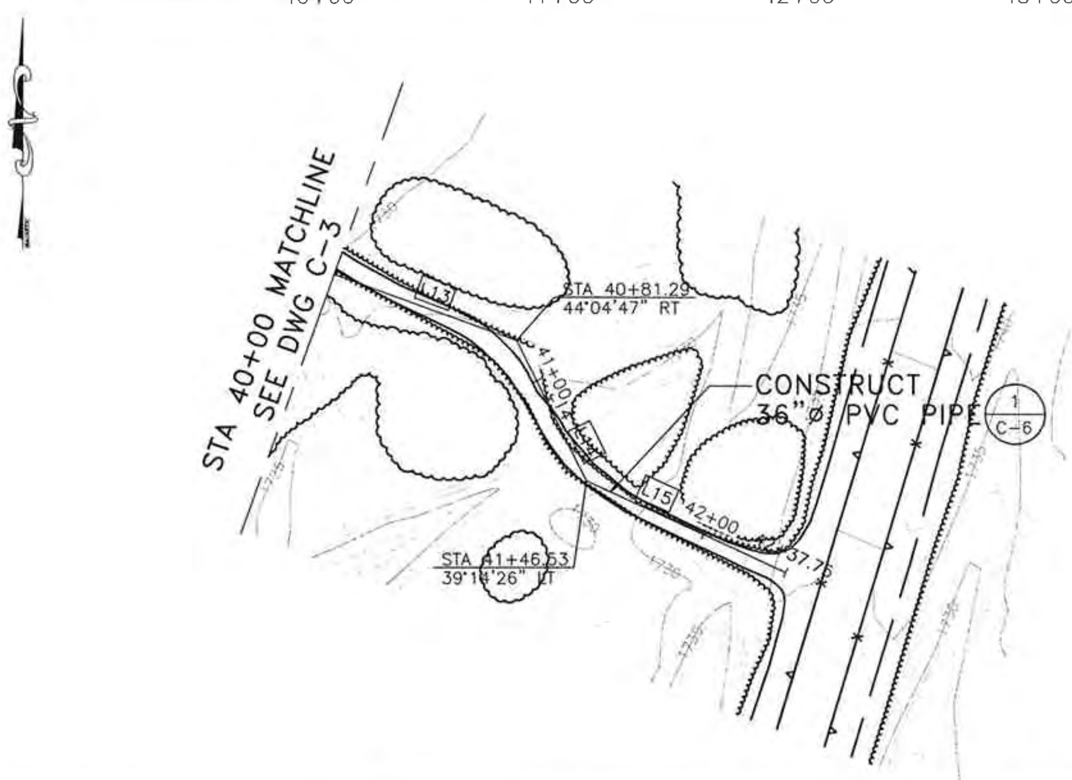

LINE TABLE		
LINE	LENGTH	BEARING
L13	434.27	S70°06'34"E
L14	65.24	S26°01'47"E
L15	91.22	S65°16'13"E

STA 29+23.30 to STA 42+37.75 NOT INCLUDED IN INITIAL CONSTRUCTION OR IN COST ESTIMATE

APPROVED RICHARD W. HANSEN GENERAL MANAGER/CHIEF ENGINEER DATE

WARNING: 0 1/2 1 THIS BAR SHOULD MEASURE 1" OR DRAWING IS NOT TO SCALE

DESIGNED M. ROZMAN CHECKED
DRAWN K. CHUNG APPROVED M. ROZMAN

REV	DATE	DESCRIPTION	SUB	APP'D

REGISTERED PROFESSIONAL ENGINEER MARC J. ROZMAN No. C042862 Exp. 03/31/06 CIVIL STATE OF CALIFORNIA

Bookman-Edmonston
A Division of GEI Consultants

THREE VALLEYS MUNICIPAL WATER DISTRICT

THREE VALLEYS MUNICIPAL WATER DISTRICT
1021 MIRAMAR AVE.
CLAREMONT, CA 91711
(909) 621-5568

MIRAMAR WATER TREATMENT PLANT
X

PLAN AND PROFILE (36"ø PVC)
STA 40+00 TO STA 42+37.75

PROJ. NO: X CONTRACT NO: ---
ISSUE DATE X SUBMITTAL X
DRAWING C-4

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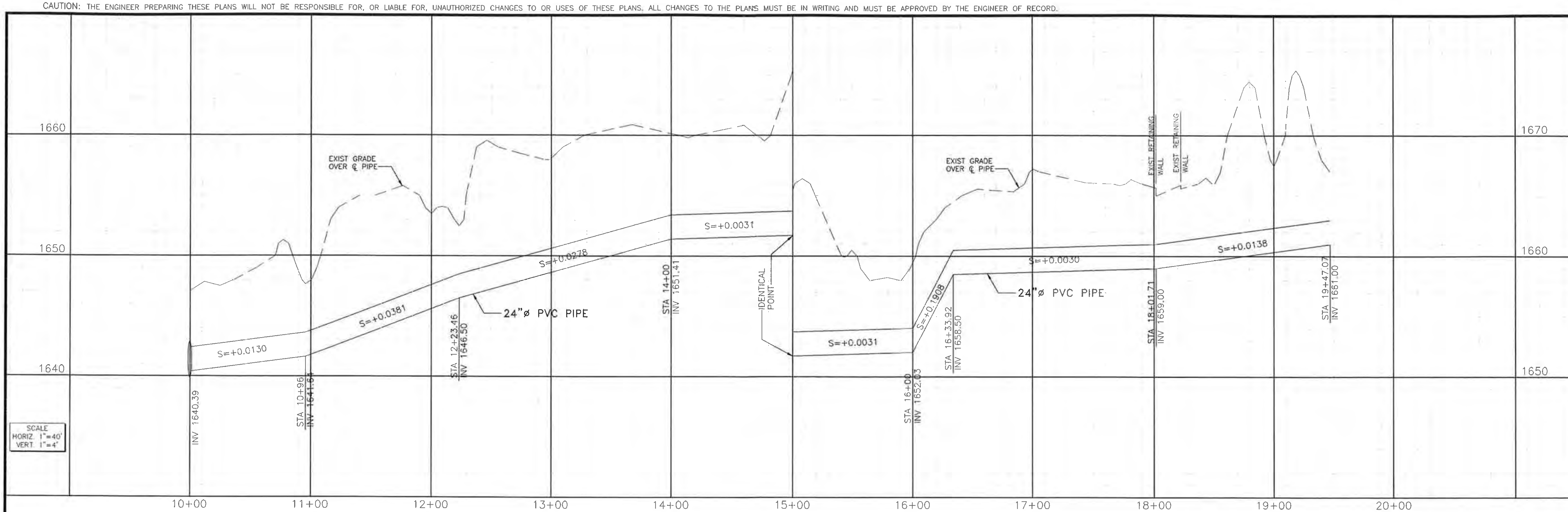
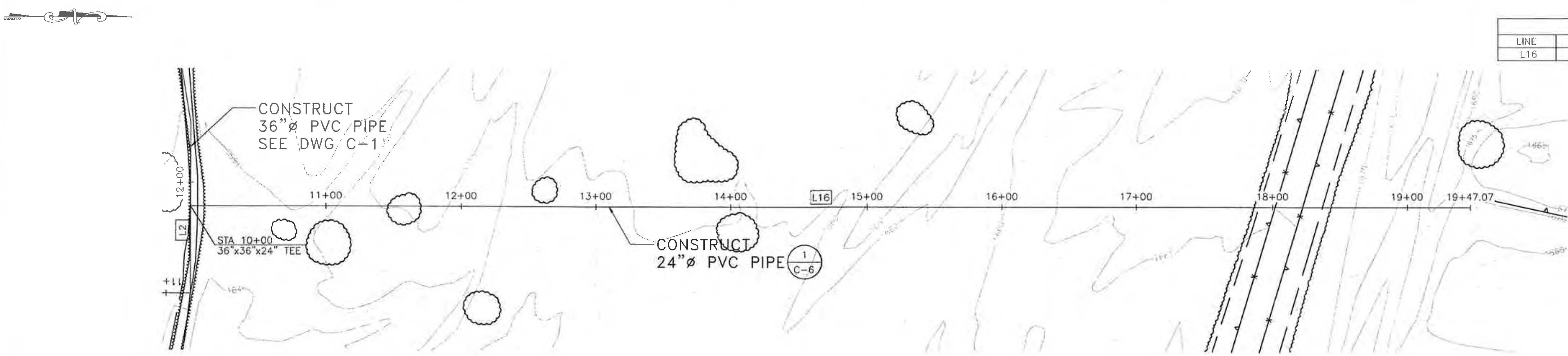


LINE TABLE		
LINE	LENGTH	BEARING
L16	947.07	N90°00'00"E



APPROVED ________ DATE
RICHARD W. HANSEN
GENERAL MANAGER/CHIEF ENGINEER

WARNING:
0 1/2 1
THIS BAR SHOULD MEASURE 1" OR DRAWING IS NOT TO SCALE

DESIGNED M. ROZMAN
DRAWN K. CHUNG
CHECKED
APPROVED M. ROZMAN

REV	DATE	DESCRIPTION	SUB	APP'D

REGISTERED PROFESSIONAL ENGINEER
MARC J. ROZMAN
No. C042862
Exp. 03/31/06
CIVIL
STATE OF CALIFORNIA

Bookman-Edmonston
A Division of GEI Consultants

THREE VALLEYS MUNICIPAL WATER DISTRICT

THREE VALLEYS MUNICIPAL WATER DISTRICT
1021 MIRAMAR AVE.
CLAREMONT, CA 91711
(909) 621-5568

MIRAMAR WATER TREATMENT PLANT
X

PLAN AND PROFILE (24"ø PVC)
STA 10+00 TO STA 19+47.07

PROJ. NO: X
CONTRACT NO: ---
ISSUE DATE: X
SUBMITTAL: X
DRAWING
C-5

GEI Consultants

Client THREE VALLEYS MWD

Subject

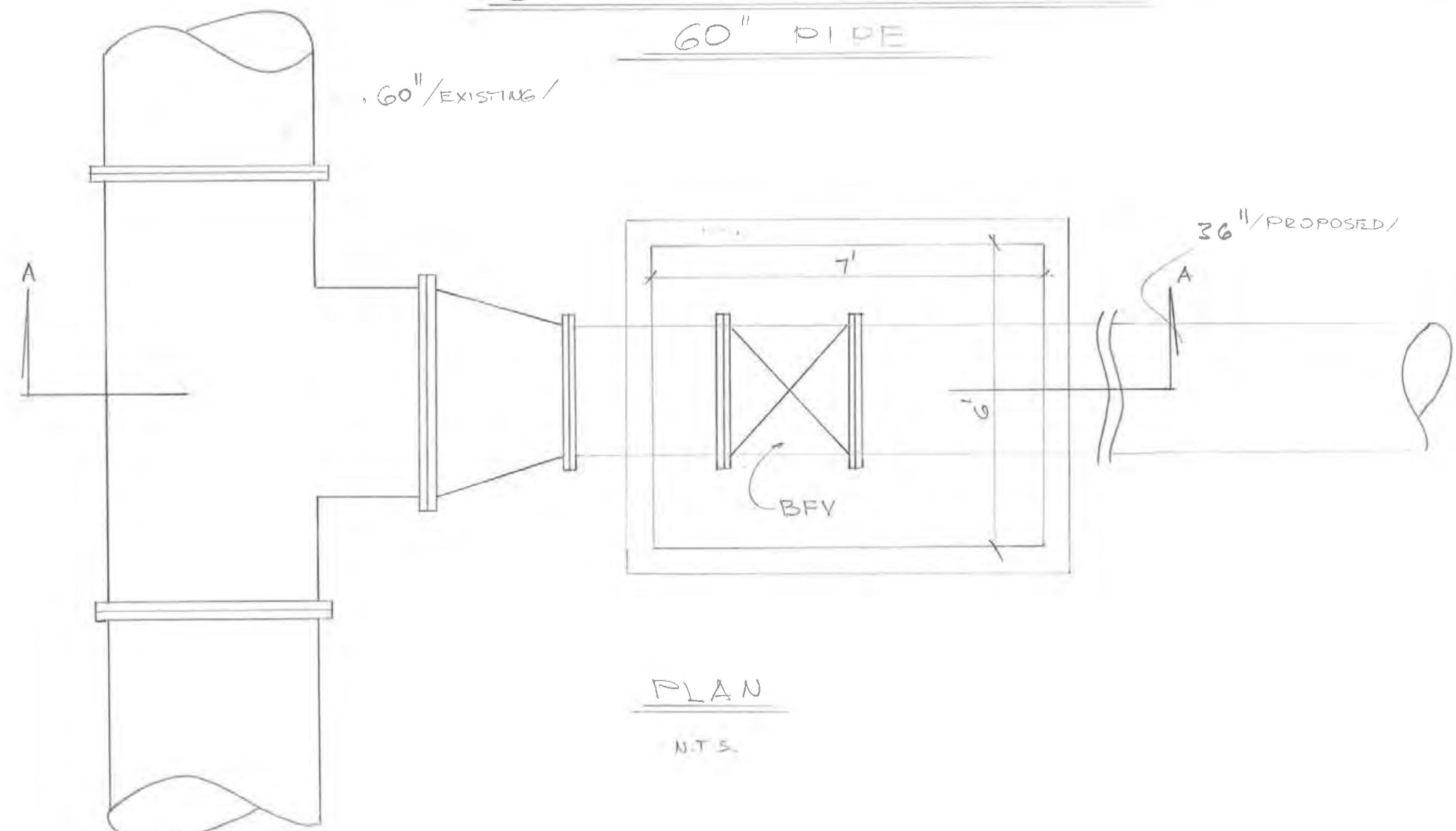
Project Nº 040740 Page

Date FEB. 16, 2006 By YK

Checked By

Approved By

CONNECTION TO EXISTING 60" PIPE



PLAN

N.T.S.

GEI Consultants

Client THREE VALLEYS MWD

Subject

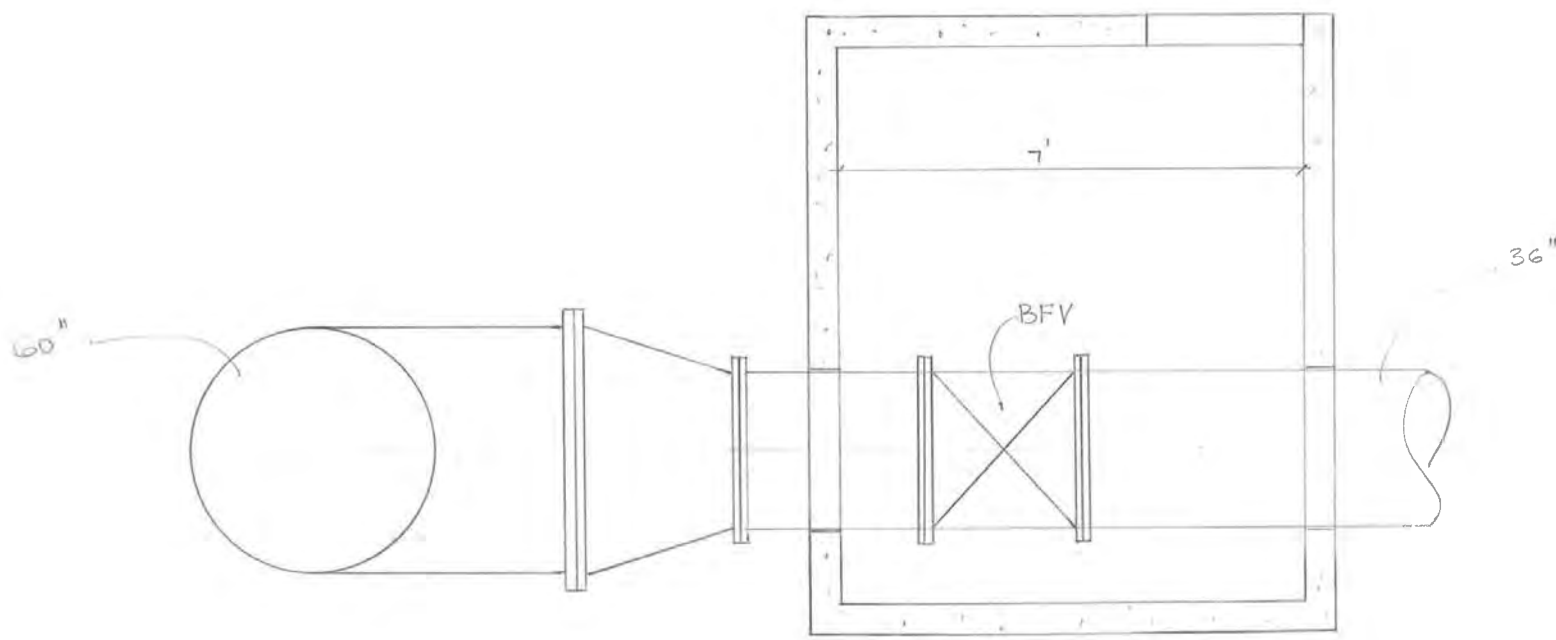
Project Nº 040740 Page

Date FEB. 16, 2005 By VK

Checked By

Approved By

CONNECTION TO EXISTING 60" PIPE



CROSS SECTION "A-A"

N.T.S.

GEI Consultants

Client THREE VALLEY MWD

Subject

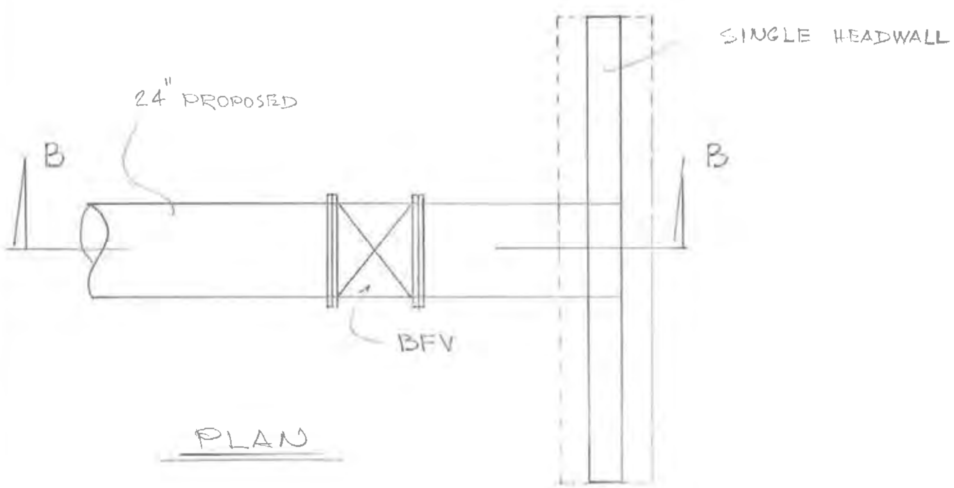
Project Nº 040740 Page

Date FEB. 16, 2005 By V.K

Checked By

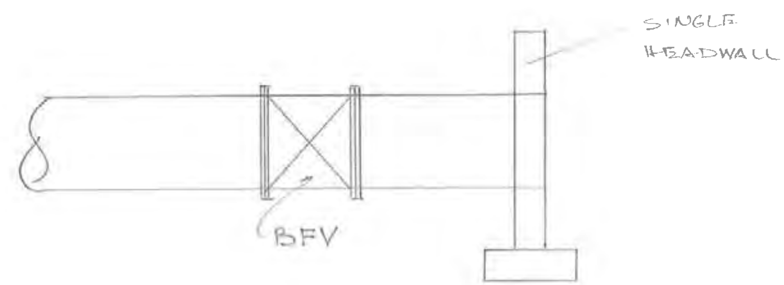
Approved By

OUTLET OF PROPOSED 24" PIPE



PLAN

N.T.S.



CROS SECTION "B-B"

N.T.S.

Imported Water Spreading at San Antonio Spreading Grounds
Cost Estimate: Design, Biological Mitigation Measures, Construction, Construction Management

(based on Feasibility Study)

Item	Quantity	Units	□□unit	Total
Capital Cost Summary				
Design				150,000
Biological focused surveys □ mitigation plans (allowance)				50,000
Construction Contract Total				1,728,794
Construction Management				160,000
Project Capital Cost, May 2005 price level			□	**2,088,794**
Adjust to midpoint of construction (2007)	3□ /year for 2 years			106□
Project Capital Cost, 2007 price level			□	**2,214,122**
Note: Does not include District administration costs.				
Mobilization □ General Conditions□General Requirements				
Project manager (20hr/wk)	15	wk	1,450.00	21,750
Superintendent (40hr/wk)	20	wk	2,600.00	52,000
Field engineer (40hr/wk)	30	wk	1,450.00	43,500
Main office expense (4□ of construction)	1	ls	44,200.00	44,200
Layout/Engineering survey	1	ls	15,000.00	15,000
Mobilization	1	ls	10,000.00	10,000
Job toilets (two)	12	mo	87.00	1,044
Storage shed	0	mo	85.00	-
Temporary water connection	1	ls	2,800.00	2,800
Temporary water	8	mo	50.00	400
Temporary electricity hookup	1	ls	1,400.00	1,400
Temporary phone connection	1	ls	300.00	300
Temporary phone service	6	mo	50.00	300
Periodic cleanup	2	mo	500.00	1,000
Final cleanup	24	hr	15.92	382
Pickup trucks/maintenance	0	mo	400.00	-
Scheduling	1	ls	1,000.00	1,000
Licenses/permits	1	ls	1,000.00	1,000
Insurance (2.5□ of construction)	1	ls	28,000.00	28,000
Submittals	120	hrs	100.00	12,000
Protection of sensitive species	1	ls	100,000.00	100,000
xxxx				-
Subtotal□				336,076
Diversion Structure and Pipeline 1 (36" Pipeline at connection up to Sta. 29□23.30)				
Earthwork/paving restoration				
Clearing	0.5	ac	2,000.00	1,000
Remove AC paving	10	ton	20.00	190
Excavation	3100	cy	4.00	12,400
Disposal of excess soil	695	cy	8.00	5,560
Stockpile soil/load and return to site (Rock processor)	620	cy	7.00	4,340
Backfill □ Compaction	2405	cy	2.50	6,013
Utility vault	1	ea	3,500.00	3,500
Pipe manifold	0.5	ac	25,000.00	12,500
Restore AC paving, 8-inch thk (.475 ton/lf)	10	ton	37.00	352
Provide and install pipe				-
Connection to 60" plant intake Pipeline	1	ls	26,500.00	26,500
36" PVC C905 pipe, material	2080	lf	135.00	280,800
Install/Rental of Backhoe (install pipe @ $1.75/dia inch)	2080	lf	63.00	131,040
36" PVC C900/905 fittings/glue	1	ls	14,040.00	14,040
36" Valve (BFV) FLG	1	ls	12,500.00	12,500
36" Valve (Plug) FLG	1	ls	70,000.00	70,000
Electrical supply/assembly for actuator	1	ls	10,000.00	10,000
Valve Vault for 36" BFV (including intall)	1	ls	7,500.00	7,500
Outlet structure (including valve box)	2	ls	4,000.00	8,000
Vegitation restoration	0.5	ac	40,000.00	20,000
Subtotal□				626,234

Imported Water Spreading at San Antonio Spreading Grounds
Cost Estimate: Design, Biological Mitigation Measures, Construction, Construction Management

(based on Feasibility Study)

Item	Quantity	Units	□unit	Total
Pipeline 1 (36" pipeline starting at Sta. 29□23.30 to Sta. 42□37.75)				
Earthwork/paving restoration				
Clearing and grubbing	0.36	ac	2,000.00	720
Excavation	1950	cy	4.00	7,800
Disposal of excess soil	438	cy	8.00	3,500
Stockpile soil/load and return to site (Rock processor)	390	cy	7.00	2,730
Backfill □ Compaction	1513	cy	2.50	3,781
Restore fence	30	lf	22.00	660
Provide and install pipe				-
36" PVC C905 pipe, material	1314	lf	135.00	177,390
Install/Rental of Backhoe (install pipe @ $1.75/dia inch)	1314	lf	63.00	82,782
36" PVC C900/905 fittings/glue	1	ls	8,869.50	8,870
36" Valve (BFV) FLG	1	ls	12,500.00	12,500
Outlet structure (including valve box)	1	ls	4,000.00	4,000
Vegitation restoration	0.36	ac	40,000.00	14,400
Subtotal□				319,133
Pipeline 2 (24" pipeline starting at Sta. 10□00 to 19□47.71)				
Earthwork/paving restoration				
Clearing and grubbing	0.26	ac	2,000.00	520
Excavation	1130	cy	4.00	4,520
Disposal of excess soil	167	cy	8.00	1,332
Stockpile soil/ filter out boulders and return to site	226	cy	7.00	1,582
Backfill □ Compaction	964	cy	2.50	2,409
Restore Gabion Mesh	200	sqft	100.00	20,000
Restore Fence	100	lf	22.00	2,200
Crossing pipeline support	1	ea	2,000.00	2,000
Outlet structure (including valve box)	1	ls	2,900.00	2,900
Provide and install pipe				-
24" PVC C905 pipe, material	925	lf	65.00	60,125
Install/Rental of Backhoe (install pipe @ $1.75/dia inch)	925	lf	42.00	38,850
24" Steel pipe, material	25	lf	51.00	1,275
36" O□PVC C900/905 fittings/glue	1	ls	3,006.25	3,006
2" Air Release Valve Assembly	1	ls	450.00	450
Rental of a crane to place the 24" steel pipe at Station	1	ls	2,000.00	2,000
Blowoff Valve Assembly	1	ls	850.00	850
24" Valve (BFV) FLG	1	ls	4,800.00	4,800
Vegitation restoration	0.26	lf	40,000.00	10,400
Subtotal□				159,219
Subtotal				1,104,586
Mobilization □ General Conditions/General Requirements				336,076
Subtotal				1,440,662
Contingency			20□	288,132
Construction Contract Total				**1,728,794**
Construction Management				160,000
Design				150,000
Biological focused surveys □ mitigation plans (allowance)				50,000
Project Capital Cost, May 2005 price level				**2,088,794**
Two years inflation	3□ /year for 2 years			106□
Project Capital Cost, 2007 price level			□	**2,214,122**

J:□040740 - Three Valleys - San Antonio SG Feasibility□Engineering□[040740□Cost Estimate 3.xls]Capital Cost

CALPOWER Engineering, Inc.
3452 E. Foothill Blvd., Suite 740
Pasadena, CA 91107
626 396-1171 Fx: 626 396-1508
CALPOWER@aol.com

APPROVED FOR PAYMENT
GEI CONSULTANTS, INC.
GLENDALE
BY:
DATE:
PM/ACCT
PO

RECEIVED-GLN
DEC 08 2004
Bookman-Edmonston
A Division of GEI Consultants, Inc.

December 6, 2003

Bookman-Edmonston
225 West Broadway, Suite 400
Glendale, CA 91204-1331

Attention: Mr. John Zoraster

Subject: Engineering Report for Electrical System Review for Project, Imported Water Spreading, TVMWD

Dear Mr. Zoraster:

Attached is our engineering review report for the electrical system of Three Valleys Municipal Water District for the project. We also attached the Southern California Edison's letter dated November 10, 2004 and e-mail copy dated December 2, 2004, for references.

Sincerely yours,

CALPOWER Engineering, Inc.

Chae Y. Lee, P.E.
Principal Engineer

Attachments:
1. Report, (4) pages
2. Dwg, Conceptual Single Line Diagram - Existing
3. Dwg, Conceptual Single Line Diagram - New
4. SCE Letter copy, dated 11/10/2004
5. SCE e-mail letter copy, dated 12/2/2004

Summary

(3) 100HP pumps and (1) 150HP pump will require 597A of new load. The existing 2000A main switchboard in hydroelectric station is sufficient to accommodate the new pump loads. According to Southern California Edison (SCE), the existing 500KVA Southern California Edison (SCE) transformer is sufficient to accommodate the additional pumps.

A new 800A breaker is required at the 2000A main switchboard in the hydroelectric station for connection of a new feeder to a new motor control center (MCC) at the pump site. A new NEMA 3R MCC with (4) soft starters is required at the site for the pump motors.

A new 800A feeder will be installed from the 800A new breaker in the existing main switchboard to the new MCC.

The new pumps are monitored and controlled through the existing SCADA system by connecting the new MCC to the existing SCADA system wires in the existing Pull Box No.6 located at south of the dual media filter.

Existing Power Distribution System
(Refer to the attached Conceptual Single Line Diagram – Existing)

The existing 480/277V, 3-phase, 4-wire, 500KVA SCE transformer is located at outside of west wall of the hydroelectric station. This 500KVA transformer services power to the existing 2000A main switchboard located in the hydroelectric station. Also, an existing 520KW hydroelectric generator is connected to the main switchboard in parallel with the SCE transformer to supply power to the switchboard. If the plant demands more than 520KW, the SCE transformer supplies difference in the power demand over the 520KW. If the plant demands less than 520KW, the excess power generated by the hydroelectric generator flows out to feed the SCE system.

The existing 2000A main switchboard feeds MCC-1 in control building through a 1600A automatic transfer switch (ATS) located in the control building. MCC-1 is the main power distribution center for the entire Miramar plant. MCC-1 sub-feeds power to MCC-2 in the dry chemical building and MCC-3 in the chlorine and ammonia storage building. In case of power failure at the 2000A main switchboard, the 1600A ATS will be automatically transferred power to an existing 250KW standby diesel engine-driven generator.

Analysis
(Refer to the attached Conceptual Single Line Diagram – New)

New pumps will require 597A new load. According to the as-built drawings, the connected load at the MCC-1 (1600A bus) is approximately 880A without considering addition of planned future loads. MCC-1 is inadequate to accommodate the new pump loads considering the future load. However, the existing 2000A switchboard will be adequate to accommodate the new pumps.

According to the SCE records, the maximum demand registered at the SCE meter in the main switchboard is 110.4KW (306.6KVA) and 367.92A. According to the national electrical code article 220.35, 125% of the SCE's demand record (367.92x125%=460A) shall consider as the maximum demand at the 500KVA SCE transformer. Assuming this 460A power demand in addition to the 520KW (782A) hydroelectric generator capacity, the existing overall maximum Miramar plant loads will be approximately 1242A. Considering 597A of a new pumping load, the new maximum demand at the 2000A main switchboard will be approximately1839A.

However, SCE planning department indicated that the existing 500KVA SCE transformer will be good for the maximum new demand of 1242A, which is 460A (125% of the registered maximum demand of 367.92A) plus 597A new pump load.

According to the as-built drawings, there are 44#14 spare wires available in the existing pull box No.6 at south of the dual media filter facilities to the main control panel CP-1 in the SCADA room. The new pumps will be monitored and controlled by the existing SCADA system utilizing these wires.

Conclusion

An addition of a new 800A switch section with 800A breaker will be required attached to the south end of the existing 2000A switchboard.

A new 800A feeder will be installed from the 800A new breaker to a new 800A MCC located at the pump site. The MCC will be NEMA 3R type with (4) soft starters for the pump motors.

The new pumps are monitored and controlled through the existing SCADA system by connecting the new MCC to the existing SCADA system wires in the existing Pull Box No.6 located at south of the dual media filter.

Design Consideration for Well and Booster Pump Station

MOTOR CONTROL CENTER (MCC)

MCC will be NEMA 3R, outdoor, non-walkin type.

MCC will be equipped with a digital meter with multiple functions and a surge protector at the incoming section.

MCC will be equipped with a phase fail relay to be protected from abnormal voltage.

MCC will be designed for (4) soft-starters for the well and booster pumps. Space will be considered in the MCC for future expansion. A bypass starter will be provided for the soft-starters for the soft-starter failure or for maintenance.

MCC will be equipped with an auxiliary single phase transformer and a panelboard to supply auxiliary power around the site.

A motor protector will be designed for the well pump motor against overload condition, light load condition (broken shaft), abnormal voltages and current, etc.

CONTROL SYSTEMS

MCC

Each starter has HOA switch. When HOA switch in Auto position, each starter will be controlled by a remote signal received from the SCADA system and will start with a lead-lag-alternate function.

Well

Thermal detector, space heater, and a lube solenoid, (if any), will be connected to the new MCC.

Solenoids and limit switches, (if any), will control the valve and will monitor the start sequencing of the well.

Suction and discharge pressure switches, (if any), will monitor the low and high pressure of the system and initiate alarms.

A pressure transmitter will monitor the discharge pressure in the plant. It will stop the well pump and will initiate alarms if it detects abnormal pressure.

A well depth meter, (if any), will monitor the well operating conditions and will initiate alarm.

Booster Pumps

New booster pump motors will be equipped with a thermal detector, space heater, and a lube solenoid.

Suction and discharge pressure switches will monitor the low and high pressure of the system and initiate alarms.

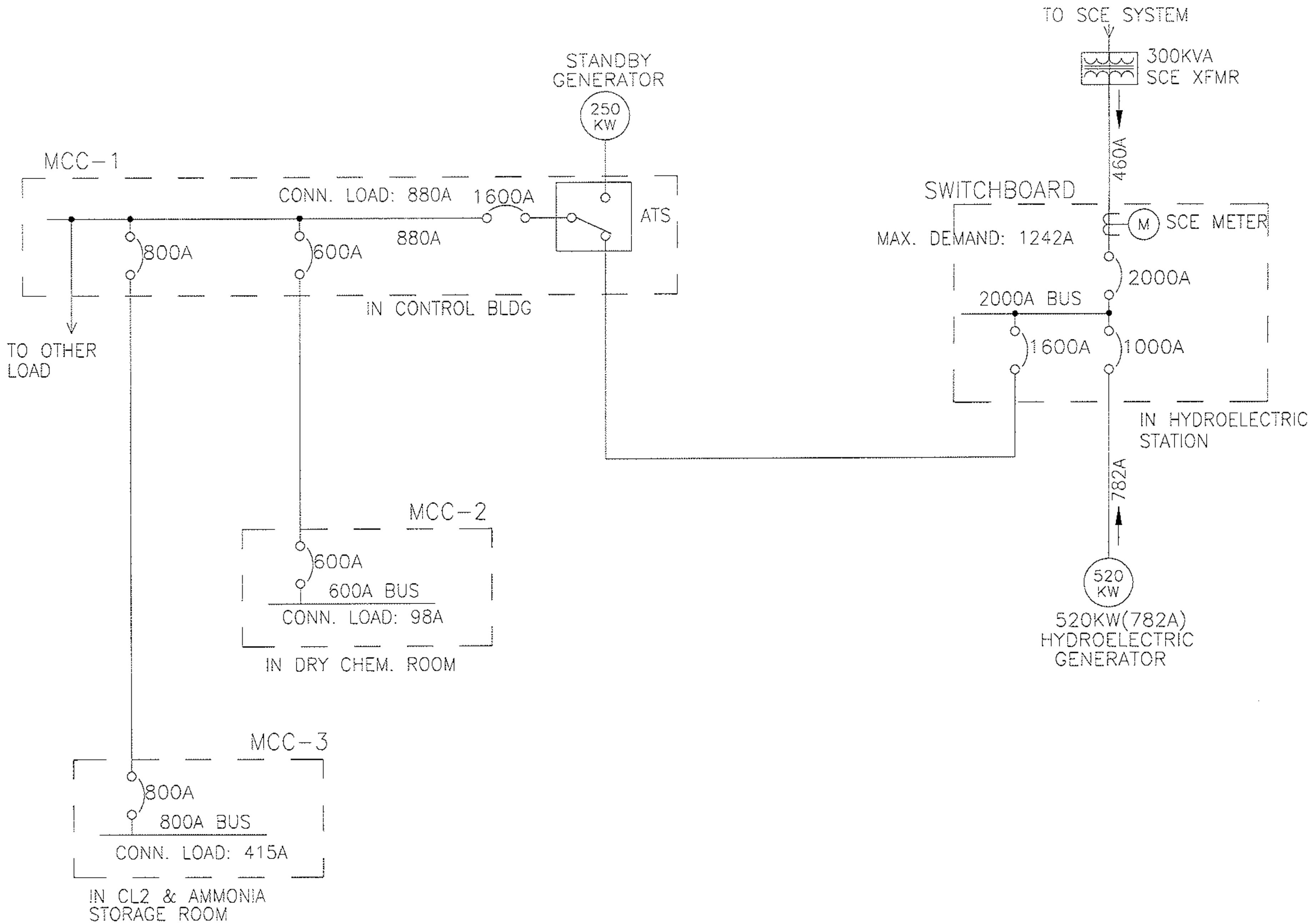
Solenoids and limit switches will control the valve (if any) and will monitor the start sequencing of the pumps.

Pressure transmitters will monitor the suction pressure out of the plant and discharge pressure into the system. It will stop the boosters and will initiate alarms if it detects abnormal pressure.

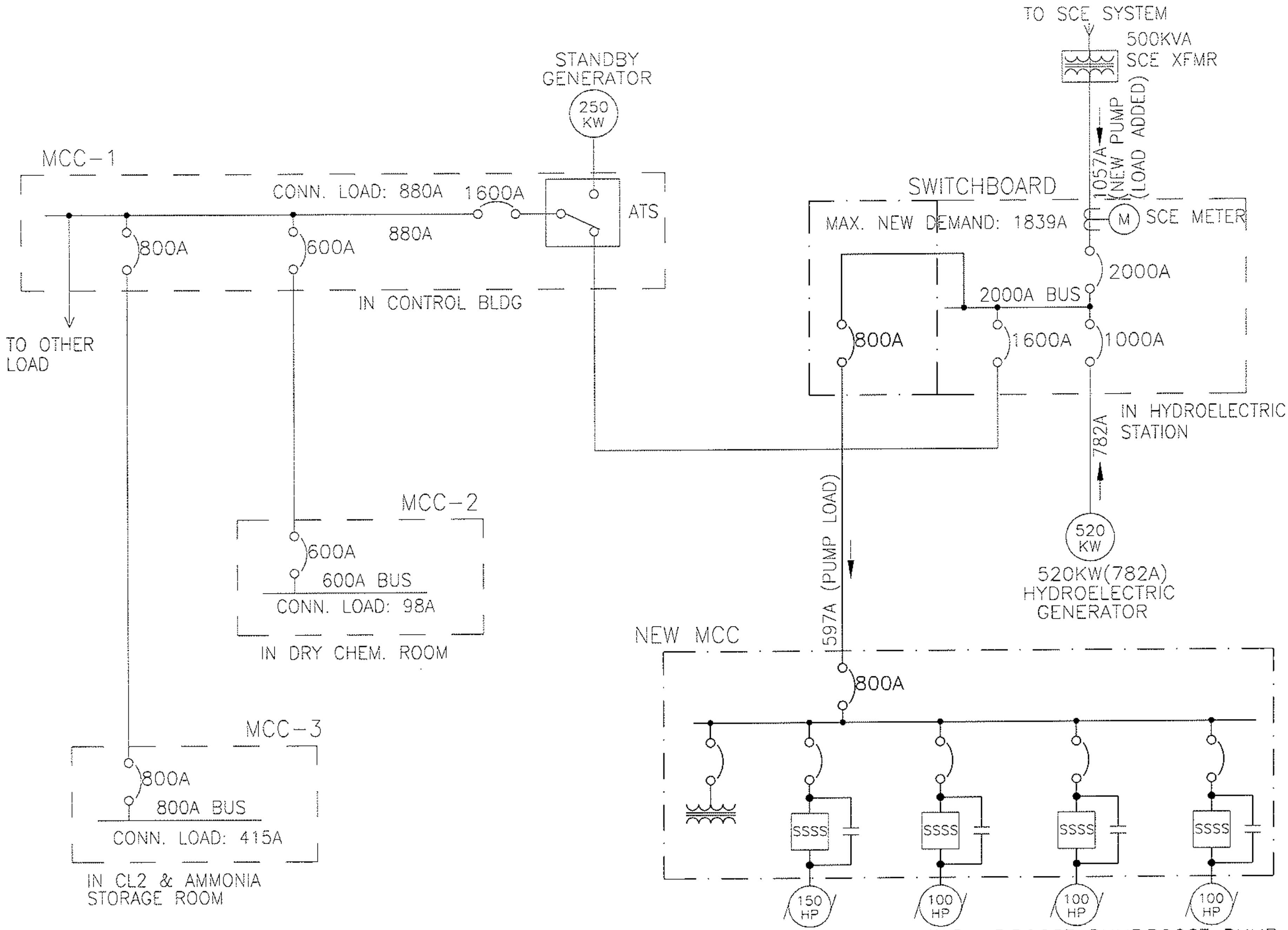
Connection to Existing SCADA System

All the above control and monitoring points in the MCC will be displayed on the MCC for operator interface and will be sent out to the SCADA in the control panel CP-1 in the control room through hardwires.

The existing SCADA system will be modified properly to accommodate the new inputs and outputs for the new MCC.



CONCEPTUAL SINGLE LINE DIAGRAM – EXISTING



CONCEPTUAL SINGLE LINE DIAGRAM – NEW

SOUTHERN CALIFORNIA
EDISON
An EDISON INTERNATIONAL Company

November 10, 2004

Chae Lee
Calpower
3452 E. Foothill Blvd
Suite 740
Pasadena, CA 91107

Dear Mr. Lee:

This letter confirms our conversation of 11/10/04 concerning power usage for the Three Valleys Water District – Meter Number V349E-002072.

The peak KW registered on this meter is 110.4 KW; 306.6 KVA; and 367.92 AMPS The current service configuration is 277/480V 3 phase service

I hope this information is sufficient for your needs Please contact me at 909-592-3718 should you require further assistance

Sincerely,

Bonni Carr

Bonni K. Carr
Service Planner
Covina Service Center

800 West Cienega Ave
San Dimas, CA 91773

Subj: **Attention: Chae Lee**
Date: 12/2/2004 4:37:21 PM Pacific Standard Time
From: Stanley.James@sce.com
To: Calpower@aol.com

Dear Mr. Lee,

In response to our conversation regarding the Three Valleys Municipal Water District and the new pumps. I have calculated that the existing electrical facilities will be able to handle the 3 - 100hp and 1 - 150hp additional pumps attached with the meter V349-002072.

While I see no problem adding the new pumps, we would like to be notified when any more load is to be added in the future.

It's been a pleasure working with you Mr. Lee, I hope we work on future projects together.

Thank you, Stan James

Stan James
Southern California Edison Co.
Covina District
Planning Dept.
Phone 909-592-3715/43715
Fax 909-592-3727/43727

Appendix E
Operations

- Groundwater levels with project
- Metropolitan Water District of Southern California letter dated October 5, 2004.

J:\040740 - Three Valleys - San Antonio SG Feasibility\Geology\Water Levels\[Operations model 2.xls]Modeled

Summary of Run

Comments: This run assumes a reliable supply of imported water and manages imported water with the intend of keeping water levels in the range of 100 to 150 ft bgs. It allows some increase in native water recovery during periods of high groundwater.
Native Water Storage: Available native water stored up to capacity of the basin. No change from existing conditions.
Imported Water Storage: 8,000 af available for storage in all years. Storage limited to 15,000 af in storage at any time. Storage space reserved for approx 6,000 af of imported water.
Change in Native Groundwater Recovery: Recover up to 3,000 af/y increase from historic depending on water levels.
Imported Water Recovery: Recover up to 12,000 af/y if WSL above 110 ft bgs from January through December or above 130 feet bgs from August through December.

Storage Capacity	
0.009	ft/af
111	af/ft

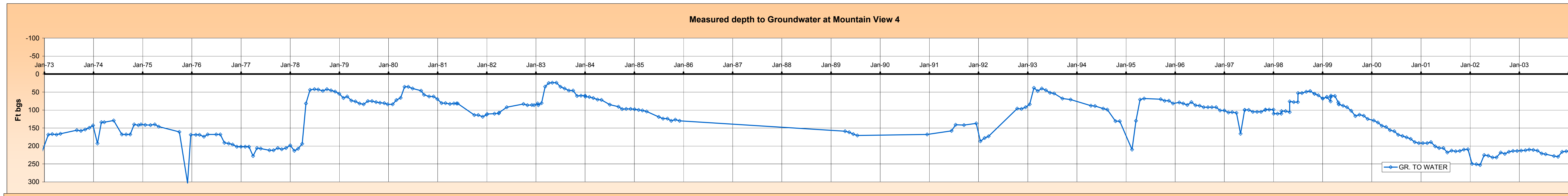
Storage Rules (based on Mountain View 4)					
Month	For Native Water		For Imported Water		
	if WSL below (Note 1)	Store	if WSL below (Note 1)	if water in storage less than (af)	Store
January	50	Available	100	15,000	Available
February	50	Available	100	15,000	Available
March	50	Available	50	15,000	Available
April	50	Available	50	15,000	Available
May	50	Available	50	15,000	Available
June	50	Available	50	15,000	Available
July	50	Available	50	15,000	Available
August	50	Available	50	15,000	Available
September	50	Available	50	15,000	Available
October	50	Available	50	15,000	Available
November	50	Available	100	15,000	Available
December	50	Available	100	15,000	Available

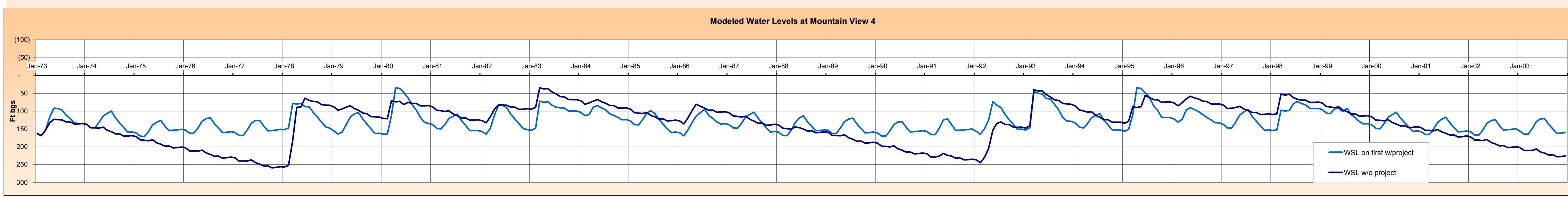
Note 1: Includes anticipated impact of previous spreading
Note 2: Includes anticipated impact of previous spreading □ snow pack

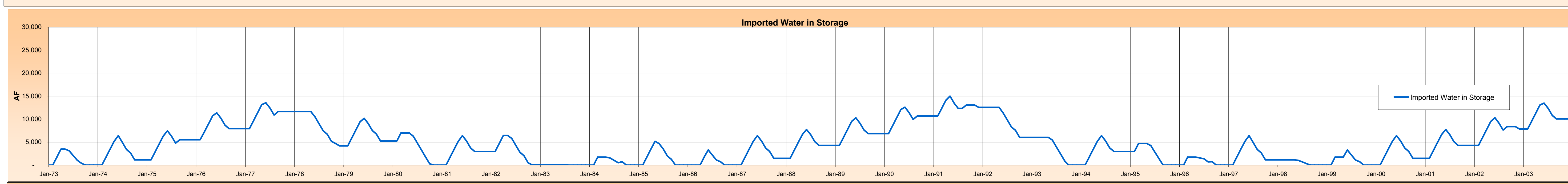
Recovery□Extraction Rules (based on Mountain View 4)						
Month	For Imported Water			For Native Water		
	WSL above	□ of water in storage	up to maximum of (af)	WSL above		Maximum (af)
January	110	0□	500	70		250
February	110	0□	500	70		250
March	110	0□	500	70		250
April	110	0□	500	70		250
May	110	0□	1,500	70		250
June	110	10□	1,500	70		250
July	110	33□	1,500	70		250
August	120	50□	1,500	70		250
Septembe	140	100□	1,500	70		250
October	140	100□	1,500	70		250
Novembe	150	100□	500	70		250
Decembe	150	100□	500	70		250
		Annual Maximum:	12,000	Annual Maximum:		3,000

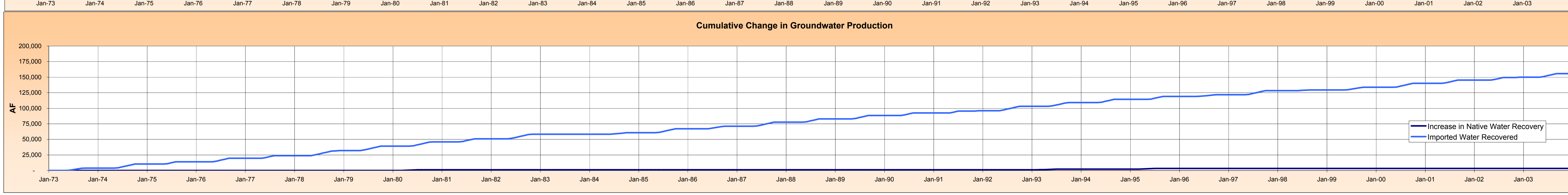
Imported Water Availability	
Use probability (Yes or No):	No
Probability less than	Water Available
90□	- af
80□	4,000 af
60□	6,000 af
40□	8,000 af

Project Performance over 31 years			
Water Surface Elevations			
Average Without Project	135.0	ft bgs	
Average with Project	128.6	ft bgs	
Change in averge WSL	(6.4)	ft bgs	
Native Water Recovery			
Change in Recovery	3,250	af	
Imported Water Recovery			
Storage	165,679	af	
Recovery	155,624	af	
Remaining	10,055	af	
Increased Groundwater Production			
Total:	158,874	af	
Annual average:	5,125	af	
Months WSL more than			
150 ft bgs	114	months	(131 months w/o project)
200 ft bgs	-	months	(66 months w/o project)









Appendix E (part)

Imported Water Spreading at San Antonio Spreading Grounds

Example of Project Operations

Calculation Detail

Model based on Historic Recharge & Groundwater Levels and adding in impact of Imported Water								Imported Water Spreading												Imported Water Recovery				Imported Water Performance			Additional Native Water Extraction						
Date	Historic Spreading of Native Water	Snow pack	Limit recharge based on WSL	1% of arrived water leaves each month for 24 months	Change in water level during month due to spreading	Change in depth during month due to "normal pumping" (1999-03)	WSL on first w/project	Random Number (resets with each calculation)	Availability of Imported Water (use prior column or other method)	Percent chance this amount of water is equaled or exceeded: 90%	80%	60%	40%	Water available this month	Available capacity based on Project Goals (1st of month)	Achieved spreading this month	Spread water affecting water level	Lost water rule (not used at this time)	Change in WSLduring month due to spreading	Imported Water Recovery Trigger	Max possible recovery (af)	Recovery	Change in water level due to imported extraction	From project inception: Stored	Recovered	Imported Water in Storage	Native Water Extraction Trigger	Amount to extract if we extract	Native extraction due to high water levels	Cummulative increase in Native Water Extraction	Change in water level due to additional native extraction	Change in water level during prior month due to project	Without project water levels
										-	4,000	6,000	8,000																				
	af		af	af	ft	ft				af	af	af	af		af	af	af	af	ft bgs	ft bgs		af	ft bgs	af	af	af	ft bgs	af	af	af	ft bgs	ft bgs	ft bgs
1-Jan-73	339	N	339	-	(3.0)	8.80	163	72%	0%					-	15,000	-	-			110	500	-	-	-	-	-	70	250	-	-	-		163
1-Feb-73	1,723	N	1,723	(3.4)	(15.5)	0.40	169							-	15,000	-	-		-	110	500	-	-	-	-	-	70	250	-	-	-	-	169
1-Mar-73	2,370	N	2,370	(20.6)	(21.1)	1.20	154			-	1,000	400	333	1,733	15,000	1,733	1,733		(15.6)	110	500	-	-	1,733	-	1,733	70	250	-	-	-	-	154
1-Apr-73	939	N	939	(44.3)	(8.1)	(3.00)	118			-	1,000	400	333	1,733	13,267	1,733	1,733		(15.6)	110	500	-	-	3,467	-	3,467	70	250	-	-	-	(15.6)	134
1-May-73	861	N	861	(53.7)	(7.3)	8.20	91			-	1,000	400	333	1,733	11,533	-	-		-	110	1,500	-	-	3,467	-	3,467	70	250	-	-	-	(15.6)	123
1-Jun-73	371	N	371	(62.3)	(2.8)	4.00	92				1,000	400	333	1,733	11,533	-	-		-	110	1,500	347	3.1	3,467	347	3,120	70	250	-	-	-	-	124
1-Jul-73	121	N	121	(66.0)	(0.5)	5.60	97						333	333	11,880	-	-		-	110	1,500	1,040	9.4	3,467	1,387	2,080	70	250	-	-	-	3.1	125
1-Aug-73	-	N	-	(67.2)	0.6	(0.80)	111							-	12,920	-	-		-	120	1,500	1,040	9.4	3,467	2,427	1,040	70	250	-	-	-	9.4	130
1-Sep-73	1	N	1	(67.2)	0.6	5.60	120					400		400	13,960	400	400		(3.6)	140	1,500	1,040	9.4	3,867	3,467	400	70	250	-	-	-	9.4	130
1-Oct-73	0	N	0	(67.3)	0.6	(1.00)	132							-	14,600	-	-		-	140	1,500	400	3.6	3,867	3,867	-	70	250	-	-	-	5.8	136
1-Nov-73	1	N	1	(67.3)	0.6	(1.60)	136							-	15,000	-	-		-	150	500	-	-	3,867	3,867	-	70	250	-	-	-	3.6	136
1-Dec-73	1	N	1	(67.3)	0.6	2.00	135							-	15,000	-	-		-	150	500	-	-	3,867	3,867	-	70	250	-	-	-	-	135
1-Jan-74	17	N	17	(67.3)	0.5	8.80	137	66%	0%					-	15,000	-	-		-	150	500	-	-	3,867	3,867	-	70	250	-	-	-	-	137
1-Feb-74	85	N	85	(67.4)	(0.2)	0.40	146							-	15,000	-	-		-	150	500	-	-	3,867	3,867	-	70	250	-	-	-	-	146
1-Mar-74	116	N	116	(68.3)	(0.4)	1.20	147			-	1,000	400	333	1,733	15,000	1,733	1,733		(15.6)	150	500	-	-	5,600	3,867	1,733	70	250	-	-	-	-	147
1-Apr-74	46	N	46	(69.4)	0.2	(3.00)	132			-	1,000	400	333	1,733	13,267	1,733	1,733		(15.6)	150	500	-	-	7,333	3,867	3,467	70	250	-	-	-	(15.6)	147
1-May-74	42	N	42	(69.9)	0.2	8.20	113			-	1,000	400	333	1,733	11,533	1,733	1,733		(15.6)	150	1,500	-	-	9,067	3,867	5,200	70	250	-	-	-	(15.6)	145
1-Jun-74	18	N	18	(70.3)	0.5	4.00	106				1,000	400	333	1,733	9,800	1,733	1,733		(15.6)	150	1,500	520	4.7	10,800	4,387	6,413	70	250	-	-	-	(15.6)	153
1-Jul-74	6	N	6	(70.5)	0.6	5.60	100						333	333	8,587	-	-		-	150	1,500	1,500	13.5	10,800	5,887	4,913	70	250	-	-	-	(10.9)	158
1-Aug-74	0	N	-	(70.6)	0.6	(0.80)	119							-	10,087	-	-		-	150	1,500	1,500	13.5	10,800	7,387	3,413	70	250	-	-	-	13.5	164
1-Sep-74	0	N	0	(70.6)	0.6	5.60	133					400	333	733	11,587	733	733		(6.6)	150	1,500	1,500	13.5	11,533	8,887	2,647	70	250	-	-	-	13.5	164
1-Oct-74	0	N	0	(70.6)	0.6	(1.00)	146							-	12,353	-	-		-	150	1,500	1,500	13.5	11,533	10,387	1,147	70	250	-	-	-	6.9	170
1-Nov-74	0	N	0	(70.6)	0.6	(1.60)	159							-	13,853	-	-		-	150	500	-	-	11,533	10,387	1,147	70	250	-	-	-	13.5	169
1-Dec-74	0	N	0	(70.6)	0.6	2.00	158							-	13,853	-	-		-	150	500	-	-	11,533	10,387	1,147	70	250	-	-	-	-	168
1-Jan-75	1	N	1	(70.6)	0.6	8.80	161	33%	0%					-	13,853	-	-		-	150	500	-	-	11,533	10,387	1,147	70	250	-	-	-	-	171
1-Feb-75	7	N	7	(67.2)	0.5	0.40	170							-	13,853	-	-		-	150	500	-	-	11,533	10,387	1,147	70	250	-	-	-	-	181
1-Mar-75	9	N	9	(50.0)	0.4	1.20	171			-	1,000	400	333	1,733	13,853	1,733	1,733		(15.6)	150	500	-	-	13,267	10,387	2,880	70	250	-	-	-	-	181
1-Apr-75	4	N	4	(26.4)	0.2	(3.00)	157			-	1,000	400	333	1,733	12,120	1,733	1,733		(15.6)	150	500	-	-	15,000	10,387	4,613	70	250	-	-	-	(15.6)	183
1-May-75	3	N	3	(17.1)	0.1	8.20	139			-	1,000	400	333	1,733	10,387	1,733	1,733		(15.6)	150	1,500	-	-	16,733	10,387	6,347	70	250	-	-	-	(15.6)	180
1-Jun-75	1	N	1	(8.5)	0.1	4.00	131				1,000	400	333	1,733	8,653	1,733	1,733		(15.6)	150	1,500	635	5.7	18,467	11,021	7,445	70	250	-	-	-	(15.6)	189
1-Jul-75	0	N	0	(4.8)	0.0	5.60	126						333	333	7,555	333	333		(3.0)	150	1,500	1,500	13.5	18,800	12,521	6,279	70	250	-	-	-	(9.9)	193
1-Aug-75	0	N	-	(3.6)	0.0	(0.80)	142							-	8,721	-	-		-	150	1,500	1,500	13.5	18,800	14,021	4,779	70	250	-	-	-	10.5	198
1-Sep-75	0	N	0	(3.6)	0.0	5.60	154					400	333	733	10,221	733	733		(6.6)	150	1,500	-	-	19,533	14,021	5,512	70	250	-	-	-	13.5	197
1-Oct-75	0	N	0	(3.6)	0.0	(1.00)	154							-	9,488	-	-		-	150	1,500	-	-	19,533	14,021	5,512	70	250	-	-	-	(6.6)	203
1-Nov-75	0	N	0	(3.6)	0.0	(1.60)	153							-	9,488	-	-		-	150	500	-	-	19,533	14,021	5,512	70	250	-	-	-	-	202
1-Dec-75	1	N	1	(3.6)	0.0	2.00	151							-	9,488	-	-		-	150	500	-	-	19,533	14,021	5,512	70	250	-	-	-	-	201
1-Jan-76	8	N	8	(3.6)	(0.0)	8.80	153	76%	0%					-	9,488	-	-		-	150	500	-	-	19,533	14,021	5,512	70	250	-	-	-	-	203
1-Feb-76	39	N	39	(3.5)	(0.3)	0.40	162							-	9,488	-	-		-	150	500	-	-	19,533	14,021	5,512	70	250	-	-	-	-	211
1-Mar-76	54	N	54	(3.0)	(0.5)	1.20	162			-	1,000	400	333	1,733	9,488	1,733	1,733		(15.6)	150	500	-	-	21,267	14,021	7,245	70	250	-	-	-	-	211
1-Apr-76	21	N	21	(2.4)	(0.2)	(3.00)	147			-	1,000	400	333	1,733	7,755	1,733	1,733		(15.6)	150	500	-	-	23,000	14,021	8,979	70	250	-	-	-	(15.6)	212
1-May-76	20	N	20	(2.2)	(0.2)	8.20	128			-	1,000	400	333	1,733	6,021	1,733	1,733		(15.6)	150	1,500	-	-	24,733	14,021	10,712	70	250	-	-	-	(15.6)	209
1-Jun-76	8	N	8	(1.9)	(0.1)	4.00	121				1,000	400	333	1,733	4,288	1,733	1,733		(15.6)	150	1,500	1,071	9.6	26,467	15,093	11,374	70	250	-	-	-	(15.6)	217
1-Jul-76	3	N	3	(1.8)	(0.0)	5.60	119						333	333	3,626	333	333		(3.0)	150	1,500	1,500	13.5	26,800	16,593	10,207	70	250	-	-	-	(6.0)	221
1-Aug-76	0	N	-	(1.8)	0.0	(0.80)	135							-	4,793	-	-		-	150	1,500	1,500	13.5	26,800	18,093	8,707	70	250	-	-	-	10.5	227
1-Sep-76	0	N	0	(1.8)	0.0	5.60	147					400	333	733	6,293	733	733		(6.6)	150	1,500	1,500	13.5	27,533	19,593	7,941	70	250	-	-	-	13.5	226
1-Oct-76	0	N	0	(1.8)	0.0	(1.00)	160							-	7,059	-	-		-	150	1,500	-	-	27,533	19,593	7,941	70	250	-	-	-	6.9	231
1-Nov-76	1	N	1	(1.8)	0.0	(1.60)	159							-	7,059	-	-		-	150	500	-	-	27,533	19,593	7,941	70	250	-	-	-	-	230
1-Dec-76	1	N	1	(1.8)	0.0	2.00	157							-	7,059	-	-		-	150	500	-	-	27,533	19,593	7,941	70	250	-	-	-	-	229
1-Jan-77	14	N	14	(1.8)	(0.1)	8.80	159	91%	0%					-	7,059	-	-		-	150	500	-	-	27,533	19,593	7,941	70	250	-	-	-	-	231
1-Feb-77	70	N	70	(1.9)	(0.6)	0.40	168							-	7,059	-	-		-	150	500	-	-	27,533	19,593	7,941	70	250	-	-	-	-	240
1-Mar-77	96	N	96	(2.6)	(0.8)	1.20	168			-	1,000	400	333	1,733	7,059	1,733	1,733		(15.6)	150	500	-	-	29,267	19,593	9,674	70	250	-	-	-	-	239
1-Apr-77	38	N	38	(3.4)	(0.3)	(3.00)	153			-	1,000	400	333	1,733	5,326	1,733	1,733		(15.6)	150	500	-	-	31,000	19,593	11,407	70	250	-	-	-	(15.6)	240
1-May-77	35	N	35	(3.8)	(0.3)	8.20	134			-	1,000	400	333	1,733	3,593	1,733	1,733		(15.6)	150	1,500	-	-	32,733	19,593	13,141	70	250	-	-	-	(15.6)	236
1-Jun-77	15	N	15	(4.1)	(0.1)	4.00	126				1,000	400	333	1,733	1,859	1,733	1,733		(15.6)	150	1,500	1,314	11.8	34,467	20,907	13,560	70	250	-	-	-	(15.6)	244
1-Jul-77	5	N	5	(4.2)	(0.0)	5.60	126						333	333	1,440	333	333		(3.0)	150	1,500	1,500	13.5	34,800	22,407	12,393	70	250	-	-	-	(3.8)	248
1-Aug-77	0	N	-	(4.3)	0.0	(0.80)	142							-	2,607	-	-		-	150	1,500	1,500	13.5	34,800	23,907	10,893	70	250	-	-	-	10.5	254
1-Sep-77	0	N	0	(4.3)	0.0	5.60	155					400	333	733	4,107	733	733		(6.6)	150	1,500	-	-	35,533	23,907	11,627	70	250	-	-	-	13.5	253
1-Oct-77	5	N	5	(4.3)	(0.0)	(1.00)	154							-	3,373	-	-		-	150	1,500	-	-	35,533	23,907	11,627	70	250	-	-	-	(6.6)	259
1-Nov-77	63	N	63	(4.3)	(0.5)	(1.60)	153							-	3,373	-	-		-	150	500	-	-	35,533	23,907	11,627	70	250	-	-	-	-	258
1-Dec-77	101	N	101	(5.0)	(0.9)	2.00	151							-	3,373	-	-		-	150	500	-	-	35,533	23,907	11,627	70	250	-	-	-	-	256
1-Jan-78	1,519	N	1,519	(6.0)	(13.6)	8.80	152	49%	0%					-	3,373	-	-		-	150	500	-	-	35,533	23,907	11,627	70	250	-	-	-	-	257
1-Feb-78	7,726	N	7,726	(21.1)	(69.3)	0.40	147							-	3,373	-	-		-	150	500	-	-	35,533	23,907	11,627	70	250	-	-	-	-	252
1-Mar-78	10,628	N	-	(97.9)	0.9	1.20	78			-	1,000	400	333	1,733	3,373	-	-		-	150	500	-	-	35,533	23,907	11,627	70	250	-	-	-	-	183
1-Apr-78	4,211	N	-	(97.4)	0.9	(3.00)	80			-	1,000	400	333	1,733	3,373	-	-		-	150	500	-	-	35,533	23,907	11,627	70	250	-	-	-	-	89
1-May-78	3,859	N	-	(97.2)	0.9	8.20	78			-	1,000	400	333	1,733	3,373	-	-		-	150	1,500	-	-	35,533	23,907	11,627	70	250	-	-	-	-	88
1-Jun-78	1,664	N	1,664	(97.0)	(14.1)	4.00	87				1,000	400	333	1,733	3,373	-	-		-	150	1,500	1,163	10.5	35,533	25,069	10,464	70	250	-	-	-	-	63
1-Jul-78	542	N	542	(113.6)	(3.9)	5.60	88						333	333	4,536	-	-		-	150	1,500	1,500	13.5	35,533	26,569	8,964	70	250	-	-	-	10.5	70
1-Aug-78	-	N	-	(118.9)	1.1	(0.80)	103							-	6,036	-	-		-	150	1,500	1,500	13.5	35,533	28,069	7,464	70	250	-	-	-	13.5	73
1-Sep-78	3	N	3	(118.9)	1.0	5.60	117					400	333	733	7,536	733	733		(6.6)	150	1,500	1,500	13.5	36,267	29,569	6,697	70	250	-	-	-	13.5	74
1-Oct-78	0	N	0	(119.0)	1.1	(1.00)	130							-	8,303	-	-		-	150	1,500	1,500	13.5	36,267	31,069	5,197	70	250	-	-	-	6.9	82
1-Nov-78	6	N	6	(119.0)	1.0	(1.60)	144							-	9,803	-	-		-	150	500	500	4.5	36,267	31,569	4,697	70	250	-	-	-	13.5	83
1-Dec-78	9	N	9	(119.0)	1.0	2.00	148							-	10,303	-	-		-	150	500	500	4.5	36,267	32,069	4,197	70	250	-	-	-	4.5	84
1-Jan-79	135	N	135	(119.1)	(0.1)	8.80	155	64%	0%					-	10,803	-	-		-	150	500	-	-	36,267	32,069	4,197	70	250	-	-	-	4.5	88
1-Feb-79	688	N	688	(120.3)	(5.1)	0.40	164							-	10,803	-	-		-	150	500	-	-	36,267	32,069	4,197	70	250	-	-	-	-	98
1-Mar-79	947	N	947	(126.5)	(7.4)	1.20	159			-	1,000	400	333	1,733	10,803	1,733	1,733		(15.6)	150	500	-	-	38,000	32,069	5,931	70	250	-	-	-	-	94
1-Apr-79	375	N	375	(135.0)	(2.2)	(3.00)	137			-	1,000	400	333	1,733	9,069	1,733	1,733		(15.6)	150	500	-	-	39,733	32,069	7,664	70	250	-	-	-	(15.6)	89
1-May-79	344	N	344	(138.4)	(1.8)	8.20	117			-	1,000	400	333	1,733	7,336	1,733	1,733		(15.6)	150	1,500	-	-	41,467	32,069	9,397	70	250	-	-	-	(15.6)	85
1-Jun-79	148	N	148	(141.5)	(0.1)	4.00	107				1,000	400	333	1,733	5,603	1,733	1,733		(15.6)	150	1,500	940	8.5	43,200	33,009	10,191	70	250	-	-	-	(15.6)	92
1-Jul-79	48	N	48	(142.8)	0.9	5.60	104						333	333	4,809	333	333		(3.0)	150	1,500	1,500	13.5	43,533	34,509	9,024	70	250	-	-	-	(7.1)	98
1-Aug-79	-	N	-	(143.2)	1.3	(0.80)	121							-	5,976	-	-		-	150	1,500	1,500	13.5	43,533	36,009	7,524	70	250	-	-	-	10.5	105
1-Sep-79	0	N	0	(143.2)	1.3	5.60	135					400	333	733	7,476	733	733		(6.6)	150	1,500	1,500	13.5	44,267	37,509	6,758	70	250	-	-	-	13.5	107
1-Oct-79	4	N	4	(143.2)	1.3	(1.00)	149							-	8,242	-	-		-	150	1,500	1,500	13.5	44,267	39,009	5,258	70	250	-	-	-	6.9	115
1-Nov-79	49	N	49	(143.2)	0.9	(1.60)	163							-	9,742	-	-		-	150	500	-	-	44,267	39,009	5,258	70	250	-	-	-	13.5	116
1-Dec-79	78	N	78	(143.1)	0.6	2.00	162							-	9,742	-	-		-	150	500	-	-	44,267	39,009	5,258	70	250	-	-	-	-	117
1-Jan-80	1,165	N	1,165	(142.8)	(9.2)	8.80	164	70%	0%					-	9,742	-	-		-	150	500	-	-	44,267	39,009	5,258	70	250	-	-	-	-	120
1-Feb-80	5,925	N	5,925	(139.3)	(52.1)	0.40	164							-	9,742	-	-		-	150	500	-	-	44,267	39,009	5,258	70	250	-	-	-	-	121
1-Mar-80	8,151	N	8,151	(121.3)	(72.3)	1.20	112			-	1,000	400	333	1,733	9,742	1,733	1,733		(15.6)	150	500	-	-	46,000	39,009	6,991	70	250	-	-	-	-	71
1-Apr-80	3,229	N	-	(202.8)	1.8	(3.00)	35			-	1,000	400	333	1,733	8,009	-	-		-	150	500	-	-	46,000	39,009	6,991	70	250	250	250	2	(15.6)	74
1-May-80	2,960	N	-	(202.8)	1.8	8.20	36			-	1,000	400	333	1,733	8,009	-	-		-	150	1,500	-	-	46,000	39,009	6,991	70	250	250	500	2	2.3	72
1-Jun-80	1,276	N	-	(202.8)	1.8	4.00	48				1,000	400	333	1,733	8,009	-	-		-	150	1,500	699	6.3	46,000	39,708	6,292	70	250	250	750	2	2.3	82
1-Jul-80	416	N	416	(186.2)	(2.1)	5.60	63						333	333	8,708	-	-		-	150	1,500	1,500	13.5	46,000	41,208	4,792	70	250	250	1,000	2	8.5	75
1-Aug-80	-	N	-	(184.9)	1.7	(0.80)	82							-	10,208	-	-		-	150	1,500	1,500	13.5	46,000	42,708	3,292	70	250	-	1,000	-	15.8	78
1-Sep-80	3	N	3	(184.9)	1.6	5.60	96					400	333	733	11,708	-	-		-	150	1,500	1,500	13.5	46,000	44,208	1,792	70	250	-	1,000	-	13.5	78
1-Oct-80	0	N	0	(184.9)	1.7	(1.00)	117							-	13,208	-	-		-	150	1,500	1,500	13.5	46,000	45,708	292	70	250	-	1,000	-	13.5	85
1-Nov-80	0	N	0	(184.9)	1.7	(1.60)	131							-	14,708	-	-		-	150	500	292	2.6	46,000	46,000	-	70	250	-	1,000	-	13.5	85
1-Dec-80	0	N	0	(184.8)	1.7	2.00	134							-	15,000	-	-		-	150	500	-	-	46,000	46,000	-	70	250	-	1,000	-	2.6	85
1-Jan-81	2	N	2	(184.8)	1.6	8.80	138	94%	0%					-	15,000	-	-		-	150	500	-	-	46,000	46,000	-	70	250	-	1,000	-	-	88
1-Feb-81	10	N	10	(183.4)	1.6	0.40	148							-	15,000	-	-		-	150	500	-	-	46,000	46,000	-	70	250	-	1,000	-	-	97
1-Mar-81	14	N	14	(176.6)	1.5	1.20	150			-	1,000	400	333	1,733	15,000	1,733	1,733		(15.6)	150	500	-	-	47,733	46,000	1,733	70	250	-	1,000	-	-	99
1-Apr-81	5	N	5	(167.3)	1.5	(3.00)	137			-	1,000	400	333	1,733	13,267	1,733	1,733		(15.6)	150	500	-	-	49,467	46,000	3,467	70	250	-	1,000	-	(15.6)	101
1-May-81	5	N	5	(163.6)	1.4	8.20	120			-	1,000	400	333	1,733	11,533	1,733	1,733		(15.6)	150	1,500	-	-	51,200	46,000	5,200	70	250	-	1,000	-	(15.6)	99
1-Jun-81	2	N	2	(160.2)	1.4	4.00	114				1,000	400	333	1,733	9,800	1,733	1,733		(15.6)	150	1,500	520	4.7	52,933	46,520	6,413	70	250	-	1,000	-	(15.6)	108
1-Jul-81	1	N	1	(158.8)	1.4	5.60	108						333	333	8,587	333	333		(3.0)	150	1,500	1,500	13.5	53,267	48,020	5,247	70	250	-	1,000	-	(10.9)	112
1-Aug-81	-	N	-	(158.3)	1.4	(0.80)	126							-	9,753	-	-		-	150	1,500	1,500	13.5	53,267	49,520	3,747	70	250	-	1,000	-	10.5	119
1-Sep-81	0	N	0	(158.3)	1.4	5.60	140					400	333	733	11,253	733	733		(6.6)	150	1,500	1,500	13.5	54,000	51,020	2,980	70	250	-	1,000	-	13.5	119
1-Oct-81	1	N	1	(158.3)	1.4	(1.00)	154							-	12,020	-	-		-	150	1,500	-	-	54,000	51,020	2,980	70	250	-	1,000	-	6.9	125
1-Nov-81	16	N	16	(158.3)	1.3	(1.60)	154							-	12,020	-	-		-	150	500	-	-	54,000	51,020	2,980	70	250	-	1,000	-	-	125
1-Dec-81	25	N	25	(157.9)	1.2	2.00	154							-	12,020	-	-		-	150	500	-	-	54,000	51,020	2,980	70	250	-	1,000	-	-	124

Calculation Detail

	Model based on Historic Recharge □ Groundwater Levels and adding in impact of Imported Water							Imported Water Spreading												Imported Water Recovery				Imported Water Performance			Additional Native Water Extraction						
Date	Historic Spreading of Native Water	Snow pack	Limit recharge based on WSL	1□ of arrived water leaves each month for 24 months	Change in water level during month due to spreading	Change in depth during month due to "normal pumping" (1999-03	WSL on first w/project	Random Number (resets with each calculation)	Availability of Imported Water (use prior column or other method)	Percent chance this amount of water is equaled or exceeded: 90□	80□	60□	40□	Water available this month	Available capacity based on Project Goals (1st of month)	Achieved spreading this month	Spread water affecting water level	Lost water rule (not used at this time)	Change in WSLduring month due to spreading	Imported Water Recovery Trigger	Max possible recovery (af)	Recovery	Change in water level due to imported extraction	From project inception: Stored	From project inception: Recovered	Imported Water in Storage	Native Water Extraction Trigger	Amount to extract if we extract	Native extraction due to high water levels	Cummulative increase in Native Water Extraction	Change in water level due to additional native extraction	Change in water level during prior month due to project	Without project water levels
										-	4,000	6,000	8,000																				
	af		af	af	ft	ft				af	af	af	af		af	af	af	af	ft bgs	ft bgs		af	ft bgs	af	af	af	ft bgs	af	af	af	ft bgs	ft bgs	ft bgs
1-Jan-73	339	N	339	-	(3.0)	8.80	163	72□	0□					-	15,000	-	-			110	500	-	-	-	-	-	70	250	-	-	-		163
1-Jan-82	380	N	380	(157.4)	(2.0)	8.80	157	70□	0□					-	12,020	-	-		-	150	500	-	-	54,000	51,020	2,980	70	250	-	1,000	-	-	127
1-Feb-82	1,931	N	1,931	(149.6)	(16.0)	0.40	164							-	12,020	-	-		-	150	500	-	-	54,000	51,020	2,980	70	250	-	1,000	-	-	133
1-Mar-82	2,657	N	2,657	(109.6)	(22.9)	1.20	149			-	1,000	400	333	1,733	12,020	1,733	1,733		(15.6)	150	500	-	-	55,733	51,020	4,713	70	250	-	1,000	-	-	117
1-Apr-82	1,053	N	1,053	(54.7)	(9.0)	(3.00)	111			-	1,000	400	333	1,733	10,287	1,733	1,733		(15.6)	150	500	-	-	57,467	51,020	6,447	70	250	-	1,000	-	(15.6)	94
1-May-82	965	N	965	(65.2)	(8.1)	8.20	84			-	1,000	400	333	1,733	8,553	-	-		-	150	1,500	-	-	57,467	51,020	6,447	70	250	-	1,000	-	(15.6)	82
1-Jun-82	416	N	416	(74.9)	(3.1)	4.00	84				1,000	400	333	1,733	8,553	-	-		-	150	1,500	645	5.8	57,467	51,665	5,802	70	250	-	1,000	-	-	83
1-Jul-82	135	N	135	(79.0)	(0.5)	5.60	90						333	333	9,198	-	-		-	150	1,500	1,500	13.5	57,467	53,165	4,302	70	250	-	1,000	-	5.8	84
1-Aug-82	-	N	-	(76.2)	0.7	(0.80)	109							-	10,698	-	-		-	150	1,500	1,500	13.5	57,467	54,665	2,802	70	250	-	1,000	-	13.5	89
1-Sep-82	1	N	1	(76.2)	0.7	5.60	122					400	333	733	12,198	733	733		(6.6)	150	1,500	1,500	13.5	58,200	56,165	2,035	70	250	-	1,000	-	13.5	89
1-Oct-82	5	N	5	(76.2)	0.6	(1.00)	136							-	12,965	-	-		-	150	1,500	1,500	13.5	58,200	57,665	535	70	250	-	1,000	-	6.9	95
1-Nov-82	70	N	70	(76.2)	0.1	(1.60)	149							-	14,465	-	-		-	150	500	500	4.5	58,200	58,165	35	70	250	-	1,000	-	13.5	95
1-Dec-82	112	N	112	(76.9)	(0.3)	2.00	152							-	14,965	-	-		-	150	500	-	-	58,200	58,165	35	70	250	-	1,000	-	4.5	93
1-Jan-83	1,681	N	1,681	(78.1)	(14.4)	8.80	153	1□	0□					-	14,965	-	-		-	150	500	-	-	58,200	58,165	35	70	250	-	1,000	-	-	95
1-Feb-83	8,550	N	8,550	(94.9)	(76.1)	0.40	148							-	14,965	-	-		-	150	500	-	-	58,200	58,165	35	70	250	-	1,000	-	-	89
1-Mar-83	11,762	N	-	(180.3)	1.6	1.20	72			-	1,000	400	333	1,733	14,965	-	-		-	150	500	-	-	58,200	58,165	35	70	250	-	1,000	-	-	35
1-Apr-83	4,660	N	-	(180.1)	1.6	(3.00)	75			-	1,000	400	333	1,733	14,965	-	-		-	150	500	-	-	58,200	58,165	35	70	250	-	1,000	-	-	38
1-May-83	4,271	N	-	(180.1)	1.6	8.20	73			-	1,000	400	333	1,733	14,965	-	-		-	150	1,500	-	-	58,200	58,165	35	70	250	-	1,000	-	-	36
1-Jun-83	1,841	N	-	(180.0)	1.6	4.00	83				1,000	400	333	1,733	14,965	-	-		-	150	1,500	4	0.0	58,200	58,168	32	70	250	-	1,000	-	-	46
1-Jul-83	600	N	600	(180.0)	(3.8)	5.60	89						333	333	14,968	-	-		-	150	1,500	11	0.1	58,200	58,179	21	70	250	-	1,000	-	0.0	52
1-Aug-83	-	N	-	(186.0)	1.7	(0.80)	91							-	14,979	-	-		-	150	1,500	11	0.1	58,200	58,189	11	70	250	-	1,000	-	0.1	59
1-Sep-83	4	N	4	(186.0)	1.6	5.60	92					400	333	733	14,989	-	-		-	150	1,500	11	0.1	58,200	58,200	-	70	250	-	1,000	-	0.1	60
1-Oct-83	0	N	0	(186.0)	1.7	(1.00)	99							-	15,000	-	-		-	150	1,500	-	-	58,200	58,200	-	70	250	-	1,000	-	0.1	67
1-Nov-83	5	N	5	(186.0)	1.6	(1.60)	100							-	15,000	-	-		-	150	500	-	-	58,200	58,200	-	70	250	-	1,000	-	-	68
1-Dec-83	8	N	8	(185.9)	1.6	2.00	100							-	15,000	-	-		-	150	500	-	-	58,200	58,200	-	70	250	-	1,000	-	-	68
1-Jan-84	123	N	123	(185.7)	0.6	8.80	103	66□	0□					-	15,000	-	-		-	150	500	-	-	58,200	58,200	-	70	250	-	1,000	-	-	71
1-Feb-84	628	N	628	(183.2)	(4.0)	0.40	113							-	15,000	-	-		-	150	500	-	-	58,200	58,200	-	70	250	-	1,000	-	-	81
1-Mar-84	863	N	863	(170.1)	(6.2)	1.20	109			-	1,000	400	333	1,733	15,000	1,733	1,733		(15.6)	150	500	-	-	59,933	58,200	1,733	70	250	-	1,000	-	-	77
1-Apr-84	342	N	342	(152.2)	(1.7)	(3.00)	89			-	1,000	400	333	1,733	13,267	-	-		-	150	500	-	-	59,933	58,200	1,733	70	250	-	1,000	-	(15.6)	72
1-May-84	314	N	314	(145.1)	(1.5)	8.20	84			-	1,000	400	333	1,733	13,267	-	-		-	150	1,500	-	-	59,933	58,200	1,733	70	250	-	1,000	-	-	67
1-Jun-84	135	N	135	(138.6)	0.0	4.00	91				1,000	400	333	1,733	13,267	-	-		-	150	1,500	173	1.6	59,933	58,373	1,560	70	250	-	1,000	-	-	74
1-Jul-84	44	N	44	(135.8)	0.8	5.60	96						333	333	13,440	-	-		-	150	1,500	520	4.7	59,933	58,893	1,040	70	250	-	1,000	-	1.6	78
1-Aug-84	-	N	-	(134.9)	1.2	(0.80)	107							-	13,960	-	-		-	150	1,500	520	4.7	59,933	59,413	520	70	250	-	1,000	-	4.7	84
1-Sep-84	0	N	0	(134.9)	1.2	5.60	112					400	333	733	14,480	733	733		(6.6)	150	1,500	520	4.7	60,667	59,933	733	70	250	-	1,000	-	4.7	84
1-Oct-84	0	N	0	(134.9)	1.2	(1.00)	117							-	14,267	-	-		-	150	1,500	733	6.6	60,667	60,667	-	70	250	-	1,000	-	(1.9)	91
1-Nov-84	0	N	0	(134.8)	1.2	(1.60)	124							-	15,000	-	-		-	150	500	-	-	60,667	60,667	-	70	250	-	1,000	-	6.6	91
1-Dec-84	1	N	1	(134.1)	1.2	2.00	124							-	15,000	-	-		-	150	500	-	-	60,667	60,667	-	70	250	-	1,000	-	-	91
1-Jan-85	-	N	-	(133.0)	1.2	8.80	127	50□	0□					-	15,000	-	-		-	150	500	-	-	60,667	60,667	-	70	250	-	1,000	-	-	94
1-Feb-85	-	N	-	(116.2)	1.0	0.40	137							-	15,000	-	-		-	150	500	-	-	60,667	60,667	-	70	250	-	1,000	-	-	104
1-Mar-85	44	N	44	(30.7)	(0.1)	1.20	138			-	1,000	400	333	1,733	15,000	1,733	1,733		(15.6)	150	500	-	-	62,400	60,667	1,733	70	250	-	1,000	-	-	105
1-Apr-85	-	N	-	(31.1)	0.3	(3.00)	124			-	1,000	400	333	1,733	13,267	1,733	1,733		(15.6)	150	500	-	-	64,133	60,667	3,467	70	250	-	1,000	-	(15.6)	106
1-May-85	-	N	-	(31.1)	0.3	8.20	105			-	1,000	400	333	1,733	11,533	1,733	1,733		(15.6)	150	1,500	-	-	65,867	60,667	5,200	70	250	-	1,000	-	(15.6)	104
1-Jun-85	-	N	-	(31.1)	0.3	4.00	98				1,000	400	333	1,733	9,800	-	-		-	150	1,500	520	4.7	65,867	61,187	4,680	70	250	-	1,000	-	(15.6)	112
1-Jul-85	-	N	-	(31.1)	0.3	5.60	107						333	333	10,320	333	333		(3.0)	150	1,500	1,500	13.5	66,200	62,687	3,513	70	250	-	1,000	-	4.7	116
1-Aug-85	-	N	-	(25.1)	0.2	(0.80)	124							-	11,487	-	-		-	150	1,500	1,500	13.5	66,200	64,187	2,013	70	250	-	1,000	-	10.5	122
1-Sep-85	-	N	-	(25.1)	0.2	5.60	137					400	333	733	12,987	733	733		(6.6)	150	1,500	1,500	13.5	66,933	65,687	1,247	70	250	-	1,000	-	13.5	121
1-Oct-85	-	N	-	(25.1)	0.2	(1.00)	149							-	13,753	-	-		-	150	1,500	1,247	11.2	66,933	66,933	-	70	250	-	1,000	-	6.9	127
1-Nov-85	-	N	-	(25.1)	0.2	(1.60)	160							-	15,000	-	-		-	150	500	-	-	66,933	66,933	-	70	250	-	1,000	-	11.2	127
1-Dec-85	0	N	0	(25.0)	0.2	2.00	158							-	15,000	-	-		-	150	500	-	-	66,933	66,933	-	70	250	-	1,000	-	-	125
1-Jan-86	66	N	66	(25.0)	(0.4)	8.80	161	35□	0□					-	15,000	-	-		-	150	500	-	-	66,933	66,933	-	70	250	-	1,000	-	-	127
1-Feb-86	1,940	N	1,940	(24.4)	(17.2)	0.40	169							-	15,000	-	-		-	150	500	-	-	66,933	66,933	-	70	250	-	1,000	-	-	136
1-Mar-86	2,450	Y	2,450	(37.5)	(21.7)	1.20	152			-	1,000	400	333	1,733	15,000	-	-		-	150	500	-	-	66,933	66,933	-	70	250	-	1,000	-	-	119
1-Apr-86	1,700	Y	1,700	(53.4)	(14.8)	(3.00)	132			-	1,000	400	333	1,733	15,000	-	-		-	150	500	-	-	66,933	66,933	-	70	250	-	1,000	-	-	98
1-May-86	331	N	331	(66.9)	(2.4)	8.20	114			-	1,000	400	333	1,733	15,000	1,733	1,733		(15.6)	150	1,500	-	-	68,667	66,933	1,733	70	250	-	1,000	-	-	81
1-Jun-86	6	N	6	(67.1)	0.5	4.00	104				1,000	400	333	1,733	13,267	1,733	1,733		(15.6)	150	1,500	173	1.6	70,400	67,107	3,293	70	250	-	1,000	-	(15.6)	86
1-Jul-86	-	N	-	(65.8)	0.6	5.60	95						333	333	11,707	-	-		-	150	1,500	1,098	9.9	70,400	68,204	2,196	70	250	-	1,000	-	(14.0)	91
1-Aug-86	-	N	-	(65.4)	0.6	(0.80)	111							-	12,804	-	-		-	150	1,500	1,098	9.9	70,400	69,302	1,098	70	250	-	1,000	-	9.9	97
1-Sep-86	6	N	6	(65.4)	0.5	5.60	120					400	333	733	13,902	733	733		(6.6)	150	1,500	1,098	9.9	71,133	70,400	733	70	250	-	1,000	-	9.9	97
1-Oct-86	-	N	-	(65.4)	0.6	(1.00)	130							-	14,267	-	-		-	150	1,500	733	6.6	71,133	71,133	-	70	250	-	1,000	-	3.3	103
1-Nov-86	-	N	-	(65.4)	0.6	(1.60)	136							-	15,000	-	-		-	150	500	-	-	71,133	71,133	-	70	250	-	1,000	-	6.6	103
1-Dec-86	1	N	1	(65.4)	0.6	2.00	135							-	15,000	-	-		-	150	500	-	-	71,133	71,133	-	70	250	-	1,000	-	-	102
1-Jan-87	8	N	8	(65.4)	0.5	8.80	138	4□	0□					-	15,000	-	-		-	150	500	-	-	71,133	71,133	-	70	250	-	1,000	-	-	104
1-Feb-87	0	N	0	(65.5)	0.6	0.40	147							-	15,000	-	-		-	150	500	-	-	71,133	71,133	-	70	250	-	1,000	-	-	114
1-Mar-87	-	N	-	(65.5)	0.6	1.20	148			-	1,000	400	333	1,733	15,000	1,733	1,733		(15.6)	150	500	-	-	72,867	71,133	1,733	70	250	-	1,000	-	-	115
1-Apr-87	-	N	-	(65.1)	0.6	(3.00)	134			-	1,000	400	333	1,733	13,267	1,733	1,733		(15.6)	150	500	-	-	74,600	71,133	3,467	70	250	-	1,000	-	(15.6)	116
1-May-87	-	N	-	(65.1)	0.6	8.20	116			-	1,000	400	333	1,733	11,533	1,733	1,733		(15.6)	150	1,500	-	-	76,333	71,133	5,200	70	250	-	1,000	-	(15.6)	114
1-Jun-87	-	N	-	(65.1)	0.6	4.00	109				1,000	400	333	1,733	9,800	1,733	1,733		(15.6)	150	1,500	520	4.7	78,067	71,653	6,413	70	250	-	1,000	-	(15.6)	123
1-Jul-87	-	N	-	(65.1)	0.6	5.60	103						333	333	8,587	333	333		(3.0)	150	1,500	1,500	13.5	78,400	73,153	5,247	70	250	-	1,000	-	(10.9)	127
1-Aug-87	-	N	-	(65.1)	0.6	(0.80)	120							-	9,753	-	-		-	150	1,500	1,500	13.5	78,400	74,653	3,747	70	250	-	1,000	-	10.5	134
1-Sep-87	3	N	3	(65.1)	0.6	5.60	133					400	333	733	11,253	733	733		(6.6)	150	1,500	1,500	13.5	79,133	76,153	2,980	70	250	-	1,000	-	13.5	133
1-Oct-87	12	N	12	(65.1)	0.5	(1.00)	146							-	12,020	-	-		-	150	1,500	1,500	13.5	79,133	77,653	1,480	70	250	-	1,000	-	6.9	139
1-Nov-87	164	N	164	(65.2)	(0.9)	(1.60)	159							-	13,520	-	-		-	150	500	-	-	79,133	77,653	1,480	70	250	-	1,000	-	13.5	139
1-Dec-87	46	N	46	(66.9)	0.2	2.00	156							-	13,520	-	-		-	150	500	-	-	79,133	77,653	1,480	70	250	-	1,000	-	-	136
1-Jan-88	31	N	31	(67.3)	0.3	8.80	159	40□	0□					-	13,520	-	-		-	150	500	-	-	79,133	77,653	1,480	70	250	-	1,000	-	-	139
1-Feb-88	4	N	4	(67.0)	0.6	0.40	168							-	13,520	-	-		-	150	500	-	-	79,133	77,653	1,480	70	250	-	1,000	-	-	148
1-Mar-88	21	N	21	(47.6)	0.2	1.20	169			-	1,000	400	333	1,733	13,520	1,733	1,733		(15.6)	150	500	-	-	80,867	77,653	3,213	70	250	-	1,000	-	-	149
1-Apr-88	364	N	364	(23.3)	(3.1)	(3.00)	155			-	1,000	400	333	1,733	11,787	1,733	1,733		(15.6)	150	500	-	-	82,600	77,653	4,947	70	250	-	1,000	-	(15.6)	150
1-May-88	695	N	695	(10.0)	(6.2)	8.20	133			-	1,000	400	333	1,733	10,053	1,733	1,733		(15.6)	150	1,500	-	-	84,333	77,653	6,680	70	250	-	1,000	-	(15.6)	144
1-Jun-88	63	N	63	(13.6)	(0.4)	4.00	119				1,000	400	333	1,733	8,320	1,733	1,733		(15.6)	150	1,500	668	6.0	86,067	78,321	7,745	70	250	-	1,000	-	(15.6)	146
1-Jul-88	-	N	-	(14.2)	0.1	5.60	113						333	333	7,255	333	333		(3.0)	150	1,500	1,500	13.5	86,400	79,821	6,579	70	250	-	1,000	-	(9.6)	150
1-Aug-88	-	N	-	(14.2)	0.1	(0.80)	129							-	8,421	-	-		-	150	1,500	1,500	13.5	86,400	81,321	5,079	70	250	-	1,000	-	10.5	155
1-Sep-88	-	N	-	(14.2)	0.1	5.60	142					400	333	733	9,921	733	733		(6.6)	150	1,500	1,500	13.5	87,133	82,821	4,312	70	250	-	1,000	-	13.5	155
1-Oct-88	-	N	-	(14.1)	0.1	(1.00)	155							-	10,688	-	-		-	150	1,500	-	-	87,133	82,821	4,312	70	250	-	1,000	-	6.9	161
1-Nov-88	-	N	-	(14.1)	0.1	(1.60)	154							-	10,688	-	-		-	150	500	-	-	87,133	82,821	4,312	70	250	-	1,000	-	-	160
1-Dec-88	142	N	142	(14.1)	(1.2)	2.00	153							-	10,688	-	-		-	150	500	-	-	87,133	82,821	4,312	70	250	-	1,000	-	-	158
1-Jan-89	22	N	22	(15.5)	(0.1)	8.80	153	7□	0□					-	10,688	-	-		-	150	500	-	-	87,133	82,821	4,312	70	250	-	1,000	-	-	159
1-Feb-89	33	N	33	(15.7)	(0.2)	0.40	162							-	10,688	-	-		-	150	500	-	-	87,133	82,821	4,312	70	250	-	1,000	-	-	168
1-Mar-89	45	N	45	(16.0)	(0.3)	1.20	162			-	1,000	400	333	1,733	10,688	1,733	1,733		(15.6)	150	500	-	-	88,867	82,821	6,045	70	250	-	1,000	-	-	168
1-Apr-89	1	N	1	(16.5)	0.1	(3.00)	148			-	1,000	400	333	1,733	8,955	1,733	1,733		(15.6)	150	500	-	-	90,600	82,821	7,779	70	250	-	1,000	-	(15.6)	169
1-May-89	-	N	-	(16.5)	0.1	8.20	129			-	1,000	400	333	1,733	7,221	1,733	1,733		(15.6)	150	1,500	-	-	92,333	82,821	9,512	70	250	-	1,000	-	(15.6)	166
1-Jun-89	-	N	-	(16.5)	0.1	4.00	122				1,000	400	333	1,733	5,488	1,733	1,733		(15.6)	150	1,500	951	8.6	94,067	83,773	10,294	70	250	-	1,000	-	(15.6)	174
1-Jul-89	-	N	-	(16.5)	0.1	5.60	119						333	333	4,706	333	333		(3.0)	150	1,500	1,500	13.5	94,400	85,273	9,127	70	250	-	1,000	-	(7.0)	179
1-Aug-89	-	N	-	(16.5)	0.1	(0.80)	135							-	5,873	-	-		-	150	1,500	1,500	13.5	94,400	86,773	7,627	70	250	-	1,000	-	10.5	184
1-Sep-89	-	N	-	(16.5)	0.1	5.60	148					400	333	733	7,373	733	733		(6.6)	150	1,500	1,500	13.5	95,133	88,273	6,861	70	250	-	1,000	-	13.5	184
1-Oct-89	-	N	-	(16.4)	0.1	(1.00)	161							-	8,139	-	-		-	150	1,500	-	-	95,133	88,273	6,861	70	250	-	1,000	-	6.9	189
1-Nov-89	-	N	-	(16.3)	0.1	(1.60)	160							-	8,139	-	-		-	150	500	-	-	95,133	88,273	6,861	70	250	-	1,000	-	-	189
1-Dec-89	-	N	-	(14.7)	0.1	2.00	159							-	8,139	-	-		-	150	500	-	-	95,133	88,273	6,861	70	250	-	1,000	-	-	187
1-Jan-90	-	N	-	(14.2)	0.1	8.80	161	26□	0□					-	8,139	-	-		-	150	500	-	-	95,133	88,273	6,861	70	250	-	1,000	-	-	189
1-Feb-90	2	N	2	(13.9)	0.1	0.40	170							-	8,139	-	-		-	150	500	-	-	95,133	88,273	6,861	70	250	-	1,000	-	-	198
1-Mar-90	-	N	-	(13.9)	0.1	1.20	170			-	1,000	400	333	1,733	8,139	1,733	1,733		(15.6)	150	500	-	-	96,867	88,273	8,594	70	250	-	1,000	-	-	199
1-Apr-90	-	N	-	(13.7)	0.1	(3.00)	156			-	1,000	400	333	1,733	6,406	1,733	1,733		(15.6)	150	500	-	-	98,600	88,273	10,327	70	250	-	1,000	-	(15.6)	200
1-May-90	-	N	-	(10.0)	0.1	8.20	137			-	1,000	400	333	1,733	4,673	1,733	1,733		(15.6)	150	1,500	-	-	100,333	88,273	12,061	70	250	-	1,000	-	(15.6)	197
1-Jun-90	-	N	-	(3.1)	0.0	4.00	130				1,000	400	333	1,733	2,939	1,733	1,733		(15.6)	150	1,500	1,206	10.9	102,067	89,479	12,588	70	250	-	1,000	-	(15.6)	205
1-Jul-90	-	N	-	(2.5)	0.0	5.60	129						333	333	2,412	333	333		(3.0)	150	1,500	1,500	13.5	102,400	90,979	11,421	70	250	-	1,000	-	(4.7)	209
1-Aug-90	-	N	-	(2.5)	0.0	(0.80)	146							-	3,579	-	-		-	150	1,500	1,500	13.5	102,400	92,479	9,921	70	250	-	1,000	-	10.5	215
1-Sep-90	-	N	-	(2.5)	0.0	5.60	158					400	333	733	5,079	733	733		(6.6)	150	1,500	-	-	103,133	92,479	10,655	70	250	-	1,000	-	13.5	214
1-Oct-90	-	N	-	(2.5)	0.0	(1.00)	157							-	4,345	-	-		-	150	1,500	-	-	103,133	92,479	10,655	70	250	-	1,000	-	(6.6)	220
1-Nov-90	-	N	-	(2.5)	0.0	(1.60)	156							-	4,345	-	-		-	150	500	-	-	103,133	92,479	10,655	70	250	-	1,000	-	-	219
1-Dec-90	9	N	9	(2.5)	(0.1)	2.00	155							-	4,345	-	-		-	150	500	-	-	103,133	92,479	10,655	70	250	-	1,000	-	-	217

Calculation Detail

Columns: Model based on Historic Recharge □ Groundwater Levels and adding in impact of Imported Water (Historic Spreading through WSL on first w/project); Imported Water Spreading (Random Number through Change in WSL during month due to spreading); "Percent chance this amount of water is equaled or exceeded" covers the 90%, 80%, 60% and 40% columns.

Date	Historic Spreading of Native Water (af)	Snow pack	Limit recharge based on WSL (af)	1□ of arrived water leaves each month for 24 months (af)	Change in water level during month due to spreading (ft)	Change in depth during month due to "normal pumping" (1999-03 (ft)	WSL on first w/project	Random Number (resets with each calculation)	Availability of Imported Water (use prior column or other method)	90% - (af)	80% 4,000 (af)	60% 6,000 (af)	40% 8,000 (af)	Water available this month	Available capacity based on Project Goals (1st of month) (af)	Achieved spreading this month (af)	Spread water affecting water level (af)	Lost water rule (not used at this time) (af)	Change in WSLduring month due to spreading (ft bgs)
1-Jan-73	339	N	339	-	(3.0)	8.80	163	72%	0%					-	15,000	-	-		
1-Jan-91	-	N	-	(1.1)	0.0	8.80	157	15%	0%					-	4,345	-	-		-
1-Feb-91	19	N	19	(0.9)	(0.2)	0.40	165							-	4,345	-	-		-
1-Mar-91	426	N	426	(0.8)	(3.8)	1.20	166			-	1,000	400	333	1,733	4,345	1,733	1,733		(15.6)
1-Apr-91	495	N	495	(4.6)	(4.4)	(3.00)	147			-	1,000	400	333	1,733	2,612	1,733	1,733		(15.6)
1-May-91	344	N	344	(9.5)	(3.0)	8.20	124			-	1,000	400	333	1,733	879	879	879		(7.9)
1-Jun-91	194	N	194	(13.0)	(1.6)	4.00	122				1,000	400	333	1,733	-	-	-		-
1-Jul-91	-	N	-	(14.9)	0.1	5.60	138						333	333	1,500	333	333		(3.0)
1-Aug-91	-	N	-	(14.9)	0.1	(0.80)	154							-	2,667	-	-		-
1-Sep-91	-	N	-	(14.9)	0.1	5.60	153					400	333	733	2,667	733	733		(6.6)
1-Oct-91	-	N	-	(14.9)	0.1	(1.00)	152							-	1,933	-	-		-
1-Nov-91	-	N	-	(14.9)	0.1	(1.60)	151							-	1,933	-	-		-
1-Dec-91	-	N	-	(14.9)	0.1	2.00	150							-	1,933	-	-		-
1-Jan-92	72	N	72	(14.9)	(0.5)	8.80	157	39%	0%					-	2,433	-	-		-
1-Feb-92	1,753	N	1,753	(15.6)	(15.6)	0.40	165							-	2,433	-	-		-
1-Mar-92	2,857	Y	2,857	(33.1)	(25.4)	1.20	150			-	1,000	400	333	1,733	2,433	-	-		-
1-Apr-92	5,491	Y	5,491	(61.7)	(48.9)	(3.00)	125			-	1,000	400	333	1,733	2,433	-	-		-
1-May-92	3,152	Y	-	(116.6)	1.0	8.20	74			-	1,000	400	333	1,733	2,433	-	-		-
1-Jun-92	1,007	Y	1,007	(116.6)	(8.0)	4.00	83				1,000	400	333	1,733	2,433	-	-		-
1-Jul-92	84	N	84	(126.7)	0.4	5.60	90						333	333	3,690	-	-		-
1-Aug-92	-	N	-	(127.5)	1.1	(0.80)	110							-	5,190	-	-		-
1-Sep-92	-	N	-	(127.5)	1.1	5.60	123					400	333	733	6,690	733	733		(6.6)
1-Oct-92	-	N	-	(127.5)	1.1	(1.00)	137							-	7,457	-	-		-
1-Nov-92	-	N	-	(127.5)	1.1	(1.60)	151							-	8,957	-	-		-
1-Dec-92	64	N	64	(127.5)	0.6	2.00	150							-	8,957	-	-		-
1-Jan-93	1,881	N	1,881	(128.1)	(15.8)	8.80	153	87%	0%					-	8,957	-	-		-
1-Feb-93	11,505	N	11,505	(146.9)	(102.2)	0.40	146							-	8,957	-	-		-
1-Mar-93	8,683	Y	-	(261.7)	2.4	1.20	44			-	1,000	400	333	1,733	8,957	-	-		-
1-Apr-93	2,044	Y	-	(257.5)	2.3	(3.00)	50			-	1,000	400	333	1,733	8,957	-	-		-
1-May-93	902	Y	-	(252.5)	2.3	8.20	51			-	1,000	400	333	1,733	8,957	-	-		-
1-Jun-93	1,371	Y	1,371	(249.1)	(10.1)	4.00	64				1,000	400	333	1,733	8,957	-	-		-
1-Jul-93	928	Y	928	(260.9)	(6.0)	5.60	66						333	333	9,561	-	-		-
1-Aug-93	-	N	-	(270.1)	2.4	(0.80)	81							-	11,061	-	-		-
1-Sep-93	-	N	-	(270.1)	2.4	5.60	96					400	333	733	12,561	-	-		-
1-Oct-93	-	N	-	(270.1)	2.4	(1.00)	118							-	14,061	-	-		-
1-Nov-93	-	N	-	(270.1)	2.4	(1.60)	128							-	15,000	-	-		-
1-Dec-93	-	N	-	(270.1)	2.4	2.00	128							-	15,000	-	-		-
1-Jan-94	-	N	-	(270.1)	2.4	8.80	133	48%	0%					-	15,000	-	-		-
1-Feb-94	-	N	-	(269.4)	2.4	0.40	144							-	15,000	-	-		-
1-Mar-94	-	N	-	(251.9)	2.3	1.20	147			-	1,000	400	333	1,733	15,000	1,733	1,733		(15.6)
1-Apr-94	11	N	11	(223.3)	1.9	(3.00)	135			-	1,000	400	333	1,733	13,267	1,733	1,733		(15.6)
1-May-94	-	N	-	(168.5)	1.5	8.20	118			-	1,000	400	333	1,733	11,533	1,733	1,733		(15.6)
1-Jun-94	-	N	-	(168.5)	1.5	4.00	112				1,000	400	333	1,733	9,800	1,733	1,733		(15.6)
1-Jul-94	-	N	-	(158.4)	1.4	5.60	107						333	333	8,587	333	333		(3.0)
1-Aug-94	-	N	-	(157.6)	1.4	(0.80)	124							-	9,753	-	-		-
1-Sep-94	-	N	-	(157.6)	1.4	5.60	138					400	333	733	11,253	733	733		(6.6)
1-Oct-94	-	N	-	(157.6)	1.4	(1.00)	152							-	12,020	-	-		-
1-Nov-94	-	N	-	(157.6)	1.4	(1.60)	153							-	12,020	-	-		-
1-Dec-94	-	N	-	(157.6)	1.4	2.00	153							-	12,020	-	-		-
1-Jan-95	1,708	N	1,708	(157.0)	(14.0)	8.80	156	7%	0%					-	12,020	-	-		-
1-Feb-95	4,681	N	4,681	(155.2)	(40.7)	0.40	151							-	12,020	-	-		-
1-Mar-95	12,791	N	12,791	(87.0)	(114.3)	1.20	111			-	1,000	400	333	1,733	12,020	1,733	1,733		(15.6)
1-Apr-95	564	Y	-	(214.9)	1.9	(3.00)	35			-	1,000	400	333	1,733	10,287	-	-		-
1-May-95	4,412	Y	-	(214.9)	1.9	8.20	36			-	1,000	400	333	1,733	10,287	-	-		-
1-Jun-95	1,507	Y	-	(214.9)	1.9	4.00	49				1,000	400	333	1,733	10,287	-	-		-
1-Jul-95	389	N	-	(201.2)	1.8	5.60	61						333	333	10,758	-	-		-
1-Aug-95	-	N	-	(191.9)	1.7	(0.80)	83							-	12,172	-	-		-
1-Sep-95	-	N	-	(191.9)	1.7	5.60	97					400	333	733	13,586	-	-		-
1-Oct-95	-	N	-	(191.9)	1.7	(1.00)	117							-	15,000	-	-		-
1-Nov-95	-	N	-	(191.9)	1.7	(1.60)	118							-	15,000	-	-		-
1-Dec-95	-	N	-	(191.9)	1.7	2.00	118							-	15,000	-	-		-
1-Jan-96	214	N	214	(191.9)	(0.2)	8.80	122	8%	0%					-	15,000	-	-		-
1-Feb-96	1,087	N	1,087	(194.0)	(8.0)	0.40	130							-	15,000	-	-		-
1-Mar-96	1,495	N	1,495	(204.9)	(11.6)	1.20	123			-	1,000	400	333	1,733	15,000	1,733	1,733		(15.6)
1-Apr-96	592	N	592	(219.9)	(3.4)	(3.00)	97			-	1,000	400	333	1,733	13,267	-	-		-
1-May-96	543	N	543	(225.7)	(2.9)	8.20	90			-	1,000	400	333	1,733	13,267	-	-		-
1-Jun-96	234	N	234	(231.1)	(0.0)	4.00	96				1,000	400	333	1,733	13,267	-	-		-
1-Jul-96	76	N	76	(233.4)	1.4	5.60	101						333	333	13,440	333	333		(3.0)
1-Aug-96	-	N	-	(234.2)	2.1	(0.80)	110							-	13,627	-	-		-
1-Sep-96	0	N	0	(234.2)	2.1	5.60	117					400	333	733	14,313	733	733		(6.6)
1-Oct-96	0	N	0	(234.2)	2.1	(1.00)	125							-	14,267	-	-		-
1-Nov-96	2	N	2	(234.2)	2.1	(1.60)	132							-	15,000	-	-		-
1-Dec-96	4	N	4	(234.2)	2.1	2.00	133							-	15,000	-	-		-
1-Jan-97	60	N	60	(234.3)	1.6	8.80	137	70%	0%					-	15,000	-	-		-
1-Feb-97	304	N	304	(217.8)	(0.8)	0.40	147							-	15,000	-	-		-
1-Mar-97	418	N	418	(174.0)	(2.2)	1.20	147			-	1,000	400	333	1,733	15,000	1,733	1,733		(15.6)
1-Apr-97	166	N	166	(50.3)	(1.0)	(3.00)	130			-	1,000	400	333	1,733	13,267	1,733	1,733		(15.6)
1-May-97	152	N	152	(52.0)	(0.9)	8.20	111			-	1,000	400	333	1,733	11,533	1,733	1,733		(15.6)
1-Jun-97	65	N	65	(53.5)	(0.1)	4.00	102				1,000	400	333	1,733	9,800	1,733	1,733		(15.6)
1-Jul-97	21	N	21	(54.1)	0.3	5.60	95						333	333	8,587	-	-		-
1-Aug-97	-	N	-	(54.3)	0.5	(0.80)	115							-	10,087	-	-		-
1-Sep-97	0	N	0	(54.3)	0.5	5.60	128					400	333	733	11,587	733	733		(6.6)
1-Oct-97	4	N	4	(54.3)	0.5	(1.00)	141							-	12,353	-	-		-
1-Nov-97	51	N	51	(54.4)	0.0	(1.60)	154							-	13,853	-	-		-
1-Dec-97	82	N	82	(54.9)	(0.2)	2.00	152							-	13,853	-	-		-
1-Jan-98	1,221	N	1,221	(55.7)	(10.5)	8.80	154	61%	0%					-	13,853	-	-		-
1-Feb-98	6,208	N	6,208	(65.8)	(55.3)	0.40	152							-	13,853	-	-		-
1-Mar-98	8,540	N	-	(117.0)	1.1	1.20	97			-	1,000	400	333	1,733	13,853	-	-		-
1-Apr-98	3,383	Y	-	(102.0)	0.9	(3.00)	100			-	1,000	400	333	1,733	13,853	-	-		-
1-May-98	3,101	Y	3,101	(96.1)	(27.0)	8.20	98			-	1,000	400	333	1,733	13,853	-	-		-
1-Jun-98	1,337	Y	1,337	(121.7)	(10.9)	4.00	79				1,000	400	333	1,733	13,853	-	-		-
1-Jul-98	435	N	435	(132.7)	(2.7)	5.60	73						333	333	13,968	-	-		-
1-Aug-98	-	N	-	(136.3)	1.2	(0.80)	79							-	14,312	-	-		-
1-Sep-98	3	N	3	(136.3)	1.2	5.60	82					400	333	733	14,656	-	-		-
1-Oct-98	0	N	0	(136.3)	1.2	(1.00)	92							-	15,000	-	-		-
1-Nov-98	0	N	0	(136.3)	1.2	(1.60)	93							-	15,000	-	-		-
1-Dec-98	0	N	0	(136.3)	1.2	2.00	92							-	15,000	-	-		-
1-Jan-99	2	N	2	(136.3)	1.2	8.80	95	63%	0%					-	15,000	-	-		-
1-Feb-99	10	N	10	(135.7)	1.1	0.40	105							-	15,000	-	-		-
1-Mar-99	14	N	14	(132.8)	1.1	1.20	107			-	1,000	400	333	1,733	15,000	1,733	1,733		(15.6)
1-Apr-99	6	N	6	(128.7)	1.1	(3.00)	94			-	1,000	400	333	1,733	13,267	-	-		-
1-May-99	5	N	5	(127.1)	1.1	8.20	92			-	1,000	400	333	1,733	13,267	-	-		-
1-Jun-99	2	N	2	(125.6)	1.1	4.00	101				1,000	400	333	1,733	13,267	1,733	1,733		(15.6)
1-Jul-99	1	N	1	(125.0)	1.1	5.60	92						333	333	11,707	-	-		-
1-Aug-99	-	N	-	(124.8)	1.1	(0.80)	109							-	12,804	-	-		-
1-Sep-99	0	N	0	(124.8)	1.1	5.60	119					400	333	733	13,902	733	733		(6.6)
1-Oct-99	0	N	0	(124.8)	1.1	(1.00)	129							-	14,267	-	-		-
1-Nov-99	0	N	0	(124.8)	1.1	(1.60)	136							-	15,000	-	-		-
1-Dec-99	0	N	0	(124.3)	1.1	2.00	135							-	15,000	-	-		-

Columns: Imported Water Recovery (Imported Water Recovery Trigger through Recovery); Imported Water Performance (Stored through Imported Water in Storage), with "From project inception" covering Stored and Recovered; Additional Native Water Extraction (Native Water Extraction Trigger through Change in water level due to additional native extraction).

Date	Imported Water Recovery Trigger (ft bgs)	Max possible recovery (af)	Recovery (af)	Change in water level due to imported extraction (ft bgs)	Stored (af)	Recovered (af)	Imported Water in Storage (af)	Native Water Extraction Trigger (ft bgs)	Amount to extract if we extract (af)	Native extraction due to high water levels (af)	Cummulative increase in Native Water Extraction (af)	Change in water level due to additional native extraction (ft bgs)	Change in water level during prior month due to project (ft bgs)	Without project water levels (ft bgs)
1-Jan-73	110	500	-	-	-	-	-	70	250	-	-	-		163
1-Jan-91	150	500	-	-	103,133	92,479	10,655	70	250	-	1,000	-	-	219
1-Feb-91	150	500	-	-	103,133	92,479	10,655	70	250	-	1,000	-	-	228
1-Mar-91	150	500	-	-	104,867	92,479	12,388	70	250	-	1,000	-	-	228
1-Apr-91	150	500	-	-	106,600	92,479	14,121	70	250	-	1,000	-	(15.6)	226
1-May-91	150	1,500	-	-	107,479	92,479	15,000	70	250	-	1,000	-	(15.6)	218
1-Jun-91	150	1,500	1,500	13.5	107,479	93,979	13,500	70	250	-	1,000	-	(7.9)	223
1-Jul-91	150	1,500	1,500	13.5	107,812	95,479	12,333	70	250	-	1,000	-	13.5	226
1-Aug-91	150	1,500	-	-	107,812	95,479	12,333	70	250	-	1,000	-	10.5	232
1-Sep-91	150	1,500	-	-	108,545	95,479	13,067	70	250	-	1,000	-	-	231
1-Oct-91	150	1,500	-	-	108,545	95,479	13,067	70	250	-	1,000	-	(6.6)	237
1-Nov-91	150	500	-	-	108,545	95,479	13,067	70	250	-	1,000	-	-	236
1-Dec-91	150	500	500	4.5	108,545	95,979	12,567	70	250	-	1,000	-	-	234
1-Jan-92	150	500	-	-	108,545	95,979	12,567	70	250	-	1,000	-	4.5	236
1-Feb-92	150	500	-	-	108,545	95,979	12,567	70	250	-	1,000	-	-	245
1-Mar-92	150	500	-	-	108,545	95,979	12,567	70	250	-	1,000	-	-	229
1-Apr-92	150	500	-	-	108,545	95,979	12,567	70	250	-	1,000	-	-	205
1-May-92	150	1,500	-	-	108,545	95,979	12,567	70	250	-	1,000	-	-	153
1-Jun-92	150	1,500	1,257	11.3	108,545	97,235	11,310	70	250	-	1,000	-	-	134
1-Jul-92	150	1,500	1,500	13.5	108,545	98,735	9,810	70	250	-	1,000	-	11.3	131
1-Aug-92	150	1,500	1,500	13.5	108,545	100,235	8,310	70	250	-	1,000	-	13.5	137
1-Sep-92	150	1,500	1,500	13.5	109,279	101,735	7,543	70	250	-	1,000	-	13.5	137
1-Oct-92	150	1,500	1,500	13.5	109,279	103,235	6,043	70	250	-	1,000	-	6.9	144
1-Nov-92	150	500	-	-	109,279	103,235	6,043	70	250	-	1,000	-	13.5	145
1-Dec-92	150	500	-	-	109,279	103,235	6,043	70	250	-	1,000	-	-	145
1-Jan-93	150	500	-	-	109,279	103,235	6,043	70	250	-	1,000	-	-	148
1-Feb-93	150	500	-	-	109,279	103,235	6,043	70	250	-	1,000	-	-	141
1-Mar-93	150	500	-	-	109,279	103,235	6,043	70	250	250	1,250	2	-	39
1-Apr-93	150	500	-	-	109,279	103,235	6,043	70	250	250	1,500	2	2.3	43
1-May-93	150	1,500	-	-	109,279	103,235	6,043	70	250	250	1,750	2	2.3	43
1-Jun-93	150	1,500	604	5.4	109,279	103,840	5,439	70	250	250	2,000	2	2.3	54
1-Jul-93	150	1,500	1,500	13.5	109,279	105,340	3,939	70	250	250	2,250	2	7.7	60
1-Aug-93	150	1,500	1,500	13.5	109,279	106,840	2,439	70	250	-	2,250	-	15.8	68
1-Sep-93	150	1,500	1,500	13.5	109,279	108,340	939	70	250	-	2,250	-	13.5	70
1-Oct-93	150	1,500	939	8.5	109,279	109,279	-	70	250	-	2,250	-	13.5	78
1-Nov-93	150	500	-	-	109,279	109,279	-	70	250	-	2,250	-	8.5	80
1-Dec-93	150	500	-	-	109,279	109,279	-	70	250	-	2,250	-	-	80
1-Jan-94	150	500	-	-	109,279	109,279	-	70	250	-	2,250	-	-	85
1-Feb-94	150	500	-	-	109,279	109,279	-	70	250	-	2,250	-	-	96
1-Mar-94	150	500	-	-	111,012	109,279	1,733	70	250	-	2,250	-	-	99
1-Apr-94	150	500	-	-	112,745	109,279	3,467	70	250	-	2,250	-	(15.6)	103
1-May-94	150	1,500	-	-	114,479	109,279	5,200	70	250	-	2,250	-	(15.6)	102
1-Jun-94	150	1,500	520	4.7	116,212	109,799	6,413	70	250	-	2,250	-	(15.6)	111
1-Jul-94	150	1,500	1,500	13.5	116,545	111,299	5,247	70	250	-	2,250	-	(10.9)	117
1-Aug-94	150	1,500	1,500	13.5	116,545	112,799	3,747	70	250	-	2,250	-	10.5	124
1-Sep-94	150	1,500	1,500	13.5	117,279	114,299	2,980	70	250	-	2,250	-	13.5	124
1-Oct-94	150	1,500	-	-	117,279	114,299	2,980	70	250	-	2,250	-	6.9	131
1-Nov-94	150	500	-	-	117,279	114,299	2,980	70	250	-	2,250	-	-	131
1-Dec-94	150	500	-	-	117,279	114,299	2,980	70	250	-	2,250	-	-	131
1-Jan-95	150	500	-	-	117,279	114,299	2,980	70	250	-	2,250	-	-	134
1-Feb-95	150	500	-	-	117,279	114,299	2,980	70	250	-	2,250	-	-	129
1-Mar-95	150	500	-	-	119,012	114,299	4,713	70	250	-	2,250	-	-	88
1-Apr-95	150	500	-	-	119,012	114,299	4,713	70	250	250	2,500	2	(15.6)	90
1-May-95	150	1,500	-	-	119,012	114,299	4,713	70	250	250	2,750	2	2.3	87
1-Jun-95	150	1,500	471	4.2	119,012	114,770	4,242	70	250	250	3,000	2	2.3	56
1-Jul-95	150	1,500	1,414	12.7	119,012	116,184	2,828	70	250	250	3,250	2	6.5	61
1-Aug-95	150	1,500	1,414	12.7	119,012	117,598	1,414	70	250	-	3,250	-	15.0	68
1-Sep-95	150	1,500	1,414	12.7	119,012	119,012	-	70	250	-	3,250	-	12.7	68
1-Oct-95	150	1,500	-	-	119,012	119,012	-	70	250	-	3,250	-	12.7	75
1-Nov-95	150	500	-	-	119,012	119,012	-	70	250	-	3,250	-	-	75
1-Dec-95	150	500	-	-	119,012	119,012	-	70	250	-	3,250	-	-	74
1-Jan-96	150	500	-	-	119,012	119,012	-	70	250	-	3,250	-	-	77
1-Feb-96	150	500	-	-	119,012	119,012	-	70	250	-	3,250	-	-	85
1-Mar-96	150	500	-	-	120,745	119,012	1,733	70	250	-	3,250	-	-	76
1-Apr-96	150	500	-	-	120,745	119,012	1,733	70	250	-	3,250	-	(15.6)	65
1-May-96	150	1,500	-	-	120,745	119,012	1,733	70	250	-	3,250	-	-	58
1-Jun-96	150	1,500	173	1.6	120,745	119,185	1,560	70	250	-	3,250	-	-	63
1-Jul-96	150	1,500	520	4.7	121,079	119,705	1,373	70	250	-	3,250	-	1.6	66
1-Aug-96	150	1,500	687	6.2	121,079	120,392	687	70	250	-	3,250	-	1.7	72
1-Sep-96	150	1,500	687	6.2	121,812	121,079	733	70	250	-	3,250	-	6.2	73
1-Oct-96	150	1,500	733	6.6	121,812	121,812	-	70	250	-	3,250	-	(0.4)	80
1-Nov-96	150	500	-	-	121,812	121,812	-	70	250	-	3,250	-	6.6	80
1-Dec-96	150	500	-	-	121,812	121,812	-	70	250	-	3,250	-	-	80
1-Jan-97	150	500	-	-	121,812	121,812	-	70	250	-	3,250	-	-	83
1-Feb-97	150	500	-	-	121,812	121,812	-	70	250	-	3,250	-	-	93
1-Mar-97	150	500	-	-	123,545	121,812	1,733	70	250	-	3,250	-	-	92
1-Apr-97	150	500	-	-	125,279	121,812	3,467	70	250	-	3,250	-	(15.6)	90
1-May-97	150	1,500	-	-	127,012	121,812	5,200	70	250	-	3,250	-	(15.6)	86
1-Jun-97	150	1,500	520	4.7	128,745	122,332	6,413	70	250	-	3,250	-	(15.6)	94
1-Jul-97	150	1,500	1,500	13.5	128,745	123,832	4,913	70	250	-	3,250	-	(10.9)	98
1-Aug-97	150	1,500	1,500	13.5	128,745	125,332	3,413	70	250	-	3,250	-	13.5	104
1-Sep-97	150	1,500	1,500	13.5	129,479	126,832	2,647	70	250	-	3,250	-	13.5	103
1-Oct-97	150	1,500	1,500	13.5	129,479	128,332	1,147	70	250	-	3,250	-	6.9	110
1-Nov-97	150	500	-	-	129,479	128,332	1,147	70	250	-	3,250	-	13.5	109
1-Dec-97	150	500	-	-	129,479	128,332	1,147	70	250	-	3,250	-	-	107
1-Jan-98	150	500	-	-	129,479	128,332	1,147	70	250	-	3,250	-	-	109
1-Feb-98	150	500	-	-	129,479	128,332	1,147	70	250	-	3,250	-	-	107
1-Mar-98	150	500	-	-	129,479	128,332	1,147	70	250	-	3,250	-	-	53
1-Apr-98	150	500	-	-	129,479	128,332	1,147	70	250	-	3,250	-	-	55
1-May-98	150	1,500	-	-	129,479	128,332	1,147	70	250	-	3,250	-	-	53
1-Jun-98	150	1,500	115	1.0	129,479	128,447	1,032	70	250	-	3,250	-	-	62
1-Jul-98	150	1,500	344	3.1	129,479	128,791	688	70	250	-	3,250	-	1.0	67
1-Aug-98	150	1,500	344	3.1	129,479	129,135	344	70	250	-	3,250	-	3.1	69
1-Sep-98	150	1,500	344	3.1	129,479	129,479	-	70	250	-	3,250	-	3.1	69
1-Oct-98	150	1,500	-	-	129,479	129,479	-	70	250	-	3,250	-	3.1	76
1-Nov-98	150	500	-	-	129,479	129,479	-	70	250	-	3,250	-	-	75
1-Dec-98	150	500	-	-	129,479	129,479	-	70	250	-	3,250	-	-	75
1-Jan-99	150	500	-	-	129,479	129,479	-	70	250	-	3,250	-	-	77
1-Feb-99	150	500	-	-	129,479	129,479	-	70	250	-	3,250	-	-	87
1-Mar-99	150	500	-	-	131,212	129,479	1,733	70	250	-	3,250	-	-	88
1-Apr-99	150	500	-	-	131,212	129,479	1,733	70	250	-	3,250	-	(15.6)	90
1-May-99	150	1,500	-	-	131,212	129,479	1,733	70	250	-	3,250	-	-	88
1-Jun-99	150	1,500	173	1.6	132,945	129,652	3,293	70	250	-	3,250	-	-	97
1-Jul-99	150	1,500	1,098	9.9	132,945	130,750	2,196	70	250	-	3,250	-	(14.0)	101
1-Aug-99	150	1,500	1,098	9.9	132,945	131,848	1,098	70	250	-	3,250	-	9.9	108
1-Sep-99	150	1,500	1,098	9.9	133,679	132,945	733	70	250	-	3,250	-	9.9	108
1-Oct-99	150	1,500	733	6.6	133,679	133,679	-	70	250	-	3,250	-	3.3	114
1-Nov-99	150	500	-	-	133,679	133,679	-	70	250	-	3,250	-	6.6	114
1-Dec-99	150	500	-	-	133,679	133,679	-	70	250	-	3,250	-	-	113

Calculation Detail

	Model based on Historic Recharge □ Groundwater Levels and adding in impact of Imported Water							Imported Water Spreading											
Date	Historic Spreading of Native Water	Snow pack	Limit recharge based on WSL	1□ of arrived water leaves each month for 24 months	Change in water level during month due to spreading	Change in depth during month due to "normal pumping" (1999-03	WSL on first w/project	Random Number (resets with each calculation	Availability of Imported Water (use prior column or other method)	Percent chance this amount of water is equaled or exceeded: 90□	80□	60□	40□	Water available this month	Available capacity based on Project Goals (1st of month)	Achieved spreading this month	Spread water affecting water level	Lost water rule (not used at this time)	Change in WSLduring month due to spreading
										-	4,000	6,000	8,000						
	af		af	af	ft	ft				af	af	af	af		af	af	af	af	ft bgs
1-Jan-73	339	N	339	-	(3.0)	8.80	163	72□	0□					-	15,000	-	-		
1-Jan-00	4	N	4	(123.4)	1.1	8.80	138	59□	0□					-	15,000	-	-		-
1-Feb-00	21	N	21	(111.3)	0.8	0.40	148							-	15,000	-	-		-
1-Mar-00	30	N	30	(49.4)	0.2	1.20	149			-	1,000	400	333	1,733	15,000	1,733	1,733		(15.6)
1-Apr-00	12	N	12	(49.7)	0.3	(3.00)	135			-	1,000	400	333	1,733	13,267	1,733	1,733		(15.6)
1-May-00	11	N	11	(49.8)	0.4	8.20	117			-	1,000	400	333	1,733	11,533	1,733	1,733		(15.6)
1-Jun-00	5	N	5	(18.9)	0.1	4.00	110				1,000	400	333	1,733	9,800	1,733	1,733		(15.6)
1-Jul-00	2	N	2	(5.6)	0.0	5.60	103						333	333	8,587	333	333		(3.0)
1-Aug-00	-	N	-	(1.3)	0.0	(0.80)	119							-	9,753	-	-		-
1-Sep-00	0	N	0	(1.3)	0.0	5.60	132					400	333	733	11,253	733	733		(6.6)
1-Oct-00	0	N	0	(1.2)	0.0	(1.00)	144							-	12,020	-	-		-
1-Nov-00	1	N	1	(1.2)	0.0	(1.60)	157							-	13,520	-	-		-
1-Dec-00	2	N	2	(1.2)	(0.0)	2.00	155							-	13,520	-	-		-
1-Jan-01	114	N	114	(1.3)	(1.0)	8.80	157	33□	0□					-	13,520	-	-		-
1-Feb-01	4	N	4	(2.4)	(0.0)	0.40	165							-	13,520	-	-		-
1-Mar-01	18	N	18	(2.3)	(0.1)	1.20	165			-	1,000	400	333	1,733	13,520	1,733	1,733		(15.6)
1-Apr-01	90	N	90	(2.4)	(0.8)	(3.00)	151			-	1,000	400	333	1,733	11,787	1,733	1,733		(15.6)
1-May-01	146	N	146	(3.2)	(1.3)	8.20	132			-	1,000	400	333	1,733	10,053	1,733	1,733		(15.6)
1-Jun-01	57	N	57	(4.6)	(0.5)	4.00	123				1,000	400	333	1,733	8,320	1,733	1,733		(15.6)
1-Jul-01	-	N	-	(5.2)	0.0	5.60	117						333	333	7,255	333	333		(3.0)
1-Aug-01	-	N	-	(5.1)	0.0	(0.80)	133							-	8,421	-	-		-
1-Sep-01	-	N	-	(5.1)	0.0	5.60	146					400	333	733	9,921	733	733		(6.6)
1-Oct-01	-	N	-	(5.1)	0.0	(1.00)	158							-	10,688	-	-		-
1-Nov-01	-	N	-	(5.1)	0.0	(1.60)	157							-	10,688	-	-		-
1-Dec-01	-	N	-	(5.1)	0.0	2.00	156							-	10,688	-	-		-
1-Jan-02	-	N	-	(5.1)	0.0	8.80	158	21□	0□					-	10,688	-	-		-
1-Feb-02	-	N	-	(5.1)	0.0	0.40	167							-	10,688	-	-		-
1-Mar-02	-	N	-	(4.9)	0.0	1.20	167			-	1,000	400	333	1,733	10,688	1,733	1,733		(15.6)
1-Apr-02	-	N	-	(4.6)	0.0	(3.00)	153			-	1,000	400	333	1,733	8,955	1,733	1,733		(15.6)
1-May-02	-	N	-	(4.5)	0.0	8.20	134			-	1,000	400	333	1,733	7,221	1,733	1,733		(15.6)
1-Jun-02	-	N	-	(4.4)	0.0	4.00	127				1,000	400	333	1,733	5,488	1,733	1,733		(15.6)
1-Jul-02	-	N	-	(4.3)	0.0	5.60	124						333	333	4,706	333	333		(3.0)
1-Aug-02	-	N	-	(4.3)	0.0	(0.80)	140							-	5,873	-	-		-
1-Sep-02	-	N	-	(4.3)	0.0	5.60	153					400	333	733	7,373	733	733		(6.6)
1-Oct-02	-	N	-	(4.3)	0.0	(1.00)	152							-	6,639	-	-		-
1-Nov-02	-	N	-	(4.3)	0.0	(1.60)	151							-	6,639	-	-		-
1-Dec-02	-	N	-	(4.3)	0.0	2.00	149							-	6,639	-	-		-
1-Jan-03	27	N	27	(4.3)	(0.2)	8.80	156	10□	0□					-	7,139	-	-		-
1-Feb-03	41	N	41	(3.4)	(0.3)	0.40	164							-	7,139	-	-		-
1-Mar-03	152	N	152	(3.8)	(1.3)	1.20	164			-	1,000	400	333	1,733	7,139	1,733	1,733		(15.6)
1-Apr-03	129	N	129	(5.1)	(1.1)	(3.00)	149			-	1,000	400	333	1,733	5,406	1,733	1,733		(15.6)
1-May-03	-	N	-	(5.5)	0.0	8.20	129			-	1,000	400	333	1,733	3,673	1,733	1,733		(15.6)
1-Jun-03	98	N	98	(4.1)	(0.8)	4.00	122				1,000	400	333	1,733	1,939	1,733	1,733		(15.6)
1-Jul-03	-	N	-	(4.5)	0.0	5.60	121						333	333	1,512	333	333		(3.0)
1-Aug-03	-	N	-	(4.5)	0.0	(0.80)	137							-	2,679	-	-		-
1-Sep-03	-	N	-	(4.5)	0.0	5.60	150					400	333	733	4,179	733	733		(6.6)
1-Oct-03	-	N	-	(4.5)	0.0	(1.00)	162							-	4,945	-	-		-
1-Nov-03	-	N	-	(4.5)	0.0	(1.60)	161							-	4,945	-	-		-
1-Dec-03	-	N	-	(4.5)	0.0	2.00	160							-	4,945	-	-		-
	215,773		133,501				129												(1,491.1)
	133,501																		
	82,272																		

	Imported Water Recovery				Imported Water Performance			Additional Native Water Extraction						
Date	Imported Water Recovery Trigger	Max possible recovery (af)	Recovery	Change in water level due to imported extraction	From project inception: Stored	Recovered	Imported Water in Storage	Native Water Extraction Trigger	Amount to extract if we extract	Native extraction due to high water levels	Cummulative increase in Native Water Extraction	Change in water level due to additional native extraction	Change in water level during prior month due to project	Without project water levels
	ft bgs		af	ft bgs	af	af	af	ft bgs	af	af	af	ft bgs	ft bgs	ft bgs
1-Jan-73	110	500	-	-	-	-	-	70	250	-	-	-		163
1-Jan-00	150	500	-	-	133,679	133,679	-	70	250	-	3,250	-	-	116
1-Feb-00	150	500	-	-	133,679	133,679	-	70	250	-	3,250	-	-	125
1-Mar-00	150	500	-	-	135,412	133,679	1,733	70	250	-	3,250	-	-	126
1-Apr-00	150	500	-	-	137,145	133,679	3,467	70	250	-	3,250	-	(15.6)	127
1-May-00	150	1,500	-	-	138,879	133,679	5,200	70	250	-	3,250	-	(15.6)	124
1-Jun-00	150	1,500	520	4.7	140,612	134,199	6,413	70	250	-	3,250	-	(15.6)	132
1-Jul-00	150	1,500	1,500	13.5	140,945	135,699	5,247	70	250	-	3,250	-	(10.9)	136
1-Aug-00	150	1,500	1,500	13.5	140,945	137,199	3,747	70	250	-	3,250	-	10.5	142
1-Sep-00	150	1,500	1,500	13.5	141,679	138,699	2,980	70	250	-	3,250	-	13.5	141
1-Oct-00	150	1,500	1,500	13.5	141,679	140,199	1,480	70	250	-	3,250	-	6.9	146
1-Nov-00	150	500	-	-	141,679	140,199	1,480	70	250	-	3,250	-	13.5	145
1-Dec-00	150	500	-	-	141,679	140,199	1,480	70	250	-	3,250	-	-	144
1-Jan-01	150	500	-	-	141,679	140,199	1,480	70	250	-	3,250	-	-	146
1-Feb-01	150	500	-	-	141,679	140,199	1,480	70	250	-	3,250	-	-	154
1-Mar-01	150	500	-	-	143,412	140,199	3,213	70	250	-	3,250	-	-	154
1-Apr-01	150	500	-	-	145,145	140,199	4,947	70	250	-	3,250	-	(15.6)	155
1-May-01	150	1,500	-	-	146,879	140,199	6,680	70	250	-	3,250	-	(15.6)	151
1-Jun-01	150	1,500	668	6.0	148,612	140,867	7,745	70	250	-	3,250	-	(15.6)	158
1-Jul-01	150	1,500	1,500	13.5	148,945	142,367	6,579	70	250	-	3,250	-	(9.6)	162
1-Aug-01	150	1,500	1,500	13.5	148,945	143,867	5,079	70	250	-	3,250	-	10.5	167
1-Sep-01	150	1,500	1,500	13.5	149,679	145,367	4,312	70	250	-	3,250	-	13.5	167
1-Oct-01	150	1,500	-	-	149,679	145,367	4,312	70	250	-	3,250	-	6.9	172
1-Nov-01	150	500	-	-	149,679	145,367	4,312	70	250	-	3,250	-	-	171
1-Dec-01	150	500	-	-	149,679	145,367	4,312	70	250	-	3,250	-	-	170
1-Jan-02	150	500	-	-	149,679	145,367	4,312	70	250	-	3,250	-	-	172
1-Feb-02	150	500	-	-	149,679	145,367	4,312	70	250	-	3,250	-	-	181
1-Mar-02	150	500	-	-	151,412	145,367	6,045	70	250	-	3,250	-	-	181
1-Apr-02	150	500	-	-	153,145	145,367	7,779	70	250	-	3,250	-	(15.6)	182
1-May-02	150	1,500	-	-	154,879	145,367	9,512	70	250	-	3,250	-	(15.6)	179
1-Jun-02	150	1,500	951	8.6	156,612	146,318	10,294	70	250	-	3,250	-	(15.6)	188
1-Jul-02	150	1,500	1,500	13.5	156,945	147,818	9,127	70	250	-	3,250	-	(7.0)	192
1-Aug-02	150	1,500	1,500	13.5	156,945	149,318	7,627	70	250	-	3,250	-	10.5	197
1-Sep-02	150	1,500	-	-	157,679	149,318	8,361	70	250	-	3,250	-	13.5	196
1-Oct-02	150	1,500	-	-	157,679	149,318	8,361	70	250	-	3,250	-	(6.6)	202
1-Nov-02	150	500	-	-	157,679	149,318	8,361	70	250	-	3,250	-	-	201
1-Dec-02	150	500	500	4.5	157,679	149,818	7,861	70	250	-	3,250	-	-	200
1-Jan-03	150	500	-	-	157,679	149,818	7,861	70	250	-	3,250	-	4.5	202
1-Feb-03	150	500	-	-	157,679	149,818	7,861	70	250	-	3,250	-	-	210
1-Mar-03	150	500	-	-	159,412	149,818	9,594	70	250	-	3,250	-	-	210
1-Apr-03	150	500	-	-	161,145	149,818	11,327	70	250	-	3,250	-	(15.6)	210
1-May-03	150	1,500	-	-	162,879	149,818	13,061	70	250	-	3,250	-	(15.6)	206
1-Jun-03	150	1,500	1,306	11.8	164,612	151,124	13,488	70	250	-	3,250	-	(15.6)	214
1-Jul-03	150	1,500	1,500	13.5	164,945	152,624	12,321	70	250	-	3,250	-	(3.8)	217
1-Aug-03	150	1,500	1,500	13.5	164,945	154,124	10,821	70	250	-	3,250	-	10.5	223
1-Sep-03	150	1,500	1,500	13.5	165,679	155,624	10,055	70	250	-	3,250	-	13.5	222
1-Oct-03	150	1,500	-	-	165,679	155,624	10,055	70	250	-	3,250	-	6.9	228
1-Nov-03	150	500	-	-	165,679	155,624	10,055	70	250	-	3,250	-	-	227
1-Dec-03	150	500	-	-	165,679	155,624	10,055	70	250	-	3,250	-	-	225
				1,400.6										135

Note:
Without Imported Water Project there is 64,776 af of native water that I show not affecting water level at Mountain View 4.

MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

Executive Office

October 5, 2004

Mr. Richard Hansen
General Manager
Three Valleys Municipal Water Department
1021 East Miramar Avenue
Claremont, CA 91711

Dear Mr. Hansen:

Upper Claremont Heights Conjunctive Use Program
Participation in Groundwater Storage Programs using Proposition 13 Funds

Thank you for your submittal to the Request for Proposals for Participation in Groundwater Storage Programs using Proposition 13 funds. We are pleased to inform you that Proposition 13 funds are now available to fund the Upper Claremont Heights Conjunctive Use Program. As requested in your proposal, $1,228,375 has been allocated to this proposed project. In our April 8, 2004 letter to you, Metropolitan had indicated that the Upper Claremont Heights project had been wait-listed to receive Proposition 13 funds.

Metropolitan staff has provided a draft funding agreement to Three Valleys Municipal Water District, and has worked with your staff to develop a schedule for execution of the agreement. Given the deadline for expenditure of Proposition 13 funds, it is imperative that all efforts be made to hold to the execution milestone of February 2005. This allows your agency to complete CEQA documentation for the project during 2004, with TVMWD Board action in January 2005, followed by Metropolitan Board action in February.

We look forward to working with Three Valleys MWD to implement this project. Please direct any questions you may have to Mr. Steve Arakawa at (213) 217-6052 or to Ms. Kathy Kunysz of my staff at (213) 217-6272.

Very truly yours,

Ronald R. Gastelum
Chief Executive Officer

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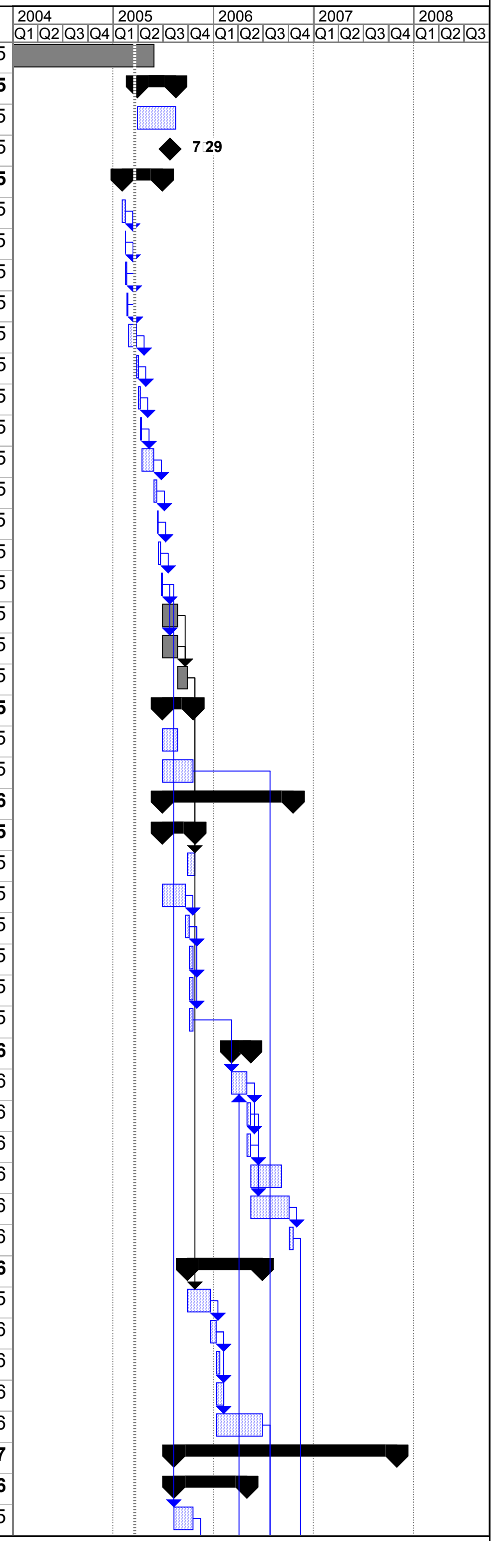
Appendix F
Proposed Schedule

Appendix F - Proposed Schedule

Imported Water Spreading at San Antonio Spreading Grounds (production well at Miramar WTP included)

ID		Task Name	Duration	Start	Finish
1		**Feasibility Study**	370 days	Thu 1/1/04	Tue 5/31/05
2		**Institutional Coordination**	**100 days**	**Fri 4/1/05**	**Thu 8/18/05**
3		PVPA agreement for construction/op	100 days	Fri 4/1/05	Thu 8/18/05
4		Metropolitan storage funding agreen	0 days	Fri 7/29/05	Fri 7/29/05
5		**Environmental/CEQA**	**105 days**	**Sat 2/5/05**	**Thu 6/30/05**
6		Kick-off, NOP / IS, sample EIR sect	8 days	Sat 2/5/05	Tue 2/15/05
7		IS/NOP to District	1 day	Wed 2/16/05	Wed 2/16/05
8		IS/NOP to EIR w/District Comments	3 days	Thu 2/17/05	Mon 2/21/05
9		Circulate IS/NOP	4 days	Tue 2/22/05	Fri 2/25/05
10		Public Review of IS/NOP, Prepare /	21 days	Mon 2/28/05	Mon 3/28/05
11		Submit Admin Draft EIR	5 days	Tue 3/29/05	Mon 4/4/05
12		District Comments on ADEIR	5 days	Tue 4/5/05	Mon 4/11/05
13		Draft EIR Released for review	4 days	Tue 4/12/05	Fri 4/15/05
14		Public Review (45 days)	31 days	Mon 4/18/05	Mon 5/30/05
15		Admin FEIR to District for Review	9 days	Tue 5/31/05	Fri 6/10/05
16		District Review of AFEIR	3 days	Mon 6/13/05	Wed 6/15/05
17		Final EIR packet to District	7 days	Thu 6/16/05	Fri 6/24/05
18		Certification Hearing	4 days	Mon 6/27/05	Thu 6/30/05
19		**RFP Process - Spreading Connection**	40 days	Fri 7/1/05	Thu 8/25/05
20		**RFP Process - Production Well**	40 days	Fri 7/1/05	Thu 8/25/05
21		**MWD review of budget and schedule**	25 days	Fri 8/26/05	Thu 9/29/05
22		**DWSAP Program**	**80 days**	**Fri 7/1/05**	**Thu 10/20/05**
23		Preparation	40 days	Fri 7/1/05	Thu 8/25/05
24		DHS Review	80 days	Fri 7/1/05	Thu 10/20/05
25		**Imported Water Connection Design**	**340 days**	**Fri 7/1/05**	**Thu 10/19/06**
26		**60 percent bid documents**	**85 days**	**Fri 7/1/05**	**Thu 10/27/05**
27		Survey	20 days	Fri 9/30/05	Thu 10/27/05
28		Design	60 days	Fri 7/1/05	Thu 9/22/05
29		Review by Three Valleys	10 days	Fri 9/23/05	Thu 10/6/05
30		Review by PVPA	10 days	Fri 10/7/05	Thu 10/20/05
31		Coordination with Claremont	10 days	Fri 10/7/05	Thu 10/20/05
32		Coordination with Upland	10 days	Fri 10/7/05	Thu 10/20/05
33		**100 percent bid documents**	**50 days**	**Fri 3/10/06**	**Thu 5/18/06**
34		Design	40 days	Fri 3/10/06	Thu 5/4/06
35		Review by Three Valleys	10 days	Fri 5/5/06	Thu 5/18/06
36		Review by PVPA	10 days	Fri 5/5/06	Thu 5/18/06
37		LACDPW (Corps) permit review	80 days	Fri 5/19/06	Thu 9/7/06
38		Additional permitting/legal requireme	100 days	Fri 5/19/06	Thu 10/5/06
39		Final bid documents	10 days	Fri 10/6/06	Thu 10/19/06
40		**Production Well Design**	**195 days**	**Fri 9/30/05**	**Thu 6/29/06**
41		Prepare Specifications and Bid Doc	60 days	Fri 9/30/05	Thu 12/22/05
42		Review by Three Valleys	15 days	Fri 12/23/05	Thu 1/12/06
43		Coordination with Claremont	10 days	Fri 1/13/06	Thu 1/26/06
44		Permitting by County DHS	20 days	Fri 1/13/06	Thu 2/9/06
45		Additional permitting requirements	120 days	Fri 1/13/06	Thu 6/29/06
46		**Environmental Mitigation**	**580 days**	**Fri 8/12/05**	**Thu 11/1/07**
47		**Not construction dependent**	**190 days**	**Fri 8/12/05**	**Thu 5/4/06**
48		Surveys, not construction depen	50 days	Fri 8/12/05	Thu 10/20/05



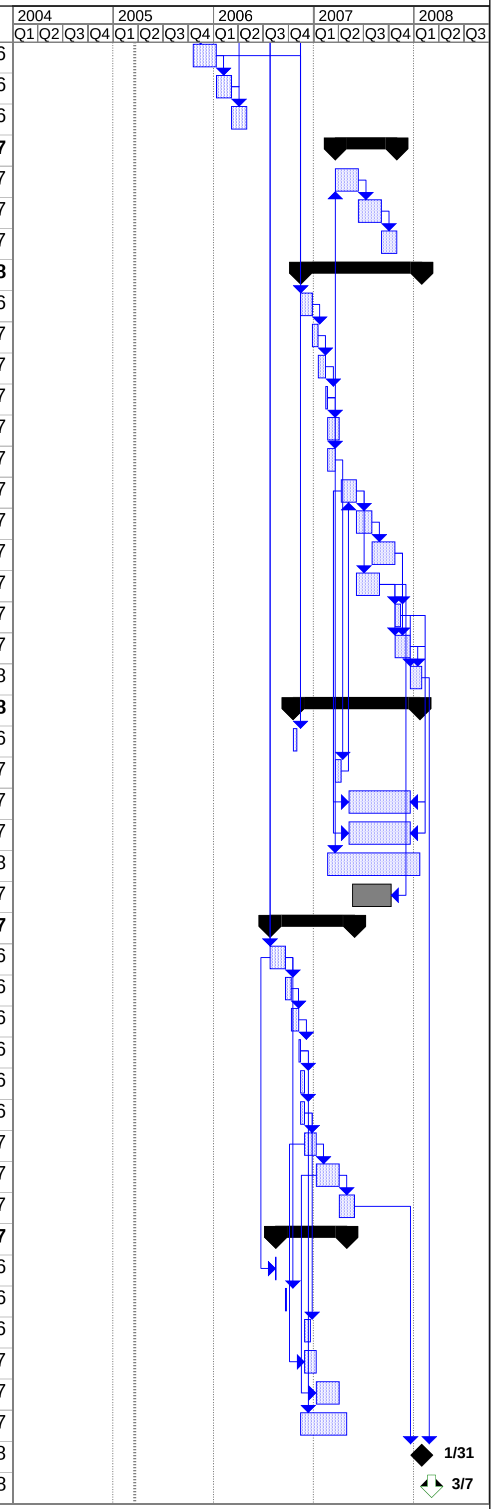
File name: Project Schedule
Date: Sat 3/19/05 3:01 PM

Task	Project Summary	Deadline	
Milestone	External Tasks		
Summary	External Milestone		

Appendix F - Proposed Schedule

Imported Water Spreading at San Antonio Spreading Grounds (production well at Miramar WTP included)

ID		Task Name	Duration	Start	Finish
49		Develop mitigation measures 1	60 days	Fri 10/21/05	Thu 1/12/06
50		Approval of mitigations measure	40 days	Fri 1/13/06	Thu 3/9/06
51		Implementation of mitigation me	40 days	Fri 3/10/06	Thu 5/4/06
52		**Construction dependent**	**160 days**	**Fri 3/23/07**	**Thu 11/1/07**
53		Surveys, construction depended	60 days	Fri 3/23/07	Thu 6/14/07
54		Develop mitigation measures 2	60 days	Fri 6/15/07	Thu 9/6/07
55		Approval of mitigation measures	40 days	Fri 9/7/07	Thu 11/1/07
56		**Imported Connection Construction**	**315 days**	**Fri 11/17/06**	**Thu 1/31/08**
57		Advertising period	30 days	Fri 11/17/06	Thu 12/28/06
58		Contractor selection	15 days	Fri 12/29/06	Thu 1/18/07
59		Board appoval	20 days	Fri 1/19/07	Thu 2/15/07
60		Notice to proceed	5 days	Fri 2/16/07	Thu 2/22/07
61		Mobilization	30 days	Fri 2/23/07	Thu 4/5/07
62		Submittals	20 days	Fri 2/23/07	Thu 3/22/07
63		Material deliveries	40 days	Fri 4/13/07	Thu 6/7/07
64		Diversion structure	40 days	Fri 6/8/07	Thu 8/2/07
65		Pipeline installation	60 days	Fri 8/3/07	Thu 10/25/07
66		Outlet structures	60 days	Fri 6/8/07	Thu 8/30/07
67		Revegitation	15 days	Fri 10/26/07	Thu 11/15/07
68		Other biological mitigation	40 days	Fri 10/26/07	Thu 12/20/07
69		Project closeout	30 days	Fri 12/21/07	Thu 1/31/08
70		**Imported Connection CM**	**330 days**	**Fri 10/20/06**	**Thu 1/24/08**
71		Construction bid review	10 days	Fri 10/20/06	Thu 11/2/06
72		Submittal review	15 days	Fri 3/23/07	Thu 4/12/07
73		Inspection of engineering constructi	160 days	Fri 5/11/07	Thu 12/20/07
74		Inpection of biological mitigation	160 days	Fri 5/11/07	Thu 12/20/07
75		RFPS, review invoices, etc	240 days	Fri 2/23/07	Thu 1/24/08
76		**Operating committee & initial operati**	100 days	Fri 5/25/07	Thu 10/11/07
77		**Production Well Construction**	**220 days**	**Fri 7/28/06**	**Thu 5/31/07**
78		Advertising period	40 days	Fri 7/28/06	Thu 9/21/06
79		Contractor selection	15 days	Fri 9/22/06	Thu 10/12/06
80		Board appoval	20 days	Fri 10/13/06	Thu 11/9/06
81		Notice to proceed	5 days	Fri 11/10/06	Thu 11/16/06
82		Mobilization	10 days	Fri 11/17/06	Thu 11/30/06
83		Submittals	10 days	Fri 11/17/06	Thu 11/30/06
84		Well drilling, casing installation, testi	30 days	Fri 12/1/06	Thu 1/11/07
85		Pump & motor installation, electrical	60 days	Fri 1/12/07	Thu 4/5/07
86		Project close out	40 days	Fri 4/6/07	Thu 5/31/07
87		**Production Well CM**	**185 days**	**Fri 8/18/06**	**Thu 5/3/07**
88		Pre-bid Tour	1 day	Fri 8/18/06	Fri 8/18/06
89		Construction bid review	2 days	Fri 9/22/06	Mon 9/25/06
90		Submittal review	15 days	Fri 12/1/06	Thu 12/21/06
91		Inspection of drilling	30 days	Fri 12/1/06	Thu 1/11/07
92		Inpection of mechanical/electrical	60 days	Fri 1/12/07	Thu 4/5/07
93		Review invoices	120 days	Fri 11/17/06	Thu 5/3/07
94		Project completion	0 days	Thu 1/31/08	Thu 1/31/08
95		**Funding Deadline for Imported Conne**	0 days	Fri 3/7/08	Fri 3/7/08

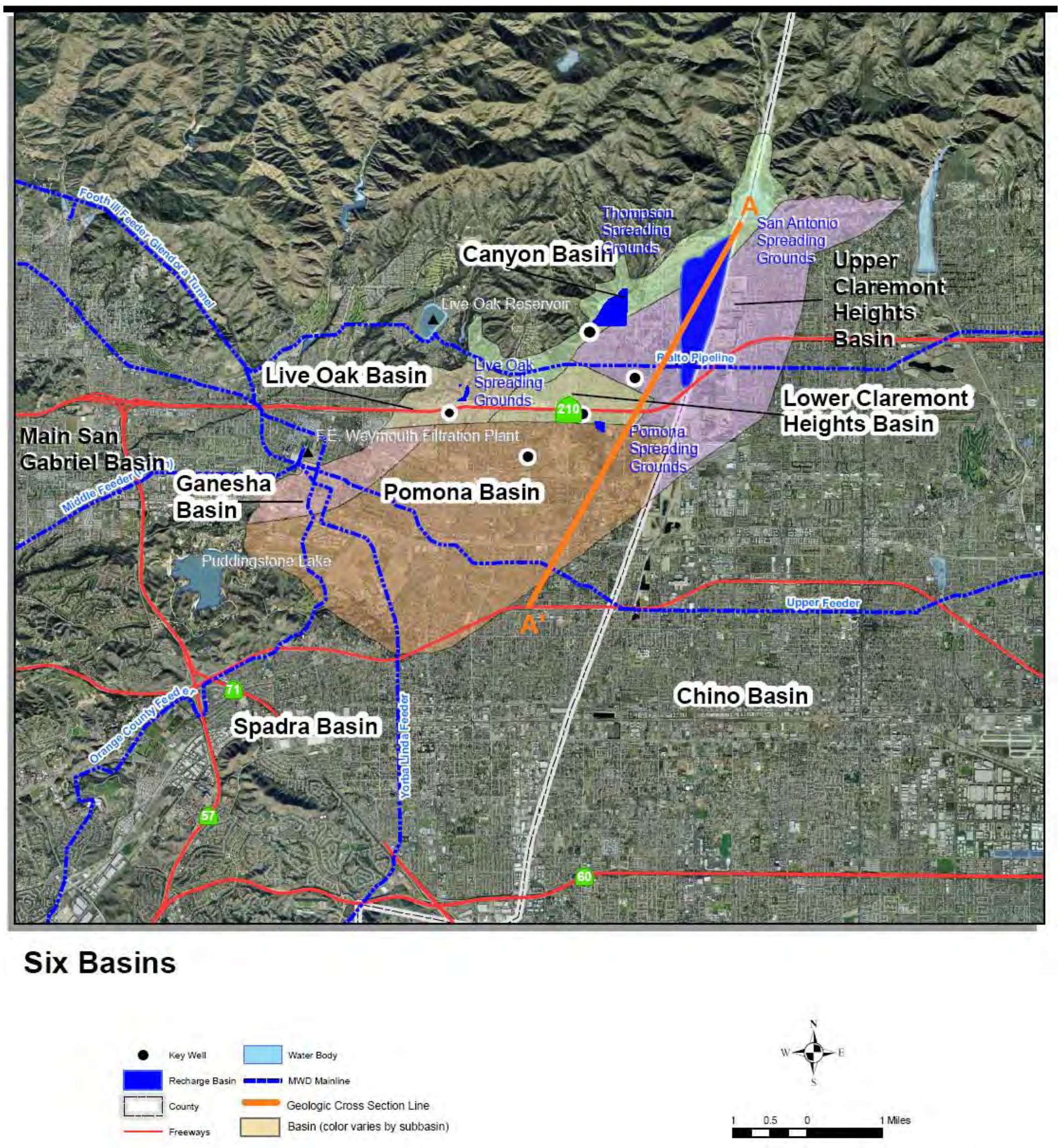


File name: Project Schedule
Date: Sat 3/19/05 3:01 PM

Task		Project Summary		Deadline	
Milestone		External Tasks			
Summary		External Milestone			

The Six Basins are located in the eastern Los Angeles County and western San Bernardino County, bounded on the southwest by the San Jose Hills, on the north by the San Gabriel Mountains, on the south and east by the Chino Basin and on the west by the Main San Gabriel Basin. The Six Basins are comprised of the Canyon, Upper and Lower Claremont Heights, Pomona, Live Oak, and Ganesha Basins. They underlie the service areas of Three Valleys Municipal Water District (Three Valleys) and Inland Empire Utilities Agency (IEUA). These Six Basins underlie the cities of Claremont, La Verne, Pomona and northern Upland. A map of the basin is provided in **Figure 9-1**.

Figure 9-1
Map of the Six Basins



BASIN CHARACTERIZATION

The following section describes the physical properties of the Six Basins, including its hydrogeologic characteristics and analysis of inflows and outflows.

Basin Producing Zones and Storage Capacity

Individual subbasins within the Six Basins are defined by faults and physical boundaries. The Indian Hills fault separates the Live Oak, Upper and Lower Claremont Heights, and Canyon basins (herein referred to as upper basins) to the north from the Pomona and Ganesha Basins (herein referred to as lower basins) to the south (Three Valleys, 2004). The Canyon Basin is separated from the other basins by the Sierra Madre-Cucamonga fault. The Ganesha and Pomona Basins are separated by the San Antonio fault. These faults do not appear to be barriers to flow. The San Jose fault separates the Six Basins from the Chino Basin. This boundary is not a complete barrier to flow and groundwater appears to flow at least to some extent between the basins.

Table 9-1 summarizes the hydrogeologic characteristics of the Six Basins. Studies are currently underway to reevaluate the basin geology. Changes to the basin structure as part of these studies were not available at the time of this report. In addition, limited data are available for the Ganesha and Live Oak Basins so data are provided for the four basins: Canyon, Upper Claremont Heights, Lower Claremont Heights and Pomona Basins (herein referred to as Four Basins Area). A geologic cross section through the Six Basins area from north to south is provided in **Figure 9-2**. Maximum basin depths range from about 200 feet in Canyon Basin to about 1,200 feet in the Pomona Basin. As shown in **Figure 9-2**, bedrock is offset by faulting, thereby increasing the basin depth toward the south.

Groundwater in Six Basins occurs under both unconfined and confined conditions. In the upper basins where material is generally coarser and mostly younger alluvium, the groundwater is unconfined. In the lower basins, fine-grained silts and clays overlie more permeable materials and groundwater can be confined. For example, the Pomona Basin consists of at least two aquifers. Most of the production from the Pomona Basin is from the underlying confined aquifers. Issues related to rising groundwater occur in the upper unconfined aquifer in the Pomona Basin. These issues are discussed in more detail below.

Total storage estimates range from about 15,000 AF of storage in the Canyon Basin to more than 200,000 AF of storage in the Pomona Basin. Total storage in the Four Basins Area is estimated to be about 335,000 AF (Three Valleys, 2004). Available storage space is estimated to be approximately 20,000 AF in 2005/06 (Three Valleys, 2006). Groundwater in storage in the upper basins has decreased from a high of about 74,500 AF in 1999 to about 65,200 AF in early 2004, a decrease of about 9,300 AF. Groundwater in storage increased by over 20,000 AF as a result of the near record rainfall in 2005.

Safe Yield/Long-Term Balance of Recharge and Discharge

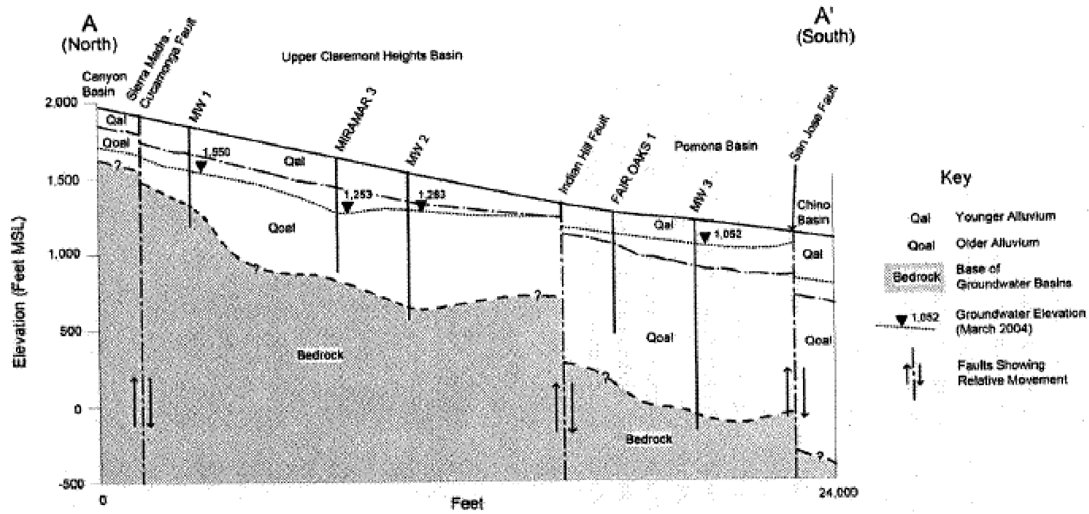
Water supply to Six Basins is greatly affected by precipitation in the area and in the watershed of San Antonio Canyon. **Figure 9-3** shows the historical annual average rainfall in the Six Basins area measured at San Antonio Dam. (Six Basins, 2005) The historical annual rainfall average for the period between 1985 and 2004 at this location is approximately 23.5 inches. The long-term precipitation averages range from about 40 inches in the upper reaches of San Antonio Canyon to 24 inches at the mouth of the canyon, and 17 inches at the southerly edge of the Pomona Basin. Much of the precipitation in the higher elevation falls as snow with the beneficial effect of delayed runoff. This creates a base flow of surface water, which is available for direct diversion or for surface spreading. (Six Basins, 2005)

Table 9-1
Summary of Hydrogeologic Parameters of the Six Basins

Parameter	Description
Structure	
Aquifer(s)	Unconfined alluvium in upper basins Confined to semi-confined in lower basins
Depth of groundwater basin	0 to 1,200 feet
Thickness of water-bearing units	Canyon: Up to 200 feet Upper Claremont Heights: Up to 1,000 feet Lower Claremont Heights: Up to 700 feet Pomona: Up to 1,200 feet
Yield and Storage	
Natural Safe Yield	19,300 AFY
Operating Safe Yield (Calendar Year 2005)	18,000 AFY
Total Storage	Canyon: 15,000 AF Upper Claremont Heights: 100,000 AF Lower Claremont Heights: 20,000 AF Pomona: 200,000 AF **Total: 335,000 AF**
Unused Storage Space	Unknown
Portion of Unused Storage Space Available for Storage (in 2005/06)	~20,000 AF

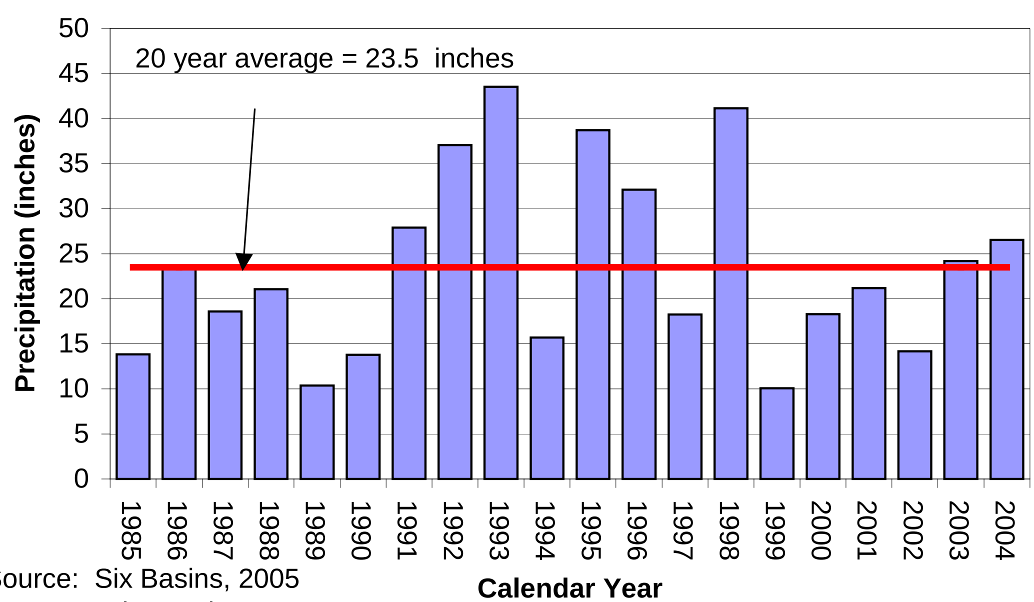
Source: Three Valleys, 2004; 2006

Figure 9-2
Generalized Hydrogeologic Cross Section in the Six Basins



Source: Three Valleys, 2004

Figure 9-3
Historical Precipitation in Six Basins Area



Source: Six Basins, 2005
(San Antonio Dam)

Groundwater generally flows from the upper basins to the lower basins. Therefore, the primary source of recharge to the lower basins is subsurface flow from the upper basins. The long term natural safe yield for all groundwater supplies within the Six Basins area, including the benefits of historical augmentation is estimated to be approximately 19,300 AFY. The operating safe yield for the Four Basins Area, which is updated annually, is dependent on rainfall and groundwater recharge of surface water runoff from the local mountains. Since 1999, when the basins were adjudicated, the operating safe yield has ranged from 17,000 AFY to 24,000 AFY. In 2005, the operating safe yield was established at 18,000 AFY.

GROUNDWATER MANAGEMENT

The following section describes how the Six Basins area is currently managed.

Basin Governance

The Six Basins are adjudicated. The Six Basins were adjudicated in 1999 and administrated by Three Valleys MWD, through a contract with the Six Basins Watermaster Board of Directors. The Board is comprised of nine parties representing producers and interests in the basins. The Board of Directors rotates board positions on a yearly basis. Each party is represented on the governing Watermaster Board of Directors. A summary of the management agencies in the Six Basins is provided in **Table 9-2**.

Table 9-2
Summary of Management Agencies in the Six Basins

Agency	Role
Six Basins Watermaster Board of Directors	Governance and Oversight of Adjudicated Basins
Golden State Water Company	Major Party and Producer
City of Pomona	Major Party and Producer Operates Pomona Spreading Grounds pursuant to storage and recovery agreement with Watermaster
City of Upland	Major Party and Producer
City of La Verne	Major Party and Producer
Pomona College	Minor Party and Producer
City of Claremont	Minor Party and Producer (Sells rights to Golden State Water Company)
San Antonio Water Company	Major Party and Producer
Three Valleys MWD	Minor Party and Administrator (Storage & Recovery only)
Pomona Valley Protective Association (PVPA)	Operates San Antonio and Thompson Creek Spreading Grounds
Los Angeles County Department of Public Works (LACDPW)	Operates Live Oak Spreading Grounds

In accordance with the adjudication, pumping is limited to the annual operating safe yield within the Four Basins Area. Pumping is not limited in the Ganesha or Live Oak Basins. According to the adjudication, annual over-pumping in the Four Basins Area is allowed with no specified upper limit but incurs replenishment obligation of equal amount. Carryover of 25 percent of the original annual allocation or unused balance, whichever is less, is allowed. Additional storage is allowed with no specified upper limit but only pursuant to a storage and recovery agreement between Watermaster and a single party. Imported water deliveries are allowed for replenishment obligation or Storage/Recovery account (Six Basins, 2005). However, facilities to spread and store imported water are not yet available in the Six Basins area.

Criteria for monitoring of the basin include monthly monitoring and groundwater modeling of water levels and monthly reporting and groundwater modeling of production. Pumping rights are allocated to each producer in the Four Basins Area based on the percentages in the Judgment. The Base Annual Production percentage owned by each producer is applied to the current Operating Safe Yield, and the resulting allocation is the pumping allowance available to each party without incurring a replacement water obligation (Six Basins, 2005)

Interactions with Adjoining Basins

Subsurface outflow to the Chino Basin across the San Jose fault has not been estimated but is considered to be very low (Three Valleys, 2004). The quantity of flow is not currently known with enough certainty for a formal exchange agreement to be made. Future studies have been proposed to better quantify this outflow.

Under the adjudication, Six Basins producers are allowed to export water upon approval by the Watermaster. For example, production from the western edge of the Pomona Basin is exported to the Main San Gabriel Basin. In addition, production by the City of La Verne is exported outside the boundaries of the Live Oak and Ganesha Basins (Three Valleys, 2004).

WATER SUPPLY FACILITIES AND OPERATIONS

The following provides a summary of the facilities within the Six Basins. Facilities for groundwater supply and storage include approximately 68 production wells and nearly 700 acres of recharge basins.

Municipal Production Wells

Table 9-3 provides details of the production wells within the Six Basins area. There are approximately 68 municipal production wells in the Six Basins area. Fourteen municipal wells are inactive. The total production capacity of active municipal wells is at least 35,000 AFY (Three Valleys, 2007). It is important to note that groundwater demand is only about 24,000 AFY. Approximately seven wells are anticipated to be replaced in the next five years (Six Basins, 2006).

Figure 9-4 summarizes the historical production data in the Four Basins Area. Data from the Live Oak and Ganesha Basins were not available at the time of this report. However, because of water quality issues in these two basins, production is limited but still significant. Most of the groundwater production in the Six Basins area is from the Upper Claremont Heights Basin and the Pomona Basin. Between 1985 and 2004, pumping in the Upper Claremont Heights Basin ranged from 7,857 AFY to 14,732 AFY with an average of 9,890 AFY. Production in this basin generally correlates with precipitation. There has been limited pumping in the Lower Claremont Heights Basin after 1998, and extractions from the Canyon Basin are a result of precipitation because it responds quickly to runoff from San Antonio Canyon. Production from the Pomona Basin ranged from 5,028 AFY to 9,195 AFY between 1985 and 2004. Production from the Pomona Basin has been less than the adjudicated allowance because of water quality issues in this basin. However, in recent years, production from the Pomona Basin has increased as facilities to remove contaminants from the groundwater are constructed.

Table 9-3
Summary of Production Wells in the Six Basins

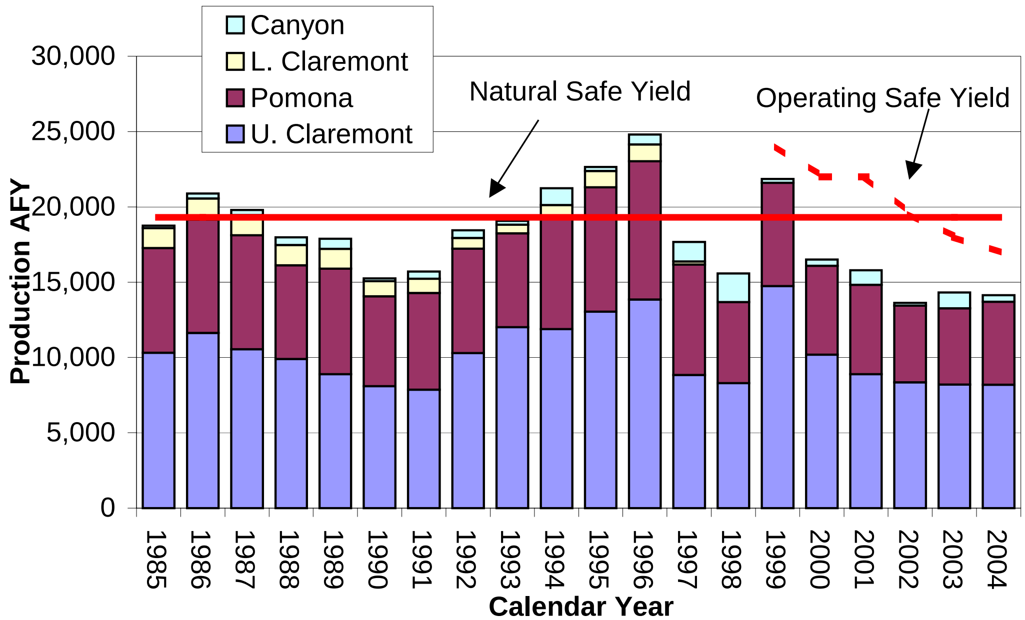
<table>
<tr><th>Basin</th><th>Number of Wells</th><th>Estimated Production Capacity (AFY)</th><th>Average Production 1985-2004 (AFY)</th><th>Well Operation Cost ($/AF)</th></tr>
<tr><td>Canyon</td><td rowspan="6">54 Active
14 Inactive</td><td rowspan="6">At least 35,000</td><td>595</td><td rowspan="7">$60-175
(average of $125)
Power only</td></tr>
<tr><td>Upper Claremont Heights</td><td>10,199</td></tr>
<tr><td>Lower Claremont Heights</td><td>723</td></tr>
<tr><td>Pomona</td><td>6,649</td></tr>
<tr><td>Ganesha</td><td>Data not available</td></tr>
<tr><td>Live Oak</td><td>Data not available</td></tr>
<tr><td>Total</td><td>68</td><td>35,000</td><td>18,164</td></tr>
</table>

Source: Three Valleys, 2006

Other Production

Other non-municipal production has not been reported for the Six Basins. Non-municipal production is included in production data discussed above.

Figure 9-4
Historical Groundwater Production in the Six Basins



ASR Wells

There are no ASR wells in the Six Basins.

Spreading Basins

There are four spreading basin areas in the Six Basins area. These include: San Antonio, Thompson Creek, Live Oak and Pomona. Each of these is discussed below and summarized in **Table 9-4**. **Figure 9-5** summarizes the historical groundwater recharge spreading operations in the Six Basins. An average of about 6,200 AFY has been recharged in the Six Basins area between 1995 and 2004. During the wet years of 1995 and 1998 more than 25,000 AFY was recharged.

The San Antonio Spreading Grounds consist of about 600 acres of spreading grounds in the Upper Claremont Heights Basin. This facility is owned and operated by the Pomona Valley Protective Agency (PVPA). The primary source of water for this facility is runoff from San Antonio Creek by way of controlled releases from San Antonio Dam by the Army Corps of Engineers. Imported water from Metropolitan will also spread at this facility as part of the Upper Claremont Heights Conjunctive Use Program discussed below. Facilities to spread imported water have not been constructed yet. Although larger volumes of water have been spread in the San Antonio Spreading Grounds historically, the recharge capacity of the San Antonio Spreading Grounds has been estimated by Bookman-Edmonston to range from about 13,000 to 18,000 AFY taking into consideration adjustments to avoid impacts of high groundwater (Three Valleys, 2004).

The Live Oak Spreading Grounds consist of about five acres of spreading facilities in the Live Oak Basin. This facility is owned an operated by LACDPW. The primary source of water is runoff from the Live Oak Dam. Imported from Metropolitan is also recharged at this facility as part of the Live Oak Conjunctive Use Program discussed below.

Table 9-4
Summary of Recharge Basins in Six Basins

Basin	Area (acres)	Wetted Area (acres)	Recharge Capacity (cfs)	Recharge Capacity (AFY)	Source Water	Owner
San Antonio	600	Data not available	Data not available	13,000 to 18,000 [1]	Runoff	Pomona Valley Protection Agency
Thompson Creek	53	5	15	Data not available	Runoff	Pomona Valley Protection Agency
Live Oak	5	3	13	Data not available	Runoff Imported	LACDPW
Pomona	8	Data not available	Data not available	Data not available	Runoff	City of Pomona

Source: Three Valleys, 2004; LACDPW, 2006
1. Spreading capacity as determined by Bookman Edmonston (Three Valleys, 2004)

The Pomona spreading groundwater facilities are owned by the City of Pomona adjacent to its Pedley Water Treatment Plant pursuant to a storage and recovery agreement with Watermaster.

The Thompson Creek Spreading Grounds consist of about 53 acres of spreading facilities in the Canyon Basin. The primary source of recharge is runoff from the adjacent drainages upstream of the facilities.

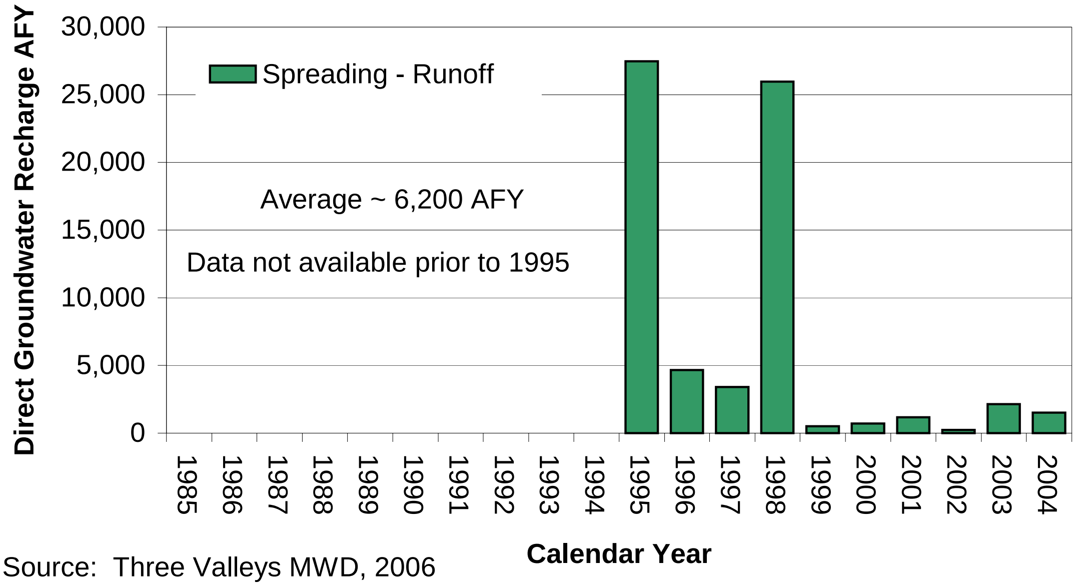
Seawater Intrusion Barriers

There are no seawater intrusion barriers in the Six Basins area.

Desalters

There are no desalters in the Six Basins area.

Figure 9-5
Historical Groundwater Recharge in Six Basins Area



Source: Three Valleys MWD, 2006

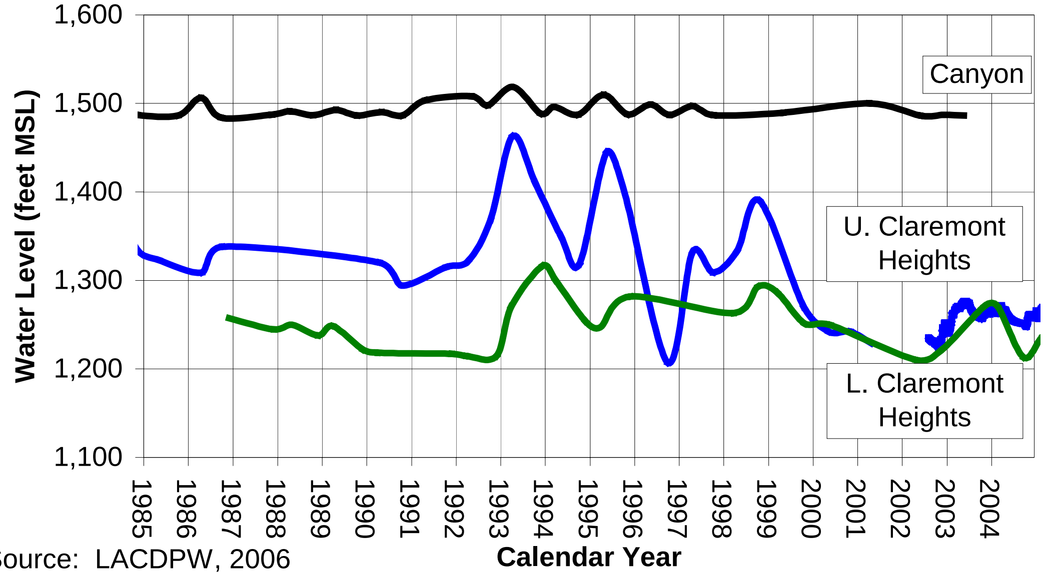
GROUNDWATER LEVELS

The general direction of groundwater flow is south to southwest from the upper basins to the lower basins. Historical water levels for the Six Basins area are shown in **Figure 9-6**. Water levels generally decreased in each basin between1985 and 2004. Decreases have ranged from slight decreases in the Canyon Basin to more than 80 feet (between 1985 and 2004) in the Upper Claremont Heights Basin. However, since the heavy rains of early 2005, water levels have recovered and, during 2005 and 2006 are near historical highs.

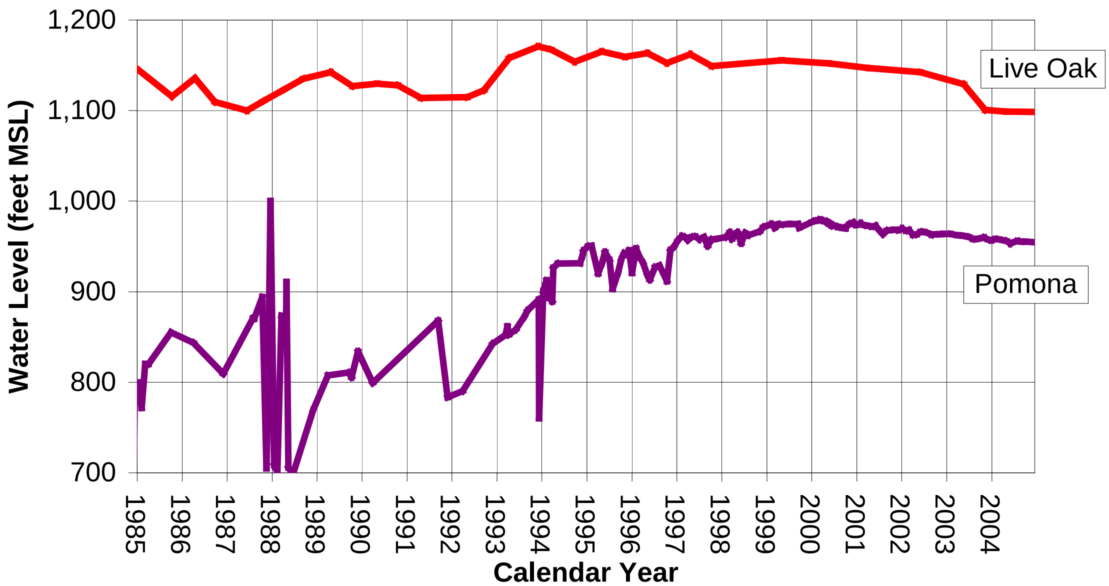
Despite the overall decrease after 1985, water levels in the Pomona Basin increased between 1990 and 1994 because wells were shutdown due to water quality issues in this basin. Water levels have remained higher since that time. Unlike the three upper basins, water levels in the Pomona Basin are above desired levels (Six Basins, 2005). Areas of rising groundwater (cienegas) are present in various locations in the Pomona Basin and are a concern for management of the basin. The approximate locations of known cienegas are provided in **Figure 9-7.**

Basin water levels must be closely managed to avoid rising water and property damage. Canyon Basin and Upper Claremont Heights Basin both experienced rising groundwater conditions in early 2005. In 1993, James M. Montgomery Consulting Engineers (JMM) developed a spreadsheet model to evaluate spreading conditions. Based upon the model assumptions, water is not to be spread when the Index Water Level (weighted average of 5 wells in Upper Claremont Heights Basin) approaches or reaches an elevation of 1,455 feet MSL. Since 1993, the index water level has ranged from 1262.3 feet MSL to 1,342.4 feet MSL. The index water level in March 2004 was 1,296.1 feet MSL (Six Basins, 2005). In 2006, CDM developed a new spreadsheet model, which utilizes data from nine dedicated monitoring wells in the Six Basins. The new threshold index for this model is 1,475 feet MSL.

Figure 9-6
Historical Water Levels in the Six Basins

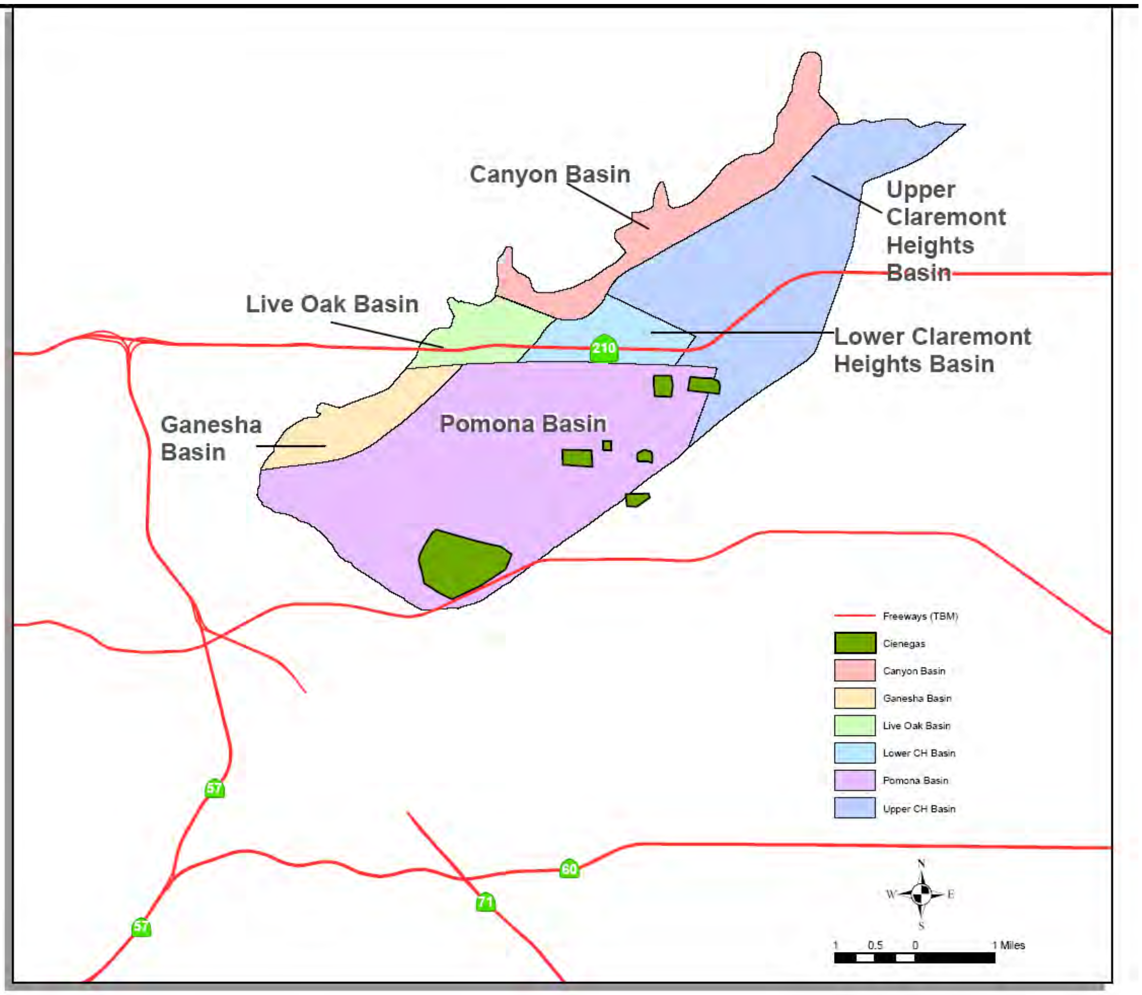


Source: LACDPW, 2006



Source: LACDPW, 2006

Figure 9-7
Locations of Cienegas in the Six Basins Area



GROUNDWATER QUALITY

The following section describes the overall water quality considerations for the Six Basins. Fourteen wells, particularly in the Live Oak and Pomona Basins are offline because of water quality issues.

Groundwater Quality Monitoring

Basin water quality assessments utilize Title 22 reporting for production wells. There is no formal groundwater quality-monitoring program established for the Six Basins.

Groundwater Contaminants

General water quality information was collected from the various water agencies in the Six Basins Area to conduct an assessment of water quality conditions in the area. The water quality analysis was collected for 2005/06. **Table 9-5** provides summary of the primary constituents of concern in the Six Basins areas. Constituents of concern include: total dissolved solids (TDS), nitrate, volatile organic compounds, or VOCs (trichloroethylene, or TCE, tetrachloroethylene, or PCE), and perchlorate. A brief discussion of water quality conditions for each of the compounds of potential concern is presented below.

Nitrate is a main water quality concern in the Live Oak Basin and the westerly portion of the Pomona Basin, where most of the wells currently exceeding the MCL (13 of the 44 wells reported). Nitrate concentrations in some of the city of La Verne wells are 20 to 22 mg/L as N, over twice the current MCL. The eastern half of the Pomona Basin and the Upper Claremont Basin experience lower nitrate concentrations with most of the wells below 50 percent MCL. **Figure 9-8** illustrates nitrate concentrations for the reporting wells in the Six Basins area.

TDS information was obtained for only 14 of the producing wells in the area. TDS is currently not an issue of concern as none of the wells exceed the secondary MCL of 500 mg/L; further, 11 of the 14 wells showed concentrations below 50 percent MCL. **Figure 9-8** illustrates TDS concentrations for the reporting wells in the Six Basins area.

The Pomona Basin also contains VOCs at four wells above the appropriate MCL. As described below, the City of Pomona has constructed VOC treatment/removal facilities in the Pomona Basin. TCE is an issue of concern at two primary locations in the Pomona Basin. In the vicinity of the historical Del Monte Cienega there are 2 wells with TCE concentrations exceeding MCL. Similarly, the there are 2 wells located east of the Palomares Cienega with elevated concentrations of TCE. These four wells are treated or blended to meet drinking water standards. **Figure 9-9** illustrates PCE and TCE concentrations for the reporting wells in the Six Basins area. Some levels of perchlorate have also been observed, but below notification levels.

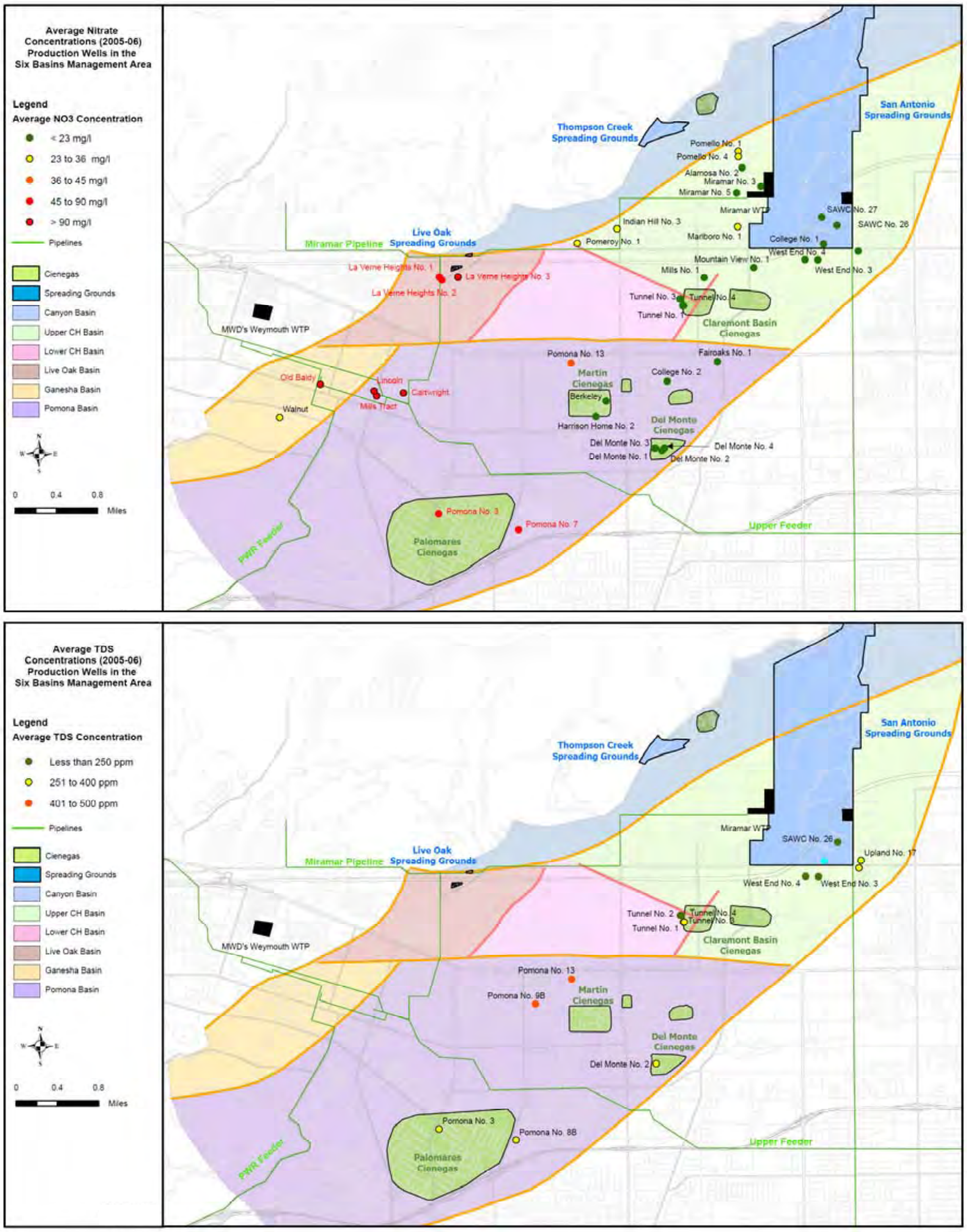
Blending Needs

The City of Pomona blends 60 percent of imported SWP water with treated groundwater to improve nitrate concentrations. The Golden State Water Company also blends with imported SWP water to improve nitrate concentrations. Blending needs are summarized in **Table 9-6**.

Groundwater Treatment

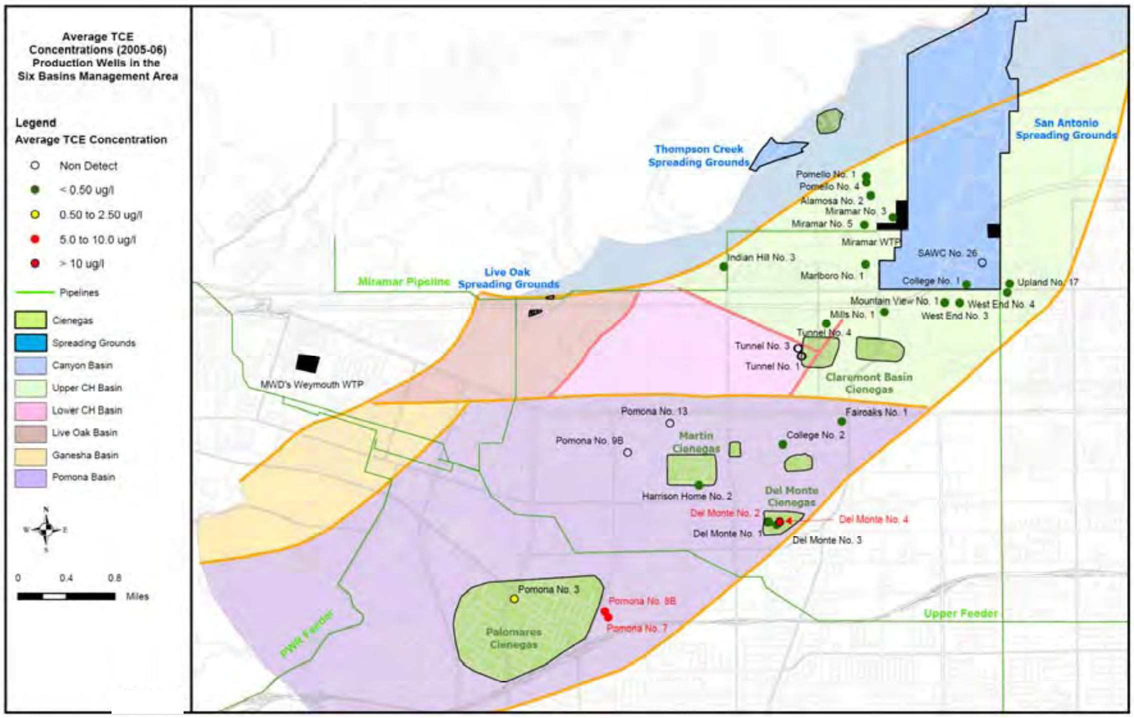
Table 9-7 summarizes the treatment type and constituents of concern for Six Basins. In addition, the city of La Verne is currently constructing ion exchange facilities for removal of nitrates in Live Oak Basin. It is estimated that up to 5,000 AFY additional production capacity can be achieved with groundwater treatment facilities over and above those mentioned here. (Three Valleys, 2006).

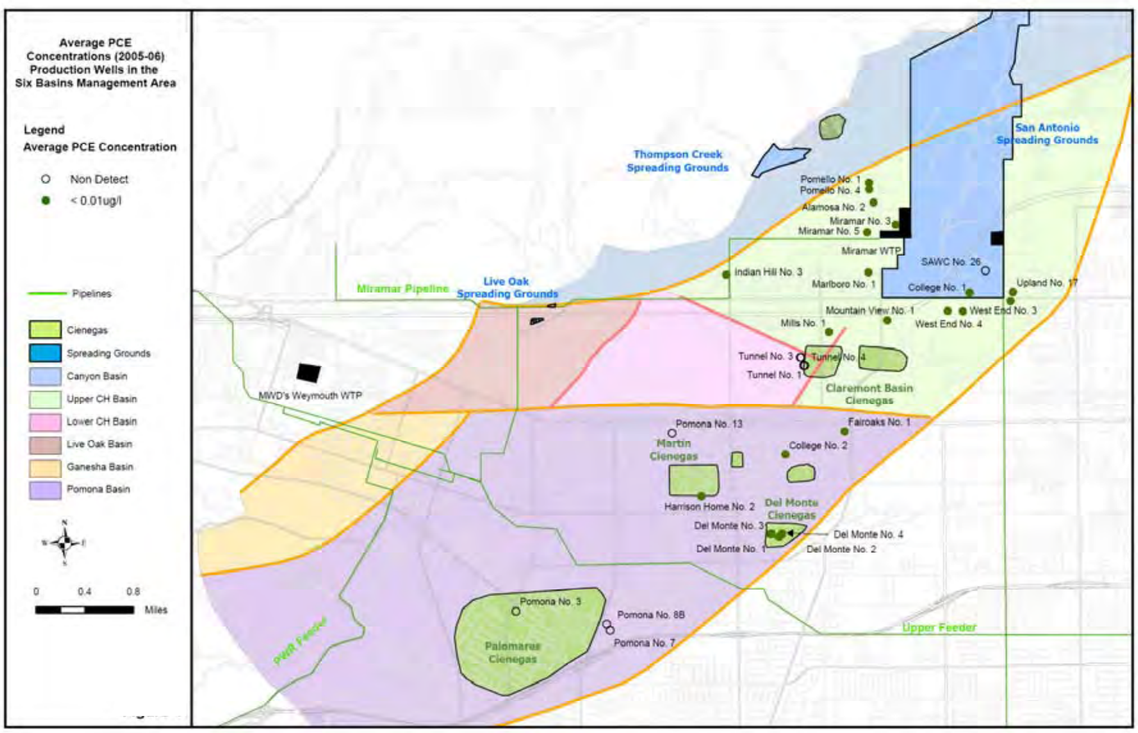
Figure 9-8
Nitrate and TDS Concentrations in the Six Basins



Source: Three Valleys, 2007

Figure 9-9
Volatile Organic Compound Concentrations in the Six Basins





Source: Three Valleys, 2007

Table 9-5
Summary of Constituents of Concern in Six Basins

Constituent	Units	Range	Description
TDS Secondary MCL = 500	mg/L	190 to 480	Below MCL of 500 in all basins (14 of 14 wells)
Nitrate (as N) Primary MCL = 10	mg/L	ND to 22	Above MCL in some portions of Pomona, Lower Claremont Heights and Live Oak Basins (13 of 44 wells exceed MCL and 24 of 44 wells are less than 50 percent of MCL)
VOCs (TCE and PCE) Primary MCL for TCE = 5 Primary MCL for PCE = 5	µg/L	ND to > 10 for TCE ND to < 0.01 for PCE	Above MCL in some portions of Pomona Basin. VOC treatment occurs in Pomona Basin (4 of 32 wells exceed MCL for TCE and no wells exceed MCL for PCE – 28 of 32 well had TCE concentrations less than 50 percent of MCL and all wells had PCE concentration less than 50 percent of MCL)
Perchlorate Notification level = 6	µg/L	< 6	No reported exceedances of notification level found in Six Basins

Source: Three Valleys, 2007

CURRENT GROUNDWATER STORAGE PROGRAMS

Metropolitan has recently implemented two conjunctive programs under the Proposition 13 program in the Six Basins. These include programs in the Live Oak and Upper Claremont Heights Basins. Each of these programs is described in **Table 9-8**. Total storage from these programs is 6,000 AF. As of June 30, 2006, about 610 AF was in storage under these combined programs.

Table 9-6
Summary of Blending Needs in the Six Basins

Purveyor	**Constituent Blended**	**Average Groundwater Blended (AFY)**
City of Pomona	Nitrate (blended with imported water)	1,363
Golden State Water Company	Nitrate (blended with imported water)	648
Total		**2,011**

Source: Three Valleys, 2006

Table 9-7
Summary of Groundwater Treatment in the Six Basins

# Wells	**Treatment Type**	**Constituents of Concern**	**Treatment Target**	**Treatment Cost**	**Amount Treated (AFY)**
3	Air-Strippin g	1,1-DCE PCE TCE	ND	$70/AF	1,363
2	GAC	VOC	ND	$81/AF	460

Source: Three Valleys, 2006

Live Oak Basin Conjunctive Use Project

Metropolitan, Three Valleys, and the City of La Verne executed the Live Oak Basin Conjunctive Use Project agreement on October 21, 2002. The Live Oak Conjunctive Use Project will allow the storage of up to 3,000 AF of water. Surplus water will be stored when available and during dry, drought, or emergency periods. Metropolitan will be able to recover 1,000 AF of water per year.

Table 9-8
Summary of Conjunctive Use Programs in the Six Basins

Program	Member Agencies	Year Began	Total Storage (AF)	Amount in storage [1] (AF)
Live Oak Conjunctive Use Program	Three Valleys	2002	3,000	610
Upper Claremont Heights Conjunctive Use Program	Three Valleys	2005	3,000	0

[1]As of June 30, 2006

Upper Claremont Heights Conjunctive Use Program (San Antonio Spreading Grounds Conjunctive Use Project)

In October 2005, Three Valleys entered into an agreement with Metropolitan to store up to 3,000 AF in the Upper Claremont Heights Basin. Three Valleys plans to construct a production well to take advantage of the available storage capacity in the Upper Claremont Heights Basin. Three Valleys has available storage within this basin as a part of an agreement with the Six Basins Watermaster. The Watermaster agreement provides Three Valleys with an annual storage account of up to 1,000 AF and an extraction limit of up to 3,500 AF that would be used for the program. Facilities to store water have not yet been completed for this program. Facility construction is expected to be completed by the end of 2007.

BASIN MANAGEMENT CONSIDERATIONS

Potential constraints to groundwater storage and extraction include:

- Because the shallower upstream basins production ability is largely dependent upon natural recharge, during dry years, these basins produce very little.

- Production limits as a result of the adjudication may limit ability to extract water from the Four Basins Area.

- Spreading may be limited in the Upper Claremont Heights Basin if water level index exceeds 1,475 feet MSL. New CDM model calculates amount of storage available for recharge based upon the 1,475 index. Additional monitoring wells wills be needed to monitor water levels.

- Rising groundwater conditions in the Pomona Basin may limit the ability to store water in the upstream basins.

- Groundwater quality, particularly nitrate and VOCs in the Live Oak, Pomona and Lower Claremont Basins may limit ability to store and extract water.

- In the event that there is imported water in storage that prohibits the spreading of local runoff, provisions in the Judgment would reduce the amount of imported water spreading by an equivalent amount of local surface water that could not be spread. Imported water would be the first stored water lost in the event that surface water could not be spread. As such, groundwater accounting would be affected.

References:

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Six Basins Watermaster (Six Basins), 2004. Preliminary Determination of Operating Safe Yield for calendar year 2005.

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Three Valleys Municipal Water District (Three Valleys), 2004. Initial Study/Mitigated Negative Declaration - Imported Water Spreading at San Antonio Spreading Grounds.

Three Valley Municipal Water District (Three Valleys), 2006 Groundwater Study Questionnaire.

Three Valley Municipal Water District (Three Valleys), 2007. Comments from Mike Sovich on Draft Groundwater Assessment Study, March 2007 dated June 12, 2007.

APPENDIX K

Leo J. Vander Lans Advanced Water Treatment Plant Expansion – Water Replenishment District

Water Replenishment District of Southern California

Alamitos Barrier Recycled Water Project

Feasibility Study

For Federal Funding under Title XVI of Public Law 102-575, as Amended

OCTOBER 1999

Submitted to:

United States Department of the Interior
Bureau of Reclamation

Prepared by:

PSOMAS
3187 Red Hill Avenue, Suite 250
Costa Mesa, California 92626

WRD
WATER REPLENISHMENT DISTRICT
OF SOUTHERN CALIFORNIA

SCANNED

October 21, 1999

Mr. Dennis Wolfe
U.S. Department of the Interior
Bureau of Reclamation
Southern California Office
27710 Jefferson Avenue, Suite 201
Temecula, California 92590-2628

Dear Mr. Wolfe:

Application for Federal Funding Assistance
Alamitos Barrier Recycled Water Project

Enclosed is an application for federal funding assistance from the U.S. Department of the Interior Bureau of Reclamation (Reclamation) for the Alamitos Barrier Recycled Water Project (Project) submitted by the Water Replenishment District of Southern California (District). Funding is available through the Reclamation Wastewater and Groundwater Study and Facilities Act of 1992 (Title XVI of Public Law 102-575), as amended by the Reclamation Recycling and Water Conservation Act (Public Law 104-266). Section 1628 of this amendment authorized Reclamation to participate in projects that increase water recycling in the city of Long Beach.

Also enclosed is the report "Alamitos Barrier Recycled Water Project - Feasibility Study for Federal Funding under Title XVI of Public Law 102-575, as Amended", October 1999. This was prepared in accordance with "Guidelines for Preparing, Reviewing, and Processing Water Reclamation and Reuse Project Proposals Under Title XVI of Public Law 102-575, as Amended", December 1999.

The project will receive disinfected tertiary treated effluent from the existing Long Beach Water Reclamation Plant, provide advanced treatment utilizing microfiltration and reverse osmosis, blend the product water with potable water, and then deliver the blend to the Alamitos Seawater Barrier. By doing so, 50 percent of the existing potable water supply currently used in the barrier will be replaced with recycled water, thereby improving the reliability of supply to the barrier. The Barrier is an engineered freshwater ridge and seawater trough that prevents the intrusion of seawater into the Central Groundwater Basin of Los Angeles County and the Orange County Groundwater Basin.

In Phase I, 3,000 acre feet per year of product water will be produced by the advanced treatment plant. Ultimately, it is desired to replace all of the potable water used at the

12621 E. 166th Street, Cerritos, California 90703 Phone (562) 921-5521 Fax (562) 921-6101

barrier; with improved efficiency of barrier operation, up to 8,000 acre feet per year of recycled water may be delivered to the barrier. Estimated cost for Phase I is $16.0 million. The federal share of funds is $4 million.

The feasibility study was based on cost estimates provided in May 1998 by Separation Processes, Inc., (SPI) a consultant to the District. However, you requested that the most current costs be reflected in the application with no contingencies on Standard Form 424C. Total project costs now total $16.0 million. Table 5-1's Project Capital Costs of the study would be revised to read in part as follows:

Project Capital Costs	Original	Revised
Capital Construction Costs	$13,333,675	$15,963,000
(less assumed USBR Grants)	($3,333,419)	($3,991,000)
Net Capital Costs	$10,000,256	$11,972,000
CSDLAC Connection Fee	$2,201,470	$0
Net Cost to WRD	$12,201,726	$11,972,000

The major changes are: 1) the capital construction costs are higher by about $2.6 million than the original estimate, and 2) the $2.2 million County Sanitation Districts of Los Angeles County (CSDLAC) Connection Fee, which is the sewer connection fee to for disposal of residuals from the treatment process, will not be a lump sum fixed fee to be paid prior to operation, but rather, an annual fixed fee. There is also a slight reduction in the operations and maintenance costs. The project is still considered economically feasible.

A Final Initial Study / Negative Declaration was certified by the Water Replenishment District of Southern California on November 19, 1998. Furthermore, Reclamation issued a Categorical Exclusion on July 22, 1999 for the Project.

If you have further questions, please call Mr. Hoover Ng, Program Manager, of my staff on (562) 407-1905.

Yours truly,

Robert L. Campbell

Robert L. Campbell,
General Manager

Enclosures (2)

APPLICATION FOR FEDERAL ASSISTANCE

OMB Approval No. 0348-0043

1. TYPE OF SUBMISSION: Application [x] Construction [ ] Non-Construction; Preapplication [ ] Construction [ ] Non-Construction	**2. DATE SUBMITTED**	Applicant Identifier
	3. DATE RECEIVED BY STATE	State Application Identifier
	4. DATE RECEIVED BY FEDERAL AGENCY	Federal Identifier

5. APPLICANT INFORMATION

Legal Name: Water Replenishment District of Southern California

Organizational Unit:

Address (*give city, county, State, and zip code*): 12621 E. 166th Street, Cerritos, CA 90703

Name and telephone number of person to be contacted on matters involving this application (*give area code*): Hoover Ng, 562-921-5521

6. EMPLOYER IDENTIFICATION NUMBER (*EIN*): 95-6006456

7. TYPE OF APPLICANT: (*enter appropriate letter in box*) N

A. State H. Independent School Dist.
B. County I. State Controlled Institution of Higher Learning
C. Municipal J. Private University
D. Township K. Indian Tribe
E. Interstate L. Individual
F. Intermunicipal M. Profit Organization
G. Special District N. Other (Specify) Special Water District

8. TYPE OF APPLICATION:

[x] New [ ] Continuation [ ] Revision

If Revision, enter appropriate letter(s) in box(es) [ ] [ ]

A. Increase Award B. Decrease Award C. Increase Duration
D. Decrease Duration Other(*specify*):

9. NAME OF FEDERAL AGENCY:

U.S. Dept. of the Interior
Bureau of Reclamation

10. CATALOG OF FEDERAL DOMESTIC ASSISTANCE NUMBER: [ ][ ]-[ ][ ][ ]

TITLE: 16, P.L.102-575, Amended P.L.104266

11. DESCRIPTIVE TITLE OF APPLICANT'S PROJECT:

The Alamitos Barrier Recycled Water Project willutilize recycled water to reduce the potable water at the existing seawater barrier, which prevents groundwater contamination.

12. AREAS AFFECTED BY PROJECT (*Cities, Counties, States, etc.*):

Long Beach, Seal Beach, Los Angeles and Orange Counties

13. PROPOSED PROJECT

Start Date	Ending Date
9/98	7/01

14. CONGRESSIONAL DISTRICTS OF:

a. Applicant: 39th
b. Project: 38th and 45th

15. ESTIMATED FUNDING:

a. Federal	$ 3,991,000	.00
b. Applicant	$ 11,972,000	.00
c. State	$	.00
d. Local	$	.00
e. Other	$	.00
f. Program Income	$	.00
g. TOTAL	$ 15,963,000	.00

16. IS APPLICATION SUBJECT TO REVIEW BY STATE EXECUTIVE ORDER 12372 PROCESS?

a. YES. THIS PREAPPLICATION/APPLICATION WAS MADE AVAILABLE TO THE STATE EXECUTIVE ORDER 12372 PROCESS FOR REVIEW ON:

DATE ________

b. No. [x] PROGRAM IS NOT COVERED BY E. O. 12372
[ ] OR PROGRAM HAS NOT BEEN SELECTED BY STATE FOR REVIEW

17. IS THE APPLICANT DELINQUENT ON ANY FEDERAL DEBT?

[ ] Yes If "Yes," attach an explanation. [x] No

18. TO THE BEST OF MY KNOWLEDGE AND BELIEF, ALL DATA IN THIS APPLICATION/PREAPPLICATION ARE TRUE AND CORRECT, THE DOCUMENT HAS BEEN DULY AUTHORIZED BY THE GOVERNING BODY OF THE APPLICANT AND THE APPLICANT WILL COMPLY WITH THE ATTACHED ASSURANCES IF THE ASSISTANCE IS AWARDED.

a. Type Name of Authorized Representative: Robert L. Campbell	b. Title: General Manager	c. Telephone Number: 562-921-5521
d. Signature of Authorized Representative: Robert L Campbell		e. Date Signed: 10/21/99

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Standard Form 424 (Rev. 7-97)
Prescribed by OMB Circular A-102

OMB Approval No.: 0348-0041

BUDGET INFORMATION - Construction Programs

NOTE: Certain Federal assistance programs require additional computations to arrive at the Federal share of project costs eligible for participations. If such is the case you will be notified.

	COST CLASSIFICATION	a. Total Cost	b. Costs Not Allowable for Participation	c. Total Allowable Costs (Column a-b)
1.	Administrative and legal expenses	$ 232,000 .00	$ .00	$ 232,000 .00
2.	Land, structures, rights-of-way, appraisals, etc.	$ 1,014,000 .00	$ 1,014,000 .00	$ 0 .00
3.	Relocation expenses and payments	$ 0 .00	$ .00	$ 0 .00
4.	Architectural and engineering fees	$ 1,255,000 .00	$ .00	$ 1,255,000 .00
5.	Other architectural and engineering fees	$ 726,000 .00	$ .00	$ 726,000 .00
6.	Project inspection fees	$ 322,000 .00	$ .00	$ 322,000 .00
7.	Site work	$ 1,211,000 .00	$ .00	$ 1,211,000 .00
8.	Demolition and removal	$ 0 .00	$ .00	$ 0 .00
9.	Construction	$ 10,500,000 .00	$ .00	$ 10,500,000 .00
10.	Equipment	$ 1,867,000 .00	$ .00	$ 1,867,000 .00
11.	Miscellaneous	$ 300,000 .00	$ .00	$ 300,000 .00
12.	SUBTOTAL (sum of lines 1-11)	$ 16,977,000 .00	$ 1,014,000 .00	$ 15,963,000 .00
13.	Contingencies	$ 0 .00	$ 0 .00	$ 0 .00
14.	SUBTOTAL	$ 16,977,000 .00	$ 1,014,000 .00	$ 15,963,000 .00
15.	Project (program) income	$ 0 .00	$ 0 .00	$ 0 .00
16.	TOTAL PROJECT COSTS (subtract #15 from #14)	$ 16,977,000 .00	$ 1,014,000 .00	$ 15,963,000 .00

FEDERAL FUNDING

17.	Federal assistance requested, calculates as follows: (Consult Federal agency for Federal percentage share). Enter the resulting Federal share.	Enter eligible costs from line 16c. Multiply X ~~25%~~	$ 3,991,000 .00

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Standard Form 424C (Rev. 4-92)
Prescribed by OMB Circular A-102

Standard Form 424D

OMB Approved No. 0348-0042

ASSURANCES -- CONSTRUCTION PROGRAMS

Note: Certain of these assurances may not be applicable to your project or program. If you have questions, please contact the Awarding Agency. Further, certain federal assistance awarding agencies may require applicants to certify to additional assurances. If such is the case, you will be notified.

As the duly authorized representative of the applicant I certify that the applicant:

1. Has the legal authority to apply for Federal assistance, and the institutional, managerial and financial capability (including funds sufficient to pay the non-Federal share of project costs) to ensure proper planning, management and completion of the project described in this application.

2. Will give the awarding agency, the Comptroller General of the United States, and if appropriate, the State, through any authorized representative, access to and the right to examine all records, books, papers, or documents related to the assistance; and will establish a proper accounting system in accordance with generally accepted accounting standards or agency directives.

3. Will not dispose of, modify the use of, or change the terms of the real property title, or other interest in the site and facilities without permission and instructions from the awarding agency. Will record the Federal interest in the title of real property in accordance with awarding agency directives and will include a covenant in the title of real property acquired in whole or in part with Federal assistance funds to assure nondiscrimination during the useful life of the project.

4. Will comply with the requirements of the assistance awarding agency with regard to the drafting, review and approval of construction plans and specifications.

5. Will provide and maintain competent and adequate engineering supervision at the construction site to ensure that the complete work conforms with the approved plans and specifications and will furnish progress reports and such other information as may be required by the assistance awarding agency or State.

6. Will initiate and complete the work within the applicable timeframe after receipt of approval of the awarding agency.

7. Will establish safeguards to prohibit employees from using their positions for a purpose that constitutes or presents the appearance of personal or organizational conflict of interest, or personal gain.

8. Will comply with the Intergovernmental Personnel Act of 1970 (42 U.S.C. §§ 4728-4763) relating to prescribed standards for merit systems for programs funded under one of the nineteen statutes or regulations specified in Appendix A of OPM's Standards for a Merit System of Personnel Administration (5. C.F.R. 900, Subpart F).

9. Will comply with the Lead-Based Paint Poisoning Prevention Act (42 U.S.C. §§ 4801 et seq.) which prohibits the use of lead based paint in construction or rehabilitation of residence structures.

10. Will comply with all Federal statutes relating to non-discrimination. These include but are not limited to: (a) Title VI of the Civil Rights Act of 1964 (P.L. 88-352) which prohibits discrimination on the basis of race, color or national origin; (b) Title IX of the Education Amendments of 1972, as amended (20 U.S.C. §§ 1681-1683, and 1685-1686) which prohibits discrimination on the basis of sex; (c) Section 504 of the Rehabilitation Act of 1973, as amended (29 U.S.C. § 794) which prohibit discrimination on the basis of handicaps; (d) the Age Discrimination Act of 1975, as amended (42 U.S.C. U.S.C. §§ 6101-6107) which prohibits discrimination on the basis of age; (e) the Drug Abuse Office and Treatment Act of 1972 (P.L. 93-255), as amended, relating to non-discrimination on the basis of drug abuse; (f) the Comprehensive Alcohol Abuse and Alcoholism Prevention, Treatment and Rehabilitation Act of 1970 (P.L. 91-616), as amended, relating to nondiscrimination on the basis of alcohol abuse or alcoholism; (g) §§ 523 and 527 of the Public Health Service Act of 1912 (42 U.S.C. 290 dd-3 and 290 ee-3), as amended, relating to confidentiality of alcohol and drug abuse patient records; (h) Title VIII of Civil Rights Act of 1968 (42 U.S.C. §3601 et seq.), as amended, relating to non-discrimination in the sale, rental or financing of housing; (i) any other non-discrimination provisions in the specific statute(s) under which application for Federal assistance is being made, and (j) the requirements on any other non-discrimination Statute(s) which may apply to the application.

11. Will comply, or has already complied, with the requirements of Titles II and II of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (P.L. 91-646) which provides for fair and equitable treatment of persons displaced or whose property is acquired as a result of the Federal and Federally assisted programs. These requirements apply to all interests in real property acquired for project purposes regardless of Federal participation in purchases.

Standard Form 424D (cont'd.)

12. Will comply with the provisions of the Hatch Act (5 U.S.C. §§ 1501-1508 and 7324-7328) which limit the political activities of employees whose principal employment activities are funded in whole or in part with Federal funds.

13. Will comply, as applicable, with the provisions of the Davis-Bacon Act (40 U.S.C. §§ 276a to 276a-7), the Copeland Act (40 U.S.C. § 276c and 18 U.S.C. § 874), the Contract Work Hours and Safety Standards Act (40 U.S.C. §§ 327-333) regarding labor standards for federally assisted construction subagreements.

14. Will comply with the flood insurance purchase requirements of Section 102(a) of the Flood Disaster Protection Act of 1973 (P.L. 93-234) which requires recipients in a special flood hazard area to participate in the program and to purchase flood insurance if the total cost of insurable construction and acquisition is $10,000 or more.

15. Will comply with environmental standards which may be prescribed pursuant to the following: (a) institution of environmental quality control measures under the National Environmental Policy Act of 1969 (P.L. 91-190) and Executive Order (EO) 11514; (b) notification of violating facilities pursuant to EO 11738; (c) protection of wetlands pursuant to EO 11990; (d) evaluation of flood hazards in floodplains in accordance with EO 11988; (e) assurance of project consistency with the approved State management program developed under the Coastal Zone Management Act of 1972 (16 U.S.C. §§ 1451 et seq.); (f) conformity of Federal actions to State (Clean Air) Implementation Plans under Section 176(c) of the Clean Air Act of 1955, as amended (42 U.S.C. § 7401 et seq.); (g) protection of underground sources of drinking water under the Safe Drinking Water Act of 1974, as amended, (P.L. 93-523); and (g) protection of endangered species under the Endangered Species Act of 1973, as amended, (P.L. 93-205).

16. Will comply with the Wild and Scenic Rivers Act of 1968 (16 U.S.C. §§ 1271 et seq.) related to protecting components or potential components or potential components of the national wild and scenic rivers system.

17. Will assist the awarding agency in assuring compliance with Section 106 of the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470), EO 11593 (identification and preservation of historic properties), and the Archaeological Historic Preservation Act of 1974 (16 U.S.C. 469a-1 et seq.).

18. Will cause to be performed the required financial and compliance audits in accordance with the Single Audit Act of 1984.

19. Will comply with all applicable requirements of all other Federal laws, Executive Orders, regulations and policies governing this program.

SIGNATURE OF AUTHORIZED CERTIFYING OFFICIAL	TITLE
Robert L Campbell	General Manager
APPLICANT ORGANIZATION	DATE SUBMITTED
Water Replenishment District of Southern California	10/21/99

FEASIBILITY STUDY

Water Replenishment District of Southern California
Alamitos Barrier Recycled Water Project

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EXECUTIVE SUMMARY

The Alamitos Barrier is an engineered freshwater pressure ridge seawater trough located in the City of Long Beach, California. The Barrier is designed to protect the Central Groundwater Basin of Los Angeles County and the Orange County Groundwater Basin from seawater intrusion. Currently, the Barrier is maintained through injection of treated, imported potable water.

The Water Replenishment District of Southern California proposes to replace fifty-percent of the potable water currently used in the Alamitos Barrier Project (ABP) with treated recycled water obtained from the Long Beach Water Reclamation Plant (LBWRP). The objective of the proposed project is to reduce dependence of the ABP on imported water, while maintaining the seawater barrier.

The proposed project site is four acres in size and located between the San Gabriel River and Coyote Creek, just north of the LBWRP. Project facilities would consist of a treatment plant, with microfiltration and reverse osmosis units, a booster pump station, pipelines, and associated electrical/communication connections to existing utilities. Residuals from the reverse osmosis and microfiltration process would be discharged into the existing trunk sewer that conveys LBWRP solids to the County Sanitation District's Joint Water Pollution Control in Carson. In 1995, an Initial Study/Negative Declaration (IS/ND) was prepared for the same project, except that the process residuals were proposed to be discharged into the San Gabriel River, including the San Gabriel River estuary; reviewers of the document differed with the conclusion. Subsequent changes in the project design, including the discharge of residuals into the sewer system instead of the river, have lead to the revised environmental analysis presented in the final IS/ND certified by WRD on November 19, 1998 and in this document. The IS/ND conforms to requirements of the California Environmental Quality Act (CEQA). A federal nexus is derived from potential involvement of the US Bureau of Reclamation (USBR) providing future funding for the project. A separate environmental document has been prepared by the USBR to comply with the National Environmental Policy Act (NEPA) regulations.

The alternatives evaluated for this project included varying blended portions of recycled water for injecting into the barrier. The amount of recycled water considered for the ABRWP was 100%, 50%, and 20%. The proportions were then analyzed to determine the most cost effective and environmentally feasible alternative. The 50% alternative was deemed the most feasible.

In the initial stages of the project, the system will utilize approximately 3,000 acre-feet per year (afy) of recycled water as injection into the barrier, with the ultimate goal of replacing 8,000 afy of potable water with recycled water, given appropriate regulatory and environmental approval.

Design and environmental concerns raised in the 1995 version of the project have been addressed and are incorporated into the proposed project. Analysis of environmental impacts of the proposed project concludes that the project would have no significant impacts on the environment. These findings resulted in a Negative Declaration being certified by WRD on November 19, 1998.

The economic analyses conducted as part of this study determined that in order to make the Alamitos Barrier Recycled Water Project (ABRWP) economically feasible, outside funding assistance would be need. The funding sources identified for this project include:

- The United States Bureau of Reclamation (USBR) Project Funding Assistance, 25 percent cost sharing grants.

- Metropolitan Water District of Southern California (MWD) Local Resources Program (LRP). Under the proposed LRP, the requested contribution of MWD, when converted to its total present worth for a 25-year term, is equal to $95 per acre-foot (AF).

The economic viability of the proposed project will be determined in part by the funding assistance provided by the 25 percent cost-sharing grant from USBR in combination with the Metropolitan LRP rebates. It is therefore recommended that the ABRWP apply for Title XVI Grant Funding from USBR.

The use of recycled water at the Barrier would represent a significant step forward in using innovative methods to continue protecting local groundwater resources from seawater intrusion while conserving California's precious water resources. With the assistance of the federal grant money being sought, the goal of the proposed project to lessen the demand placed on potable water by replacing approximately 3,000 acre-feet per year with recycled water can be achieved and will allow a greater use of the excess potable water for other needs. Additionally, as the cost of imported water rises, the Alamitos Barrier Recycled Water Project (ABRWP) would become increasingly more cost effective.

SECTION 1 INTRODUCTION

Introduction

This Feasibility Study of the use of recycled water at the Alamitos Barrier Project (ABP) represents a significant step forward in using innovative methods to continue protecting the local groundwater resources from seawater intrusion while conserving California's precious water resources. The ABP was designed and constructed to protect the groundwater supplies of the Central Basin of Los Angeles County and the East Coastal Plain area of Orange County from the intrusion of seawater through the Alamitos Gap and has been operational since 1965. The project facilities, located near the Los Angeles-Orange County line about two miles inland of the mouth of the San Gabriel River include injection wells to form a freshwater pressure ridge and extraction wells to form a trough which breaks the landward gradient of intruding seawater.

Currently, fresh water for injection at the Alamitos Barrier consists of treated, imported State Water Project and/or Colorado River potable water. In the early 1990s, it was conceived that 50 percent of this potable water could be replaced by recycled water. This replacement would reduce the amount of imported water required in Southern California, and also provide a beneficial use for excess recycled water. In 1995, CH2M Hill prepared an Initial Study/Mitigated Negative Declaration (IS/ND) for the Alamitos Barrier Recycled Water Project (ABRWP), in compliance with requirements of the California Environmental Quality Act (CEQA). However, this document was never certified and the project did not go forward, at least partly because the project at that time proposed to release process residuals into the San Gabriel River. This proposal lead to concerns about the impacts on the San Gabriel River estuary, a significant biological resource located south and downstream of the project site.

Since 1995, a number of technological and design improvements to the ABRWP have been incorporated, and discharge of process residuals will not be discharged into the San Gabriel River. Instead, the process residuals would be discharged into the sewer system and treated by the Los Angeles County Sanitation District's sewerage system. This alternative was considered in previous environmental documentation, however, it was not the preferred alternative. Changes in the project design itself warranted new environmental documentation. In addition, the Water Replenishment District of Southern California (WRD) is seeking cost share funding from the US Bureau of Reclamation (USBR). Consequently, the most recently completed IS/ND (Psomas and Associates, September 28, 1998) was used to update the previous document and satisfy state (CEQA) requirements. This IS/ND was certified by the WRD Board of Directors on November 19, 1998.

Background

The Central Groundwater Basin of Los Angles County and the Orange County Groundwater Basin, which are geologically one basin, provide over 50 percent of the total water demand for the region, and thus serve as very important water resources.

The Alamitos Barrier, an engineered freshwater pressure ridge and seawater trough, is designed to protect these groundwater basins from intrusion of seawater through an alluvium-filled erosional gap, commonly known as the Alamitos Gap. The Gap is located near the Los Angeles-Orange County line, two miles upstream from the mouth of the San Gabriel River. The pressure ridge is created by the injection of fresh water into the groundwater aquifer through 35 wells located in an arc spanning the Alamitos Gap. The trough is created by the extraction of brackish groundwater from four wells located on the seaward side of the injection well arc, and barrier performance is monitored through observations conducted at 230 monitoring wells located at multiple sites near the Alamitos Gap.

The combination of wells is designed to reverse the inland gradient of subsurface water and thus prevent further seawater intrusion. Fresh water for injection to the Alamitos Barrier consists of treated, imported State Water Project and/or Colorado River water obtained through a turnout from the Metropolitan Water District of Southern California's (MWD) South Coast Feeder. Monitoring wells in the vicinity of the barrier provide data for tracking the migration of seawater in and around the barrier.

The Water Replenishment District of Southern California (WRD) and the Orange County Water District (OCWD) currently purchase imported water for injection to the Barrier from MWD. WRD and OCWD have jointly embarked on a recycled water program for the Alamitos Barrier to reduce the use of the potable imported water supply, thereby benefiting the entire region. The use of recycled water at the Barrier would represent a significant step forward in using innovative methods to continue protecting local groundwater resources from seawater intrusion while conserving California's precious water resources. In addition, as the cost of imported water rises, the Alamitos Barrier Recycled Water Project (ABRWP) would become increasingly more cost effective.

Prompted in part by the successful use of recycled water for injection at the Talbert Gap Barrier in Orange County by OCWD, the agencies that have an interest in the ABRWP began initial investigations into the possibility of substituting recycled water at the Alamitos Barrier, as well. The Long Beach Water Reclamation Plant (LBWRP), located approximately two miles from the Alamitos Barrier, was identified as a potential source of recycled water for this purpose. The LBWRP already provides substantial quantities of recycled water for irrigation of parks, golf courses and green belts in the Long Beach area.

The current total production of the LBWRP is 23,000 afy. The average annual demand of customers currently served with recycled water from the LBWRP is 4,000 afy. Phased expansion of the recycled water system calls for the addition of 82 new users to the system with an estimated recycled water demand of 7,900 afy. Current demands and planned future demands total approximately 11,900 afy, which is well below the LBWRP production level of 23,000 afy. LBWRP staff has stated that the LBWRP has sufficient capacity to provide treated effluent for the proposed project.

In December 1995, CH2M Hill issued the contract documents and conceptual documents for the design and construction of the ABRWP. These documents were prepared for WRD and OCWD, and it was anticipated that the project would be implemented through the design/build project approach. Financing and permitting for the project exceeded required timelines and the project was deemed not economically feasible at that time. Since then, the technologies to be used in the project have advanced. In March 1998, WRD asked Separation Processes, Inc. to reevaluate the feasibility of the project for delivery of 3,000 acre feet per year (afy) of water. The project description, as described in Section 4 of this Study, incorporates modification to the project discussed in the evaluation.

As currently envisioned, the first phase of the ABRWP, which would supply 3,000 afy, or half the total water demand for the Alamitos Barrier, could be completed by the year 2001 for a total cost of about $16 million. Net project costs would be competitive with the cost of imported water used for the barrier if financial assistance is secured. As the cost of imported water rises, the ABRWP would become increasingly more cost effective. The second phase of the project would provide close to 100 percent of the water needs for the barrier if regulatory approval were granted.

Purpose of the Study

The purpose of this Feasibility Study is to provide an evaluation of the proposed project for WRD's application for project funding under the requirements of the U.S. Bureau of Reclamation Title XVI Water Recycling Grant Funding Program.

The primary objective of the ABRWP is to develop a reliable and constant supply of recycled water to the Alamitos Barrier to maintain the existing seawater barrier and to minimize reliance on MWD imported water sources, thereby improving the reliability of supply to the ABP. Maintaining the barrier during a drought is critical, and since recycled water would not be subject to reductions during a drought, this would allow WRD to continuously maintain the barrier. It will also enable agencies to continue to safely pump from the groundwater basin even if imported water supply from MWD is partially cut.

Preparer and Non-Federal Project Sponsor

Preparer:
Psomas
Costa Mesa, California
WRD retained Psomas to assist in the development of the ABRWP, including the preparation of this Feasibility Study as required under the U.S. Bureau of Reclamation Title XVI Water Recycling Grant Funding Program.

Non-Federal Project Sponsor:
Water Replenishment District of Southern California (WRD)
Cerritos, California
The Water Replenishment District of Southern California (WRD) covers approximately 420 square miles of groundwater resources in the southern half of Los Angeles County, and serves 43 cities. WRD's purpose is to protect the groundwater resources of the Central and West Coast groundwater basins in Southern Los Angeles County. WRD's mission is "To provide a sufficient supply of high quality groundwater in the Central and West Coast Basins through progressive, cost effective and environmentally sensitive basin management."

Study Area

The Alamitos Barrier Project (ABP) was designed and constructed to protect the groundwater supplies of the Central Basin of Los Angeles County and the East Coastal Plain area of Orange County from the intrusion of seawater through the Alamitos Gap. The project facilities, located near the Los Angeles-Orange County line about two miles inland from the mouth of the San Gabriel River, include injection wells to form a freshwater pressure ridge and extraction wells to form a trough, which breaks the landward gradient of intruding seawater. Figure 1-1 illustrates the location of the Alamitos Barrier Recycled Water Project and the ABP.

Project Site

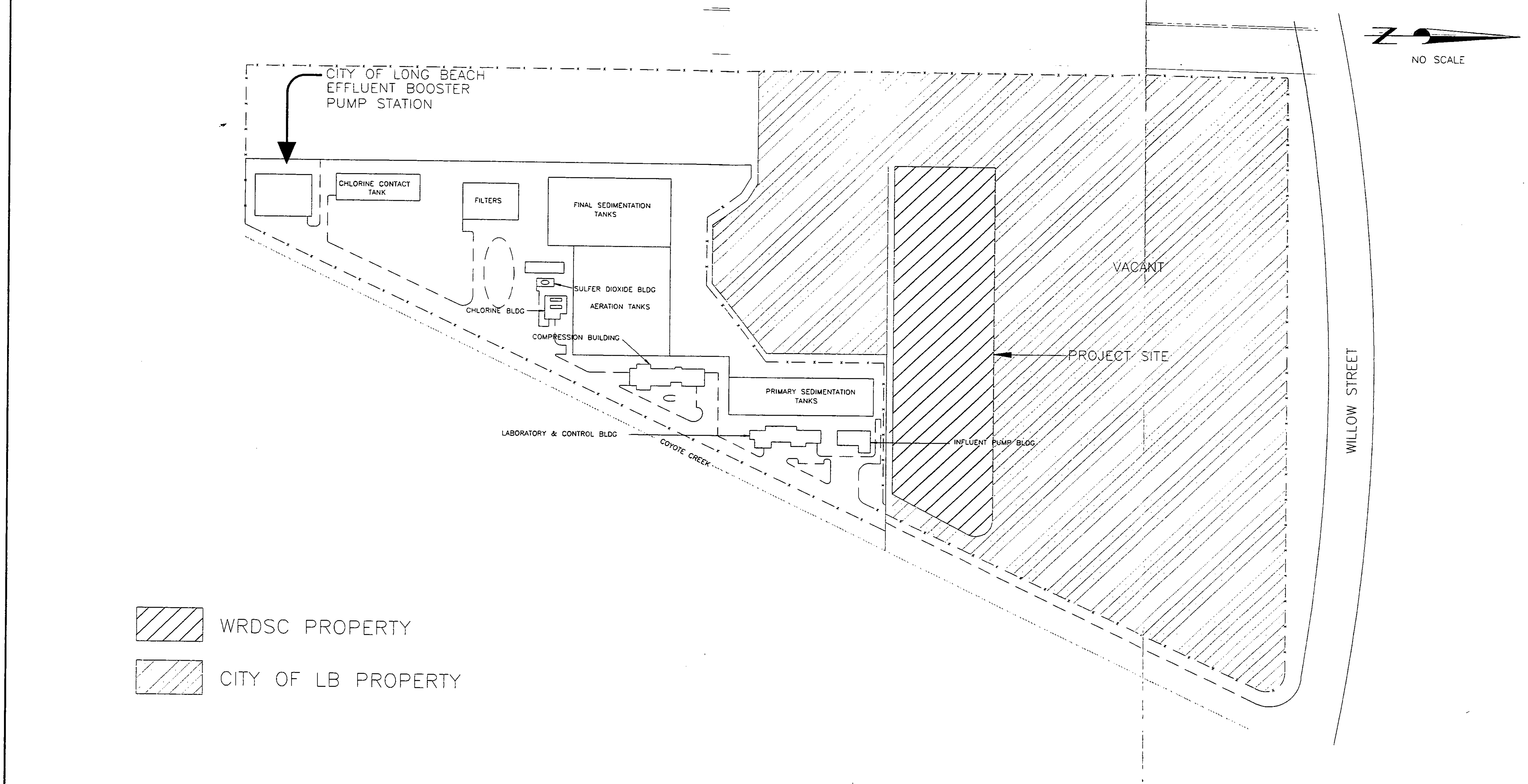
The proposed project site is 4 acres in size and located between the San Gabriel River and Coyote Creek, just north of the LBWRP. The project site is currently undeveloped, vacant land, occupied by non-native annual grassland that is frequently disked for weed abatement purposes. There is also a narrow, open, concrete-lined storm drain that crosses the site in the northeastern corner. An Edison powerline right-of-way and the San Gabriel River to the west, a four-lane street (Willow Street), border the site to the north, Coyote Creek and access road to LBWRP to the east, and the existing LBWRP to the south. Both the San Gabriel River and Coyote Creek are concrete-lined, trapezoidal channels in the reaches that border the site. Surrounding land uses include a park, golf course, and bike trails along the San Gabriel River and Coyote Creek. Commercial buildings are located east of the project on the other side of Coyote Creek, and a residential area is located 0.5 mile south of the site. View of the site is obscured along the eastern and southern boundaries due to presence of eucalyptus trees and other ornamental plantings. Plantings and landscaping associated with the proposed project would additionally reduce visibility of the facilities from nearby areas. Figure 1-2 shows the proposed project site plan.

ALAMITOS BARRIER RECLAIMED WATER PROJECT

PROJECT LOCATION

SCALE 1"=4000'

FIGURE 1-1



ALAMITOS BARRIER RECLAIMED WATER PROJECT

SITE LOCATION

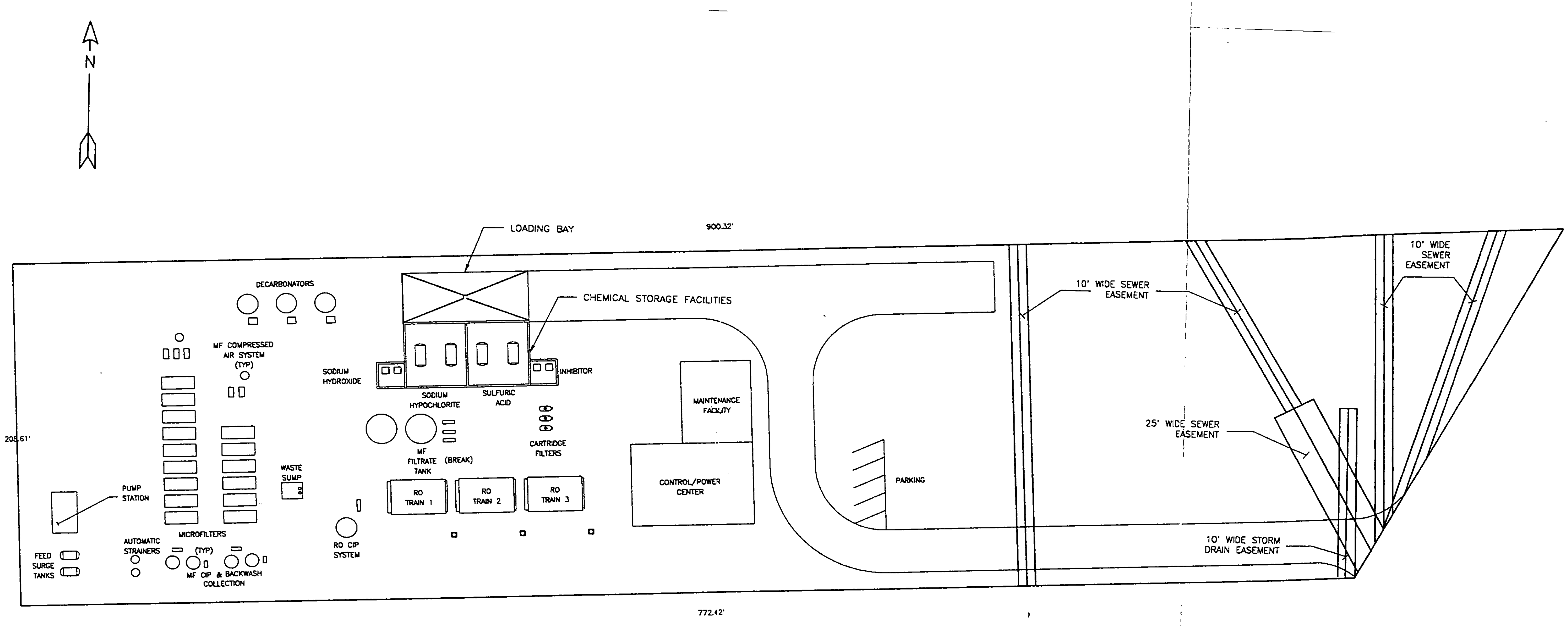
FIGURE 1-2

Project Facilities

Project facilities would consist of a treatment plant, with microfiltration and reverse osmosis units, a booster pump station, pipelines, and associated electrical/communication connections to existing utilities. The proposed site layout is shown in Figure 1-3. Residuals from the reverse osmosis and microfiltration process would be discharged into the existing trunk sewer that conveys LBWRP solids to the County Sanitation District's Joint Water Pollution Control Plant in Carson. The Process Flow Diagram is shown in Figure 1-4.

In 1995, an Initial Study/Negative Declaration (IS/ND) was prepared for the same project, except that the process residuals were proposed to be discharged into the San Gabriel River. While the IS/ND concluded that such disposal would not significantly impact water quality in downstream reaches of the San Gabriel River, including the San Gabriel River estuary, reviewers of the document differed with this conclusion. Subsequent changes in the project design, including discharge into the sewer system instead of the river, have lead to the revised environmental analysis presented in the September 28, 1998 Initial Study/Negative Declaration for the Alamitos Barrier Recycled Water Project. The analysis conformed to requirements of the California Environmental Quality Act (CEQA) and with National Environmental Policy Act (NEPA) regulations.

Design and environmental concerns regarding water quality, raised in the previous version of the proposed project have been addressed and are incorporated into the current proposed project. Analysis of environmental impacts of the proposed project concludes that the project, as described in Section 4, Description of Alternatives, would have no significant impacts on the environment. In preparing the environmental document, it was determined that the findings warranted the preparation of a Negative Declaration under CEQA



CIP	= CLEAN IN PLACE
RO	= REVERSE OSMOSIS
MF	= MICROFILTRATION
DASHED UNITS	= POTENTIAL FUTURE EXPANSION UNITS
═	= CONTAINMENT FACILITIES

REV	DATE	DESCRIPTION	DRAWN	APP.

SEPARATION PROCESSES, INC.

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

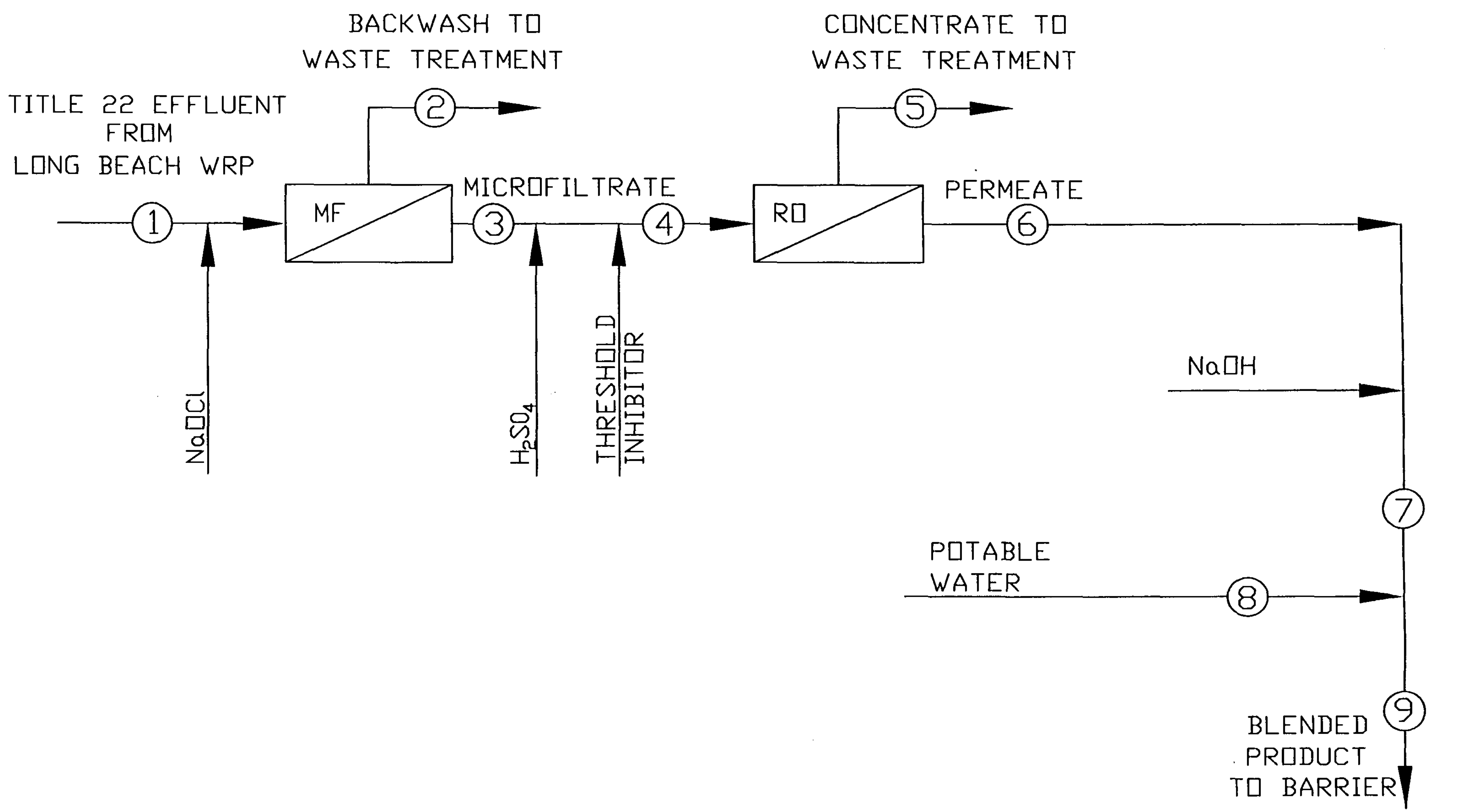
DIMENSIONAL TOLERANCE (UNLESS SPECIFIED) FRACTIONS ± 1/2" DECIMALS (INCHES) XX 0.1 XXX 0.01 XXXX 0.001 ANGLES (DEGREES) ± 1/2

DRAWN BY: B S KOPP DATE: 09-15-98
CHECKED BY: G. POOLE DATE:
APPROVED BY: DATE:
CLIENT APPROVAL: DATE:
CLIENT APPROVAL: DATE:

ALAMITOS BARRIER RECLAIMED WATER PROJECT
PRELIMINARY PLANT DESIGN

SCALE: NO SCALE
DRAWING NUMBER: FIGURE 1–3
SHEET
REVISION

F:\WATER\WAT0205\DRAWINGS\Figure1-4.dwg



ALAMITOS BARRIER RECLAMATION PLANT
PROCESS FLOW DIAGRAM

FIGURE 1-4

SECTION 2 PROBLEMS AND NEEDS

Key Water Management Problem

Southern California is a semi-arid region that depends heavily on imported water from the Colorado River and Northern California through the State Water Project. The high cost of imported water and the uncertainty of its reliability in time of drought are of great concern. Water managers are looking to other sources for reliability. The primary project objective of the ABRWP is to develop a reliable and constant supply of water to the Alamitos Barrier to maintain the existing seawater barrier and minimize reliance on imported water sources. Maintaining the barrier during a drought is critical, and since recycled water would not be subject to cuts during a drought, this would allow WRD to continuously maintain the barrier. It would also enable agencies to continue to safely pump from the groundwater basin even if the imported water supply from the Metropolitan Water District of Southern California (MWD) was partially cut. The ABRWP would obtain treated recycled water from the Long Beach Water Reclamation Plant at, essentially, an uninterrupted flow and would meet the Regulatory Requirements of the agencies involved, as well as the operational requirements imposed by the City of Long Beach and WRD.

The ABRWP would accomplish the following objectives: 1) increase the permitted use of recycled water for groundwater recharge, 2) increase the use of recycled water for seawater intrusion barriers, and 3) develop a reliable and constant supply of recycled water to the Alamitos Barrier.

Near- and Long-Term Water Demand and Supplies in the Alamitos Barrier

WRD encompasses a dense urban/suburban area that results in heavy demands on the groundwater supply. A population of nearly 4 million resides within the District with an average density of 9,500 persons per square mile (15 persons/acre). Many industrial and commercial land uses also exist within the Central and West Coast Basins, which furthers the consumption of water. The area's water demand averages approximately 625,000 acre-feet per year (afy). The Alamitos Barrier protects the Central Groundwater Basin of Los Angeles County and the Orange County Groundwater Basin from seawater intrusion, which are geologically one basin. They are important sources of local groundwater that meet over 40 (or 250,000 afy) percent of the water demands in the region.

The Alamitos Barrier Project (ABP) currently uses between 5,000 and 7,000 afy of MWD imported State Water Project or Colorado River water for injection into the barrier. Given the increasing shortage and rising costs of imported water in southern California, it is important that new and innovative ways to conserve this valuable resource be investigated.

The ABRWP proposes to initially produce and utilize approximately 3,000 afy of recycled water in the ABP, with possible ultimate facility production and utilization of 8,000 afy, should regulatory conditions allow.

The ABRWP benefits the region in two ways: First, use of recycled water makes more potable water available to the entire region. Second, recycled water deliveries will be maintained in a drought, allowing the barrier to function even if a portion of the imported water supply is cut. This is critical, especially in a drought, because groundwater production can only be maintained at pre-drought levels if the barrier is functioning. The use of recycled water at the ABP would represent a significant step forward in using innovative methods to continue protecting the local groundwater resources from seawater intrusion while conserving California's precious water resources.

Cost to Develop the Water Supplies

WRD retained Separation Processes, Inc. (SPI) of Vista, California, to develop the microfiltration (MF) and reverse osmosis (RO) process, including development of cost estimates for facilities development, operating and maintenance manuals, site inspection services, facility construction, and other related requirements during startup and demonstration testing.

SPI presented MF and RO options, and recommended the TFC-HR (thin film composite – high rejection) membrane without the chlorine contact basin as the optimum method for the ABRWP. Thin film composite (TFC) membrane is a composite of a polysulfone porous support and an ultra thin film polyamide membrane barrier layer. The TFC membrane has been extensively tested at the Orange County Water District's Water Factory 21, West Basin Water Reclamation Facility, San Diego's San Pasqual test facility, and Scottdale, Arizona's Gainey Ranch Municipal Wastewater Reclamation test facility. It is now the membrane of choice and composite polyamide membrane from three membrane element manufacturers has been qualified.

In order to estimate the costs of the project, SPI clearly defined the project in their report reevaluating the ABRWP. Net project costs are estimated at $15.5 million as shown on Table 2-1.

WRD is seeking additional funding sources to reduce the total project cost to WRD and its constituents. MWD has approved the ABRWP for Local Resources Program funding beginning at $209 per acre-foot of recycled water produced in Fiscal Year 2001 and declining to $151 per acre-foot at the end of the 25 year term.

Table 2-1. ABRWP Estimated Capital Costs

Alamitos Barrier Recycled Water Project	**Current Costs**
Total Project Capital Cost	$13,333,675
LACSD Connection Fee	2,201,470
Total Project Cost	**$15,535,145**
Detail of Capital Costs	
Microfiltration	$2,981,000
MF Installation	$ 490,000
Reverse Osmosis	$2,700,000
Influent Pump Station	$ 180,000
Effluent Pump Station	$ 150,000
Miscellaneous	$ 325,050
Total Equipment	$6,826,050
Site Development	$ 850,000
Covered Pads - MF	$ 360,000
Covered Pads - RO	$ 262,500
Interconnecting Piping	$1,023,908
Engineering	$ 932,246
Project Administration	$ 466,123
Subtotal	$10,720,827
Contingency – 20%	$2,144,165
Sales Tax – MF & RO	$ 468,683
Total Estimated Capital Costs	**$13,333,675**

SECTION 3 WATER REUSE OPPORTUNITIES

Opportunities for Water Reuse and Sources of Water

The opportunity for water reuse in the study area is solely for the purpose of groundwater recharge, which will in turn protect the groundwater basin from seawater intrusion. The source of water to be used in the project would come from the Long Beach Water Reclamation Plant (LBWRP), located approximately two miles from the Alamitos Barrier, and adjacent to the advanced treatment facility of the ABRWP.

The LBWRP already provides substantial quantities of recycled water for the irrigation of parks, golf courses and greenbelts in the Long Beach area. For the ABRWP, the LBWRP would provide tertiary treated effluent, which has been treated to meet Title 22 non-potable use standards. Its quantity would be upgraded to meet the standards required for injection into the Alamitos Barrier using microfiltration and reverse osmosis. This advanced treated water would initially be blended with potable water at a 50 percent blend for injection into the Barrier. Ultimately, 100 percent recycled water is desired for injection, making more potable water available for other uses.

As currently envisioned, the initial plant effluent capacity would be 3.0 million gallons per day (mgd), which when operated at full capacity for 90% of the time (328.5 days per year) would produce 3,023.9 acre feet per year (afy) of reverse osmosis permeate. The plant would be designed to accommodate future expansion to 8.0 mgd of reverse osmosis permeate at some future date, should sufficient supply be available and regulatory conditions permit.

Status of Water Reuse and Water Reclamation Technology for the Project / Opportunities for Development of Improved Technologies

Resolution of public policy questions concerning the recharge of our drinking water aquifers with recycled water is among the most important questions in water. Water agencies are responsible for protecting and ensuring the quality of water within the basin served and are also accountable for the cost of water it uses for replenishment. The proposed ABRWP uses state-of-the-art technology to provide water quality that ensures regulatory compliance and public acceptance. The use of this technology also encourages innovation by the equipment manufacturers that leads to further improvements. For example, equipment prices for microfiltration systems have decreased approximately 25 percent from one year ago in direct response to competition brought about by Southern California water recycling efforts.

The project provides a state of the art solution to a fundamental policy question; the need to conserve potable water. The seawater barriers themselves and the use of recycled water as supply to those barriers are models of responsible water management. The ABRWP serves as an important demonstration of new technology and a monument to innovative public works projects.

Potential Uses of Recycled Water

The ABRWP represents a sustained and permanent source of dependable water for Southern California. The supply of water to the barrier is vital for protection of water supplies in the Central and Orange County Groundwater Basins, and the ABRWP is a dedicated supply source for that use. Whereas, many projects may develop supplies for uses that could potentially be reduced or eliminated in a severe drought, the ABRWP supplies an absolutely essential and consistent use.

SECTION 4 DESCRIPTION OF ALTERNATIVES

Alternatives Considered

The project objective, for which facility alternatives have been developed, is to provide the most cost-effective system to receive, treat and deliver water from the LBWRP to the ABRWP that satisfies the needs of the project and all regulatory, public health and operational requirements. Several alternatives were investigated and consist of the following (a more detailed description of each will follow later in this section):

1. **Maximum Reuse** – Uses 100 percent recycled water as injection into the barrier.
2. **Preferred Reuse** – The preferred alternative uses 50 percent recycled water as injection into the barrier.
3. **Minimum Reuse** – Uses 20 percent recycled water as injection into the barrier.

Four major studies have been conducted for the Alamitos Barrier Recycled Water Project: CDM (1991), CH2M Hill (1994), WRD (1996), and Separation Processes, Inc. (1998). The following discussions are based on the information contained in these reports.

No Action Alternative

Required as part of CEQA and NEPA documentation, a No Project alternative was considered as part of the analysis to determine the most environmentally feasible project alternative. In the environmental documents prepared, it was determined that there would be no significant effect on the environment with or without the project.

The ultimate impact on potable water supplies if the project does not go forward as proposed will lead to a greater demand and use placed upon existing sources. In times of drought, the reliability of sources used will be undependable and may fluctuate given the severity and duration of the drought, which in turn may lead to possible saltwater contamination of the barrier.

Further to the analysis of a No Project alternative, if the project does not go forward as proposed, the Alamitos Barrier would continue to be maintained with 100 percent potable water. The site of the proposed project would remain undeveloped.

Alternative if No Federal Funding

While federal funds for the project improve the overall economics of the project, WRD has allocated funds sufficient to cover the full capital cost of the facility. WRD has appropriated $16.8 million for the Alamitos Barrier Recycled Water Project construction fund, and is committed to proceed to construct, demonstrated by resolution dated September 17, 1998 (Exhibit B).

In particular, federal grant funds are being sought from the US Bureau of Reclamation (USBR) consistent with an authorization contained in Title 16 of Public Law 102-575 and amended in Public Law 104-266. It is understood that this authorization allows for the USBR to reimburse up to 25 percent of the project capital costs. Federal grant funds, would provide approximately $3.33 million for the ABRWP. Without this federal funding, the cost of debt service would increase, thereby increasing the overall cost of the project.

Analysis of Alternative Recycled Water Measures or Technologies for the Project

Alternatives considered for treatment of the recycled water obtained from the Long Beach Water Reclamation Plant, prior to injection into the Alamitos Barrier, essentially fall into two categories: 1) alternative blend proportions for recycled vs. potable water, and 2) alternative materials used in treating water itself.

Alternative Blend Proportions

The alternative blend proportions analyzed for the ABRWP consist of varying amounts of recycled water as injection: 100 percent, 50 percent, or 20 percent. The Preferred Reuse alternative, as discussed in the following subsection, is to inject 50 percent recycled water into the Alamitos Barrier to prevent seawater intrusion into the groundwater table.

The Maximum Reuse alternative is 100 percent injection of recycled water in the barrier. This option would make available more potable water for public consumption and lessen the amount of water needed from outside sources. This is not the preferred alternative due to the fact that during summer months, effluent would be unavailable from the LBWRP in the late night and early morning hours. This means that about 12 hours of flow (about 5.5 mg) ahead of the ABP treatment facility must be provided from storage for the 100 percent recycled water option.

The Minimum Reuse alternative is 20 percent injection of recycled water into the barrier. This alternative would also lessen the need for additional sources of potable water, but not to the extent of the previously discussed alternative. Additionally, this alternative would require 1/3 day of storage, or an estimated fill rate of 3 million gallons per day (mgd). It also would not optimize the use of recycled water for the barrier.

Description of Each Alternative

Alternative blend percentages considered and their potential environmental effects are as follows:

1. **Maximum Reuse**. Under this alternative, recycled water would make up 100 percent of the storage supply to the Alamitos Barrier. This alternative would require larger storage capacity and possibly a larger treatment facility size than the preferred alternative of using 50 percent recycled water as injection, in order to meet the fully anticipated delivery rate of 8,000 acre-feet/year or 7 mgd. It is assumed that improvement to barrier capacity would permit injection at this rate. Construction of the larger facility could require an incrementally larger amount of land. Environmental impacts of this larger facility are not expected to be significantly different from the proposed project (described below), other than the benefit that a proportionally greater amount of potable water would be made available for domestic consumption. However, current DOHS regulations allow only 50 percent blending of potable and recycled water; thereby deferring this as a viable alternative until regulations allow.

2. **Preferred Reuse.** Under this alternative, recycled water would be used for 50 percent of the current annual rate of delivery as injection into the barrier. This method was determined to be the preferred alternative due to it having a significant effect on reducing the reliance on imported water, having no significant effect on the environment, and also most likely being able to meet regulatory requirements. Treatment facilities, as described in Section 6, for this method would be similar to the Maximum Reuse alternative. No storage facility is needed.

3. **Minimum Reuse**. Under this alternative, the amount of recycled water would be limited to 20 percent of the total injection. This alternative has the smallest facility. In addition, reverse osmosis as a treatment would not be required, and could be replaced with a granular activated carbon (GAC) treatment system. The facility would be sized to meet an anticipated delivery rate of 1,200 acre-feet/year of recycled water, or about 1.4 mgd. Construction of this facility would require an incrementally smaller amount of land than the proposed project, but overall environmental impacts would not differ significantly from the proposed project. Nearly 50 percent more imported potable water would be needed for this alternative compared to the proposed project, proportionally reducing the amount of potable water that would otherwise be available for domestic use.

Process Analysis

Separation Processes, Inc. (1998) investigated alternative reverse osmosis processes for the recycled water, prior to injection into the Alamitos Barrier. These alternatives consisted of different materials that would be used for the reverse osmosis membrane: cellulose acetate and various types of composite polyamide membranes.

Cellulose acetate was rejected as the membrane of choice because of its lower rejections of total dissolved solids (TDS), total organic carbon (TOC), and nitrogen-bearing compounds as compared to the newer polyamide materials. Correspondingly, the process resulting from use of the polyamide materials tends to produce lower levels of TDS, TOC, and nitrogen-bearing compounds than if cellulose acetate were used. The higher quality of the process residuals using cellulose acetate would result in less environmental impact than the proposed polyamide material, only if it was proposed that the process residuals be discharged directly into the San Gabriel River or Coyote Creek. With the proposed disposal into the existing sewage treatment system, no significant difference in environmental impacts between the various membrane material alternatives would be expected.

Engineering Cost Estimate

This section describes the costs associated using the high rejection composite polyamide (TFC-HR) membrane with an 85 percent recovery. As shown in Table 4-1, the estimated capital costs for the proposed project is approximately $13.3 million plus $2.2 million for residual disposal connection fees.

Map of Each Alternative

The construction map of the project does not vary greatly from one alternative to the next. The actual variance in the project site lies in the size of the tank needed for storing the appropriate amount of excess recycled water to fulfill the need for a constant flow.

For all alternatives, the new plant would be constructed directly north of and adjacent to the existing LBWRP. The proposed advanced recycled water treatment plant would occupy about 4 acres. The project would be built at an elevation of 30 feet mean sea level (msl), which is 18.5 feet above the flood elevation level. Approximately 100,000 cubic yards of fill material would be transported to the site for the creation of the site building pad.

The proposed site layout showing the building site and each of the treatment process units is shown in Section 1, page 1-9, Figure 1-4. Treatment process equipment includes:

- multiple microfiltration units;
- approximately 20,000 gallon break tank and transfer pumps;

Table 4-1. Project Capital Costs

Alamitos Barrier Recycled Water Project	Current Costs
Total Project Costs	$13,333,675
LACSD Connection Fee	$2,201,740
Net Project Costs	**$15,535,145**
Detail of Capital Costs	
Microfiltration	$2,981,000
The West Basin Municipal Water District and the City of Scottsdale, Arizona, base the Microfiltration equipment costs on recent actual procurement of Memtc Model 90M10C units.	
MF Installation	$490,000
The MF installation cost was the average estimate of contactors for the installation of a 90M10C unit for the West Basin MWD Barrier Expansion Project.	
Reverse Osmosis	$2,700,000
The installed cost of a reverse osmosis system is based on TFC-HR85% - $.90 per gpd of Permeate capacity.	
Influent Pump Station	$180,000
Influent and effluent pump stations are an order of magnitude cost.	
Effluent Pump Station	$150,000
Influent and effluent pump stations are an order of magnitude cost.	
Miscellaneous	$325,050
Miscellaneous equipment costs are assumed to cover such items as the MF to RO transfer System and are assumed to be 5% of the other costs.	
Total Equipment	**$6,826,050**
Site Development	$850,000
Site Development was based on an estimation provided in the 1995 CH2M Hill report.	
Covered Pads – MF	$360,000
It is assumed that the MF and RO system will be located on covered and trenched pads, Which will cost $75 per square foot.	
Covered Pads – RO	$262,500
It is assumed that the MF and RO system will be located on covered and trenched pads, Which will cost $75 per square foot.	
Interconnecting Piping	$1,023,908
Interconnecting piping is assumed to cost 15% of the equipment cost.	
Engineering	$932,246
Engineering costs were determined as 10% of the cost of equipment, site development, Contact basin,covered pads, and interconnecting piping while project administration Costs were valued at 5% of the same cost items.	
Project Administration	$466,123
Subtotal	**$10,720,827**
Contingency - 20%	$2,144,165
Contingency costs have been limited to 20% of the total construction costs before sales Tax.	
Sales Tax - MF & RO	
Sales tax for the MF and RO systems were assumed to be 8.25% of the cost of these items. Sales tax for other costs are assumed to be included in the cost of these items.	$468,683
Total Estimated Capital Costs	**$13,333,675**

The total estimated capital costs shown above do not include the cost of land, the cost of providing electrical service, the cost of emergency power (if required), nor the cost for any redundant equipment.

- one reverse osmosis train with 3.0 mg capacity, approximately 30 feet wide by 25 feet long by 7 feet high;
- one 500 horsepower pump associated with the reverse osmosis unit;
- one decarbonator with a 6,600 cubic feet per minute (cfm) blower to strip carbon dioxide; and
- chemical storage.

Enclosed facilities include electric and control equipment and a 2,000 square-foot maintenance facility constructed to a height of approximately 15 to 18 feet. The reverse osmosis units and perhaps the microfiltration units would be closed. Specific design of the microfiltration and reverse osmosis systems would be designed based on the specific characteristics of the feed water.

Buildings would be constructed of metal or tilt-up concrete. Site drainage and runoff will enter the existing Willow Street storm channel. Electrical power and other utilities will be obtained from the existing underground service at Willow Street. Chemicals necessary in the treatment process will be stored on site in compliance with federal and state regulations. A spill prevention plan and emergency procedures plan will be provided and explained to all employees responsible for handling these materials.

Quantities of Recycled Water for Each Alternative and When Needed

For the alternatives considered for this project, the amount of recycled water needed for each and when are as follows:

1. **Maximum Reuse** – As previously discussed, this method uses 100 percent recycled water, or a fully anticipated delivery rate of 8,000 acre-feet per year, as injection into the barrier. This alternative would require constant delivery and use of the recycled water to meet its objective. As a result of this constant need, storage tanks would need to be constructed prior to the treatment and delivery of this recycled water in order to provide a constant flow. While this is currently not the preferred alternative for the proposed project, ultimately the ABRWP would like to employ 100 percent recycled water as injection, given appropriate permitting and environmental clearance.

2. **Preferred Reuse** – This method uses 50 percent recycled water (3,000 acre-feet per year – 50 percent of current average annual injection) as injection into the barrier. Similar to the maximum reuse method discussed above, this alternative would also require a constant flow, but at a lesser rate. Storage facilities would also need to be built to accommodate this method's need; however, the size of tanks required would be smaller in size.

3. <u>Minimum Reuse</u> – Under this alternative, the maximum amount of recycled water used as injection into the barrier would be 20 percent of the maximum anticipated delivery rate, or approximately 1,200 acre-feet per year. This method would also utilize storage facilities, but at a much smaller scale than the Maximum Reuse or Preferred Reuse alternatives.

Market For or Dedicated Use of the Recycled Water for Each Alternative

The project, as proposed, and each alternative described within this document, is solely intended to be a dedicated use of recycled water, specifically, to inject the recycled water into the barrier to prevent seawater intrusion.

Barriers to the Use of Recycled Water for the Project and How to Overcome

Public Perception

One of the primary obstacles to overcome in a project of this nature is public perception. Overall, the water community is supportive of the project because it reduces WRD reliance on imported potable water. The community has embraced the use of recycled water, and has accepted it to be environmentally proper. There are no residential properties within 0.5 miles in any direction from the project site, and no dissention from nearby residents has been voiced during the environmental review period for the IS/ND.

The ABRWP proposes to discharge effluent into the Los Angeles County Sanitation District (LACSD) sewer system, which has been accepted by environmental and community groups. The Friends of LA River and the Los Angeles and San Gabriel River Watershed Councils support WRD in its efforts to construct the ABRWP.

Safety

From the standpoint of the perception of safety, the water injected at the Barrier travels inland and is eventually (after a minimum of 2.5 to 10 years) extracted by potable water supply wells. With the knowledge that this water will eventually be used as a potable source, great steps have been taken to incorporate safety features.

These features include such methods as adhering to stringent reliability and operating protocols, including a contingency plan, to insure that the recycled water meets or exceeds all water quality requirements of the permitting agencies.

The reliability features of the ABRWP, defined as the ability to prevent impairment of the groundwater basin as a result of the direct injection of recycled water, would be established by: 1) selection of high-quality source water; 2) adoption of a stringent operation protocol including continuous on-line monitoring of key parameters; and 3) selection of a treatment process with appropriate reliability.

The proposed treatment process consists of microfiltration followed by reverse osmosis treatment. The disinfected tertiary effluent from the LBWRP would be treated to reduce organics and TOC in order to meet the more stringent Title 22 standards for a direct injection recharge project. The organics/TOC removal can be accomplished primarily in the reverse osmosis process. The performance of the reverse osmosis process for organics removal is well documented, and is capable of producing a discharge that significantly exceeds standards for injection projects.

An additional benefit of using reverse osmosis is improving basin groundwater salinity; the treated water will have TDS about ten times less than imported water before blending. The reverse osmosis membranes would also provide a barrier to potentially suspended pathogenic materials, including viruses. Additionally, the tertiary-treatment process producing Title 22 recycled water achieves significant virus removal. The reverse osmosis process adds another step to removing viruses.

Reliability features include cartridge filters at the front end of the reverse osmosis system to protect the unit from improper function of the microfiltration units.

A comprehensive monitoring program would also be developed and performed to document program operations and compliance with permit conditions. It would provide the data necessary to optimize the treatment of the recycled water, indicate when to divert from recharge any recycled water of unacceptable quality, and modify or completely suspend injection of recycled water, if necessary. Continuous monitoring of selected parameters at various stages of treatment will ensure reliable operation.

ABRWP water quality would be monitored at intermediate locations within the water reclamation process and at the end of the reclamation process prior to blending for injection. Monitoring at intermediate locations would provide data on treatment process performance, and advanced warning of potential problems. Discharge monitoring would provide data on the final recycled water quality. Monitoring requirements would be reviewed and updated to incorporate new federal and state drinking water standards, or to make necessary revisions based on review of prior monitoring data during the permit renewal process.

The ABRWP would include a contingency plan to ensure that any inadequately treated water is not delivered to the recharge area through the injection system. Key elements of the contingency plan would be:

1. Engineering staff with specific knowledge and expertise in the operation of the LBWRP, ABRWP and the Barrier.

2. A warning system with four warning levels, each level reflecting the relative potential for water of unacceptable quality to reach the recharge area.

3. Ability to divert recycled water of unacceptable quality away from the recharge area by returning the product water from the ABRWP treatment facilities to the LBWRP or by shutting down the ABRWP facilities altogether. Water could continue to be supplied to the Barrier using imported MWD water. If the supply of the imported MWD water was insufficient to meet full barrier needs in the short-term, the Barrier could be operated at less than full capacity and use the imported MWD water that was available. The Barrier could potentially be out of operation for up to two weeks without serious consequences to the barrier integrity.

An injection site-monitoring program would be developed and performed to collect sufficient data in the groundwater basin and domestic water supply wells. Monitoring wells located ¼ and ½ the distance between the injection barrier and extraction wells will be used to estimate travel time and water quality in the groundwater. The nearest domestic water supply well will be monitored as well. A full monitoring program plan would be developed by WRD to ensure that representative samples are obtained. The monitoring plan would require approval by the appropriate regulatory agencies. Monitoring reports would be submitted by WRD to the regulatory agencies.

Costs

As outlined in Table 4-1, the cost for the project is substantial enough to warrant extensive analysis of the proposed project and its alternatives. To overcome the potential barrier of having the project become cost prohibitive, the ABRWP has been approved to receive MWD LRP funding and is seeking federal funds to assist in its implementation. Additionally, this project has sought assistance from other agencies involved in this project. As an example, the Orange County Water District will participate by paying WRD for a portion of the recycled water, approximately 30%, injected into the Alamitos Barrier.

Regulatory Approval

Water quality requirements imposed by the various permitting agencies could also pose as a potential obstacle to implementing this project. Once the proposed project size and configuration was identified, the lead agency was able to initiate the application for a Waste Discharge Requirements or Water Reclamation Requirements. Significant input from DOHS and the Regional Water Quality Control Board is anticipated in the review and approval process. The project would begin by using smaller quantities of recycled water and gradually, as permitting allows, increase the quantity as performance and reliability are demonstrated. The Waste Discharge or Water Reclamation Requirements will specify an extensive monitoring program, as discussed above, which will become part of the project operation.

Further to the idea of interagency approval and involvement, the political, geographical and hydrological setting of the ABRWP require that nine public agencies participate in the project. These agencies include the following:

- Central Basin Municipal Water District (CBMWD)
  CBMWD supplies imported water to the Water Replenishment District of Southern California for groundwater replenishment and barrier injection. CBMWD is the project sponsor's MWD agency, and will continue to supply necessary imported water. The CBMWD General Manager has signed a statement supporting the ABRWP and requesting LRP consideration. The CBMWD Board also supports WRD in its efforts to construct the ABRWP, as confirmed by Resolution No. 9-98-596.
- Water Replenishment District of Southern California (WRD)
  WRD is the project sponsor and serves as the lead agency under the California Environmental Quality Act (CEQA) requirements. WRD owns the site on which the ABRWP will be built, and WRD will be the project owner.
- City of Long Beach
  Although the Long Beach Water Reclamation Plant is owned and operated by the County Sanitation Districts of Los Angeles County, the City of Long Beach owns the rights to the recycled water to be used for the ABRWP. The Plant is located approximately two miles from the ABP and is adjacent to the site for the new treatment facility. The Plant will provide the source of recycled water for the Alamitos Barrier Recycled Water Project. The City and WRD have executed an agreement for the City of Long Beach to operate and maintain the ABRWP and to provide the advanced treated water to the Barrier.
- Orange County Water District (OCWD)
  Since the ABP provides protection against seawater intrusion into both Orange County and Los Angeles County, OCWD receives benefits from the project. WRD and OCWD currently purchase MWD water for injection in the Alamitos Barrier. WRD and OCWD originally embarked on a joint recycled water program for the Alamitos Barrier to reduce the use of potable water supply, thereby benefiting the entire region. OCWD and WRD have executed a contract in which OCWD agrees to pay WRD for a portion of the recycled water injected into the Barrier. OCWD supports WRD in its efforts to construct the ABRWP.
- Los Angeles County Department of Public Works (LACDPW)
  The LACDPW operates and maintains the ABP and its physical facilities. The LACDPW would continue to operate and maintain the existing water transmission pipeline, distribution header, injection wells, extraction wells, and monitoring wells along the Barrier itself. The LACDPW operations and maintenance of the barrier will be unaffected by the introduction of recycled water.

Additionally, the LACDPW manages generation of hydroelectric power for the ABP, and is under agreement for distribution for this power. WRD is working cooperatively with the LACDPW to manage reduction in imported water production and its effect on the generation of hydroelectric power.

- County Sanitation Districts of Los Angeles (CSD)
  The Long Beach Water Reclamation Plant is owned and operated by the CSD. The City of Long Beach owns the rights to the recycled water from the Plant to be used for the ABRWP. WRD will enter into an agreement with the City of Long Beach for purchase of the recycled water, and the CSD would provide the process water for the operation of the proposed treatment plant. Process residuals consisting of micro-filter backwash and reverse osmosis concentrate would be discharged to the CSD sanitary sewer. WRD will pay a one-time connection fee and annual service charges to CSD for this discharge method. CSD has granted WRD an easement to use their access road to the ABRWP site.

- Regional Water Quality Control Board (RWQCB)
  The RWQCB is responsible for overseeing the groundwater quality and issuing a permit for this project. The project site is on the border between both the Los Angeles and the Santa Ana RWQCBs. Each has established water reclamation requirements for projects involving groundwater recharge with recycled water, and early in defining the ABRWP, the SARWQCB deferred to the LARWQCB for review of the Project Engineering Report.

- California Department of Health Services (DOHS)
  The DOHS sets standards for the use of recycled water as set forth in Title 22 of the California Code of Regulations. Although the RWQCB issues the water reclamation requirements for a water reclamation permit, the DOHS reviews the engineering report, conducts a public hearing on the project, and makes recommendations to the RWQCB regarding the permit applications. WRD will work cooperatively with both the RWQCB and the DOHS during project development.

- US Bureau of Reclamation (USBR)
  The USBR, as authorized by Title XVI of PL102-575, is the federal funding agency for water recycling projects. It is working cooperatively with WRD, in conjunction with the State of California and other local and regional entities, to assess the feasibility of a comprehensive water reclamation and reuse system for Southern California.

- California State Water Resources Control Board (SWRCB)
  The SWRCB offers programs that provide financial assistance to local agencies for water recycling projects.

- Metropolitan Water District of Southern California (MWD)
  MWD is providing financial support for the ABRWP through its Local Resources Program (LRP), which in turn will reduce the demands placed on MWD for imported

potable water. This will result in making more water available to other users on the MWD system without an additional MWD investment in capital facilities or the cost of pumping additional water over the Tehachapi Mountains.

In summary, the project objective, for which facility alternatives have been developed, are to provide the most cost-effective system to receive, treat and deliver water from the LBWRP to the ABRWP that satisfies the needs of the project and all regulatory, public health and operational requirements.

Specific Quantified Analysis – Would the Project:

Reduce, Postpone, or Eliminate Development of New or Expanding Water Supplies

This project may have the potential to reduce the likelihood of having to expand water supplies by making potable water more readily available for general public usage. The project, as proposed, would reduce dependence on the imported potable water currently used for injection into the Barrier. The proposed project would inject 50 percent recycled water into the Barrier allowing more use of the remaining potable water. This replacement would reduce the amount of imported water required in Southern California, and also provide a beneficial use for excess recycled water.

Similar to the ABRWP, the City of Long Beach owns the rights to the recycled water system known as the Long Beach Water Reclamation Plant (LBWRP), which treats up to 25 million gallons per day (mgd), or 23,000 afy, with a plant capacity of 30 mgd, or 28,000 afy. The existing LBWRP distribution system supplies 47 customers an average of 4,000 afy. Phased expansions of the distribution system will supply 82 additional customers approximately 7,900 afy. At ultimate build out, the water distribution system will provide 129 customers approximately 11,900 afy. In addition, the ABRWP will have an immediate demand of 3,000 afy with an additional 5,000 afy demand possible upon future expansion of the plant. At current production levels of 23,000 afy, even after all currently planned or proposed demands are imposed on the LBWRP, a surplus of 3,100 afy will still be discharged to the ocean.

The ABRWP would take disinfected tertiary treated effluent from the LBWRP and improve the quality of that water to the standards required for injection into the Alamitos Barrier using microfiltration and reverse osmosis. In the initial stages of operation, this advanced treated water would replace a portion of the imported water, approximately 3,000 acre-feet per year, now supplying the Barrier, making more potable water available for other uses.

The source of recycled water for the ABRWP is the Long Beach Water Reclamation Plant. Space is available future expansion and use of recycled water in the ABRWP, should sufficient supply be available, barrier or other demand allow, and regulatory conditions permit. Initially, the ABRWP effluent capacity would be 3 mgd and designed for future expansion up to 8 mgd of reverse osmosis permeates.

Statewide Water Plan (Bulletins 160-93 AND 160-95)

The water supply reliability goals established for the region are based upon a combination of local and imported water supplies. Without additional local water resources development, MWD and member agencies could expect to encounter some type of water supply shortage periodically. Such a level of service would greatly impact and be devastating to the local and state economy.

In an attempt to address this potential crisis, the State of California published the "*California Water Plan Update – Volume 1*" in October 1994. The report was developed by the State over three years and incorporated extensive public involvement. The Department of Water Resources (DWR) initiated the Statewide plan in 1957, with the publication of Bulletin No. 3 (The California Water Plan). The Bulletin became the foundation for a series of water plan updates, now known as the Bulletin 160 series. The updates were published five times between 1966 and 1987.

Bulletin 160-93, greatly influenced by the extended 1987-1992 drought in Southern California, reported that:

> *For the first time in recent history, Californians are finding that existing water management systems are no longer able to provide sufficiently reliable water service to users. In most areas of the State, the 1987-1992 drought caused increased water conservation, and in some cases mandatory rationing, for urban water users; and strained environmental resources. The six-year drought stretched California's developed supply to its limits, yet innovative water banking, water transfers, water supply interconnections, and changes in project operations to benefit fish and wildlife all helped reduce the harmful effect of drought.*

Also in Bulletin 160-93, under the title *"Will There be Enough Water?"* the report states:

> *Today, areas of the State relying on the Delta for all or a portion of their supplies find those supplies unreliable. Annual reductions in total water supply for urban and agricultural uses could be in the range of 500,000 acre-feet to 1.0 million acre-feet (maf) in average years and 2.0 to 3.0 maf in drought years. These reductions result mainly from compliance with the ESA biological opinions, they basically fall within 1.0 - 3.0 maf ranges for the proposed additional environmental demands for protection and enhancement of aquatic species. Such uncertainty of water supply*

delivery and reliability will continue until issues involving the Delta and other long-term environmental water management concerns are resolved.

The report continues:

By 2020, without additional facilities and improved water management, annual shortages of 3.7 to 5.7 maf could occur during average years depending on the outcome of various actions taking place to protect aquatic species. Average year shortages are considered chronic and indicate the need for implementing long-term water supply augmentation and demand management measures to improve water service reliability. Similarly, by 2020, annual drought year shortages could increase to 7.0 to 9.0 maf under D-1485 criteria, also indicating the need for long-term measures in addition to short-term drought management measures.

Bulletin 160-95 sets forth a series of "Level I" recommendations to help meet California's water supply needs to 2020. Under the title "Supply Augmentation" the report recommends *"Water reclamation-plans for an additional 0.2 maf of water recycling and ground water reclamation by 2020 could provide annual net water supplies of nearly 0.8 maf after accounting for reuse."*

The State of California in its Water Plan has established the needed priority to continue the development of recycled water projects.

California Public Policy and Legislation

California public policy places a strong emphasis on water recycling. For example, California Water Code Section 461 provides that the public policy of the State requires the maximum reuse of wastewater. California Water Reclamation Law (Cal. Water Code Sections 13550-13556) declares that the people of California have a primary interest in developing water reclamation facilities to meet the State's reliable water needs and augment existing surface and groundwater resources. California Water Code Section 13512 declares the intent of the Legislature and the State to undertake steps to encourage development of water reclamation facilities and beneficial reuse of recycled water. The Water Recycling Act of 1991 (Cal Water Code Section 13577) set recycling goals of 700,000 acre-feet of water annually by year 2000 and 1,000,000 acre-feet annually by year 2010.

Further legislative and regulatory provisions reiterate the general tenets of California Water Reclamation Law, specifically focusing on coastal areas. In coastal zone areas, recycling of treated water that would have otherwise been disposed into the ocean creates a "new" supply of water into that region. This is recognized legislatively in California Water Code Section 13142(e), which urges wastewater treatment agencies located in the coastal zone to reclaim and reuse as much of their treated effluent as practicable. It is also recognized through regulation by the State Water Resources Control Board in its 1984 decision 'in the matter of the Sierra Club, San Diego Chapter', Order No. WQ 84-7, where the Board held as follows:

> *"In the case and all other cases where an applicant...(i.e., for a permit to discharge effluent into receiving waters)...proposes to discharge effluent consisting of once-used wastewater into the ocean, the report of the discharge should include an explanation of why the effluent is not being reclaimed for further beneficial use."*

This is consistent with State policy established by the Legislature in Cal. Water Code Section 13142.5(e).

The State Water Resources Control Board (SWRCB) addressed these issues in its draft water rights decision 1630 for the Bay-Delta Water Control Plan in 1991.

DRAFT WATER RIGHTS DECISION 1630

Water Supply Management Measures

- *Reliability:* "steps must be taken to ensure a reliable water supply...through drought contingency plans."
- *Conservation: "implement all practical conservation measures (BMPs)"*
- *Pricing:* "water purveyors should develop water pricing schedules for their customers that make it increasingly expensive to (1) obtain water in amounts in excess, (2) to use potable water where nonpotable water is available and suitable."
- *Groundwater management and conjunctive use:* "local agencies should manage conjunctive use programs to maximize use of groundwater during dry periods."
- *Water Recycling:* - "wherever practicable, all local agencies should reduce imported water demands by maximizing water reclamation and reuse."
- *Contingency Funds:* - "Municipal water agencies should establish a fund to improve reliability during future droughts (e.g., public education, emergency conservation programs, water transfers)."

Water Supply Development

- *Alternative Projects:* - "Wastewater recycling plants and distribution system, saline and seawater desalination plants, and alternative water supply projects should be developed and implemented where feasible."

(State Water Resources Control Board, 1991)

State policy further state that – *"development of recycled water projects is essential if we are going to meet our future water resource needs in California. Recycled water can be used for all types of greenbelt irrigation and numerous other non-potable uses such as washing airplanes or cars. Many agencies have found that large industrial users are concerned about the reliability of imported water supplies and are eager to convert to recycled water use because of its dependability as a source."*

In a 1992 San Diego speech entitled ***Ending California's Water Wars,*** California Governor Pete Wilson stated the following:

> *"Water recycling can also stretch our limited supply of water. Reclamation and recycling, vigorously pursued, can provide a reliable water source for agriculture, greenbelts, recreation and industrial uses. We must ensure that new developments in water-short areas make maximum use of recycled water, through the installation of dedicated distribution systems. And that's why I have proposed bond revenues for public reclamation facilities. To promote the use of recycled water, I am directing the Department of Health Services and the State Water Resources Control Board to work with the EPA to remove obstacles to reclamation activities. But for our reclamation program to maximize the use of recycled water, it must both set strong health standards and create a streamlined process for the construction and operation of both public and private reclamation facilities."*

The DWR and the Water Reuse Association are currently propagating development of local recycled water projects as a means of relieving demand on imported water supplies. Both agencies currently project increase development of water recycling supplies over time.

Reduce or Eliminate the Use of Existing Diversions from Natural Watercourses or Withdrawals from Aquifers

The Alamitos Barrier, operational since 1965, and expanded in October 1982, has generally been effective in reducing intrusion into the groundwater basin. The Alamitos Barrier influences both the Central Groundwater Basin in Los Angeles County and the Orange County Groundwater Basin. WRD and OCWD currently purchase imported water for injection in the Barrier from MWD. WRD and OCWD have jointly embarked on a recycled water program for the Alamitos Barrier to reduce the use of this potable imported water supply. This benefits the region in two ways. First, the use of recycled water makes more potable water available for the entire region. Second, recycled water at the ABP would represent a significant step forward in using innovative methods to continue protecting the local groundwater sources from seawater intrusion while conserving California's precious water resources.

Between 5,000 and 7,000 acre-feet per year (afy) of imported State Water Project and/or Colorado River water obtained through the MWD have been used to maintain the Barrier. Given the increasing shortage and rising costs of imported water in southern California, it is important that new and innovative ways to conserve this valuable resource be investigated. The injection of recycled water into the Barrier would reduce this demand on state and federal water supply facilities.

CALFED Water Use Efficiency Program

A Bay Delta Area Council Water Use Efficiency Work group is assisting CALFED Program staff in identifying policy issues with respect to water use efficiency implementation. The Work Group will also identify techniques that encourage implementation of water use efficiency programs and integrated resource planning at the local level. Water recycling is being evaluated at a range of 800,000 to 1,000,000 AFY increase over current implementation commitments.

The following action and implementation methods, regarding recycled water, are in addition to the proposed CALFED core actions:

> *More efficient use of developed supplies may be achieved through water recycling. Urban wastewater recycling options include recharging groundwater, use for agricultural irrigation, recycling and treating for potable and non-potable urban use, use of gray water, and storage for use in meeting Delta flow standards. Agricultural recycling options include using drainage for irrigation purposes, while maintaining appropriate salt leaching requirements. Reclamation and reuse programs will focus on facilities that currently discharge treated wastewater into salt sinks and other degraded bodies of water. The use of recycled water will increase the overall availability of water and may reduce the amount of Delta exports at times. The level of implementation of water recycling in any alternative will depend on storage and conveyance components of the alternative as well as conditions in particular service areas. For example, increased implementation of water recycling may be evaluated at a range of 0.8 to 1.0 million acre-feet per year over current implementation commitments.*

Implementation of the water use efficiency program may be achieved in several ways. Ideally, local and regional water users will carry out integrated resources planning (IRP). This planning will take into consideration existing supplies, new opportunities created by CALFED storage and conveyance components, the cost of existing and new supplies, and the opportunities for water conservation and recycling. The best mix of these approaches will be selected to meet local conditions and needs. Other mechanisms may be used to ensure or to increase implementation of water use efficiency measures. Preferred mechanisms include incentives and the potential benefits, concerns, and other considerations to be addressed in CALFED water use efficiency programs include:

- Reduces demand for Delta exports and related entrainment effects of fisheries.
- Can help in timing of diversions for reduced entrainment effects on fisheries.
- Could make water available for transfers.
- May delay need (and size) for new water facilities.

- May improve overall Delta and tributary water quality.
- Could reduce the total salt load to the San Joaquin Valley.

Reduce the Demand on Existing Federal Water Supply Facilities

The ABRWP will reduce the demand placed on the Colorado River, a federal water supply and a major contributor to MWD's available potable water. Since the imported water used for injection by MWD is a blend of State Project Water and Colorado River Water, the proposed project will replace a portion of the federal water used in the ABP. The reduced demand on the Colorado River would allow a greater percent of potable water to be used for other needs. The reduced demands on State Project Water will allow Delta water to be used for other needs, including the Central Valley Project.

Other Sources, When Needed, and Development Costs

The Long Beach Water Reclamation Plant is the sole source of recycled water dedicated for the Project. This supply of recycled water will vary with the diurnal flow pattern from the LBWRP. It is also dependent upon the magnitude and daily pattern of supply for other recycled water uses from the LBWRP. Conversely, the demand for water to supply the ABRWP is essentially continuous. Furthermore, there would be definite economic and operational advantages to sizing any treatment facilities for continuous average flows rather than peak flows. Therefore, storage for balancing flows prior to treatment and delivery is desirable. Two options for balancing flows are (a) dedicated storage for the ABRWP requirements; and (b) combined storage with other recycled water uses.

Promotion or Application of a Regional or Watershed Perspective to Water Resource Management or Cross-Boundary Issues

Regionally, the project would directly replace 3,000 acre-feet per year of imported water with recycled water, thus making that imported water available to the rest of the region on a permanent basis. The project would also allow the barrier to be maintained in a drought when imported water supplies may be cut. The barrier must be functioning if pumping from the groundwater basin is to be maintained during a drought. If pumping cannot be maintained in a drought, agencies may request additional imported water deliveries from MWD, further worsening the water shortage.

The ABRWP leads to demand reductions in what is essentially the end of MWD's treated water distribution system (the central pool). Since it serves to relieve demands on the Weymouth, Diemer or Jensen Filtration Plant, it reduces the need for any type of Central Pool augmentation project. The project reduces the regional need for emergency storage since it supplies an essential demand that would not be subject to reduction in an emergency.

The barrier is less influenced by the amount of precipitation received; therefore, the quantity of recycled water purchased for any given year for injection does not fluctuate to the degree observed for other groundwater replenishment requirements, such as spreading.

Surrounding groundwater basins, such as the Central and West Coast Basins, must rely on various sources of water for recharge. These sources include local water, recycled water and imported water.

Local water consists of precipitation throughout the basins and storm inflow. This source is generally limited to the rainy season from November through March.

Recycled water as a resource is generally considered to have a relatively low unit cost, with year round availability, thereby making it very desirable. Its use, however, is restricted by regulatory agencies.

Imported water, originating from the State Water Project or the Colorado River, is a source for high-quality replenishment water. Costs associated with its treatment and transportation makes this the most expensive source for recharge water. The availability of this source is limited and varies, especially during drought years.

With the implementation of the ABRWP, additional sources of potable water will be made available to these basins, and lessen the variability of the sources currently used in their operations.

SECTION 5 ECONOMIC ANALYSIS OF ALTERNATIVES

Introduction

This analysis assesses the economic feasibility of the proposed Alamitos Barrier Recycled Water Project (ABRWP) and evaluates its cost-effectiveness in consideration of alternative projects.

The economic analysis considers four potential operating scenarios for the Alamitos Barrier: continuing existing practices, 20 percent recycled water, 50 percent recycled water and 100 percent recycled water. Existing practices continue injection of 100 percent potable water, and the three alternative scenarios evaluate the effect of blending varying amounts of recycled water to offset potable water demand. A general discussion of the three recycled water alternatives is given in Section 4.

Currently, 100 percent of all water injected at the Alamitos Barrier is imported potable water from either the State Water Project or the Colorado River Aqueduct. Historic injection volumes in the Alamitos Barrier have averaged 6,000 AFY.

Present and Future Conditions

Presently, existing conditions within the project area make it economically feasible for implementation of the ABRWP as proposed. A projection based on the current rate at which potable water is used and the increase in population in the area surrounding the project area shows that there will be greater demands placed on potable water in the near future.

Water demand projections for Southern California are estimated to increase 20 percent during the 2000-2020 period (March 1996, Southern California's Integrated Water Resources Plan (IWRP), Metropolitan Water District of Southern California (MWD)). This demand increase balances an increase in municipal and industrial uses with a reduction in agricultural demands; thereby, resulting in a greater demand on potable water. Comparing the existing supplies to the projected hot/dry weather retail demands, including conservation measures, results in a potential water supply shortage of 2.1 million acre-feet in year 2020 for the Southern California region.

MWD's Southern California's IWRP identifies local resource investments and imported supply investments as an approach for potential supply resources needed to ensure a reliable and high-quality water supply for Southern California. Reclamation projects are an important component of this plan.

Over the last seven years, growth in the Southern California area of Los Angeles, Orange and San Diego Counties, have equaled 39 percent of the state's population growth. According to the Census Bureau, California is projected to be the fastest growing state in the nation during the 2000-2025 period, resulting in the highest rate of population change at 52 percent, equaling nearly 17 million persons. If Southern California's share of this growth continues as in the past seven years, it will grow by over 6.6 million people by the year 2025.

With the proposed ABRWP in place, there will be a reduced need to find other sources of potable water to serve the projected growth and water demand thus, less money spent on exploring and obtaining these new sources. Initially, the preferred alternative will provide for 3,000 AFY with the potential future expansion of up to 8,000 AFY as regulatory conditions allow. This recycled water source will utilize effluent water that may go otherwise unused, and offset valuable potable water that can be used for additional municipal and industrial water demands.

Without the ABRWP in place, there will be a greater need to develop additional sources of potable water for injection into the barrier. If, during years of drought, these sources are unable to be fully utilized because they are directed to municipal and industrial uses, then there will be a greater likelihood of saltwater intrusion and contamination of the groundwater basins.

Given the high projections for an increased demand in potable water, and the likelihood that Southern California will experience another drought, similar to the early 1990s, the ABRWP will help conserve potable water needed for increased demands and potential drought.

Project Alternatives

Current Conditions, No Recycled Water - Currently 100 percent of the injection demand at the barrier is met by imported potable water purchased from the Metropolitan Water District of Southern California (MWD) through the Central Basin Municipal Water District (CBMWD). Injection amounts are typically between 5,000 AFY and 7,000 AFY, with an overall average of 6,000 AFY. WRD does not consider this option viable to improve the reliability of supply to the barrier.

Maximum Reuse, 100% Recycled Water - The California Department of Health Services (DOHS) currently limits the maximum volume of recycled water for injection to 50 percent. Since this alternative exceeds the DOHS maximum, an economic analysis was not done. This option has been deferred as a viable alternative until regulations permit 100 percent injection of recycled water.

Preferred Reuse, 50% Recycled Water – Under this alternative, 50 percent of current barrier water demand would be replaced with recycled water. Current DOHS regulations limit blending to a maximum of 50 percent recycled water with potable water for injection at barriers. Using the current average injection amount of 6,000 AFY, approximately 3,000 AFY of imported potable water would be offset by this preferred alternative.

Separation Processes, Inc. (SPI) was retained by WRD to review and evaluate preferred reuse options and reverse osmosis processes for the ABRWP. SPI's evaluation determined the treatment processes required and estimated the cost for treating 3,000 AFY of injection water. SPI's report calls for the facilities, plant layout, and electrical service to be designed and constructed to have an initial capacity of 3,000 afy and ultimately 8,000 afy, the ultimate maximum injection at the barrier.

Table 5-1 shows the capital and unit costs of the 50% Preferred Reuse Alternative; 3,000 AFY. The following assumptions were made in the Table 5-1 financial analysis:

- USBR grants recompense 25 percent of the capital construction costs.
- Annual O&M costs include disposal costs, monitoring costs and recycled water purchases, and uses the projected O&M costs from the SPI reported dated May 1998.
- County Sanitation Districts of Los Angeles County (CSDLAC) connection fee is not financed; rather, it will be paid directly by WRD.
- Certificates of Participation are issued at 5.00% for 25 years.
- The annual inflation rate is assumed to be 4.00%.

Minimum Reuse, 20% Recycled Water – Under this alternative, 20 percent of current barrier demand would be replaced with recycled water. Since current DOHS regulations allow up to 50 percent of recycled water blended with potable water for injection, this alternative would be permitted. Using the current average injection numbers of 6,000 AFY, approximately 1,200 AFY of potable water would be offset by this alternative, requiring a greater amount of potable water needed for injection compared to the preferred alternative.

SPI's evaluation of the Preferred Reuse-50% Recycled Alternative determined the requirements and estimated costs for treating 3,000 AFY, and design and construction for a capacity of 4,000 AFY. In order to conduct a reasonable economic analysis of the 20% Reuse Alternative, facility capital costs for the 50% Reuse Alternative were reduced by 60 percent, which is the percent reduction from 3,000 AFY to 1,200 AFY recycled project water.

Table 5-1. Project Capital Costs and Unit Costs - Preferred Reuse - 50% Reuse Alternative

Capital Costs and Funding	Amount ($)	Interest Rate (%)	Term First Last Yr. Yr.		
Project Capital Costs					
Capital Construction Costs	$ 13,333,675				
(less assumed USBR Grants)	$ (3,333,419)				
Net Capital Costs	$ 10,000,256				
CSDLAC Connection Fee	$ 2,201,470				
Net Cost to WRD	$ 12,201,726				
Capital Funding Measures					
Certificates of Participation	$ 10,000,256	5.00%	1999 2023		
WRD Contribution	$ 2,201,470	0.00%	2000 2024		
Assumed Annual Inflation Rate	4.00%				

Project Year	(1) Fiscal Year End	(2) Annual Yield (AF)	(3) Annual Capital Cost ($)	(4) Annual O & M Cost ($)	(5) Total Project Cost ($)	(6) Project Unit Costs ($/AF)	(7) CBMWD Price ($/AF)
1	2001	1,512	$ 354,771	$ 618,507	$ 973,278	$ 644	$445
2	2002	3,024	$ 709,543	$ 1,286,495	$ 1,996,037	$ 660	463
3	2003	3,024	$ 709,543	$ 1,337,954	$ 2,047,497	$ 677	481
4	2004	3,024	$ 709,543	$ 1,391,473	$ 2,101,015	$ 695	501
5	2005	3,024	$ 709,543	$ 1,447,132	$ 2,156,674	$ 713	521
6	2006	3,024	$ 709,543	$ 1,505,017	$ 2,214,559	$ 732	541
7	2007	3,024	$ 709,543	$ 1,565,217	$ 2,274,760	$ 752	563
8	2008	3,024	$ 709,543	$ 1,627,826	$ 2,337,369	$ 773	586
9	2009	3,024	$ 709,543	$ 1,692,939	$ 2,402,482	$ 794	609
10	2010	3,024	$ 709,543	$ 1,760,657	$ 2,470,199	$ 817	633
11	2011	3,024	$ 709,543	$ 1,831,083	$ 2,540,626	$ 840	659
12	2012	3,024	$ 709,543	$ 1,904,326	$ 2,613,869	$ 864	685
13	2013	3,024	$ 709,543	$ 1,980,499	$ 2,690,042	$ 890	712
14	2014	3,024	$ 709,543	$ 2,059,719	$ 2,769,262	$ 916	741
15	2015	3,024	$ 709,543	$ 2,142,108	$ 2,851,651	$ 943	771
16	2016	3,024	$ 709,543	$ 2,227,793	$ 2,937,335	$ 971	801
17	2017	3,024	$ 709,543	$ 2,316,904	$ 3,026,447	$ 1,001	833
18	2018	3,024	$ 709,543	$ 2,409,580	$ 3,119,123	$ 1,031	867
19	2019	3,024	$ 709,543	$ 2,505,964	$ 3,215,506	$ 1,063	901
20	2020	3,024	$ 709,543	$ 2,606,202	$ 3,315,745	$ 1,096	938
21	2021	3,024	$ 709,543	$ 2,710,450	$ 3,419,993	$ 1,131	975
22	2022	3,024	$ 709,543	$ 2,818,868	$ 3,528,411	$ 1,167	1,014
23	2023	3,024	$ 709,543	$ 2,931,623	$ 3,641,166	$ 1,204	1,055
24	2024	3,024	$ 709,543	$ 3,048,888	$ 3,758,431	$ 1,243	1,097
25	2025	3,024	$ 709,543	$ 3,170,843	$ 3,880,386	$ 1,283	1,141

(1) Year 1 is from January 1 to June 30; remaining 6 months of fiscal year
(2) Projected annual production in acre-feet, excluding existing uses in expansion projects; plant output of 3.0 mgd of RO permeate for 328.5 days per year is equivalent to an annual RO permeate production of 3,024 acre-feet per year; Year 1 annual yield represents six months of production
(3) Annual debt service/amortization
(4) Projected annual O&M costs (escalated over time), includes chemicals, energy, membrane replacement, disposal, purchases and monitoring costs
(5) Sum of (3) + (4)
(6) *Project Unit Costs - (5)/(2)*
(7) Central Basin Municipal Water District (CBMWD) supplies imported water from the Metropolitan Water District of Southern California (MWD) with a $14 seawater barrier surcharge - 1997/98 rate

Table 5-2 shows the capital and unit costs of the 20% Reuse Alternative. The same assumptions for Table 5-2 were made as noted for the Preferred Reuse-50% Recycled Alternative.

Economic Analysis of Viable Reuse Alternatives

As detailed in the Annual Survey and Report on Groundwater Replenishment (WRD, 1998), the cost of buying imported water to satisfy the District's replenishment and injection needs is based on the unit rates set by the various retailers with whom the District deals. Cost of imported potable water for injection into the Alamitos Barrier for fiscal year 1997-98 was $445 per acre-foot (AF). The 1997-98 imported water rate will be used to compare estimated capital and O&M costs for the recycled water as prepared in Separation Processes, Inc. April 1998 "Re-evaluation of the ABRWP " against the comparable cost of imported water.

Capital Costs

The preferred 50% Reuse Alternative requires a total estimated capital investment of $13.3 million (April 1998, SPI Reevaluation of the ABRWP). Costs include the microfiltration and reverse osmosis units and installation, pump stations, site development, covered pads, interconnection piping, engineering, project administration, and contingency at 20 percent.

Capital costs for the 20% Reuse Alternative have been estimated at $7.4 million, which is approximately 55 percent of the 50% Reuse Alternative estimated capital costs. Select capital costs (pump station, site development, and interconnection piping) would remain the same for either alternative, and the remainder of the capital costs has been reduced by 60 percent, which is the percent reduction from 3,000 AFY (50% Reuse Alternative) to 1,200 AFY (20% Reuse Alternative).

Project capital costs are not reduced equivalently to the reduction of annual recycled water yield when reducing from the 50% Reuse Alternative to the 20% Reuse Alternative resulting in a greater difference between the unit costs for 20% Reuse Alternative and the cost of imported water. Additionally, the treatment facility under the 20% Reuse Alternative would no longer allow the expansion of the facility to meet 50 percent of the 8,000 AFY, when conditions allow, which studies have shown to be the ultimate maximum injection at the barrier. Therefore, the 50% Reuse Alternative provides a more economically feasible alternative for capital investment over that of the 20% Reuse Alternative.

Table 5-3 shows the capital costs for the 50% and 20% Reuse Alternatives.

Table 5-2. Project Capital Costs and Unit Costs - 20% Reuse Alternative

Capital Costs and Funding	Amount ($)	Interest Rate (%)	Term First Yr.	Term Last Yr.
Project Capital Costs				
Capital Construction Costs	$ 7,427,447			
(less assumed USBR Grants)	$ (1,856,862)			
Net Capital Costs	$ 5,570,585			
CSDLAC Connection Fee	$ 880,588			
Net Cost to WRD	$ 6,451,173			
Capital Funding Measures				
Certificates of Participation	$ 5,570,585	5.00%	1999	2023
WRD Contribution	$ 880,588	0.00%	2000	2024
Assumed Annual Inflation Rate	4.00%			

Project Year	(1) Fiscal Year End	(2) Annual Yield (AF)	(3) Annual Capital Cost ($)	(4) Annual O & M Cost ($)	(5) Total Project Cost ($)	(6) Project Unit Costs ($/AF)	(7) CBMWD Price ($/AF)
1	2001	600	$ 197,623	$ 314,260	$ 511,883	$ 853	$445
2	2002	1,200	$ 395,247	$ 653,661	$ 1,048,907	$ 874	463
3	2003	1,200	$ 395,247	$ 679,807	$ 1,075,054	$ 896	481
4	2004	1,200	$ 395,247	$ 706,999	$ 1,102,246	$ 919	501
5	2005	1,200	$ 395,247	$ 735,279	$ 1,130,526	$ 942	521
6	2006	1,200	$ 395,247	$ 764,690	$ 1,159,937	$ 967	541
7	2007	1,200	$ 395,247	$ 795,278	$ 1,190,525	$ 992	563
8	2008	1,200	$ 395,247	$ 827,089	$ 1,222,336	$ 1,019	586
9	2009	1,200	$ 395,247	$ 860,173	$ 1,255,419	$ 1,046	609
10	2010	1,200	$ 395,247	$ 894,580	$ 1,289,826	$ 1,075	633
11	2011	1,200	$ 395,247	$ 930,363	$ 1,325,610	$ 1,105	659
12	2012	1,200	$ 395,247	$ 967,577	$ 1,362,824	$ 1,136	685
13	2013	1,200	$ 395,247	$ 1,006,281	$ 1,401,527	$ 1,168	712
14	2014	1,200	$ 395,247	$ 1,046,532	$ 1,441,778	$ 1,201	741
15	2015	1,200	$ 395,247	$ 1,088,393	$ 1,483,640	$ 1,236	771
16	2016	1,200	$ 395,247	$ 1,131,929	$ 1,527,175	$ 1,273	801
17	2017	1,200	$ 395,247	$ 1,177,206	$ 1,572,453	$ 1,310	833
18	2018	1,200	$ 395,247	$ 1,224,294	$ 1,619,541	$ 1,350	867
19	2019	1,200	$ 395,247	$ 1,273,266	$ 1,668,513	$ 1,390	901
20	2020	1,200	$ 395,247	$ 1,324,197	$ 1,719,443	$ 1,433	938
21	2021	1,200	$ 395,247	$ 1,377,164	$ 1,772,411	$ 1,477	975
22	2022	1,200	$ 395,247	$ 1,432,251	$ 1,827,498	$ 1,523	1,014
23	2023	1,200	$ 395,247	$ 1,489,541	$ 1,884,788	$ 1,571	1,055
24	2024	1,200	$ 395,247	$ 1,549,123	$ 1,944,369	$ 1,620	1,097
25	2025	1,200	$ 395,247	$ 1,611,088	$ 2,006,334	$ 1,672	1,141

(1) Year 1 is from January 1 to June 30; remaining 6 months of fiscal year
(2) Projected annual production in acre-feet, excluding existing uses in expansion projects;
Year 1 annual yield represents six months of production
(3) Annual debt service/amortization
(4) Projected annual O&M costs (escalated over time), includes chemicals, energy, membrane replacement, disposal, purchases and monitoring costs
(5) Sum of (3) + (4)
(6) Project Unit Costs - (5)/(2)
(7) Central Basin Municipal Water District (CBMWD) supplies imported water from the Metropolitan Water District of Southern California (MWD) with a $14 seawater barrier surcharge - 1997/98 rate

Table 5-3. Estimated Capital Costs for Reuse Alternatives

Capital Item	Capital Cost 50% Reuse	Capital Cost 20% Reuse
	3,000 afy	1,200 afy
Microfiltration	$ 2,981,000	$ 1,192,400
MF Installation	$ 490,000	$ 196,000
Reverse Osmosis	$ 2,700,000	$ 1,080,000
Influent Pump Station	$ 180,000	$ 180,000
Effluent Pump Station	$ 150,000	$ 150,000
Miscellaneous	$ 325,050	$ 325,050
Total Equipment	**$ 6,826,050**	**$ 3,123,450**
Site Development	$ 850,000	$ 850,000
Covered Pads – MF	$ 360,000	$ 144,000
Covered Pads – RO	$ 262,500	$ 105,000
Interconnection Piping	$ 1,023,908	$ 1,023,908
Engineering – 10%	$ 932,246	$ 524,636
Project Administration – 5%	$ 466,123	$ 262,318
Project Subtotal	**$ 10,720,827**	**$ 6,033,312**
Contingency – 20%	$ 2,144,165	$ 1,206,662
Sales Tax – 8.25% - MF/RO	$ 468,683	$ 187,473
Total Est. Capital Cost	**$ 13,333,675**	**$ 7,427,447**

Source: Separation Processes, Inc. – Re-evaluation of the ABRWP, April 1998

Operating and Maintenance Costs

Annual operating and maintenance costs for the 50% Reuse Alternative are based on the following:

1. SPI identifies the TFC-HR (high rejection composite polyamide) membrane as the preferred membrane of choice due to its high success in both pilot and demonstration plants.
2. A plant that operates at the full RO permeate capacity of 3.0 mgd for 90 percent of the time or 328.5 days per year.
3. Chemical and energy costs were determined by multiplying the daily chemical and energy costs by 328.5 days.
4. It was assumed that the plant would be operated remotely by the City of Long Beach and that this would require 8 hours per day for one person for 38.5 days per year at $35 per hour.
5. Maintenance labor and materials were assumed to cost $50 per year per 1,000 gallons per day of microfiltrate capacity.

6. MF membrane replacement costs are based on a straight-line accrual, $650 per module, and a five-year replacement.
7. RO membrane replacement costs are based on straight-line accrual, $500 per membrane element, and a five-year life.
8. Miscellaneous costs cover such items as cleaning chemicals, cartridge filter, etc., and this was assumed to amount to 5 percent of the total of other costs.
9. A plant output of 3.0 mgd of RO permeate for 328.5 days per year is equivalent to an annual RO permeate production of 3,023.9 acre feet per year.
10. The volumetric operating and maintenance cost per year is determined by dividing the total annual operating and maintenance cost by the annual production.

Annual operating and maintenance costs for the 20% Reuse Alternative can be reduced proportionately from the 50% Reuse Alternative, except for annual monitoring cost, which would remain the same for either alternative. Table 5-2 shows the total O&M cost for the 20% Reuse Alternative at $628,520 annually. This represents an O&M cost per acre-foot (AF)/year of $523.77; a $114.69 per AF increase from the 50% Reuse Alternative.

Operating and maintenance costs for the TFC-HR membrane and the added costs of residual disposal, recycled water purchases and annual monitoring are shown in Table 5-4.

Table 5-4. Annual O & M Costs – Preferred Reuse, 50% Recycled Water

Operating days per year	328.5
Chemicals	$80,204
MF Energy	$33,060
RO Energy	$126,834
Transfer Energy	$50,191
Operations	$91,980
Maintenance	$176,471
MF Membrane Replace	$81,900
RO Membrane Replace	$88,200
Miscellaneous	$36,442
Sub-total Annual O&M Costs	$765,281
Residual Disposal, Recycled Water, Annual Monitoring	$471,736
Total Annual O&M Costs	**$1,237,017**
Plant Production – AF/year	3,023.9
O&M Cost per AF/year	$409.08

Source: Separation Processes, Inc. – Re-evaluation of the ABRWP, April 1998

Project Unit Cost

Preferred Reuse, 50% Recycled Water - The Project Unit Cost of the preferred reuse project in Year 1 is $644 per AF. This unit cost is based upon the cost of capital, O&M costs and the total annual yield. Compared to the cost of imported potable water purchased through the Central Basin Municipal Water District (CBMWD), the project unit cost is $199 per AF more than current practice. To help offset the cost of recycled water and the use of valuable potable water, the Metropolitan Water District of Southern California (MWD) has approved the ABRWP to receive funding from its Local Resources Program (LRP) beginning at $209 per AF of annual yield. This offset assists in equalizing the cost of the project water to the cost of imported water for injection, yielding a $10 per AF savings to WRD.

Minimum Reuse, 20% Recycled Water - The Project Unit Cost of the 20 percent reuse project in Year 1 is $853 per AF. Again, this unit cost is based upon the cost of capital, O&M costs and the total annual yield for a 20% recycled water project. Compared to the cost of imported potable water purchased through the Central Basin Municipal Water District (CBMWD), the project unit cost is $408 per AF more than current practice. The MWD LRP funding will offset the cost of recycled water by $209 per AF, reducing the unit cost of project water to $644 per AF, still significantly greater that the cost of imported water at $445 per AF for injection.

Table 5-5 compares the unit costs of the viable alternatives; 50% Reuse Alternative and the 20% Reuse Alternative and also shows the importance of the MWD LRP funding. This comparison demonstrates the current cost of barrier injection water using potable water supplies to recycled water use, and the resulting cost savings for each alternative.

Cost Analysis

The cost of the recycled water to be supplied and used in the ABP under the Preferred 50% Reuse Alternative will be a lesser amount or nearly equal to what is currently being spent on potable water for injection. However, in years of drought or as time progresses and the area becomes more populated, the price and demand of potable water will increase and recycled water will become a strong economic advantage.

Table 5-5 shows the 50% Reuse Alternative will result in a $9-$11 per AF savings for the cost of injection water. This equals between $27,000 and $30,000 annually in water cost savings over a 25-year period, the period in which the MWD LRP funding is provided. Over the 25-year period, assuming a 4 percent inflation factor on O&M costs and the cost of imported water, water cost savings would be $726,000. If inflation is below 4 percent and imported water costs rise more than projected, then the total water cost savings over the 25-year period would be even greater.

Table 5-5. Comparative Project Unit Costs for Alternatives

		Project Unit Costs ($/AF)		ABRWP Unit Cost With LRP			Barrier Water Cost Savings				
								50% Preferred Reuse		20% Reuse	
Project Year	Fiscal Year End[1]	50% 3,023 AFY[2]	20% 1,200 AFY[3]	MWD LRP[4] $/AF	50% $/AF	20% $/AF	CBMWD[5] Rate	Savings $/AF	Total Annual Savings	Savings $/AF	Total Annual Savings
1	2001	$ 644	$ 853	$ 209	$ 435	$ 644	$ 445	$ 10	$ 15,120	$ (199)	$ (119,400)
2	2002	$ 660	$ 874	$ 208	$ 452	$ 666	$ 463	$ 11	$ 33,000	$ (203)	$ (243,600)
3	2003	$ 677	$ 896	$ 206	$ 471	$ 690	$ 481	$ 10	$ 30,000	$ (209)	$ (250,800)
4	2004	$ 695	$ 919	$ 205	$ 490	$ 714	$ 501	$ 11	$ 33,000	$ (213)	$ (255,600)
5	2005	$ 713	$ 942	$ 203	$ 510	$ 739	$ 521	$ 11	$ 33,000	$ (218)	$ (261,600)
6	2006	$ 732	$ 967	$ 201	$ 531	$ 766	$ 541	$ 10	$ 30,000	$ (225)	$ (270,000)
7	2007	$ 752	$ 992	$ 200	$ 552	$ 792	$ 563	$ 11	$ 33,000	$ (229)	$ (274,800)
8	2008	$ 773	$ 1,019	$ 198	$ 575	$ 821	$ 586	$ 11	$ 33,000	$ (235)	$ (282,000)
9	2009	$ 794	$ 1,046	$ 196	$ 598	$ 850	$ 609	$ 11	$ 33,000	$ (241)	$ (289,200)
10	2010	$ 817	$ 1,075	$ 194	$ 623	$ 881	$ 633	$ 10	$ 30,000	$ (248)	$ (297,600)
11	2011	$ 840	$ 1,105	$ 191	$ 649	$ 914	$ 659	$ 10	$ 30,000	$ (255)	$ (306,000)
12	2012	$ 864	$ 1,136	$ 189	$ 675	$ 947	$ 685	$ 10	$ 30,000	$ (262)	$ (314,400)
13	2013	$ 890	$ 1,168	$ 187	$ 703	$ 981	$ 712	$ 9	$ 27,000	$ (269)	$ (322,800)
14	2014	$ 916	$ 1,201	$ 185	$ 731	$ 1,016	$ 741	$ 10	$ 30,000	$ (275)	$ (330,000)
15	2015	$ 943	$ 1,236	$ 182	$ 761	$ 1,054	$ 771	$ 10	$ 30,000	$ (283)	$ (339,600)
16	2016	$ 971	$ 1,273	$ 179	$ 792	$ 1,094	$ 801	$ 9	$ 27,000	$ (293)	$ (351,600)
17	2017	$ 1,001	$ 1,310	$ 177	$ 824	$ 1,133	$ 833	$ 9	$ 27,000	$ (300)	$ (360,000)
18	2018	$ 1,031	$ 1,350	$ 174	$ 857	$ 1,176	$ 867	$ 10	$ 30,000	$ (309)	$ (370,800)
19	2019	$ 1,063	$ 1,390	$ 171	$ 892	$ 1,219	$ 901	$ 9	$ 27,000	$ (318)	$ (381,600)
20	2020	$ 1,096	$ 1,433	$ 168	$ 928	$ 1,265	$ 938	$ 10	$ 30,000	$ (327)	$ (392,400)
21	2021	$ 1,131	$ 1,477	$ 165	$ 966	$ 1,312	$ 975	$ 9	$ 27,000	$ (337)	$ (404,400)
22	2022	$ 1,167	$ 1,523	$ 162	$ 1,005	$ 1,361	$ 1,014	$ 9	$ 27,000	$ (347)	$ (416,400)
23	2023	$ 1,204	$ 1,571	$ 158	$ 1,046	$ 1,413	$ 1,055	$ 9	$ 27,000	$ (358)	$ (429,600)
24	2024	$ 1,243	$ 1,620	$ 155	$ 1,088	$ 1,465	$ 1,097	$ 9	$ 27,000	$ (368)	$ (441,600)
25	2025	$ 1,283	$ 1,672	$ 151	$ 1,132	$ 1,521	$ 1,141	$ 9	$ 27,000	$ (380)	$ (456,000)
								25 Year Savings	$ 726,120		$ (8,161,800)

[1] Year 1 is from January 1 to June 30; remaining 6 months of fiscal year

[2] Represents 50% of current average annual injection rate

[3] Represents 20% of curernt average annual injection rate

[4] The ABRWP has been selected by the Metropolitan Water District of Southern California Local Resources Program to receive a financial contribution per acre-foot of reclaimed water for the 50% preferred reuse alternative

[5] 1997/98 rate - MWD supplies potable water to WRD through Central Basin Municipal Water District

The 20% Reuse Alternative yields recycled water use of 1,200 AF/year, 1,800 AF/year less than the 50% Reuse Alternative, and currently demonstrates no cost benefit for injection water. From a cost standpoint, the 50% Reuse Alternative is clearly an economic advantage.

MWD LRP Program

The ABRWP has been selected by the Metropolitan Water District of Southern California (MWD) to receive financial assistance through its Local Resources Program (LRP) for a 25-year period. Selected eligible cost-effective water recycling and groundwater recovery projects that contribute to the region's overall water supply reliability are only considered.

MWD LRP financial assistance for the ABRWP will begin at $209 per AF for certified deliveries of project water, and decreases annually for the 25-year period to a low of $151 per AF, as shown in Table 5-5. Under the LRP, the unit cost of water for the 50% Reuse Alternative is reduced from $644 to $435 per AF in the first year, assuring that the project is financially viable, improves the overall economics of the project, provides an economic benefit to the Southern California region, and ensures that the savings in imported water sources are realized.

Financing Viability

WRD has appropriated $16.8 million in a separate Alamitos Barrier Recycled Water Project Construction Fund, and is committed to proceed to construct, demonstrated by resolution (Exhibit B).
WRD is actively pursuing project financing that supports the highest economic value to the District and its member agencies for the project. Capital costs are anticipated to be funded by means of the USBR Cost Sharing Grant, the sale of Certificates of Participation (COP) at 5 percent for 25 years, and payment by the District for the CSDLAC Connection Fee.

This financing strategy for capital, combined with the estimated annual operating and maintenance costs, establishes the project unit cost at an economically viable amount, nearly equal to or better than the current cost of imported potable water.

The most important elements of the project financing are the USBR Cost Sharing Grant for up to 25 percent of the cost, MWD LRP financial assistance, and the economical cost of issuing COPs. This financial strategy allows the project and the regional benefits to be realized.

Offset and Protection of Potable Water

Imported Water Available for Other Uses and Reduction in Long-Term Costs

The ABRWP represents a sustained and permanent source of dependable water for Southern California. Since the ABP is an existing facility, the yield of the ABRWP immediately replaces an existing demand on imported water supplies. The preferred ABRWP directly replaces 3,000 AFY of imported water with recycled water, thus making that imported water available to the rest of the region on an immediate and permanent basis. MWD has approved the ABRWP as a viable project to contribute to the region's overall water supply reliability. MWD's Integrated Water Resource Plan studies show reduced long-term costs to the region when local resources are developed due to downsizing or deferral of MWD capital improvements, reduction in operating costs for importation, treatment and distribution, and reduction in costs for developing alternative regional supplies.

Potable Groundwater Protection

The supply of water to the Alamitos Barrier is vital for protection of water supplies in the Central and Orange County Groundwater basins, and the ABRWP is a dedicated supply source for that use. The ABP protects the groundwater basins from seawater intrusion, and the ABRWP is an innovative method to continue protection of local water resources while conserving California's water supply. Maintaining the barrier during a drought is critical, and since recycled water would not be subject to cuts during a drought, this would allow WRD to continuously maintain the barrier. It would also allow water agencies to safely pump from the groundwater basin even if imported water supply from MWD is partially cut.

The ABRWP would utilize reverse osmosis as an essential treatment process. This desalted water would be blended with imported water resulting in a lower TDS (salinity) injected water. This will over the long-term lead to improvement in ground water quality in the vicinity of the barrier.

Without the ABRWP in place there will be a greater need to develop additional sources of potable water for injection into the barrier. If, during years of drought, the barrier cannot be maintained, then there will be a greater likelihood of saltwater intrusion and contamination of the groundwater basins.

Use of Effluent Water Otherwise Unused

The ABRWP provides an innovative and permanent method of utilizing effluent water that may go otherwise unused and sent to the ocean. The ABRWP treats effluent water to meet DOHS regulatory standards for injection water. The yield of the project is sustained during both drought years and years of abundant water availability and is operated at a uniform flow rate throughout each year. Thus, the ABRWP is a permanent use of recycled water that may go otherwise unused.

The City of Long Beach receives a financial benefit through the sale of recycled water otherwise unused.

Reduced Costs on Exploring and Obtaining New Sources

With the ABRWP in place, there will be less of a need to find other sources of potable water and thus, less money spent on exploring these new sources. Initially the project will provide for 3,000 AFY of recycled water to offset potable water with the potential future expansion of up to 8,000 AFY. The actual cost to locate new sources of potable water associated to the project offset is undetermined. However, it is certain that without the ABRWP and other new local resources projects that reduce demand on imported supplies, activities to explore and obtain new sources of water will increase the cost of potable water to the region at an unnecessary rate intensifying economic problems in the region.

Additional Economic Benefit Realized After Implementation

The ABRWP uses state-of-the-art technology to guarantee water quality that ensures public acceptance. The use of this technology also encourages innovation by the equipment manufacturers that leads to further improvements. For example, equipment prices for microfiltration systems decreased approximately 25 percent from one year ago, and continues to decrease as technology is refined, in direct response to competition brought about by Southern California water recycling efforts.

Alleviation of Economic Problems and Meeting Future Water Demand

Since water demand projections for Southern California are estimated to increase 20 percent during the 2000-2020 period, local resource investments are needed to ensure a reliable and high-quality water supply for Southern California. Reclamation projects are an important component of these investments. The ABRWP would augment peak demands by 3 million gallons per day in the Southern California region.

Reduced Costs to MWD

The ABRWP leads to demand reductions in what is essentially the end of MWD's treated water distribution system (the Central Pool). Since it serves to relieve demands at the end of the system, it alleviates stresses on all upstream facilities. It can lead to reduced demand on either of the three MWD filtration plants, Weymouth, Diemer or Jensen, and reduces the need for any type of Central Pool augmentation project.

As previously discussed, MWD studies show reduced long-term costs to the region when local resources are developed, due to downsizing or deferral of MWD capital improvements, reduction in operating costs for importation, treatment and distribution, and reduction in costs for developing alternative regional supplies.

Reduced Costs to WRD and Its Purveyors

The ABRWP 50% Reuse Alternative would result in a $10 per AF savings for the cost of injection water, totaling approximately $30,000 annually in water cost savings over a 25-year period, the period in which the MWD LRP funding is provided. The potential of imported water cost rising more than projected would provide even greater savings. This saving provides the ability for WRD to optimize other areas of water replenishment programs.

WRD groundwater purveyors would realize a benefit through enhanced WRD programs and projects, and assurance of groundwater quality and reliability. Overall economic benefits to WRD mean economic benefits to the Southern California water community.

CONCLUSION

It has been determined during the economic analysis conducted for this study that the Alamitos Barrier Recycled Water Project Preferred Reuse 50% Recycled Water is the most economical. The Current Conditions, No Recycled Water Alternative and the Minimum Reuse, 20% Recycled Water Alternative were not considered viable options. The Preferred Reuse, 50% Recycled Water Alternative utilizes the maximum recycled water blending allowed by the DOHS, meeting all required water quality standards for barrier injection water, while providing the greatest economic benefits.

The Preferred Reuse, 50% Recycled Water Alternative would replace 3,000 AFY of imported potable water with recycled water, and provides the ability to allow for expansion of the facility to increase to 4,000 AFY, 50 percent of 8,000 AFY, which studies have shown to be the ultimate maximum injection at the barrier. The ABRWP represents a sustained and permanent source of dependable water for Southern California.

The Preferred Reuse, 50% Recycled Water Alternative optimizes capital financing and operational and maintenance costs, resulting in an economic benefit to WRD of approximately $10 per AF or $30,000 per year of project water costs. This cost saving presents an economic benefit to WRD and its water purveyors through programs, projects, and groundwater reliability and quality.

Equally important economic benefits include the offset of imported potable water supplies for Southern California, protection of groundwater supplies, use of effluent water otherwise unused, reduction in technology costs through system improvements, and the enhanced ability to meet future water demands. Development of local resources provides water quality and reliability benefits, reduces costs of capital improvements, operating costs, treatment and distribution, and development of alternative regional supplies, and leads the water community safely and economically into the future.

SECTION 6 ENVIRONMENTAL ANALYSIS OF ALTERNATIVES

PROJECT ALTERNATIVES

Four major studies have been conducted for the Alamitos Barrier Recycled Water Project: CDM (1991), CH2M Hill (1994), WRD (1996), and Separation Processes, Inc. (1998). In addition to the aforementioned studies, the Initial Study/Negative Declaration for the Alamitos Barrier Recycled Water Project (Appendix A) was adopted by the WRD Board in November, 1998. This section is based on the information contained in those reports.

This section will address existing conditions within the environmental setting, options for individual components of the project and for various facility locations, along with environmental impact comparisons to the proposed project. Also discussed are various combinations of these individual component/siting options, and their collective environmental impacts, as project alternatives that would accomplish the same objectives as the proposed project. Finally discussed, a No Project Alternative and a summary of the reasons for considering the proposed project as the environmentally superior alternative.

EXISTING ENVIRONMENT

Environmental Setting

Basin Plan

The regional Basin Plan is the Los Angeles Regional Water Quality Control Board's *Water Quality Control Plan for the Los Angeles Region* (June 1994 draft). The Basin Plan addresses existing and proposed beneficial uses for the San Gabriel River, the lower reach of which flows along the eastern project boundary. These uses include industrial service supply, water recreation, wildlife and aquatic habitat, and shellfish harvesting. The Basin Plan does not identify specific surface or ground water quality objectives for Coyote Creek, or for the reach of the lower San Gabriel River adjacent to the project site. However, the Plan does recommend general standards for certain water constituents for purposes of protecting beneficial uses.

The Alamitos Barrier Project is intended to prevent degradation of groundwater quality due to seawater intrusion and, as proposed, will discharge process residuals into the sewer system rather than the surface waters of the San Gabriel River or Coyote Creek. Therefore, most aspects of the Basin Plan will not be applicable to the proposed project, with the exception of:

- *Water quality standards applicable to storm water runoff from the project site into the San Gabriel River and Coyote Creek; and*
- *Regulations administered by the California Department of Health Services in regard to use of recycled water in groundwater basins.*

Watershed Management Plan

It is not known at this time whether a watershed management plan is available for this region, but in any case, such a plan would not be relevant to the proposed project because none of the project actions involve surface waters or watershed-level issues.

Area-Wide Wastewater Treatment Plan

A wastewater treatment plan pertains to the existing LBWRP, which treats wastewater to a tertiary level, but the plan is not relevant to the project because the ABRWP treats tertiary effluent further and does not treat wastewater.

Regional Transportation and Housing Allocation Plans

The City of Long Beach General Plan includes transportation and housing elements. However, the proposed project does not include new transportation or housing components, and therefore these sections of the General Plan are not applicable.

Air Quality Management Plan

The project site is located within jurisdiction of the South Coast Air Quality Management District (SCAQMD). The SCAQMD Plan has quantified emission thresholds for carbon monoxide, nitrogen oxides, reactive organic gases, sulfate oxides, and particulates. In addition, as part of the Toxic Air Contaminants Program, the SCAQMD maintains a list of substances that pose a chronic or acute health threat when present in the air.

Most of the SCAQMD standards are not applicable to activities that would be involved in the proposed project, with the exception of standards pertaining to particulates (fugitive dust), vehicle emissions, and emissions from the proposed recycled water treatment plant.

Regional Land Use Plans

The regional land use plan applicable to the project is the City of Long Beach General Plan. The Plan designates the project site primarily as Open Space Park District (LUD No. 11), with a small portion zoned Institutional District.

Topography

The proposed project site is located on nearly flat (<1% gradient) terrain, surrounded on three sides by berms. These berms support Willow Street to the north, the LBWRP entrance road to the east, and the existing LBWRP to the south. Nearby major topographical features consist of Coyote Creek to the east and the San Gabriel River to the west. The site itself is at an elevation of about 13 feet above mean sea level.

Climate and Water Resources

Annual Precipitation and Seasonal Weather Patterns

Average annual precipitation in the project region is 12 inches per year. Nearly all of this precipitation falls during the winter months, especially the months of January and February. The summer months from June through September are typically dry.

Surface Water Features

No permanent surface water is present on the project site. An open, concrete-lined storm channel crosses the northern quarter of the site. This channel carries runoff from areas north of Willow Street to the Coyote Creek channel. Surface water features adjacent to the site consist of Coyote Creek and the San Gabriel River. Both of these features are trapezoidal, concrete-lined channels. After the two channels join just downstream of the LBWRP, they share a common concrete apron, which extends about 1,000 feet south before terminating at the unlined portion of the San Gabriel River estuary. The dominant flow in the San Gabriel River during the dry portion of the year is effluent from the County Sanitation Districts of Los Angeles County's (CSDLAC) Water Reclamation Plant.

Groundwater Resources

The project area includes the Central Groundwater Basin of Los Angeles County and the Orange County Groundwater Basin, both geologically one basin. They are important sources of local groundwater that meet over 50 percent of the water demands in the region. As discussed in the Project Description (Section 1) the presence of the Alamitos Barrier currently protects the quality of these groundwater resources from seawater intrusion. The distance from the project site to the nearest potable groundwater well is 4,300 feet.

The groundwater reservoirs of both groundwater basins are replenished and maintained by capturing precipitation and natural river flows, supplemented by additional recharge from imported water. The primary source of recharge in the Orange County Basin is from the Santa Ana River via percolation basins. Recharge of the Central Basin occurs primarily in the Rio Hondo and San Gabriel River spreading grounds in the Montebello

Forebay, and includes local storm runoff, imported water and recycled water from the Whittier Narrows (*Engineering Report*, Camp Dresser and McKee, May, 1992).
There are eleven production wells located within a 10,000 foot radius of the injection barrier. Four of the wells are located in Los Angeles County, of which, none are drinking water wells. Seven of the wells are located in Orange County, of which, three are water supply wells. All three drinking water wells are located northeast from the barrier wells.

Groundwater within the Central and Orange County Groundwater Basins is monitored according to Department of Health Services (DOHS) requirements which requires all groundwater for domestic use to be monitored for all applicable drinking water standards, including general mineral, trace inorganic and organic compounds, physical properties, and radioactivity. OCWD also samples for volatile organic compounds (VOCs) for other uses.

Groundwater quality varies throughout the basins both vertically and horizontally. The average Total Dissolved Solids (TDS) level for the Orange County Basin is 480 mg/1. TDS concentrations exceed 1,000 mg/L in two general areas, Yorba Linda and Irvine/Tustin. Nitrate concentrations exceeding the 10 mg/L federal drinking water standard are generally found in three areas: Fullerton, Tustin/Irvine and Garden Grove/Westminster. Selenium concentrations exceeding the federal drinking water standard of 10 parts per billion (ppb) have been detected in wells in the Fullerton and Irvine areas where concentrations range from 10 to 50 ppb. Contamination from Volatile Organic Compounds (VOCs) within the Orange County Basin appears to be minor to date. (*Engineering Report*, Camp Dresser McKee, May 1992).

In the Central Basin, TDS levels in the groundwater adjacent to the spreading ground areas have decreased from about 600 mg/L in the early 1970s to 400 mg/L in the mid 1980s (Rio Hondo spreading grounds) and from 700 mg/L to 500 mg/L (San Gabriel River spreading grounds). Nitrate presents no apparent threat to groundwater in the Central Basin, although some wells in the San Gabriel River spreading basins have exceeded the federal drinking water standard for nitrate of 10 mg/L. The presence of VOCs does not appear to be a significant basinwide problem, however TCE and PCE have been detected throughout the basin, but most levels were below the state drinking water maximum contaminate levels (MCLs) of 5 ug/L.

Receiving Water Quality

The proposed project will discharge process wastes into the CSDLAC's system for conveyance to the Joint Water Pollution Control Plant in Carson during operation, therefore the term "receiving water" for purposes of this project evaluation is not applicable.

Water Supplies for the Service Area

Existing potable water supplied for consumption in the area is provided through a pipeline operated by the Los Angeles County Department of Public Works. The Metropolitan Water District (MWD) supplies the potable water currently used for the Alamitos Barrier.

Land Use, Zoning, Agriculture, and Other Planning Designations

The City of Long Beach General Plan designates the project site primarily as Open Space Park District (LUD No. 11), with a small portion zoned Institutional District (I[H]). The I(H) zone designation indicates a horse overlay to the Institutional District. Use of horses is permitted in this area. Water treatment plants are permitted uses in the Open Space Park District zone, but not in an Institutional District zone.

The project site is not located within or near zones designated as Agriculture. Surrounding land uses include El Dorado Park on the north side of Willow Street, a golf course to the west of the San Gabriel River, the LBWRP adjacent on the south, and the San Gabriel Freeway on the east side of Coyote Creek. The western 80 feet of the property along the San Gabriel River is undeveloped right-of-way for Edison International, and high-voltage power lines currently occupy this corridor.

As of April, 1998, the Federal Emergency Management Agency (FEMA) flood maps show that the nearest special flood hazard area is adjacent to the west side of the San Gabriel River, about 0.5 mile from the project site.

Population and Housing

The nearest residences are located about 0.5 mile from the project site, on the east side of the San Gabriel Freeway.

Geology, Seismicity, and Soils

Geology

The Coastal Plain of Los Angeles and Orange Counties is underlain by a deep structural depression containing primarily sedimentary rocks, which have reached a thickness in excess of 30,000 feet. It is estimated that only the upper 4,000 feet of the sediments are of importance as a freshwater-bearing reservoir. The subsurface is characterized by variations in thickness and lithology due to folding and faulting. The Orange County Groundwater Basin is bounded by two principal fault zones, the Whittier and the Newport-Inglewood, which act as groundwater flow restrictions due to resulting placement of permeable rock against impermeable rock. In the vicinity of the Alamitos Barrier, the so-called C, B, A, I and Main aquifers are part of the San Pedro Formation.

These aquifers and the San Pedro Formation are, in general, the most prolific water-bearing deposits in both counties.

There are five water-bearing units in the Alamitos Gap which are subject to seawater intrusion. These include the recent alluvium near the surface and from top to bottom, the C, B, A, and I zones which are subdivisions of an aquifer in the middle San Pedro Formation.

Seismic Hazards

Alquist-Priolo Special Studies zones have been defined by the State Geologist around major portions of active faults. The proposed project site is not located within these designated zones. The City of Long Beach's Seismic Safety Element does not identify any active fault traces crossing the site. A similar Safety Element prepared for the County of Los Angeles identifies the Los Alamitos Fault as a potentially active fault near the proposed project site. This fault is believed to be a concealed (buried) thrust fault, the active portion of which lies north of Willow Street, outside and north of the project site boundary. The portion of the Los Alamitos Fault south of Willow Street is believed to be inactive.

The Uniform Building Code requires that structures in the project area be designed for earthquake shaking commensurate with those of at least Seismic Risk Zone 4.

Unstable Substrate, Soil Types, and Erosion Potentials

Liquefaction potential of soils on the project site is estimated to be high because of the presence of loose to medium dense sand and silty sands, plus the presence of groundwater at shallow depths. The native sediments underlying the project site are subject to moderate compression and erodability. The site soils are not considered collapsible, therefore subsidence typically associated with collapsible soils is not anticipated. The expansion potential of the soils is low.

There are no unique geologic or physical features present on the site.

Air Quality

Air Basin

The project site is located within the South Coast Los Angeles County subregion of the South Coast Air Basin, administered by the South Coast Air Quality Management District (SCAQMD). Air quality in this subregion is good in comparison to more inland subregions of the Basin. For example, no exceedances of federal standards for monitored pollutants (ozone, nitrogen dioxide, lead, carbon monoxide, sulfur dioxide, PM_{10}, and total suspended particulates) were reported for the years 1995 and 1996. Exceedances of state standards for ozone ranged from 3 to 5 days out of the year during 1995-1996, as compared to 30 or more days for more inland areas. Exceedances of state standards for PM_{10} during this period occurred in 15 percent-19 percent of the samples, as compared to 25 percent – 42 percent of the samples collected in the inland valleys. Comparison of data for other pollutants shows similar trends.

Nonattainment Area

The location of the project site within the South Coast Air Basin places the project region within the Environmental Protection Agency's "serious" nonattainment classification for particulate matter (PM_{10}).

Status of Local Air Quality Plan

Every three years, the SCAQMD prepares a plan for air quality improvement. Each plan has a 20-year horizon. The SCAQMD Board approved the most recent (1997) plan in 1996. As a requirement of federal law, this plan places greater focus on particulate matter (PM_{10}) than the previous 1994 plan.

Transportation and Circulation

The existing Long Beach Water Reclamation Plant as well as the proposed project site is accessed from Willow Street, a four-lane street with concrete median. This street currently provides regular and emergency access from the eastbound lanes. A bicycle lane is present along the San Gabriel River and the east side of Coyote Creek. A portion of the San Gabriel River bike lane crosses the proposed construction area for installation of the supply pipeline to the MWD interceptor feeder.

Biological Resources

Plant Communities and Wildlife

Two biologists from Psomas and Associates visited the proposed project site on 28 August, 1998. The dominant plant community on the site can be characterized as a highly disturbed, non-native annual grassland. The site appears to be plowed or disked on a regular basis, because the ruderal vegetation and wildlife present are typical of a frequently disturbed site. There is also a small shallow drainage (less than 50 feet in length) in the southwestern quarter of the site that supports freshwater plant species, primarily sedges (*Cyperus* spp.), cattails (*Typha latifolia*), and rushes (*Scirpus* spp.). This vegetation is immature and has probably experienced frequent disturbance in the past from disking.

The berm on the east and south boundaries of the site are occupied with ornamentals, primarily eucalyptus and pampas grass. The berm on the north side of the site is occupied by ruderal vegetation and occasional tree tobacco (*Nicotiana glauca*).

Wildlife species observed during the survey included: American crow, Anna's hummingbird, barn swallow, black phoebe, house finch, common bushtit, mourning dove, rock dove, and northern mockingbird. A red-tailed hawk was observed flying over the site, but no hawk or other raptor nests were observed in the trees bordering the site.

Special Status Species

A search of the California Natural Diversity Database (July 1998) did not reveal any records, extant or historical, of listed threatened or endangered species in the project region.

Special Status Habitats

No designated special status habitats, such as Coastal Sage Scrub, have been reported to occur on the project site.

Federal and State Jurisdictional Wetlands

As mentioned previously in the plant communities' discussion, there is a very small area (<<0.01 acre) of freshwater marsh vegetation that occurs in the southeastern quarter of the property. A soil analysis was not conducted, and it is unknown whether hydric soils (one of the qualifying criteria for a wetland) are present. The hydrology of this area is also problematic, because the vegetation does not appear to be in a streambed or pond. However, even if the marsh area were to meet the soils and hydrology criteria for a wetland, the area is well below the size for which notification of the Corps of Engineers or a Corps permit would be required for fill. The area is also well below the size that is typically regulated by the California Department of Fish and Game.

Energy and Mineral Resources

Southern California Edison will provide electrical service to the ABRWP. Preliminary analysis indicates that approximately 12,000-kilowatt hours of electricity per day are required for plant operations. A more detailed energy load profile will be developed during design to refine the preliminary estimate.

The proposed project is not located in an area of known mineral resources.

Noise

Current ambient noise levels in the project vicinity are dominated by traffic on the San Gabriel Freeway (I-605) and Willow Street. The nearest sensitive receptor to the project site is the residential area, located 0.5 mile to the south.

Public Services

Public services (fire, police, schools, roads) in the project area are provided by the City of Long Beach. Current demand on these services from the existing facilities is low due to the low number of employees required for operation.

Utilities and Service Systems

The existing LBWRP facilities currently utilize power provided by Southern California Edison. The existing facilities also utilize telephone and emergency alert systems, as well as a potable water supply line operated by the Los Angeles County Department of Public Works. In addition, about 5,000 acre-feet of potable water supplied by the Metropolitan Water District is used in the Alamitos Barrier.

Excess effluent from the existing Long Beach Water Reclamation Plant is normally discharged to the San Gabriel River. Storm water runoff is conveyed to the local drainage system. Biosolids are discharged to the CSDLAC's sewer system for conveyance to the CSDLAC's Joint Waste Pollution Control Plant in Carson.

Visual Resources

Currently, the nearest sensitive receptor for visual resources is the residential area, located 0.5 mile to the south of the project site. Primary views of the project site are from along Willow Street and the bike path located along the San Gabriel River.

Cultural Resources

The project site is highly disturbed. It was excavated in the 1960's to develop a storm water detention basin. A survey of the site and the immediately surrounding triangular area was conducted in 1975 for Los Angeles County in conjunction with development of the Long Beach Water Reclamation Plant. The survey found no archaeological or paleontological resources. A previous database search within 0.5 mile of the site, conducted in 1995 as part of a previous proposal for the ABP, did not reveal any known historical resources associated with the project area.

Recreation, Open Space, and Designated Wild/Scenic Rivers

Existing recreational facilities in the project area consist of bike trails along the San Gabriel River and Coyote Creek. No other recreational facilities occur in the project vicinity.

Alternative Project Components

Treatment Processes

Alternative processes considered for treatment of the recycled water obtained from the Long Beach Water Reclamation Plant, prior to injection into the Alamitos Barrier, essentially fall into two categories: alternative blend proportions for recycled vs. potable water and alternative materials used in treating the water itself.
The proposed proportion of recycled water for injection is 50 percent of the current annual delivery rate. Alternative blend percentages considered and their potential environmental effects are as follows:

1. **Maximum Reuse**. Under this alternative, recycled water would make up 100 percent of the supply to the Alamitos Barrier. This alternative would require larger storage capacity and possibly a larger treatment facility size than the proposed project, in order to meet the full-anticipated delivery rate of 8,000 acre-feet/year (afy) or 7 mgd (CDM 1991). Construction of the larger facility could require an incrementally larger amount of land. Environmental impacts of this larger facility would not be expected to be significantly different from the proposed project, other than the benefit that a proportionally greater amount of potable water would be made available for domestic consumption.

2. **Preferred Reuse.** Considered the preferred project alternative, this method would use 50 percent recycled water (3,000 afy) of the current annual delivery rate as injection into the barrier. The blend of recycled water and imported water would be delivered under pressure to the ABRWP through the existing dedicated 27-inch diameter pipeline located across the San Gabriel River from the proposed treatment facilities. Process residuals would be produced by the ABRWP and discharged to the CSDLAC trunk sewer system. No discharge of concentrate to the San Gabriel River estuary would occur.

3. **Minimum Reuse**. Under this alternative, the amount of recycled water would be limited to 20 percent of the full-anticipated delivery rate for injection. This alternative would require less storage capacity and possibly a smaller facility size than the proposed project. In addition, reverse osmosis as a treatment process would not be required, and could be replaced with a granular activated carbon (GAC) treatment system (CDM 1991). The facility would be sized to meet an anticipated delivery rate of 1,600 afy of recycled water, or about 1.4 mgd. Construction of this facility could require an incrementally smaller amount of land than the proposed project, but overall environmental impacts would not be expected to be significantly less than the proposed project. Nearly 50 percent of imported potable water would be needed for

this alternative compared to the proposed project, proportionally reducing the amount of potable water that would otherwise be available for domestic use.

Separation Processes, Inc. (1998) investigated alternative reverse osmosis processes for the recycled water, prior to injection into the Alamitos Barrier. These alternatives consisted of different materials that would be used for the reverse osmosis membrane: cellulose acetate and various types of composite polyamide membranes. Cellulose acetate was rejected as the membrane of choice because of its lower rejections of TDS, TOC, and nitrogen-bearing compounds as compared to the newer polyamide materials. Correspondingly, the process resulting from use of the polyamide materials tends to be higher in TDS, TOC, and nitrogen-bearing compounds than if cellulose acetate were used. The higher quality of the process residuals using cellulose acetate would result in less environmental impact than the proposed polyamide material, only if it was proposed that the process residuals be discharged directly into the San Gabriel River or Coyote Creek. With the proposed disposal into the existing sewage treatment system, no significant difference in environmental impacts between the various membrane material alternatives would be expected.

Storage

The supply of recycled water from the Long Beach Water Reclamation Plant (LBWRP) will vary diurnally and with the daily pattern of supply for other recycled water uses. However, the demand for water to supply the Barrier is essentially continuous, and there would be economic and operational advantages to sizing any facility for average flow rather than peak flows. Therefore, two alternatives for balancing flows by means of an equalization storage basin were considered:

1. ***Dedicated Storage***. This alternative would require construction of either an aboveground steel or reinforced concrete reservoir, or a below-ground concrete reservoir. The area over a buried reservoir could be used for other purposes, and would eliminate odor problems, but is likely to be more expensive.

2. ***Combined Storage with LBWRP Effluent***. If final effluent from the LBWRP were used as the source water for the Alamitos Barrier, it may be possible to combine the storage needs for other recycled water and the Barrier in the City of Long Beach recycled water distribution system.

Presently, the most likely option is storage that will be provided by the City of Long Beach that is presently used for all their customers.

Disposal Sites

Process residuals would be produced by the proposed project both as a result of microfiltration and reverse osmosis. The proposed project would convey the process residuals to the existing sewage system. Three alternatives to this disposal option and their environmental impacts are as follows:

1. ***San Gabriel River or Coyote Creek***. Under this alternative, process residuals would be discharged via a short pipeline to the edge of one of the two channels. Economic costs of this option would be negligible, but environmental impacts to the San Gabriel River estuary downstream of both channels would be a potential issue. This alternative was considered part of the proposed project in the previous Initial Study/Negative Declaration for the Alamitos Barrier Recycled Water Project prepared in 1995 by CH2M Hill. However, while the 1995 study concluded that discharge of the process wastewater would not significantly impact water quality in the San Gabriel River estuary downstream, this finding was questioned by reviewers of the CEQA document and continued monitoring of receiving waters was proposed as mitigation. The ABRWP would generate two process streams; reverse osmosis concentrate and microfilter backwash. The previous 1995 Initial Study/Negative Declaration included disposal of these wastes into the San Gabriel River with continued monitoring proposed as mitigation. Reviewers questioned this finding and as a result the reverse osmosis concentrate will be discharged to the Los Angeles County sewerage system for conveyance to the Joint Water Pollution Control Plant in Carson. Disposal options for the microfilter backwash are still under study and would either involve delivery to the LBWRP outfall or Coyote Creek, where it would be co-mingled with LBWRP effluent.

2. ***Settling Basin***. Under this alternative, microfiltration backwash would be clarified prior to disposal. However, experience at the microfiltration plant at Saratoga, California has shown that settling basins are unsuccessful, since the solids in the backwash are unsettleable. In addition, present day experience has shown that recovery of microfilter backwash may require conventional clarification and media filtration or another microfilter.

3. ***Engineered Wetland***. Under this alternative, process residuals would be routed through a wetland area that could be constructed in the 80-foot wide Edison International right-of-way west of the LBWRP, the project area, and the City of Long Beach property to the north. This wetland could be an extension of the existing small wetland in the Edison right-of-way. Implementation of this alternative would increase the extent of wetland habitat in the project region. However, there would be costs associated with the additional engineering and design needed to determine the appropriate size of the wetland and the types of vegetation that would tolerate the

brackish water. There would also be additional coordination and approvals required from Edison.

The preferred method with the least amount of environmental impact of disposal for the ABRWP is to transfer the process residuals to the CSDLAC trunk sewer system. This method would require a one-time connection fee and the payment of an annual Industrial Waste Surcharge.

Conveyance

Three alternatives were considered for conveyance facilities. These facilities would deliver final treated water from the proposed treatment plant to the injection distribution header.

1. ***New Dedicated Pipeline Option***. This option includes the construction of a pump station and approximately 11,100 linear feet of dedicated pipeline from the ABRWP to the Barrier header pipe. As shown in the site layout diagram, Figure 1-3, the alignment of the pipeline proposed would roughly parallel the existing LACDPW delivery pipeline and the western bank of the San Gabriel River and would also cross under the San Diego freeway. As a new dedicated pipeline is only being considered for the 100 percent recycled water option, the pump station must be sized to deliver 9 mgd (the ultimate ABRWP flow) at approximately 175 feet total dynamic head.

   Because there would be a direct connection to the Barrier header pipe from both recycled water and potable MWD water, there would need to be backflow prevention on the existing LACDPW delivery pipeline. Reduced pressure backflow preventors have been assumed for preliminary sizing and costing, but would require DOHS approval. For the anticipated flows, three 10-inch backflow preventor units in parallel would be needed.

2. ***Existing Pipeline, Direct Connection Option***. As with the new dedicated pipeline option, this option includes the construction of a pump station and a new pipeline. However, the pipeline would only be required to connect the pump station to a new connection with the existing 27-inch delivery pipeline near the treatment facilities, a reach of approximately 1,200 feet. Further, the new pipeline and pump station would be sized to deliver only recycled water (3.0 or 8.0 mgd depending on the treatment option), as any required blending would take place in the existing delivery pipeline. A backflow prevention facility similar to that described for the new dedicated pipeline option would be required on the existing pipeline upstream of the new connection. As with the new dedicated pipeline option, DOHS must approve of the use of a backflow prevention assembly.

3. ***Existing Pipeline, Wet Well.*** This option is similar to the existing pipeline, direct connection option, except that any MWD water required would be diverted through 1,200 feet of pipeline to a wet well of the pump station where it would be blended prior to pumping. The primary advantage of this option is that it provides an air gap to prevent any cross-contamination and simplifies the blending operation. There are two primary disadvantages associated with this option. First, the pump station and the new pipelines (2,400 feet total) must be sized to deliver the full 8.0 mgd demand of the barrier. Second, the available head in any MWD water used would be lost unless it could be recovered in an energy recovery station located at the pump station or at the connection to the MWD South Coast Feeder. This option becomes more advantageous as the ratio of recycled water to imported water gets higher.

   The third option (existing pipeline, wet well) would provide one air gap in the MWD supply pipeline. This satisfies public health concerns for preventing backflow of recycled water. Backflow prevention under the first two options would have to be accomplished with in-line reduced pressure backflow preventors. The air gap between the treated imported potable water and the ABRWP effluent would be provided by the differential pressure maintained by two structures. The structures include: 1) the pressure reducing station (located at the intersection of Wardlow Road and Woodruff Avenue); and 2) the double check valves and a reverse flow switch which would be installed between the pressure reducing station and the recycled water interconnection.

Alternative Processes Which Could Accomplish Project Objectives

There are numerous possible combinations of the alternatives discussed previously. Seven of these combinations were identified and discussed in an economic feasibility study for this project (CDM 1991). Four of the seven alternatives assumed delivery systems (new dedicated pipeline or existing pipeline/direct connection) that have subsequently been rejected by the Department of Health Services as unacceptable. One of the previously analyzed alternatives (50 percent recycled water use with reverse osmosis as the treatment process) is currently the proposed project. The two remaining alternatives, listed below, assume construction of an aboveground reservoir for storage and a delivery system consisting of the existing pipeline/wet well connection.

1. ***Maximum Recycled Water Use with Reverse Osmosis***. The principal difference between this alternative and the proposed project, other than the greater use of recycled water, is the requirement for about 4 MG greater storage capacity of the equalization basin. The capacity of the booster pump station would also be proportionally greater.

2. ***Twenty Percent Recycled Water Use with Granular Activated Carbon***. This alternative would entail a smaller equalization basin and less pump station capacity than the proposed project.

With one exception, environmental impacts of each alternative would not differ significantly from the proposed project because the site locations for each of these alternative facilities, and features of the facilities, would be similar to that of the proposed project. The exception is that the 20 percent alternative would entail greater use of imported potable water than the proposed project, Alternative 1, or the No Action Alternative. In addition, these alternatives include less efficient technology and are considered more susceptible to future environmental impacts.

No Project Alternative

Under the No Project Alternative, the Alamitos Barrier would continue to be maintained with 100 percent imported potable water. The project site would remain undeveloped, and weed abatement actions would continue on the site.

CUMULATIVE AND GROWTH – INDUCING IMPACTS

The CEQA Guidelines require a discussion of potential cumulative impacts that could result from a proposed project in conjunction with others in the vicinity. The cumulative impact of several projects is the change in the environment that results from the incremental impact of the project when added to other closely related past, present or reasonably foreseeable projects (Guidelines Section 15355).

The immediate areas surrounding the proposed project site, specifically the Long Beach Water Reclamation Plant (LBWRP) define the vicinity. Based on the current environmental analysis prepared for the LBWRP, as a separate document, the project will not result in any potentially significant impacts. Therefore, the combination of the Alamitos Barrier Recycled Water Project and LBWRP would not result in any cumulative impacts.

See Appendix A for Certified CEQA Compliance Documents.

SECTION 7 LEGAL AND INSTITUTIONAL REQUIREMENTS

Results of Consultation Activities

An environmental document (Environmental Assessment/Negative Declaration – EA/ND) was prepared for the Project consistent with the provisions of the National Environmental Protection Act (NEPA) and the California Environmental Quality Act (CEQA) in 1995. The EA/ND document has been issued to the California State Clearinghouse for public review as part of the CEQA process. Subsequent to this 1995 submittal, a revised Initial Study and Negative Declaration was prepared based on the latest design, submitted to the California State Clearinghouse for public review and certified on November 19, 1998.

Overall, the project does not have significant third party impacts and minor impacts can be mitigated to insignificance. Mitigation measures include routine traffic control, incorporation of appropriate features to mitigate sound from the facility and the use of high efficiency electrical equipment in the design.

Public Health and Environmental Quality Issues Associated with Each Alternative

Water Resources

Groundwater Resources

There are eleven production wells located within a 10,000 foot radius of the injection barrier. Of the eleven production wells, four are located within Los Angeles County and seven are located within Orange County. Of the four wells identified within Los Angeles County, none are used as drinking supply wells. Three of the seven Orange County production wells are drinking water supply wells an all are located northeast of the barrier wells.

Groundwater within the Central and Orange County Groundwater Basins is monitored according to Department of Health Services (DOHS) requirements which requires all groundwater for domestic use to be monitored for general mineral, trace inorganic and organic compounds, physical properties, and radioactivity. OCWD also samples for volatile organic compounds (VOCs) for other uses.

Groundwater quality varies throughout the basins both vertically and horizontally. The average Total Dissolved Solids (TDS) level for the Orange County Basin is 480 mg/1. TDS concentrations exceed 1,000 mg/L in two general areas, Yorba Linda and Irvine/Tustin. Nitrate concentrations exceeding the 10 mg/L federal drinking water standard are generally found in three areas: Fullerton, Tustin/Irvine and Garden Grove/Westminster. Selenium concentrations exceeding the federal drinking water standard of 10 parts per billion (ppb) have been detected in wells in the Fullerton and Irvine areas where concentrations range from 10 to 50 ppb. Contamination from Volatile Organic Compounds (VOCs) within the Orange County Basin appears to be minor to date. (*Engineering Report*, Camp Dresser McKee, May, 1992).

In the Central Basin, TDS levels in the spreading ground areas have decreased from about 600 mg/L in the early 1970s to 400 mg/L in the mid 1980s (Rio Hondo spreading grounds) and from 700 mg/L to 500 mg/L (San Gabriel River spreading grounds). Nitrate presents no apparent threat to groundwater in the Central Basin, although some wells in the San Gabriel River spreading basins have exceeded the federal drinking water standard for nitrate of 10 mg/L. The presence of VOCs does not appear to be a significant basinwide problem, however TCE and PCE have been detected throughout the basin, but most levels were below the state drinking water maximum contaminate levels (MCLs) of 5 ug/L.

The project would have a less than significant impact on groundwater quality based on the proposed substitution of 50 percent recycled water for the 100 percent potable water currently being supplied to the barrier. The California Department of Health services (DOHS) has draft regulations on the use of recycled water for use in groundwater basins (Title 22, California Code of regulations, Division 4 Environmental health, Chapter 3 reclamation criteria).

For the project to be acceptable under the proposed regulations, two threshold criteria must be met: 1) the minimum distance from the barrier to the closest potable water well must be 2,000 feet; and 2) the recycled water must have a minimum of one year of travel time prior to encountering a potable well.

An Engineering Report and draft technical memorandum based on these regulations was prepared and submitted to the DOHS. These reports are on file with the WRDSC. Based on the threshold criteria, the report concluded:

- The distance from the closest potable well to the injection barrier is approximately 4,300 feet, and therefore meets the first criterion;
- With regard to the second criterion, the three closest groundwater production wells to the barrier injection wells were examined. Based on available hydrogeological data, it is estimated that it would take 2.5 to 10 years for the front of recycled water to reach the closest well. However this estimate assumes no mixing would occur with the water in the aquifer, which is a likely worst case estimate. With mixing, the recycled water would be diluted and the travel time would decrease.

The reasonable worst case scenario for injecting recycled water into the barrier assumes that at the closest production well, the aquifer in which the water is injected would, after a sufficient interval, eventually contain 100 percent recycled water from the barrier (which is not actually the case). Based on the characteristics of the aquifers in the basin, there are no existing potable wells within a one-mile radius that would receive 100 percent barrier water after the 2.5 to 10 (worst case) years that it would take for the recycled water to reach the well.

The results of the Engineering Report indicated that the DOHS criteria would be met. The tertiary treated recycled water produced at the Long Beach Water Reclamation Plant received adequate virus removal. However, the reverse osmosis units of the proposed project provide an additional barrier to potential viruses. Also, the length of time that the recycled water would travel through the soil layers to the nearest potable water supply well will significantly reduce the potential for any health impacts from active viruses. Thus, no significant groundwater impacts are anticipated. To provide a more accurate (non-worst case) prediction, of when recycled water will reach domestic water supply wells, additional hydrogeological investigations, potentially including a groundwater model, will be conducted.

The project design incorporates reliability features and stringent operating protocols, including a contingency plan to ensure that the recycled water product meets or exceeds all water quality requirements of the permitting agencies. A comprehensive monitoring program has also been incorporated into the project to document project operation and compliance with permit requirements established to protect water quality in the groundwater basin.

With the above considerations it is concluded that the proposed project will have no significant adverse impact on groundwater quality.

Receiving Water Quality

The proposed project will discharge process wastes into the LACSD's system for conveyance to the Joint Water Pollution Control Plant in Carson during operation, therefore the term "receiving water" for purposes of this project evaluation is not applicable.

Water Supplies for the Service Area

Existing potable water supplied for consumption in the area is provided through a pipeline operated by the Los Angeles County Department of Public Works. The potable water currently used for the Alamitos Barrier is supplied by the Metropolitan Water District.

Chemicals

Various ancillary chemical treatment processes are required for each of the three alternatives evaluated for this project, consisting of varying amounts with each alternative. The ABRWP will operate in conformance with all applicable federal, state, and regional regulations regarding the handling and storage of hazardous materials. Specifically, a business plan consisting of a hazardous materials management plan and a risk management prevention plan will be developed. The plan will meet or exceed all regulations once local determinations of "hazardous" or "highly hazardous" materials are made by the local regulating agency (typically, the local fire department).

Chemicals used in the treatment processes consist of sulfuric acid, sodium hypochlorite, sodium hydroxide, and a threshold inhibitor to prevent scale buildup.

The Effects of the Change of Recycled Water From its Current Use to the Proposed Alternative Use

Currently, the recycled water used in the ABRWP will be obtained from the LBWRP. The LBWRP uses its recycled water for irrigating golf courses, parks, etc. The portion that is unused is discharged to the County Sanitation Districts of Los Angeles County (CSDLAC) sewer system. The ABRWP will decrease the amount of unused recycled water discharged to the CSDLAC while at the same time increasing the amount of potable water available for other uses.

Economic

Long Beach would receive a financial benefit through the sale of recycled water otherwise unused.

With the proposed project in place, there will be less of a need to find other sources of potable water and thus, less money spent on exploring these new sources. Initially, the project will provide for 3,000 afy with the potential future expansion of up to 8,000 afy.

Without the project in place, there will be a greater need to develop additional sources of potable water for injection into the barrier. If, during years of drought, these sources are unable to be explored or fully utilized, then there will be a greater likelihood of saltwater intrusion and contamination of the groundwater basins.

Environmental

Increased use of a recycled water resource, otherwise disposed of, saves potable water and the ultimate discharge that ends up in the ocean. This project may have the potential to reduce or delay expansion of water supplies by making potable water more readily available for general public usage. The project, as proposed, would reduce dependence on the potable water currently used for injection into the Barrier. The proposed project would inject 50 percent recycled water into the Barrier allowing more use of the remaining potable water. This replacement would reduce the amount of imported water required in Southern California, and also provide a beneficial use for excess recycled water.

Other Legal and Institutional Requirements

A water-recycling permit will be required from the LARWQCB, which includes the coordination of a Public Hearing by the California DOHS and the incorporation if the DOHS findings into the LARWQCB Permit.

It is anticipated that the regulatory requirements for use of recycled water in the Alamitos Barrier will require properly treated and disinfected recycled water followed by organics removal comprise no more than 50 percent of the water injected into the barrier. There will also have to be sufficient hydrogeologic investigations performed to establish that the blended water will be retained underground for at least 12 months, and that the distance to the nearest potable water well is at least 2,000 feet from the point of injection. The reverse osmosis process to be utilized at the ABRWP will be treating microfiltered Title 22 quality water from the Long Beach Water Reclamation Plant and is capable of producing a water that will meet all established water quality requirements for barrier injection.

Unresolved Issues Associated with the Project, How They Will Be Resolved, and How it May Affect the Project if Unresolved

As discussed within this section, issues of regulatory permitting, agreement and funding sources are continuing to be pursued/finalized. It is anticipated that no issues relating to these items would be unresolved; therefore, no affect on the project would result.

The microfiltration/reverse osmosis (MF/RO) process, in part, has been developed based on the West Basin Water Reclamation Facility (WBWRF) design. The WBWRF incorporates a comprehensive monitoring program to document project operation and compliance with permit requirements established to protect water quality in the groundwater basin. Recently, the presence of N-nitrosodimethylamine (NDMA) in recycled water has become and issue of concern to DOHS. If it is determined that this specific water quality issue is related to the proposed treatment process, refinement of the treatment process to meet established water quality requirements would be resolved during completion of the ABRWP design. WRD is working cooperatively with the DOHS and all other appropriate agencies to ensure the ABRWP design meets or exceeds all established water quality requirements.

Any Legal or Institutional Constraints That Would Affect the Ability of the Sponsor to Implement the Project

WRD has carefully considered all legal and institutional requirements for the ABRWP. The Project incorporates cooperative planning with appropriate regulating and partnering agencies for this project, and WRD has prepared schedules for meeting established legal and regulatory requirements.

No additional constraints, other than those that may have previously been discussed in this section, have been identified. Therefore, it is anticipated that WRD has the complete ability to implement the ABRWP.

SECTION 8 FINANCIAL CAPABILITY OF THE SPONSOR

Proposed Schedule for Project Implementation

Upon approval of agreements with supplemental funding agencies, including the Metropolitan Water District of Southern California (MWD) Local Resources Program (LRP) and the U.S. Bureau of Reclamation, it is anticipated that the project will be implemented as shown in the following abbreviated project schedule:

Milestone Description	Schedule/Milestone Dates
CEQA Certification	November 19, 1998
NEPA Order to Construct	July 22, 1999
Agreements	
Central Basin MWD/WRD	November 1999
MWD/CBMWD	November 1999
City of Long Beach O&M	August 1999
Orange County Water District	April 1, 1999
Los Angeles County	December 1999
Regulatory Review and Approval	
DOHS Review and Public Hearing	October 1999
RWQCB Review and Approval	October 1999 – February 2000
Baseline Monitoring Begins	March 2000 – March 2001
Site Grading Design/Bid/Award	January 14, 1999 – September 1999
Site Grading Construction	September 1999 – April 2000
Award Microfilter Purchase and Delivery	May 25, 1999 – March 2000
Design/Bid/Award Treatment Plant	January 14, 1999 – October 18, 1999
Brine Disposal LACSD Permit	March 1999 – October 1999
Treatment Plan Construction	April 2000 – April 2001
Startup	May 2001 – June 2001

Specifications for site grading and earthwork were issued for bid following Metropolitan Water District of Southern California's (MWD) recommendation for project funding assistance under their Local Resources Program. Final design of the project facilities and the award of construction contracts for those facilities would be completed concurrent with the initial site preparation work to minimize overall construction time.

Project Financing

MWD's financial support to the ABRWP is vital to its success. Therefore, the present schedule for implementation of the project is built around securing MWD's financial commitment to the project. MWD's Local Resources Program (LRP) contributes funding on a dollar per acre-foot basis for certified deliveries of project water. MWD staff recommended the ABRWP for LRP funding and is currently negotiating an agreement with Central Basin Municipal Water District, WRD's Metropolitan member agency. Provided MWD approves financial participation in accordance with the negotiated LRP agreement, WRD has appropriated $16.8 million is a separate Alamitos Barrier Recycled Water Project Construction Fund, and is committed to proceed to construct, demonstrated by resolution dated September 17, 1998 (Appendix B).

As currently estimated, recycled water cost per acre-foot with the MWD LRP subsidy is expected to be slightly less than the current cost of imported water used for the barrier. As the cost of imported water rises, the ABRWP would become increasingly more cost effective. While WRD could finance construction of the Project from existing funds, it is seeking additional funding sources to reduce the net project cost to WRD. Of note, WRD is seeking Federal Grant funds consistent with the Authorization in Title 16 of Public Law 102-575.

WRD needs the MWD LRP subsidy to establish the economic feasibility of the project compared to the estimated cost of purchasing imported water, presuming that 25 percent of the capital cost of the project is ultimately reimbursed by the USBR.

Financial Capability of the Sponsor

Section 2, Table 2-1, demonstrates the project capital cost factors. While the source of funds from the MWD LRP improve the overall economics of the project, WRD has capital reserve funds on hand in sufficient amounts to cover the full capital cost of the facility even without the Federal funding. As stated in Section 2, WRD has appropriated $16.8 million as a separate ABRWP Construction Fund. While WRD could finance construction from existing funds, it is seeking Federal funding to reduce the net project costs, including the annual capital costs, to WRD and its constituents.

SECTION 9 RESEARCH NEEDS

Several additional studies and/or data collection efforts would be desirable to provide a basis for detailed design and permitting of the facilities. These might include the following:

1. Further characterization of the groundwater basins and the impacts on local wells. This could potentially include background quality monitoring and installation and test pumping of plot wells. This might also include development of a three-dimensional model of the local groundwater system, particularly if dilution at the point of extraction is an integral part of the project basis in order to reduce the TOC requirements in the recycled water or seek higher ratios if recycled water at the wellhead (greater than 50%).

2. Additional recycled water quality data will be designed to provide design criteria for the treatment facilities. A program of periodic analysis of the effluent should be initiated for the following constituents:

   - Silica
   - Strontium
   - Complete Cations and Anions

3. Improved treatment utilizing other filters, membranes or chemicals that could be integrated into the primary treatment processes of microfiltration and reverse osmosis to improve reliability of the treatment prior to blending and injection.

SECTION 10 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are made pursuant to results obtained from studies conducted to determine the technical and economic feasibility of the proposed Alamitos Barrier Recycled Water Project (ABRWP):

CONCLUSIONS

1. The Alamitos Barrier Project (ABP) should reduce its dependence on unreliable imported water supplies. ABP should actively pursue the development of more reliable local sources of water by expanding its potential sources of recycled water.

2. The proposed ABRWP is technically feasible, and when implemented, would enable WRD to increase the availability and reliability of local and regional water supplies.

3. The total Capital Costs for the proposed ABRWP are estimated at $13.3 million, plus an additional $2.2 million for residual disposal connection fees.

4. The total O&M Costs for the proposed ABRWP are estimated at $765,281 over a 25 year life.

5. Outside funding assistance is needed to make the proposed ABRWP economically feasible.

6. The most cost-effective financing scenario considered is comprised of a combination of Metropolitan Water District of Southern California (MWD) Local Resources Program funding assistance and a USBR 25 percent Cost Sharing Grant that would fund 25 percent of the capital costs.

7. The two most important elements of any proposed financing alternatives are the MWD LRP rebate and the USBR 25 percent Cost Sharing Grants (Title XVI). The 25 percent Cost Sharing Grants are limited to a maximum of $20 million per project and if secured, would reimburse WRD for up to 25 percent of actual capital expenditures on the approved project, or $3.33 million

8. WRD completed and certified the Initial Study Checklist and Negative Declaration pursuant to the requirements of the California Environmental Quality Act (CEQA) for the proposed ABRWP in November 10, 1998.

RECOMMENDATIONS

1. The implementation of the proposed ABRWP should proceed as outlined in this report.

2. To proceed forward, WRD should apply to USBR for project funding assistance (25 percent Cost Sharing Grant) pursuant to Title XVI. This feasibility report and CEQA/NEPA compliance documentation would need to be submitted as part of the application package.

APPENDIX A

CERTIFIED CEQA COMPLIANCE DOCUMENTS FOR PROPOSED ABRWP (1998)

FINAL
INITIAL STUDY/NEGATIVE DECLARATION FOR THE ALAMITOS BARRIER RECLAIMED WATER PROJECT

Prepared for:
Water Replenishment District of Southern California

Prepared by:
Psomas and Associates

November 10, 1998

FINAL
INITIAL STUDY/NEGATIVE DECLARATION FOR THE ALAMITOS BARRIER RECLAIMED WATER PROJECT

Prepared for:
Water Replenishment District of Southern California

Prepared by:
Psomas and Associates

November 10, 1998

Notice of Determination

To: ✓ Office of Planning and Research
1400 Tenth Street, Room 121
Sacramento, CA 95814

____County Clerk
County of ____________________

From: Water Replenishment District of Southern California
(Address)
12621 E. 166th Street, Cerritos, CA 90703

Subject:
Filing of Notice of Determination in compliance with Section 21108 or 21152 of the Public Resources Code.

Alamitos Barrier Reclaimed Water Project
Project Title

#98101009	Hoover Ng	562/921-5521
State Clearinghouse Number (If submitted to Clearinghouse)	Lead Agency Contact Person	Area Code/Telephone/Extension

Vicinity of Willow Street and State Route 605, City of Long Beach, Los Angeles County, CA
Project Location (include county)

Project Description:

Replace 50% of the potable water currently used in the Alamitos Barrier with treated and reclaimed water obtained from the Long Beach Water Reclamation Plant (LBWRP).

This is to advise that the Water Replenishment District of Southern California has approved the above described project on

☑Lead Agency ☐ Responsible Agency

November 19, 1998 (Date) and has made the following determinations regarding the above described project:

1. The project [☐will ☑will not] have a significant effect on the environment.
2. ☐ An Environmental Impact Report was prepared for this project pursuant to the provisions of CEQA.
   ☑ A Negative Declaration was prepared for this project pursuant to the provisions of CEQA.
3. Mitigation measures [☑were ☐were not] made a condition of the approval of the project.
4. A statement of Overriding Considerations [☐was ☑was not] adopted for this project.
5. Findings [☑were ☐were not] made pursuant to the provisions of CEQA.

This is to certify that the final EIR with comments and responses and record of project approval is available to the General Public at:

Water Replenishment District of Southern California, 12621 E. 166th Street, Cerritos, CA 90703

Robert L Campbell	November 19, 1998	General Manager
Signature (Public Agency)	Date	Title

Date received for filing at OPR:

Revised October 1989

NEGATIVE DECLARATION (CEQA)

Pursuant to: Division 13, Public Resources Code

Description

The proposed project is located in the City of Long Beach, California. The project proposes to protect the Central Groundwater Basin of Los Angeles County and Orange County Groundwater Basin from seawater intrusion by replacing 50% of the potable water currently being used with treated reclaimed water from the Long Beach Water Reclamation Plant (LBWRP).

The proposed project is sited on 4 acres located between the San Gabriel River and Coyote Creek, just north of the LBWRP. The project site is currently undeveloped, flat vacant land, occupied by non-native grassland. There is also a narrow, open, concrete-lined storm drain that crosses the site in the northeastern corner. An Edison powerline right-of-way and the San Gabriel River to the west border the site, a four-lane street (Willow Street) to the north, Coyote Creek and access road to LBWRP to the east, and the existing LBWRP to the south. The need for the proposed project is to reduce dependence of the APB on imported water, while maintaining the seawater barrier.

Project operation and construction are not expected to result in any significant impacts.

Determination

An Initial Study has been prepared by the Water Replenishment District of Southern California. On the basis of this study it is determined that the proposed action will not have a significant effect upon the environment for the following reasons:

1. The project will not have a significant effect on water resources.

2. The project will have not significantly impact land use and zoning or population and housing.

3. The project will not have significant effect on air quality, noise levels or energy usage, nor utility and service systems.

4. The project will not significantly increase geologic, seismic and soils hazards.

5. The project will not significantly induce population growth that would generate new traffic, nor impact public services.

6. There is no significant impact to biological resources, historic, or cultural resources.

7. The project will not have any significant impact on aesthetics or recreational opportunities.

Robert L. Campbell

November 19, 1998

ROBERT L. CAMPBELL — Date

General Manager

Water Replenishment District of Southern California

FINAL
INITIAL STUDY/NEGATIVE DECLARATION
FOR THE ALAMITOS BARRIER
RECLAIMED WATER PROJECT

Prepared for:

Water Replenishment District of Southern California
12621 E. 166th Street
Cerritos, California 90703

Prepared by:

Psomas and Associates
3187 Red Hill Avenue, Suite 250
Costa Mesa, California 92626

November 10, 1998

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EXECUTIVE SUMMARY

The Alamitos Barrier is an engineered freshwater pressure ridge and seawater trough located in the City of Long Beach, California. The Barrier is designed to protect the Central Groundwater Basin of Los Angeles County and the Orange County Groundwater Basin from seawater intrusion. Currently, the Barrier is maintained through injection of treated, imported potable water.

The Water Replenishment District of Southern California, proposes to replace 50% of the potable water currently used in the Alamitos Barrier with treated reclaimed water obtained from the Long Beach Water Reclamation Plant (LBWRP). The objective of the proposed project is to reduce dependence of the ABP on imported water, while maintaining the seawater barrier.

The proposed project site is 4 acres in size and located between the San Gabriel River and Coyote Creek, just north of the LBWRP. Project facilities would consist of a treatment plant, with microfiltration and reverse osmosis units, a booster pump station, pipelines, and associated electrical/communication connections to existing utilities. Residuals from the reverse osmosis and microfiltration process would be discharged into the existing trunk sewer that conveys LBWRP solids to the County Sanitation District's Joint Water Pollution Control Plant in Carson. In 1995, an Initial Study/Negative Declaration (IS/ND) was prepared for the same project, except that the process residuals were proposed to be discharged into the San Gabriel River. While the IS/ND concluded that such disposal would not significantly impact water quality in downstream reaches of the San Gabriel River, including the San Gabriel River estuary, reviewers of the document differed with this conclusion. Subsequent changes in the project design, including discharge into the sewer system instead of the river, have lead to the revised environmental analysis presented in this document. This analysis is intended to conform to requirements of the California Environmental Quality Act (CEQA). A federal nexus is derived from potential involvement of the US Bureau of Reclamation (USBR) from providing future funding for the project. A separate environmental document will be prepared by the USBR to comply with National Environmental Policy Act (NEPA) regulations.

The project site is currently undeveloped, flat vacant land, occupied by non-native annual grassland that is frequently disked for weed abatement purposes. There is also a narrow, open, concrete-lined storm drain that crosses the site in the northeastern corner. The site is bordered by an Edison powerline right-of-way and the San Gabriel River to the west, a four-lane street (Willow Street) to the north, Coyote Creek and access road to LBWRP to the east, and the existing LBWRP to the south. Both the San Gabriel River and Coyote Creek are concrete-lined, trapezoidal channels in the reaches that border the site. Surrounding land uses include a park, golf course, and bike trails along the San Gabriel River and Coyote Creek. Commercial buildings are located east of the project on the other side of Coyote Creek, and a residential area is located 0.5 mile south of the site. View of the site is obscured along the eastern and southern boundaries due to presence of eucalyptus trees and other ornamental plantings. Plantings and landscaping associated with the proposed project would additionally reduce visibility of the facilities from nearby areas.

Design and environmental issues regarding water quality, raised in the previous version of the project, have been incorporated into the proposed project. Analysis of environmental impacts of the proposed project concludes that the project, as described in Section 2 of this document, would have no significant impacts on the environment. These findings warrant a Negative Declaration under CEQA.

1.0 INTRODUCTION

The Alamitos Barrier is an engineered freshwater pressure ridge and seawater trough located in the City of Long Beach, California. The Barrier is designed to protect the Central Groundwater Basin (Los Angeles County) and Orange County Groundwater Basin from seawater intrusion. The pressure ridge is created by injection of fresh water into the groundwater aquifer. The seawater trough is created by the extraction of brackish groundwater from wells located on the seaward side of the injection well arc.

Currently, fresh water for injection at the Alamitos Barrier consists of treated, imported State Water Project and/or Colorado River potable water. In the early 1990s, it was conceived that 50% of this potable water could be replaced by reclaimed water. This replacement would reduce the amount of imported water required in Southern California, and also provide a beneficial use for excess reclaimed water. In 1995, CH2M HILL prepared an Initial Study/Mitigated Negative Declaration (IS/ND) for the project, in compliance with requirements of the California Environmental Quality Act (CEQA). However, this document was never certified and the project did not go forward, at least partly because the project at that time proposed to release process residuals into the San Gabriel River. This proposal lead to concerns about impacts on the San Gabriel River estuary, a significant biological resource located south and downstream of the project site.

Since 1995, a number of technological and design improvements to the Alamitos Barrier Reclaimed Water Project have been incorporated, and discharge of process residuals into the San Gabriel River is no longer considered a preferred alternative. Instead, the process residuals would be discharged into the sewer system and treated by the Los Angeles County Sanitation Districts' Sewerage System. This alternative was considered in the previous environmental documentation however, it was not the preferred alternative. Changes in the project design itself warrant new environmental documentation. In addition, the Water Replenishment District of Southern California (WRD) is seeking cost share funding from state/regional agencies, as well as from the US Bureau of Reclamation (USBR). Consequently the present environmental document is intended to update the previous IS/ND and satisfy state (CEQA) requirements. An environmental document to satisfy National Environmental Policy Act (NEPA) requirements for allocation of federal funding will be prepared by the USBR under a separate cover.

2.0 PROJECT DESCRIPTION

2.1 Purpose, Need and Objectives

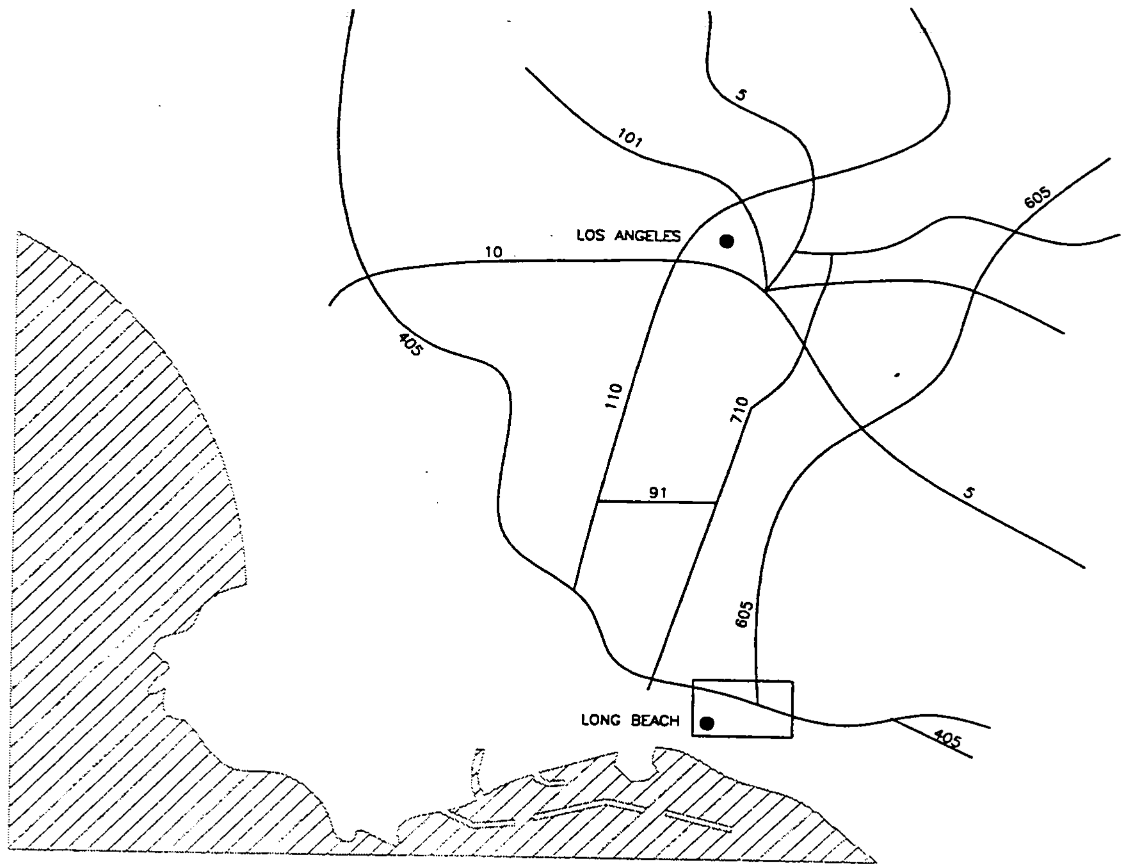
2.1.1 Background

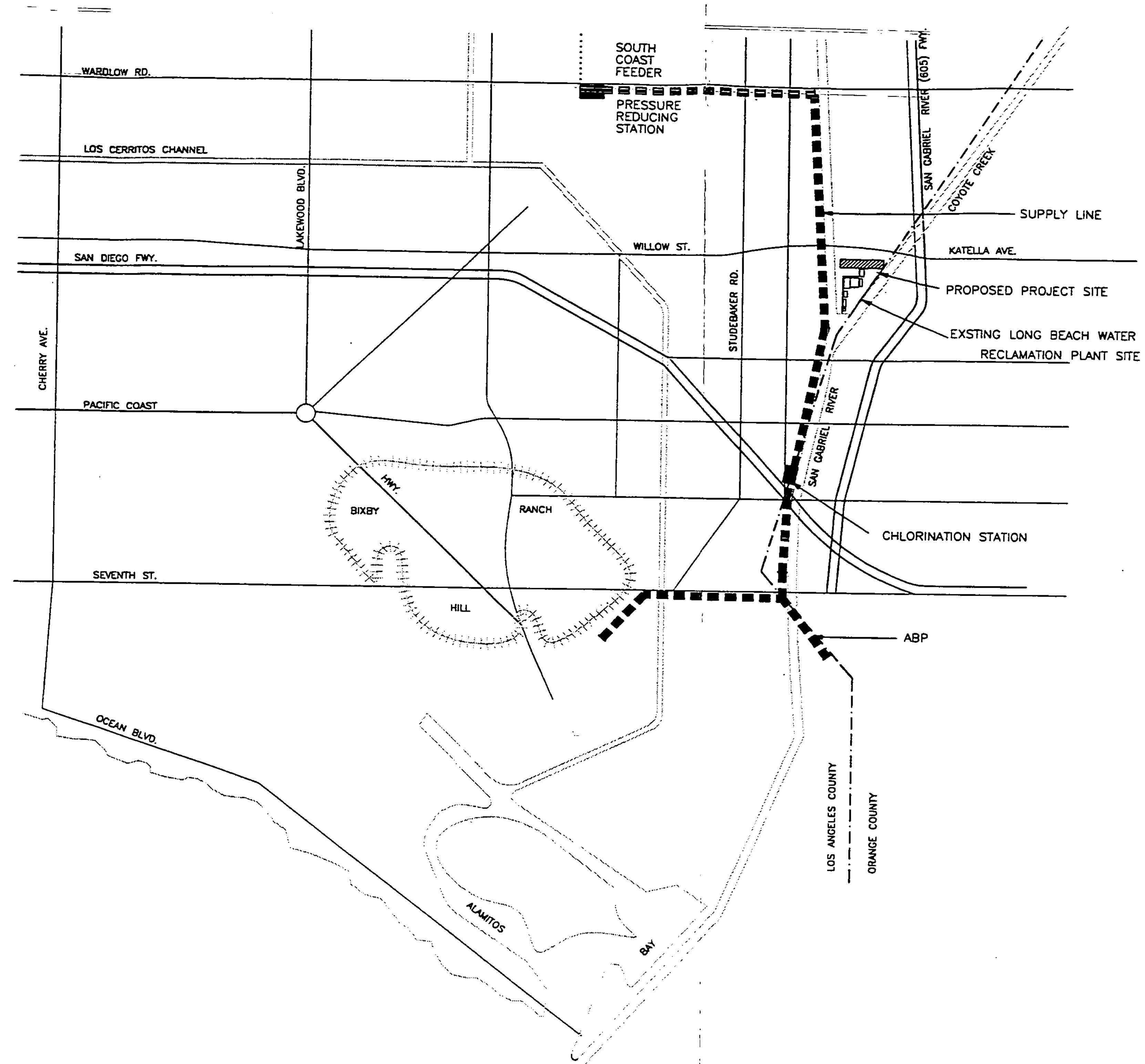
The Central Groundwater Basin of Los Angeles County and the Orange County Groundwater Basin, which are geologically one basin, provide approximately 40% of the total water demand for the region, and thus serve as very important water resources. The Alamitos Barrier is an engineered freshwater pressure ridge and seawater trough, designed to protect these groundwater basin from the intrusion of seawater through an alluvium-filled erosional gap, commonly known as the Alamitos Gap. The Gap is located near the Los Angeles-Orange County line, two miles upstream from the mouth of the San Gabriel River (Figure 1). The pressure ridge is created by the injection of fresh water into the groundwater aquifer through 35 wells located in an arc spanning the Alamitos Gap. The trough is created by the extraction of brackish groundwater from four wells located on the seaward side of the injection well arc, and barrier performance is monitored through observations conducted at 230 wells located at multiple sites near the Alamitos Gap.

The combination of wells is designed to reverse the inland gradient of subsurface water and thus prevent further seawater intrusion. Fresh water for injection to the Alamitos Barrier consists of treated, imported State Water Project and/or Colorado River water obtained through a turnout from the South Coast Feeder. Observation wells in the vicinity of the barrier provide data for tracking the migration of seawater in and around the barrier.

The Water Replenishment District of Southern California and the Orange County Water District (OCWD) currently purchase imported water for injection to the Barrier from the Metropolitan Water District (MWD). WRD and OCWD have jointly embarked on a recycled water program for the Alamitos Barrier to reduce the use of this potable imported water supply, thereby benefiting the entire region. The use of reclaimed water at the Barrier would represent a significant step forward in using innovative methods to continue protecting the local groundwater resources from seawater intrusion while conserving California's precious water resources. In addition, as the cost of imported water rises, the Alamitos Barrier Reclaimed Water Project (ABRWP) would become increasingly more cost effective.

Prompted in part by the successful use by OCWD of reclaimed water for injection at the Talbert Gap barrier in Orange County, the agencies that



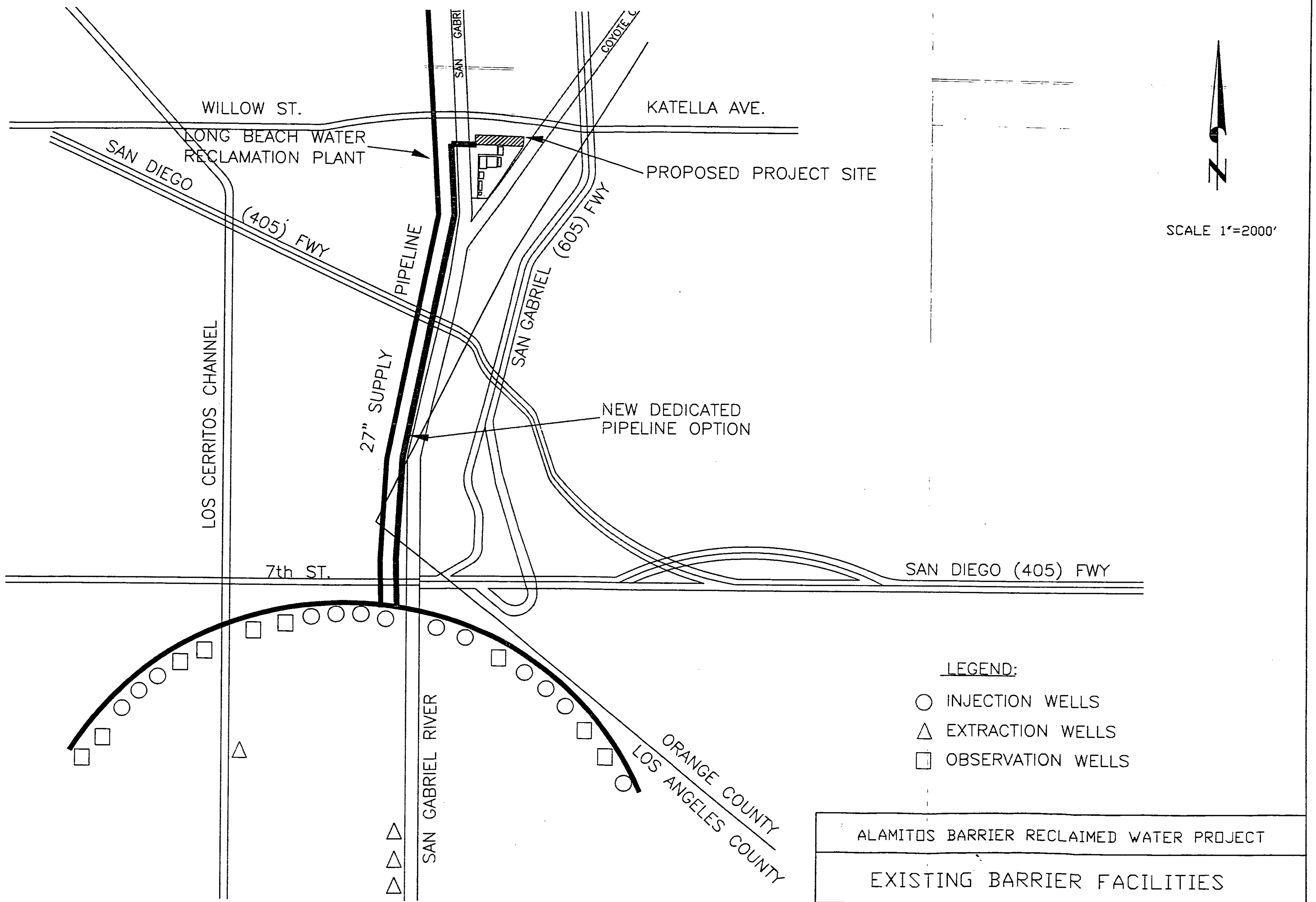


ALAMITOS BARRIER RECLAIMED WATER PROJECT

PROJECT LOCATION

SCALE 1"=4000'

FIGURE 1



ALAMITOS BARRIER RECLAIMED WATER PROJECT

EXISTING BARRIER FACILITIES

FIGURE 2

have an interest in the ABRWP began initial investigations into the possibility of substituting reclaimed water at the Alamitos Barrier, as well. The Long Beach Water Reclamation Plant (LBWRP), located approximately two miles from the Alamitos Barrier, was identified as a potential source of reclaimed water for this purpose. The LBWRP already provides substantial quantities of reclaimed water for the irrigation of parks, golf courses and greenbelts in the Long Beach area. LBWRP staff have stated that the LBWRP has sufficient capacity to provide treated effluent for the proposed project.

In December 1995, CH2M Hill issued the contract documents and conceptual documents for the design and construction of the ABRWP. These documents were prepared for the WRD and the OCWD, and it was anticipated that the project would be implemented through the design/build project approach. Financing and permitting for the project exceeded required timelines, and the technologies to be used in the project have advanced. In March 1998, the WRD asked Separation Processes, Inc. to revisit the ABRWP. Separation Processes evaluated the earlier documents to determine if the latest technology were specified for the microfiltration and reverse osmosis sections of the design/build contract and that the equipment had been properly sized for delivery of 3,000 acre feet per year (afy) of water. This project description incorporates modifications to the project discussed in that evaluation.

As currently envisioned, the first phase of the ABRWP, which would supply 3,000 afy, or half the total water demand for the Alamitos Barrier, could be completed by the year 2000 for a total cost of about $14 million. Net project costs would be competitive with the cost of imported water used for the barrier if financial assistance is provided. As the cost of imported water rises, the ABRWP would become increasingly more cost effective. The second phase of the project would provide close to 100% of the water needs for the barrier if regulatory approval were granted.

2.1.2 Project Objectives

The primary project objective of the ABRWP is to develop a reliable and constant supply of water to the Alamitos Barrier to maintain the existing seawater barrier and minimize reliance on imported water sources. The project will meet the Regulatory Requirements of the agencies involved, as well as the Operational Requirements imposed by the City of Long Beach and WRD.

The ABRWP would accomplish the following objectives: 1) increase the permitted use of recycled water for groundwater recharge, and 2) increase the use of recycled water for seawater intrusion barriers.

2.2 How Objectives Will Be Accomplished

The Water Replenishment District of Southern California (WRD), and the City of Long Beach propose to develop a new, advanced reclaimed water treatment plant (treatment plant) to provide a source of reclaimed water for use in the existing Alamitos Barrier.

The Alamitos Barrier Reclaimed Water Project (ABRWP) would take tertiary effluent, which has been treated to meet Title 22 non-potable reuse standards, from the Long Beach Water Reclamation Plant (LBWRP) and improve the quality of that water to the standards required for injection into the Alamitos Seawater Intrusion Barrier using microfiltration and reverse osmosis. This advanced treated water would ultimately replace at least some of the imported water now supplying the Barrier, making the imported potable water available for other uses.

2.3 Description of Existing Facilities

The proposed ABRWP project site is located near the southeast corner of Los Angeles County, in the City of Long Beach, California, about two miles inland from the Pacific Ocean (Figure 1).

The Los Angeles County Department of Public Works (DWP) operates and maintains the Alamitos Barrier and its physical facilities under the direction and approval of a Joint Management Committee acting on behalf of the Los Angeles County Flood Control District (LACFCD) and the OCWD. The Barrier, operational since 1971 and expanded in October 1982, has generally been effective in reducing intrusion into the groundwater basin. The Barrier influences both the Central Groundwater Basin in Los Angeles County and the Orange County Groundwater Basin. However, between 5,000 and 7,000 acre-feet per year (afy) of imported State Water Project and/or Colorado River water obtained through the MWD have been used to maintain the Barrier.

The LBWRP has been identified as a potential source of reclaimed water for the ABRWP. The LBWRP is located on a 9-acre triangular-shaped parcel of land about two miles north of the Alamitos Barrier in the City of Long Beach. The site is just north of the confluence of the San Gabriel River and Coyote Creek as shown on Figure 2. The plant is operated by the Los Angeles County Sanitation Districts (LACSD), and provides full tertiary treatment to influent water received from the City of Long Beach and the surrounding areas. Effluent exits the southern end of the plant and is either delivered to the Long Beach reclaimed water system pumping station and pumped across the San Gabriel River to the west or is dechlorinated and discharged into Coyote Creek to the east. The LBWRP currently treats up to 25 millions of gallons per year (mgd), which is less than its capacity of 30 mgd. The plant includes full secondary and tertiary (filtration) treatment capacity to meet the California Department of Health Services (DOHS) Title 22 requirements for use in unrestricted irrigation and for body contact recreation uses. Water quality of the plant effluent is generally very good due to the nature of the treatment provided and the composition of the water from the contributing areas, which are predominantly residential and commercial, with lower-than-average contribution from industrial sources.

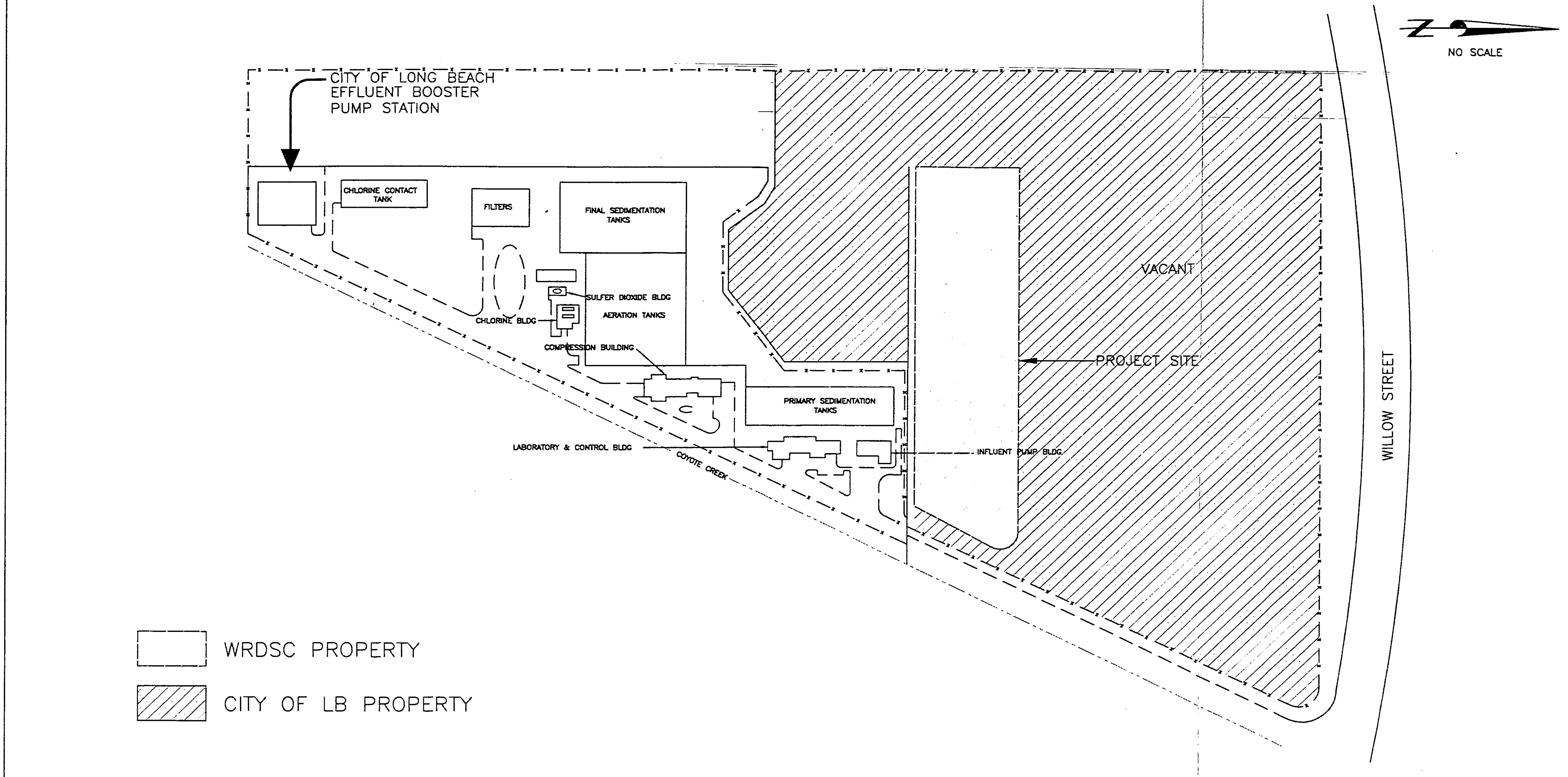
The City of Long Beach operates a reclaimed water system, which provides an annual supply average of 3.3 mgd of reclaimed water for park, golf course and greenbelt irrigation. This use is significantly less than the capacity of the system. Based upon a study by the City of Long Beach, there is a potential for expanding the use considerably to meet additional irrigation and industrial demands up to an annual average of approximately 10 mgd.

2.4 Description of Proposed Facilities

2.4.1 Project Location and Concept

The proposed project site consists of 4 acres of unpaved land that is covered with non-native vegetation in a rectangular area between the existing LBWRP and undeveloped land owned by the City of Long Beach and the adjacent Willow Street (Figure 3). An additional 5 acres of disturbed land would be required for a construction trench and installation of a pipeline along the San Gabriel River if the new dedicated pipeline option is selected for conveyance of final treated water.

The ABRWP would take tertiary effluent, which has been treated to meet Title 22 standards, from the Long Beach Water Reclamation Plant and improve the quality of that water to the standards required for injection into the Alamitos Barrier using microfiltration and reverse osmosis. The initial plant effluent capacity would be 3.0 million gallons per day (mgd), which when operated at full capacity for 90% of the time (328.5 days per year) would produce 3,023.9 acre feet per year (afy) of reverse osmosis permeate. The plant would be designed to accommodate future expansion to 8.0 mgd of reverse osmosis permeate at some future date, should sufficient supply be available, barrier or other demands allow, and regulatory conditions permit.



ALAMITOS BARRIER RECLAIMED WATER PROJECT

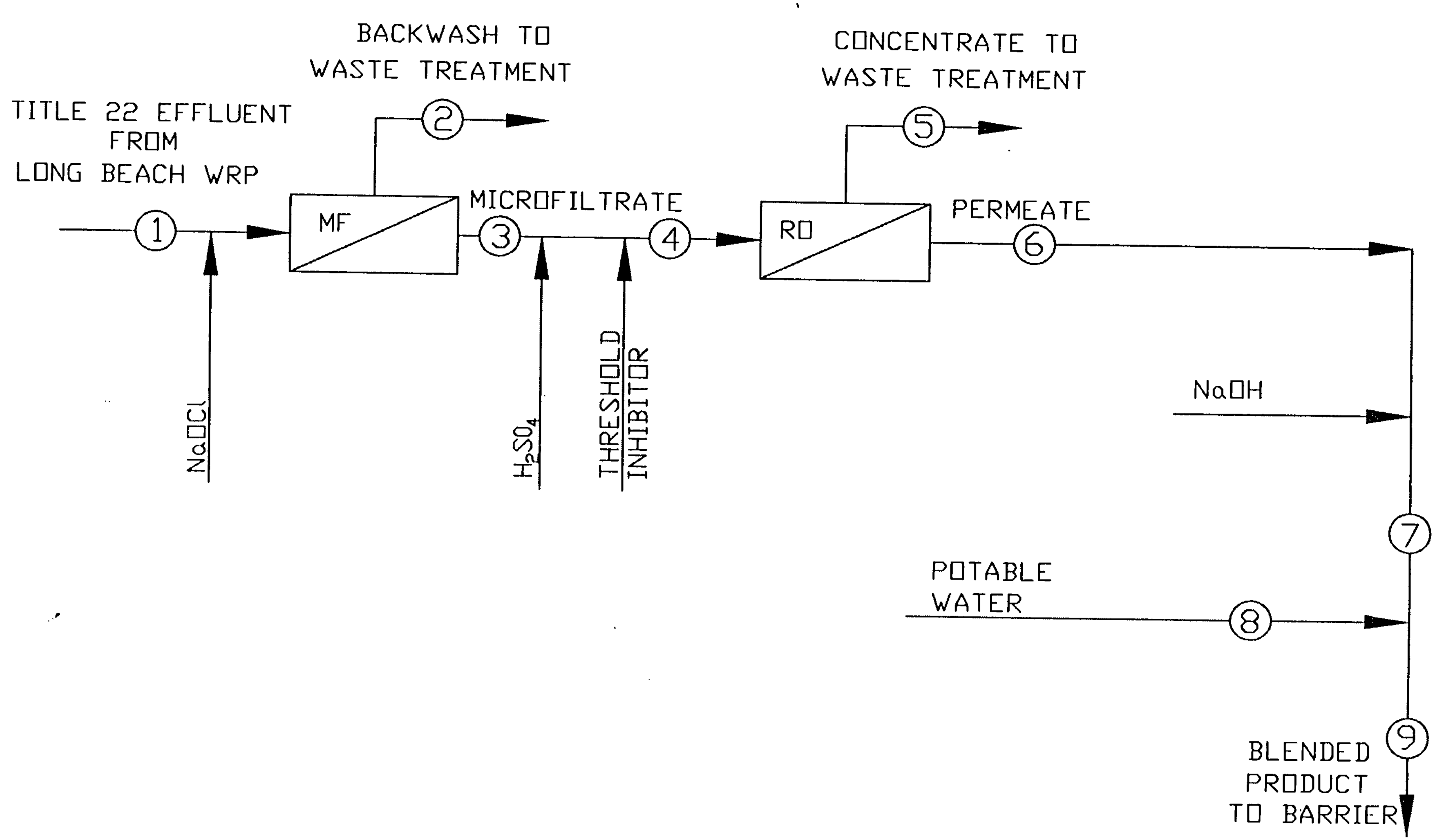
PROPOSED PROJECT SITE PLAN

FIGURE 3

Figure 4 is a process flow diagram that describes the proposed process. Tertiary effluent that has been treated to meet Title 22 standards is delivered from the LBWRP. Sodium hypochlorite (NaOCl) can be added to the Title 22 effluent, if required, prior to microfiltration (MF). The Title 22 effluent would be treated by MF, which is a membrane separation process that removes much of the biological debris in tertiary effluent, which would foul reverse osmosis membrane. The MF process uses a hollow fiber fabricated from a polymer with pores of nominal diameter from 0.1 to 0.2 micrometers (microns). The MF membrane separates the Title 22 water into a purified microfiltrate and a backwash stream. It is assumed that the MF system would be optimized to recover 95% of the feed as microfiltrate, with 5% going to waste as backwash for treatment at the Los Angeles County Sanitation District's (LACSD) sewer system. Because the microfiltration process discharges water cyclically, the water would reside in a break tank for about eight minutes prior to undergoing reverse osmosis. The break tank would store about 20,000 gallons of microfiltrate. The microfiltrate is then fed to the reverse osmosis system.

Sulfuric acid (H_2SO_4) and a threshold inhibitor are added to the reverse osmosis feed water to prevent precipitation of sparingly soluble salts, including calcium carbonate, as they become concentrated in the reverse osmosis system. The threshold inhibitor is a combination of proprietary organic chemicals that inhibit the calcium carbonate precipitation. The effectiveness of the threshold inhibitor is limited to a Langelier Saturation Index (LSI) in the reverse osmosis reject not to exceed +2.0. Should the LSI exceed +2.0, sulfuric acid is added to the reverse osmosis feed water to change the bicarbonate in the feed water to carbon dioxide, and thereby decrease the LSI in the reject to + 2.0 or less.

The reverse osmosis system separates the microfiltrate into a permeate stream and a waste concentrate stream. About 85% of the microfiltrate passes through the reverse osmosis membrane as permeate, and 15% would be concentrate for waste treatment at the Los Angeles County Sanitation District (LACSD) sewer system. The chlorinated reverse osmosis permeate is corrosive, which is minimized by mixing with potable water and elevating the pH to 8.3 with sodium hydroxide (NaOH). If regulatory conditions allow, the project were to be expanded to substitute up to 100% reclaimed water to the Barrier, lime could be added to the water to elevate the pH. The stabilized blended water is then pumped to the barrier. The reverse osmosis permeate is then blended with potable MWD water and pumped to the barrier.



ALAMITOS BARRIER RECLAMATION PLANT
PROCESS FLOW DIAGRAM

FIGURE 4

2.4.2 Proposed Site Plan and Facilities

Site Layout, Construction and Access

The new plant would be constructed directly north of and adjacent to the existing LBWRP. The proposed advanced reclaimed water treatment plant would occupy about 4 acres. The project would be built at an elevation of 30 feet mean sea level (msl), which is 18.5 feet above the flood elevation level. Approximately 100,000 cubic yards of fill material would be transported to the site for the creation of the site building pad.

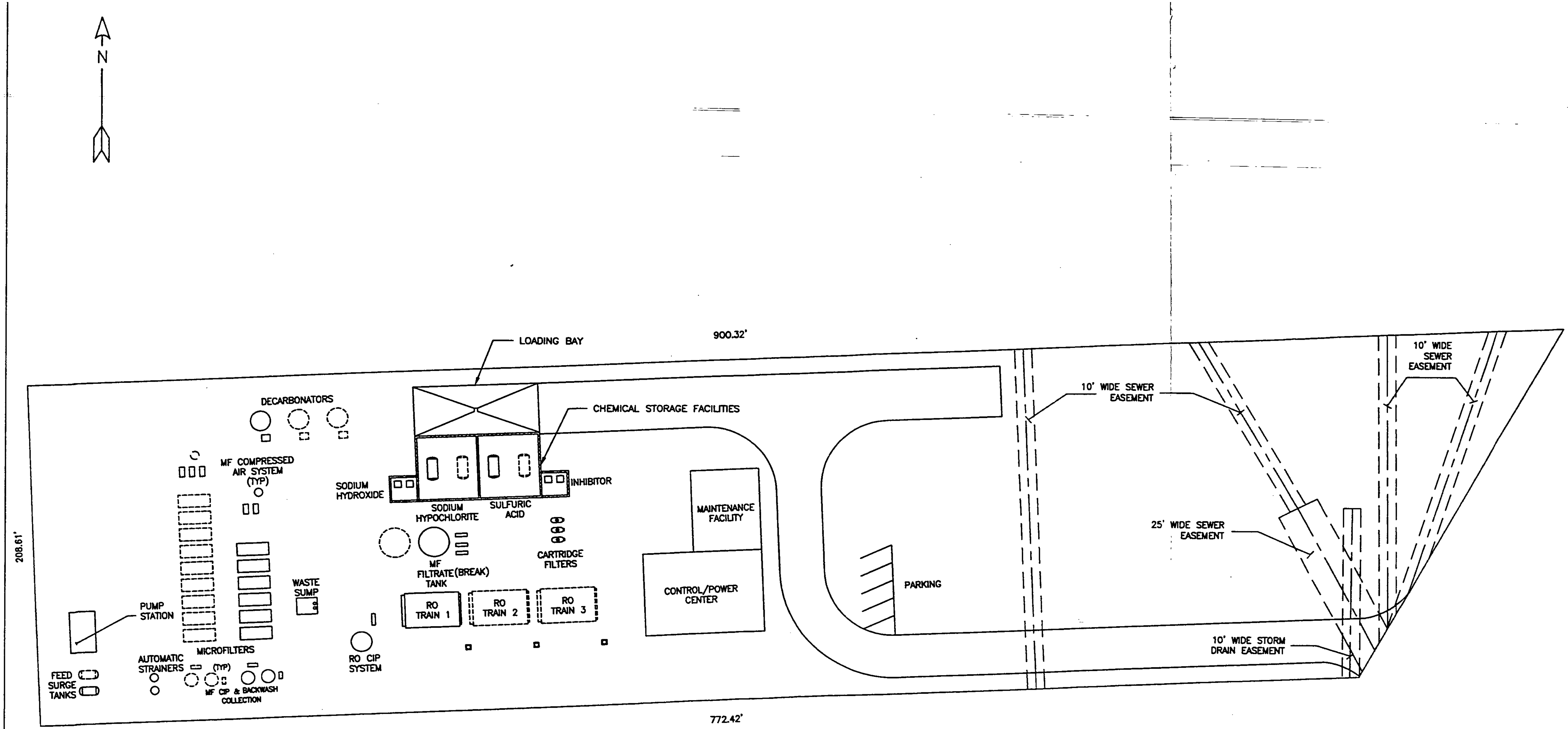
The proposed site layout showing the building site and each of the treatment process units is shown in Figure 5. Treatment process equipment includes:

- Multiple microfiltration units;
- Approximately 20,000 gallon break tank and transfer pumps;
- One reverse osmosis train with 3.0 MG capacity, approximately 30 feet wide by 25 feet long by 7 feet high;
- One 500 horsepower pump associated with the reverse osmosis unit;
- One decarbonator with a 6,600 cubic feet per minute (cfm) blower to strip carbon dioxide; and
- Chemical Storage.

Enclosed facilities include electric and control equipment and a 2,000-square-foot maintenance facility constructed to a height of approximately 15 to 18 feet. The reverse osmosis units and perhaps the microfiltration units would also be enclosed. Specific design of the microfiltration and reverse osmosis systems would be designed based on the specific characteristics of the feed water.

Buildings would be constructed of metal or tilt-up concrete. Site drainage and runoff will enter the existing Willow Street storm channel. Electrical power and other utilities will be obtained from the existing underground service at Willow Street. Chemicals necessary in the treatment process will be stored on site in compliance with federal and state regulations. A spill prevention plan and emergency procedures plan will be provided and explained to all employees responsible for handling these materials.

Access to the site would be provided from eastbound Willow Street through the existing driveway access to the LBWRP. The employee parking area would be minimal since no employees would be working at



CIP	= CLEAN IN PLACE
RO	= REVERSE OSMOSIS
MF	= MICROFILTRATION
DASHED UNITS	= POTENTIAL FUTURE EXPANSION UNITS
	= CONTAINMENT FACILITIES

REV	DATE	DESCRIPTION	DRAWN	APP.

SEPARATION PROCESSES, INC.

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

FRACTIONS ± 1/2"
DECIMALS XX 0.1, XXX 0.01, XXXX 0.001
ANGLES ± 1/2

DRAWN BY: B S KOPP — 09-15-98
CHECKED BY: G. POOLE

ALAMITOS BARRIER RECLAIMED WATER PROJECT
PROPOSED SITE LAYOUT

SCALE: NO SCALE

FIGURE 5

SHEET 1 OF 1

F:\WATER\WAT0205\DRAWINGS\CEQA FIG 5.dwn the site full time. It is anticipated that up to two employees would visit the site daily to operate and maintain the plant.

Pump Stations

The ABRWP influent will be pumped through the existing Long Beach Water Reclamation Pumping Station. New ABRWP booster pumping facilities are required during the following stages of the process:

- Microfiltrate from the MF unit will proceed to a break tank that separates the MF process from the RO process. A small booster pump will transfer microfiltrate to the larger pump required for the RO train.
- Permeate exiting the RO train will proceed to a pumping facility which will deliver the RO permeate to be blended in line and transferred to the barrier header pipe. A break tank will be installed between the RO train and the pumping facility.

Outdoor pumps, motors, and electrical panels will be used for all three applications described above.

Pipelines

The blend of reclaimed water and imported water would be delivered under pressure to the ABRWP through the existing dedicated 27-inch diameter pipeline located across the San Gabriel River from the proposed treatment facilities. A new reclaimed water treatment effluent line, which would be approximately 16 inches in diameter, would extend across the San Gabriel River. This would be accomplished by constructing the pipeline across City of Long Beach property and then hanging the pipeline beneath the Willow Street Bridge. No excavation in the San Gabriel River channel would be required.

Imported potable water for blending would be provided through MWD's South Coast Feeder. The South Coast feeder would be connected to the new 16-inch reclaimed water line downstream from the pressure reducing station located at the intersection of Wardlow Road and Woodruff Avenue. Blending of the reclaimed water with the imported potable water would occur at the interconnection of the two pipelines and throughout the 27-inch delivery pipeline. Double check valves and a reverse flow switch would be installed between the pressure reducing station and the reclaimed water interconnection. Detection of reverse flow would trigger a shutdown of the ABRWP effluent pumps.

Storage/ Contact Tanks

One storage tank would be constructed for the project: a process break tank. Equalization storage necessary for the microfiltration feed water will be constructed and maintained by the City of Long Beach,

Process Break Tank – While the microfiltration process is cyclical, and the reverse osmosis process is continuous, a break tank with an eight-minute residence time will be installed between the microfiltration and reverse osmosis units.

2.4.4 Operational Requirements

Equalization Storage

The supply of reclaimed water varies with the diurnal flow pattern of treated water from the LBWRP and upon the magnitude and daily pattern of supply for other reclaimed water uses. However, the demand for water to supply the Alamitos Barrier is essentially continuous, and there would be economic and operational advantages to sizing any treatment facilities for a continuous average flow rather than peak flows. Therefore, storage for balancing flows prior to treatment and delivery is desirable. Two options for balancing flows are to (a) construct a separate equalization storage tank to provide a continuous average flow to the treatment facilities; or (b) combine water stored for the ABRWP with water stored for other reclaimed water uses. Facilities for both options are not part of the ABRWP facilities. These facilities will be constructed by others as part of a separate project.

Reverse Osmosis Membranes

Composite polyamide reverse osmosis membranes have been developed and are considered for use at the ABRWP.

Asymmetric reverse osmosis membranes fabricated from a blend of cellulose diacetate and cellulose triacetate were first applied to the reclamation of municipal wastewaters and the fouling characteristics of these membranes proved to be acceptable and manageable. The early versions of the composite polyamide reverse osmosis membrane proved to be unacceptable due to rapid and irreversible fouling with the biological debris in municipal wastewater. However, recent developments with composite polyamide membranes have been extensively tested at the following facilities:

- Orange County Water District's Facility in Fountain Valley, California,
- Scottsdale, Arizona's Gainey Ranch Pilot Plant,
- San Diego, California's San Pasqual Pilot Plant, and
- West Basin Municipal Water District's Pilot Plant in Torrance, California.

As a result of these test the composite polyamide membrane will be installed in the 8.5 mgd reverse osmosis plant in the Water Campus facility under construction in Scottsdale, Arizona. This membrane will also be installed in the 50 mgd reverse osmosis reclamation plant being planned by the Orange County Water District and the 18 mgd reverse osmosis reclamation plant being planned by the City of San Diego. The composite polyamide membrane was installed in 3.2 mgd reverse osmosis reclamation plant built by West Basin Municipal Water district at the Mobil Refinery in Torrance, California. Plant operation was initiated in August of 1998 and membrane performance is fully as expected. The composite polyamide membrane has the following advantages over the blend cellulose acetate membrane:

- Total Organic Carbon rejection is superior.
- Total Dissolved Solids rejection is better.
- Nitrogen compound rejection is superior.
- The composite polyamide membrane will not hydrolyze and lose rejection.
- The composite polyamide membrane is not subject to bacterial attack.
- The composite polyamide membrane requires less pressure than the blend cellulose acetate membrane to deliver the same quantity of permeate and, thus, it will conserve energy.

The composite polyamide membrane is superior to the blend cellulose acetate membrane in performance and recent market conditions indicate that reverse osmosis membrane elements with this membrane are similarly priced to membrane elements with blend cellulose acetate. Consequently, the composite polyamide membranes will be used in the ABRWP reverse osmosis plant.

Three composite polyamide membranes that were considered for application in the Barrier. These membranes were the low pressure-high rejection membranes, the ultra low pressure membranes, and the softening or nanofiltration membranes. Based on a comparison of demonstrated performance, experience, and costs associated with these three types of membranes, Separation Processes, Inc. concluded that the best choice for the project was the low pressure-high rejection type of membrane. This membrane is manufactured by at least three separate companies.

Disposal of Process Residuals

Process residuals would be produced by the ABRWP both as a result of microfiltration and reverse osmosis. Several options for the disposal of these process residuals have been reviewed. The two process residuals need not be disposed of in the same manner. The environmental analysis in Section 6 will address each alternative. Discharge to the Los Angeles County Sanitation District trunk sewer system, the preferred alternative, would require a one-time connection fee and the payment of an annual Industrial Waste Surcharge. No discharge of concentrate to the San Gabriel River estuary would occur.

Delivery System

The purpose of the delivery system is to convey final treated water from the treatment facilities to the injection barrier distribution header at the required operating pressure. In addition, the delivery system must blend reclaimed water with imported potable water, when necessary, and accommodate the special requirements this imposes. Even if the normal operation allowed 100 percent reclaimed water, there would be periods when reclaimed water might not be available due to operation or maintenance conditions affecting the reclamation facilities and imported potable water must be used. The preferred option is to pump reclaimed water through a new 16-inch transmission line to a direct connection with an existing 27-inch delivery pipeline near the treatment facilities and blend (50%/50%) it in-line, downstream of the connection.

The new 16-inch pipeline would be approximately 1200 LF, and sized to deliver 3000 AF/year to be blended prior to conveyance to the Barrier.

Because there would be a direct connection to the Barrier header pipe from both reclaimed water and potable Metropolitan Water District (MWD) water, there would need to be backflow prevention on the existing Los Angeles County Department of Public Works (LACDPW) delivery pipeline. Reduced pressure backflow preventors have been assumed for preliminary sizing and costing. For the anticipated flows, three 10-inch units in parallel were selected.

Reliability Features, Monitoring Program and Contingency Plan

Because the water injected at the Barrier travels inland and is eventually (after a minimum of 2.5 to 10 years) extracted by potable water supply wells. Because of this eventual potable reuse of the reclaimed water, the ABRWP would incorporate reliability features and stringent operating protocols, including a contingency plan to insure that the reclaimed water product meets or exceeds all water quality requirements of the permitting agencies.

Reliability Features – The reliability of the ABRWP, defined as the ability to prevent impairment of the groundwater basin as a result of the direct injection of reclaimed water, would be established by: 1) selection of a high-quality source water; 2) adoption of a stringent operation protocol; and 3) selection of a treatment process with appropriate reliability.

The proposed treatment process consists of microfiltration followed by reverse osmosis treatment of the entire reclaimed water stream. The LBWRP discharge is already highly treated and would require removal of organics, TDS, and TOC in order to meet the more stringent Title 22 standards for a direct injection recharge project. The organics/TDS/TOC removal can be accomplished primarily in the reverse osmosis process. The performance of the reverse osmosis process for organics removal is well documented, and is capable of producing a discharge that significantly exceeds standards for injection projects.

In addition, the reverse osmosis membranes would provide a barrier to potentially suspended pathogenic materials, including viruses. The tertiary-treatment process producing Title 22 reclaimed water achieves significant virus removal. The reverse osmosis process adds another barrier to viruses, although not necessary from a technical or regulatory standpoint. Also, the subsurface travel time of the reclaimed water through the soil further filters out potential viruses prior to reaching groundwater wells.

Reliability features could include cartridge filters at the front end of the reverse osmosis system to protect the unit from improper function of the microfiltration units.

Monitoring Reclaimed Water Quality – A comprehensive monitoring program would be developed and performed to document program operations and compliance with permit conditions established to protect groundwater quality in the basin. The monitoring program would also provide the data necessary to optimize the treatment of reclaimed water, indicate when to divert from recharge any reclaimed water of unacceptable quality, and modify or completely suspend injection of reclaimed water, if necessary.

ABRWP water quality would be monitored at intermediate locations within the water reclamation process and at the end of the reclamation process prior to blending for injection. Monitoring at intermediate locations would provide data on treatment process performance, and advanced warning of potential treatment problems. Discharge monitoring would provide data on the final reclaimed water quality. Monitoring requirements would be reviewed and updated at least every five years to incorporate new California drinking water standards, or to make necessary revisions based on review of prior monitoring data.

Injection Site Monitoring – An injection site monitoring program would be developed and performed to collect sufficient data to detect the movement of reclaimed water within the groundwater basin and to characterize the effect of reclaimed water on the groundwater basin and domestic water supply wells. The location of the nearest domestic water supply well would be reported on an annual basis, and the well water quality monitored more frequently. A full monitoring plan would be developed by WRD to ensure that representative samples are obtained. The monitoring plan would require approval by the appropriate regulatory agencies. Monitoring reports would be submitted by WRD to the regulatory agencies.

Contingency Plan – The ABRWP would include a contingency plan to ensure that inadequately treated water is not delivered to the recharge area through the injection system. Key elements of the contingency plan would be:

1. Engineering staff with specific knowledge and expertise in the operation of the LBWRP, ABRWP and the Barrier;
2. A warning system with four warning levels, each level reflecting the relative potential for water of unacceptable quality to reach the recharge area; and
3. Ability to divert reclaimed water of unacceptable quality away from the recharge area by returning the product water from the ABRWP treatment facilities to the LBWRP or by shutting down the ABRWP facilities altogether. Water could continue to be supplied to the Barrier using imported MWD water. If the supply of imported MWD water was insufficient to meet full barrier needs in the short-term,

the Barrier could be operated at less than full capacity and use the imported MWD water that was available. The Barrier could potentially be out of operation for up to two weeks without serious consequences to the barrier integrity.

If, as a result of routine or other monitoring of a public water supply well drawing water from the recharged aquifer, the California Department of Health Services (DOHS) or Regional Water Quality Control Board (RWQCB) water sample results indicate that maximum contaminant level (MCL) or action levels are exceeded, the other will be notified.

2.4.5 Project Phasing

To expedite initiation of the project, construction of the ABRWP could begin before the final project configuration has been permitted. For instance, process residual discharge facilities are subject to Los Angeles Regional Water Quality Control Board (LARWQCB) and DOHS review and permit approval. The design and/or construction of these facilities will be completed only after requirements for permitting are completely known.

In addition, a potential expansion of the ABRWP may be considered. New treatment facilities would be required for this expansion, but would remain within the same building site location. The lead agency would not consider a Phase 2 expansion until all operating and environmental conditions of Phase 1 are evaluated. Should a second phase be considered, additional environmental review would be undertaken at that time.

2.5 Project Approvals

2.5.1 Agency Roles, Responsibilities and Agreements

The political, geographical and hydrogeological setting of the ABRWP require that ten public agencies participate in this project.

<u>Central Basin Municipal Water District (CBMWD)</u>

The CBMWD supplies imported water to the Water Replenishment District of Southern California for groundwater replenishment and barrier injection. The CBMWD is the project sponsor's Metropolitan member agency, and will continue to supply necessary Metropolitan imported water.

Water Replenishment District of Southern California (WRD)

WRD serves as lead agency under the California Environmental Quality Act (CEQA) requirements. WRD owns the site on which the ABRWP will be built and will be the project owner. The discretionary action to be performed will be a certified Negative Declaration.

City of Long Beach (The City)

Although the LBWRP is owned and operated by the Los Angeles County Sanitation District (LACSD), the City of Long Beach owns the rights to the reclaimed water to be used in the ABRWP. Long Beach also utilizes some of the reclaimed water from the Long Beach Water Reclamation Plant, although without any additional treatment, which it provides for industrial and irrigation users. The City and WRD are negotiating an agreement that would call for the City of Long Beach to operate and maintain the ABRWP and to provide the advanced treated water to the barrier. The City owns the property to the north of the WRD site, between the ABRWP and Willow Road.

Orange County Water District (OCWD)

Since ABP provides protection against seawater intrusion into both Orange County, as well as Los Angeles County, OCWD receives benefits from the project. Currently, OCWD shares with WRD in the cost of water that is injected into the barrier. OCWD and WRD are negotiating an agreement in which OCWD agrees to pay WRD for a portion of the reclaimed water injected into the Alamitos Barrier.

Los Angeles County Department of Public Works (LACDPW)

The Los Angeles County Department of Public Works would continue to operate and maintain the existing water transmission pipeline, distribution header, injection wells, extraction wells, and monitoring wells along the barrier itself.

County Sanitation Districts of Los Angeles (LACSD)

The County Sanitation Districts of Los Angeles would provide the facilities necessary to produce and deliver Title 22 effluent for operation of the proposed treatment plant. Process residuals from the ABRWP consisting of microfilter backwash and reverse osmosis concentrate would be discharged to the LACSD sanitary sewer. WRD will pay a one-time connection fee and annual service charges to LACSD for this residual disposal.

Regional Water Quality Control Board (RWQCB)

The California Regional Water Quality Control Board is responsible for overseeing groundwater quality in the state. The project site is on the border between two RWQCB regions, and, as such, is technically under the jurisdiction of the Los Angeles and Santa Ana RWQCBs, water reclamation requirements for projects involving groundwater recharge with reclaimed water. Both the Los Angeles and Santa Ana RWQCBs have previously established water reclamation requirements for projects involving groundwater recharge with reclaimed water. The LARWQCB has previously established requirements for the groundwater recharge operation involving surface spreading of reclaimed water in the Montebello Forebay area, and the SARWQCB has previously established requirements for the injection of reclaimed water from Orange County Water District Factory 21. During the early phases of this project, SARWQCB generally deferred to the LARWQB on regulatory issues concerning the ABRWP. Ultimately, both Regional Boards will issue water reclamation requirements.

The appropriate RWQCB would be responsible for monitoring the project's adherence to established water reclamation requirements. The DOHS must be promptly notified of any noncompliance detected by the RWQCB. The DOHS would provide technical assistance to the RWQCB as appropriate in determining compliance with specific aspects of the water reclamation requirements that directly relate to health.

California Department of Health Services (DOHS)

The California Department of Health Services sets standards for the use of reclaimed water as set forth in Title 22 of the California Code of Regulations. Although the Regional Water Quality Control Board issues the water reclamation requirements for a water reclamation permit, DOHS reviews the engineering report, conducts a public hearing on the project (very often simultaneous with the RWQCB public hearing), and makes recommendations to RWQCB regarding the permit applications.

U. S. Bureau of Reclamation (USBR)

In 1996, Congress enacted the Reclamation Recycling and Water Conservation Act, which authorized the U.S. Bureau of Reclamation (USBR) to participate in several water recycling projects. The USBR has authorized a study to assess the feasibility of a comprehensive water reclamation and reuse system for Southern California, in cooperation with the State of California and appropriate local and regional entities.

California State Water Resources Control Board (SWRCB)

The SWRCB offers programs that provide financial assistance to local agencies for water recycling projects. WRD is seeking low interest loan funds through the SWRCB's State Revolving Fund Loan Program to offset capital costs of the ABRWP.

2.5.2 Agency Agreements

Memorandum of Agreement (LB – WRD)

The City of Long Beach and WRD executed a memorandum of agreement setting forth the conditions under which grant funds from the U. S. Bureau of Reclamation would be shared.

Operational Agreement (WRD – LB)

The operational agreement that is under negotiation by WRD and Long Beach provides for Long Beach to operate and maintain the ABRWP and provide finished water to the barrier for a fee paid by WRD.

USBR Cost-Sharing Agreement

The agreement between the U.S. Bureau of Reclamation (USBR) and WRD is primarily based on the federal appropriation of funds for the design and construction of water reclamation and reuse projects under Title XVI of Public Law 102-575, as amended. Pending Congressional approval of the appropriation, the USBR will provide the agreed upon amount to WRD to prepare the necessary environmental analysis and engineering feasibility studies to attain approval of the proposed project. Under this agreement the USBR will serve as the federal nexus for the administration of the NEPA process and prepare a separate environmental document.

Metropolitan Water District Local Resources Program Contract

The Metropolitan Water District of Southern California (MWD) has instituted the Local Resources Program, which provides a rebate of up to $250 per acre foot of water delivered from a local source that would otherwise need to be provided by MWD. WRD has applied for such a rebate, and if approved would execute a contract with MWD and the

Central Basin Municipal Water District, the MWD member agency that provides potable water to the Barrier.

Orange County Water District Agreement

WRD is negotiating a Water Purchase Agreement with the OCWD in which OCWD will agree to pay WRD for a portion of the reclaimed water injected into the Alamitos Barrier.

Los Angeles County Sanitation District (LACSD) Water Purchase Agreement

WRD has signed an agreement with LACSD that will provide for access to the ABRWP site via the LACSD access road during construction and operation of the facility. An additional agreement may be required should any alterations or additions be attached to the LBWRP. Provisions for payment of connection fees and sewer service charges for residuals disposal would not require an agreement, but would be incorporated into LACSD's current fee procedure.

2.5.3 Discretionary Actions/Permit Requirements

The environmental review process must be completed prior to implementing the project. Several permits and actions are also required before the project can commence, including:

- Approval of the CEQA document (IS/ND) by WRD.
- Approval of a Water Reclamation Requirement permit from the RWQCB in consultation with the DOHS.
- Approval of an Authority to Construct and Permit to Operate from the South Coast Air Quality Management District.
- Approval of an engineering report by the appropriate RWQCB, the DOHS Office of Drinking Water, and local health departments. The project sponsor would have the report written to follow DOHS "Guidelines for the Preparation of an Engineering Report on the Proposed Use of Reclaimed Municipal Wastewater for Groundwater Recharge".
- The DOHS, in accordance with Section 4458 of the California health and Safety Code and Sections 13540 and 13541 of the California Water Code, would conduct a public hearing. The DOHS would then make recommendations to the appropriate RWQCB.

- The RWQCB would develop Tentative Water Reclamation Requirements and submit to the DOHS, local health departments, and the public.
- Approval of final water reclamation requirements by the RWQCB.
- Approval of miscellaneous City of Long Beach and Los Angeles County permits to construct the advanced treatment facilities as well as construct and install surface and subsurface conveyance facilities.

CEQA ENVIRONMENTAL CHECKLIST FORM

1. **Project title:** Alamitos Barrier Reclaimed Water Project

2. **CEQA Lead agency name and address:**

   Water Replenishment District of Southern California

   12621 E. 166th Street, Cerritos, CA 90703

3. **Contact person and phone number:** Mr. Jim Leserman 562/921-5521

4. **Project location:** North and adjacent to existing Long Beach Water Reclamation Plant

   7400 E. Willow Street, Long Beach, CA 90815

5. **Project sponsor's name and address:**

   Water Replenishment District of Southern California

   12621 E. 166th Street, Cerritos, CA 90703

6. **General plan designation:** Open Space and Institutional 7. **Zoning:** P and ICH

8. **Description of project:** (Describe the whole action involved, including but not limited to later phases of the project, and any secondary, support, or off-site features necessary for its implementation. Attach additional sheets if necessary.)

   See Section 2 (Project Description)

9. **Surrounding land uses and setting:** (Briefly describe the project's surroundings)

   Park, golf course, residential, and freeway. Two flood control channels (San Gabriel River and Coyote Creek) are located to the west and east respectively.

10. **Other public agencies whose approval is required** (e.g., permits, financing approval, or participation agreement.)

    See Section 2.5 (Project Approvals) of the Project Description

ENVIRONMENTAL FACTORS POTENTIALLY AFFECTED: None

The environmental factors listed below would be affected by this project, i.e. involve at least one impact that is a "Potentially Significant Impact" as indicated by the checklist on the following pages.

☐ Land Use and Planning	☐ Transportation/Circulation	☐ Public Services
☐ Population and Housing	☐ Biological Resources	☐ Utilities and Service Systems
☐ Geological Problems	☐ Energy and Mineral Resources	☐ Aesthetics
☐ Water	☐ Hazards	☐ Cultural Resources
☐ Air Quality	☐ Noise	☐ Recreation
	☐ Mandatory Findings of Significance	

DETERMINATION: (To be completed by the Lead Agency)

On the basis of this initial evaluation:

☒ I find that the proposed project COULD NOT have a significant effect on the environment, and a NEGATIVE DECLARATION will be prepared.

☐ I find that although the proposed project could have a significant effect on the environment, there will not be a significant effect in this case because the mitigation measures described on an attached sheet have been added to the project. A NEGATIVE DECLARATION will be prepared.

☐ I find that the proposed project MAY have a significant effect on the environment, and an ENVIRONMENTAL IMPACT REPORT is required.

☐ I find that the proposed project MAY have a significant effect(s) on the environment, but at least one effect 1) has been adequately analyzed in an earlier document pursuant to applicable legal standards, and 2) has been addressed by mitigation measures based on the earlier analysis as described on attached sheets, if the effect is a "potentially significant impact" or "potentially significant unless mitigated." An ENVIRONMENTAL IMPACT REPORT is required, but it must analyze only the effects that remain to be addressed.

☐ I find that although the proposed project could have a significant effect on the environment, there WILL NOT be a significant effect in this case because all potentially significant effects (a) have been analyzed adequately in an earlier EIR pursuant to applicable standards, and (b) have been avoided or mitigated pursuant to that earlier EIR, including revisions or mitigation measures that are imposed upon the proposed project.

Signature: ______________________ Date: ______________________

Printed name: Robert Campbell, General Manager For: Water Replenishment District of Southern California

EVALUATION OF ENVIRONMENTAL IMPACTS:

1) See Section 5 for explanation of checklist answers. An explanation is required for all answers except "No Impact" answers that are adequately supported by the information sources a lead agency cites in the parentheses following each question. A "No Impact" answer is adequately supported if the referenced information sources show that the impact simply does not apply to projects like the one involved (e.g., the project falls outside a fault rupture zone). A "No Impact" answer should be explained where it is based on project-specific factors as well as general standards (e.g., the project will not expose sensitive receptors to pollutants, based on a project-specific screening analysis).

2) All answers must take account of the whole action involved, including off-site as well as on-site, cumulative as well as project-level, indirect as well as direct, and construction as well as operational impacts.

3) "Potentially Significant Impact" is appropriate if there is substantial evidence that an effect is significant. If there are one or more "Potentially Significant Impact" entries when the determination is made, an EIR is required.

4) "Negative Declaration: Potentially Significant Unless Mitigation Incorporated" applies where the incorporation of mitigation measures has reduced an effect from "Potentially Significant Impact" to a "Less Significant Impact." The lead agency must describe the mitigation measures, and briefly explain how they reduce the effect to a less than significant level (mitigation measures from Section XVII, "Earlier Analyses," may be cross-referenced).

5) Earlier analyses may be used where, pursuant to the tiering, program EIR, or other CEQA process, an effect has been adequately analyzed in an earlier EIR or negative declaration. Section 15063(c)(3)(D). Earlier analyses are discussed in Section XVII at the end of the checklist.

6) Lead agencies are encouraged to incorporate into the checklist references to information sources for potential impacts (e.g., general plans, zoning ordinances). Reference to a previously prepared or outside document should, where appropriate, include a reference to the page or pages where the statement is substantiated. A source list should be attached, and other sources used or individuals contacted should be cited in the discussion. See Section 8 for the list of references.

7) This is only a suggested form, and lead agencies are free to use different ones.

ENVIRONMENTAL IMPACTS:

	Potentially Significant Impact	*Potentially Significant Unless Mitigation Incorporated*	*Less than Significant Impact*	*No Impact*
I. LAND USE AND PLANNING. *Would the proposal:*				
a) Conflict with general plan designation or zoning?	☐	☐	☒	☐
b) Conflict with applicable environmental plans or policies adopted by agencies with jurisdiction over the project?	☐	☐	☒	☐
c) Be incompatible with existing land use in the vicinity?	☐	☐	☒	☐
d) Affect agricultural resources or operations (e.g., impacts to soils or farmlands, or impacts from incompatible land uses)?	☐	☐	☐	☒
e) Disrupt or divide the physical arrangement of an established community (including a low-income or minority community)?	☐	☐	☐	☒
II. POPULATION AND HOUSING. *Would the proposal:*				
a) Cumulatively exceed official regional or local population projections?	☐	☐	☐	☒
b) Induce substantial growth in an area either directly or indirectly (e.g., through projects in an undeveloped area or extension of major infrastructure)?	☐	☐	☒	☐
c) Displace existing housing, especially affordable housing?	☐	☐	☐	☒
III. GEOLOGIC PROBLEMS. *Would the proposal result in or expose people to potential impacts involving:*				
a) Fault rupture?	☐	☐	☒	☐
b) Seismic ground shaking?	☐	☐	☒	☐
c) Seismic ground failure, including liquefaction?	☐	☐	☒	☐
d) Seiche, tsunami, or volcanic hazard?	☐	☐	☐	☒
e) Landslides or mudflows?	☐	☐	☐	☒
f) Erosion, changes in topography or unstable soil conditions from excavation, grading, or fill?	☐	☐	☒	☐
g) Subsidence of land?	☐	☐	☒	☐
h) Expansive soils?	☐	☐	☒	☐
i) Unique geologic or physical features?	☐	☐	☐	☒

IV. WATER. *Would the proposal result in:*	*Potentially Significant Impact*	*Potentially Significant Unless Mitigation Incorporated*	*Less than Significant Impact*	*No Impact*
a) Changes in absorption rates, drainage patterns, or the rate and amount surface runoff?	☐	☐	☒	☐
b) Exposure of people or property to water related hazards such as flooding?	☐	☐	☒	☐
c) Discharge into surface waters or other alteration of surface water quality (e.g., temperature, dissolved oxygen or turbidity?	☐	☐	☒	☐
d) Changes in the amount of surface water in any water body?	☐	☐	☒	☐
e) Changes in currents, or the course or direction of water movements?	☐	☐	☒	☐
f) Change in the quantity of ground waters, either through direct additions or withdrawals, or through interception of an aquifer by cuts or excavations or through substantial loss of groundwater recharge capability?	☐	☐	☐	☒
g) Altered direction or rate of flow of groundwater?	☐	☐	☐	☒
h) Impacts to groundwater quality?	☐	☐	☒	☐
i) Substantial reduction in the amount of groundwater otherwise available for public water supplies?	☐	☐	☐	☒

V. AIR QUALITY. *Would the proposal:*				
a) Violate any air quality standard or contribute to an existing or projected air quality violation?	☐	☐	☒	☐
b) Expose sensitive receptors to pollutants?	☐	☐	☐	☒
c) Alter air movement, moisture, or temperature, or cause any change in climate?	☐	☐	☒	☐
d) Create objectionable odors?	☐	☐	☒	☐

VI. TRANSPORTATION/CIRCULATION. *Would the proposal result in:*				
a) Increased vehicle trips or traffic congestion?	☐	☐	☒	☐
b) Hazards to safety from design features (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☐	☐	☐	☒
c) Inadequate emergency access or access to nearby uses?	☐	☐	☐	☒
d) Insufficient parking capacity onsite or offsite?	☐	☐	☒	☐
e) Hazards or barriers for pedestrians or bicyclists?	☐	☐	☒	☐
f) Conflicts with adopted policies supporting alternative transportation (e.g., bus turnouts, bicycle racks)?	☐	☐	☐	☒
g) Rail, waterborne or air traffic impacts?	☐	☐	☐	☒

VII. BIOLOGICAL RESOURCES. *Would the proposal result in impacts to:*				
a) Endangered, threatened or rare species or their habitats (including but not limited to plants, fish, insects, animals, and birds?	☐	☐	☐	☒
b) Locally designated species (e.g., heritage trees)?	☐	☐	☐	☒
c) Locally designated natural communities (e.g., oak forest, coastal habitat, etc.)?	☐	☐	☐	☒
d) Wetland habitat (e.g., marsh, riparian, and vernal pool)?	☐	☐	☒	☐
e) Wildlife dispersal or migration corridors?	☐	☐	☒	☐

	Potentially Significant Impact	*Potentially Significant Unless Mitigation Incorporated*	*Less than Significant Impact*	*No Impact*
VIII. ENERGY AND MINERAL RESOURCES. *Would the proposal:*				
a) Conflict with adopted energy conservation plans?	☐	☐	☒	☐
b) Use nonrenewable resources in a wasteful and inefficient manner?	☐	☐	☐	☒
c) Result in the loss of availability of a known mineral resource that would be of future value to the region and the residents of the State?	☐	☐	☐	☒
IX. HAZARDS. *Would the proposal involve:*				
a) A risk of accidental explosion or release of hazardous substances (including, but not limited to, oil, pesticides, chemicals, or radiation)?	☐	☐	☒	☐
b) Possible interference with an emergency response plan or emergency evacuation plan?	☐	☐	☒	☐
c) The creation of any health hazard or potential health hazard?	☐	☐	☒	☐
d) Exposure of people to existing sources of potential health hazards?	☐	☐	☒	☐
e) Increased fire hazard in areas with flammable brush, grass, or trees?	☐	☐	☒	☐
X. NOISE. *Would the proposal result in:*				
a) Increases in existing noise levels?	☐	☐	☒	☐
b) Exposure of people to severe noise levels?	☐	☐	☒	☐
XI. PUBLIC SERVICES. *Would the proposal have an effect upon, or result in a need for new or altered government services in any of the following areas:*				
a) Fire protection?	☐	☐	☒	☐
b) Police protection?	☐	☐	☐	☒
c) Schools?	☐	☐	☐	☒
d) Maintenance of public facilities, including roads?	☐	☐	☐	☒
e) Other government services?	☐	☐	☐	☒
XII. UTILITIES AND SERVICE SYSTEMS. *Would the proposal result in a need for new systems or supplies, or substantial alterations to the following utilities:*				
a) Power or natural gas?	☐	☐	☒	☐
b) Communications systems?	☐	☐	☒	☐
c) Local or regional water treatment or distribution facilities?	☐	☐	☒	☐
d) sewer or septic tanks?	☐	☐	☒	☐
e) Storm water drainage?	☐	☐	☒	☐
f) Solid waste disposal?	☐	☐	☒	☐
g) Local or regional water supplies?	☐	☐	☒	☐
XIII. AESTHETICS. *Would the proposal:*				
a) Affect a scenic vista or scenic highway?	☐	☐	☐	☒
b) Have a demonstrable negative aesthetic effect?	☐	☐	☒	☐
c) Create light or glare?	☐	☐	☒	☐

XIV. CULTURAL RESOURCES. *Would the proposal:*	*Potentially Significant Impact*	*Potentially Significant Unless Mitigation Incorporated*	*Less than Significant Impact*	*No Impact*
a) Disturb paleontological resources?	☐	☐	☐	☒
b) Disturb archaeological resources?	☐	☐	☐	☒
c) Have the potential to cause a physical change which would affect unique ethnic cultural values?	☐	☐	☐	☒
d) Restrict existing religious or sacred uses within the potential impact area?	☐	☐	☐	☒
XV. RECREATION. *Would the proposal:*				
a) Increase the demand for neighborhood or regional parks or other recreational facilities?	☐	☐	☐	☒
b) Affect existing recreational opportunities?	☐	☐	☒	☐
c) Affect a wild or scenic river?	☐	☐	☐	☒
XVI. MANDATORY FINDINGS OF SIGNIFICANCE.				
a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of a rare or endangered plant or animal or eliminate important examples of the major periods of California history or prehistory?	☐	☐	☐	☒
b) Does the project have the potential to achieve short-term, to the disadvantage of long-term, environmental goals?	☐	☐	☒	☐
c) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively consider-able" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)	☐	☐	☒	☐
d) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	☐	☒

4.0 ENVIRONMENTAL SETTING

4.1 Relationship of Project to Other Applicable Planning

4.1.1 Water Quality Planning

Basin Plan

The regional Basin Plan is the Los Angeles Regional Water Quality Control Board's *Water Quality Control Plan for the Los Angeles Region* (June 1994 draft). The Basin Plan addresses existing and proposed beneficial uses for the San Gabriel River, the lower reach of which flows along the eastern project boundary. These uses include industrial service supply, water recreation, wildlife and aquatic habitat, and shellfish harvesting. The Basin Plan does not identify specific surface or ground water quality objectives for Coyote Creek, or for the reach of the lower San Gabriel River adjacent to the project site. However, the Plan does recommend general standards for certain water constituents for purposes of protecting beneficial uses.

The Alamitos Barrier Project is intended to prevent degradation of groundwater quality due to seawater intrusion and, as proposed, will discharge process residuals into the sewer system rather than the surface waters of the San Gabriel River or Coyote Creek. Therefore, most aspects of the Basin Plan will not be applicable to the proposed project, with the exception of:

- Water quality standards applicable to storm water runoff from the project site into the San Gabriel River and Coyote Creek; and
- Regulations administered by the California Department of Health Services in regard to use of reclaimed water in groundwater basins.

These standards and regulations in relation to project activities are discussed in Environmental Consequences (Section 5).

Watershed Management Plan

It is not known at this time whether a watershed management plan is available for this region, but in any case, such a plan would not be relevant to the proposed project because none of the project actions involve surface waters or watershed-level issues.

Area-Wide Wastewater Treatment Plan

A wastewater treatment plan pertains to the existing LBWRP, which treats wastewater to a tertiary level, but the plan is not relevant to the project because the ABRWP treats tertiary effluent further and does not treat wastewater.

4.1.2 Regional Transportation and Housing Allocation Plans

The City of Long Beach General Plan includes transportation and housing elements. However, the proposed project does not include new transportation or housing components, and therefore these sections of the General Plan are not applicable.

4.1.3 Air Quality Management Plan

The project site is located within jurisdiction of the South Coast Air Quality Management District (SCAQMD). The SCAQMD Plan has quantified emission thresholds for carbon monoxide, nitrogen oxides, reactive organic gases, sulfate oxides, and particulates. In addition, as part of the Toxic Air Contaminants Program, the SCAQMD maintains a list of substances that pose a chronic or acute health threat when present in the air.

Most of the SCAQMD standards are not applicable to activities that would be involved in the proposed project, with the exception of standards pertaining to particulates (fugitive dust), vehicle emissions, and emissions from the proposed reclaimed water treatment plant. These aspects of the project are discussed further in Sections 4.7 and 5.5 pertaining to Air Quality.

4.1.4 Regional Land Use Plans

The regional land use plan applicable to the project is the City of Long Beach General Plan. The Plan designates the project site primarily as Open Space Park District (LUD No. 11), with a small portion zoned Institutional District (I[H]). Additional discussion of these designations and adjacent land uses in relation to the proposed use of the site is provided in Sections 4.4 and 5.2 pertaining to Land Use.

4.2 Topography

The proposed project site is located on nearly flat (<1% gradient) terrain, surrounded on three sides by berms. These berms support Willow Street to the north, the LBWRP entrance road to the east, and the existing LBWRP to the south.

Nearby major topographical features consist of Coyote Creek to the east and the San Gabriel River to the west (see Figures 1 and 2 in Section 2 – Project Description). The site itself is at an elevation of about 13 feet above mean sea level.

4.3 Climate and Water Resources

Annual Precipitation and Seasonal Weather Patterns

Average annual precipitation in the project region is 12 inches per year. Nearly all of this precipitation falls during the winter months, especially the months of January and February. The summer months from June through September are typically dry.

Surface Water Features

No permanent surface water is present on the project site. An open, concrete-lined storm channel crosses the northern quarter of the site. This channel carries runoff from areas north of Willow Street to the Coyote Creek channel. Surface water features adjacent to the site consist of Coyote Creek and the San Gabriel River. Both of these features are trapezoidal, concrete-lined channels. After the two channels join just downstream of the LBWRP, they share a common concrete apron which extends about 1,000 feet south before terminating at the unlined portion of the San Gabriel River estuary. The dominant flow in the San Gabriel River during the dry portion of the year is effluent from the LACSD's Water Reclamation Plant.

Groundwater Resources

The project area includes the Central Groundwater Basin of Los Angeles County and the Orange County Groundwater Basin, both geologically one basin. They are important sources of local groundwater that meet 40% of the water demands in the region. As discussed in the Project Description (Section 2), the presence of the Alamitos Barrier currently protects the quality of these groundwater resources from seawater intrusion. The distance from the project site to the nearest potable groundwater well is 4,300 feet.

The groundwater reservoirs of both groundwater basins are replenished and maintained by capturing precipitation and natural river flows, supplemented by additional recharge from imported water. The primary source of recharge in the Orange County Basin is from the Santa Ana River via percolation basins. Recharge of the Central Basin occurs primarily in the Rio Hondo and San Gabriel River spreading grounds in the Montebello Forebay, and includes local storm runoff, imported water and reclaimed water from the Whittier Narrows (*Engineering Report*, Camp Dresser and McKee, May, 1992).

There are 12 wells located within a two-mile radius of the injection barrier, nine of which are currently active. Five domestic wells located approximately one mile east of the barrier are located within the upper aquifer zone that receives the injected barrier water. (*Engineering Report*, Camp Dresser and McKee, May, 1992).

Groundwater within the Central and Orange County Groundwater Basins is monitored according to Department of Health Services (DOHS) requirements which requires all groundwater for domestic use to be monitored for general mineral, trace inorganic and organic compounds, physical properties, and radioactivity. OCWD also samples for volatile organic compounds (VOCs) for other uses.

Groundwater quality varies throughout the basins both vertically and horizontally. The average Total Dissolved Solids (TDS) level for the Orange County Basin is 480 mg/1. TDS concentrations exceed 1,000 mg/L in two general areas, Yorba Linda and Irvine/Tustin. Nitrate concentrations exceeding the 10 mg/L federal drinking water standard are generally found in three areas: Fullerton, Tustin/Irvine and Garden Grove/Westminster. Selenium concentrations exceeding the federal drinking water standard of 10 parts per billion (ppb) have been detected in wells in the Fullerton and Irvine areas where concentrations range from 10 to 50 ppb. Contamination from Volatile Organic Compounds (VOCs) within the Orange County Basin appears to be minor to date. (*Engineering Report*, Camp Dresser McKee, May, 1992).

In the Central Basin, TDS levels in the spreading ground areas have decreased from about 600 mg/L in the early 1970s to 400 mg/L in the mid 1980s (Rio Hondo spreading grounds) and from 700 mg/L to 500 mg/L (San Gabriel River spreading grounds). Nitrate presents no apparent threat to groundwater in the Central Basin, although some wells in the San Gabriel River spreading basins have exceeded the federal drinking water standard for nitrate of 10 mg/L. The presence of VOCs does not appear to be a significant basinwide problem, however TCE and PCE have been detected throughout the basin, but most levels were below the state drinking water maximum contaminate levels (MCLs) of 5 ug/L.

Receiving Water Quality

The proposed project will discharge process wastes into the LACSD's system for conveyance to the Joint Water Pollution Control Plant in Carson during operation, therefore the term "receiving water" for purposes of this project evaluation is not applicable.

Water Supplies for the Service Area

Existing potable water supplied for consumption in the area is provided through a pipeline operated by the Los Angeles County Department of Public Works. The potable water currently used for the Alamitos Barrier is supplied by the Metropolitan Water District.

4.4 Land Use, Zoning, Agriculture, and Other Planning Designations

The City of Long Beach General Plan designates the project site primarily as Open Space Park District (LUD No. 11), with a small portion zoned Institutional District (I[H]). The I(H) zone designation indicates a horse overlay to the Institutional District. Use of horses is permitted in this area. Water treatment plants are permitted uses in the Open Space Park District zone, but not in an Institutional District zone.

The project site is not located within or near zones designated as Agriculture. Surrounding land uses include El Dorado Park on the north side of Willow Street, a golf course to the west of the San Gabriel River, the LBWRP adjacent on the south, and the San Gabriel Freeway on the east side of Coyote Creek. The western 80 feet of the property along the San Gabriel River is undeveloped right-of-way for Edison International, and high-voltage power lines currently occupy this corridor.

As of April, 1998, the Federal Emergency Management Agency (FEMA) flood maps show that the nearest special flood hazard area is adjacent to the west side of the San Gabriel River, about 0.5 mile from the project site.

4.5 Population and Housing

The nearest residences are located about 0.5 mile from the project site, on the east side of the San Gabriel Freeway.

4.6 Geology, Seismicity, and Soils

Geology

The Coastal Plain of Los Angeles and Orange Counties is underlain by a deep structural depression containing primarily sedimentary rocks, which have reached a thickness in excess of 30,000 feet. It is estimated that only the upper 4,000 feet of the sediments are of importance as a freshwater-bearing reservoir. The subsurface is characterized by variations in thickness and lithology due to folding and faulting. The Orange County Groundwater Basin is bounded by two principal fault zones, the Whittier and the Newport-Inglewood, which act as groundwater flow restrictions due to resulting placement of permeable rock against impermeable rock. In the vicinity of the Alamitos Barrier, the so-called C, B, A, I and Main aquifers are part of the San Pedro Formation. These aquifers and the San Pedro Formation are, in general, the most prolific water-bearing deposits in both counties.

There are five water-bearing units in the Alamitos Gap which are subject to seawater intrusion. These include the recent alluvium near the surface and from top to bottom, the C, B, A, and I zones which are subdivisions of an aquifer in the middle San Pedro Formation.

Seismic Hazards

Alquist-Priolo Special Studies zones have been defined by the State Geologist around major portions of active faults. The proposed project site is not located within these designated zones. The City of Long Beach's Seismic Safety Element does not identify any active fault traces crossing the site. A similar Safety Element prepared for the County of Los Angeles identifies the Los Alamitos Fault as a potentially active fault near the proposed project site. This fault is believed to be a concealed (buried) thrust fault, the active portion of which lies north of Willow Street, outside and north of the project site boundary. The portion of the Los Alamitos Fault south of Willow Street is believed to be inactive.

The Uniform Building Code requires that structures in the project area be designed for earthquake shaking commensurate with those of at least Seismic Risk Zone 4.

Unstable Substrate, Soil Types, and Erosion Potentials

Liquefaction potential of soils on the project site is estimated to be high because of the presence of loose to medium dense sand and silty sands, plus the presence of groundwater at shallow depths. The native sediments underlying the project site are subject to moderate compression and erodability. The site soils are not considered collapsible, therefore subsidence typically associated with collapsible soils is not anticipated. The expansion potential of the soils is low.

There are no unique geologic or physical features present on the site.

4.7 Air Quality

Air Basin

The project site is located within the South Coast Los Angeles County subregion of the South Coast Air Basin, administered by the South Coast Air Quality Management District (SCAQMD). Air quality in this subregion is good in comparison to more inland subregions of the Basin. For example, no exceedances of federal standards for monitored pollutants (ozone, nitrogen dioxide, lead, carbon monoxide, sulfur dioxide, PM_{10}, total suspended particulates) were reported for the years 1995 and 1996. Exceedances of state standards for ozone ranged from 3 to 5 days out of the year during 1995-1996, as compared to 30 or more days for more inland areas. Exceedances of state standards for PM_{10} during this period occurred in 15%-19% of the samples, as compared to 25%-42% of the samples collected in the inland valleys. Comparison of data for other pollutants shows similar trends.

Nonattainment Area

The location of the project site within the South Coast Air Basin places the project region within the Environmental Protection Agency's "serious" nonattainment classification for particulate matter (PM_{10}).

Status of Local Air Quality Plan

Every three years, the SCAQMD prepares a plan for air quality improvement. Each plan has a 20 year horizon. The most recent (1997) plan was approved by the SCAQMD Board in 1996. As a requirement of federal law, this plan places greater focus on particulate matter (PM_{10}) than the previous 1994 plan.

4.8 Transportation and Circulation

The existing Long Beach Water Reclamation Plant as well as the proposed project site is accessed from Willow Street, a four-lane street with concrete median. This street currently provides regular and emergency access from the eastbound lanes. A bicycle lane is present along the San Gabriel River and the east side of Coyote Creek. A portion of the San Gabriel River bike lane crosses the proposed construction area for installation of the supply pipeline to the MWD interceptor feeder.

4.9 Biological Resources

Plant Communities and Wildlife

Two biologists from Psomas and Associates visited the proposed project site on 28 August, 1998. The dominant plant community on the site can be characterized as a highly disturbed, non-native annual grassland. The site appears to be plowed or disked on a regular basis, because the ruderal vegetation and wildlife present are typical of a frequently disturbed site. Plant species observed included: wild oat (Avena sp.), ox-tongue (*Picris echinoides*), curly dock (*Rumex crispus*), sunflower (*Helianthus annus*), bermuda grass (*Cynodon dactylon*), white sweetclover (*Melilotus alba*), heliotrope (Heliotropium curassavicum), wild radish (*Raphanus sativa*), western ragweed (*Ambrosia psilostachya*), and alkali mallow (*Sida hederacea*). There is also a small shallow drainage (less than 50 feet in length) in the southwestern quarter of the site that supports freshwater plant species, primarily sedges (*Cyperus* spp.), cattails (*Typha latifolia*), and rushes (*Scirpus* spp.). This vegetation is immature and has probably experienced frequent disturbance in the past from disking.

The berm on the east and south boundaries of the site are occupied with ornamentals, primarily eucalyptus and pampas grass. The berm on the north side of the site is occupied by ruderal vegetation and occasional tree tobacco (*Nicotiana glauca*).

Wildlife species observed during the survey included: American crow, Anna's hummingbird, barn swallow, black phoebe, house finch, common bushtit, mourning dove, rock dove, and northern mockingbird. A red-tailed hawk was observed flying over the site, but no hawk or other raptor nests were observed in the trees bordering the site.

Special Status Species

A search of the California Natural Diversity Database (July, 1998) did not reveal any records, extant or historical, of listed threatened or endangered species in the project region. However, there are a number of records for non-listed species (Figure 6). Species recorded within one mile of the project site are San Diego horned lizard (*Phyrnosoma coronatum blainvillei*; State and Federal Species of Special Concern), Monarch butterfly (*Danaus plexippus*; Global and State restricted range -- rare), tri-colored blackbird (*Agelaius tricolor*; State and Federal Species of Special Concern), and southern tarplant (*Hemizonia australis*; California Native Plant Society List 1B).

The record for San Diego horned lizard is of unknown collection date, but is reported from the area of Willow Street Bridge over the San Gabriel River, in "City Park." This location is just west of the project site. Other records for this species are to the south and northwest of the project site (see Figure 6). Thus it is highly likely that in the past, San Diego horned lizard occurred on the project site. However, based on the long history of disturbance at the site (disking), and absence of sandy soil and food source (harvester ants) favored by the species, it is unlikely that the species still occurs on the site. No individuals were observed during the survey.

The Monarch butterfly was recorded in November of 1997 from roost trees (alder and eucalyptus) at El Dorado Park, northwest of the site across Willow Street. A Monarch butterfly was observed flying through the site during the survey. The stands of ornamental trees on the site boundary are small and immature in comparison to the large eucalyptus groves off site to the north. It is unlikely that the Monarch roosts on the project site.

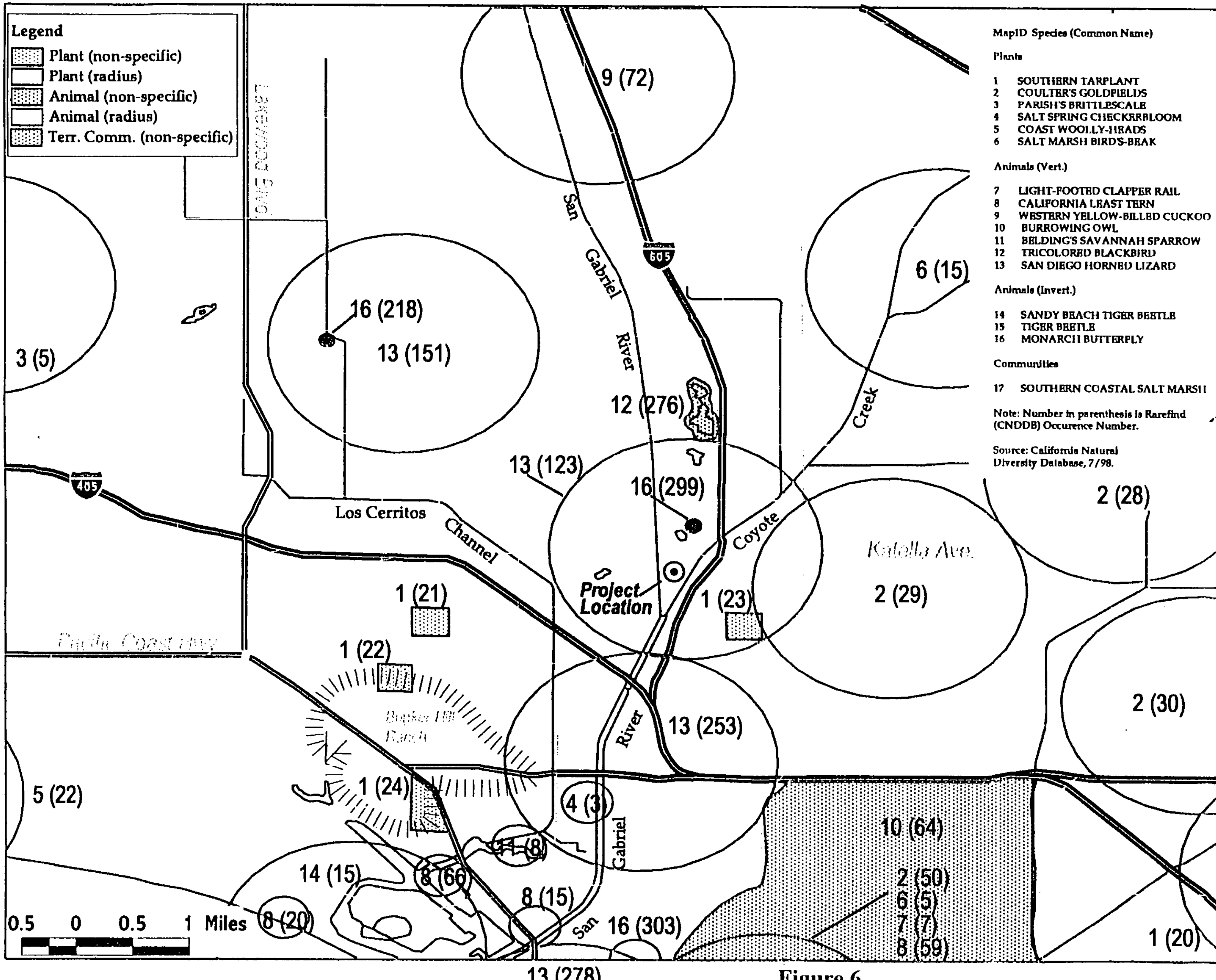


Figure 6
Reported Occurrences of Special Status Species

The tri-colored blackbird was observed in May of 1989 in El Dorado Park. The habitat consisted of several large, constructed lakes with large tule stands. This habitat does not occur on the project site, but it is possible that tri-colored blackbirds may occasionally utilize the small marsh west of the site (described in the previous section). No tri-colored blackbirds were observed during the survey.

Southern tarplant was last recorded for the project region in September of 1932. However, lack of recent records is not surprising, due to loss of habitat through urbanization and the fact that this summer-flowering species is often overlooked in spring-focused biological surveys. Today, where southern tarplant occurs in Los Angeles and Orange Counties, plants are typically found in open habitats and margins of disturbed areas that are relatively free of weedy grasses. Occurrence of southern tarplant on the project site would not be surprising, even with its disturbed condition. However, no plants were observed during the survey, despite the fact that the survey was conducted at the appropriate time of year for detecting the species. Reference populations at the Ballona wetlands (Los Angeles County) and UC Irvine (Orange County) were flowering and detectable during the period when the project site was surveyed.

Special Status Habitats

No designated special status habitats, such as Coastal Sage Scrub, have been reported to occur on the project site.

Federal and State Jurisdictional Wetlands

As mentioned previously in the plant communities discussion, there is a very small area (<<0.01 acre) of freshwater marsh vegetation that occurs in the southeastern quarter of the property. A soils analysis was not conducted, and it is unknown whether hydric soils (one of the qualifying criteria for a wetland) are present. The hydrology of this area is also problematic, because the vegetation does not appear to be in a streambed or pond. However, even if the marsh area were to meet the soils and hydrology criteria for a wetland, the area is well below the size for which notification of the Corps of Engineers or a Corps permit would be required for fill. The area is also well below the size that is typically regulated by the California Department of Fish and Game.

4.10 Energy and Mineral Resources

Electrical service to the ABRWP will be provided by Southern California Edison. Preliminary analysis indicates that approximately 12,000 kilowatt hours of electricity per day are required for plant operations. A more detailed energy load profile will be developed during design to refine the preliminary estimate.

The proposed project is not located in an area of known mineral resources.

4.11 Risk of Upset, Hazards, and Human Health

As shown in Figure 4, various ancillary chemical treatment processes are required. The ABWRP will operate in conformance with all applicable federal, state, and regional regulations regarding handling and storage of hazardous materials. Specifically, a business plan consisting of a hazardous materials management plan and a risk management prevention plan will be developed. The plan will meet or exceed all regulations once local determinations of "hazardous" or "highly hazardous" are made by the local regulating agency (typically, the local fire department).

Chemicals used in the treatment processes consist of sulfuric acid, sodium hypochlorite, sodium hydroxide, and a threshold inhibitior.

4.12 Noise

Current ambient noise levels in the project vicinity are dominated by traffic on the San Gabriel Freeway (I-605) and Willow Street. The nearest sensitive receptor to the project site is the residential area, located 0.5 mile to the south.

4.13 Public Services

Public services (fire, police, schools, roads) in the project area are provided by the City of Long Beach. Current demand on these services from the existing facilities is low due to the low number of employees required for operation.

4.14 Utilities and Service Systems

The existing LBWRP facilities currently utilize power provided by Southern California Edison. The existing facilities also utilize telephone and emergency alert systems, as well as a potable water supply line operated by the Los Angeles County Department of Public Works. In addition, about 5,000 acre-feet of potable water supplied by the Metropolitan Water District is used in the Alamitos Barrier.

Excess effluent from the existing Long Beach Water Reclamation Plant is normally discharged to the San Gabriel River. Storm water runoff is conveyed to the local drainage system. Biosolids are discharged to the LACSD's sewer system for conveyance to the LACSD's Joint Waste Pollution Control Plant in Carson.

4.15 Visual Resources

Currently, the nearest sensitive receptor for visual resources is the residential area, located 0.5 mile to the south of the project site. Primary views of the project site are from along Willow Street and the bike path located along the San Gabriel River.

4.16 Cultural Resources

The project site is highly disturbed. It was excavated in the 1960's to develop a storm water detention basin. A survey of the site and the immediately surrounding triangular area was conducted in 1975 for Los Angeles County in conjunction with development of the Long Beach Water Reclamation Plant. The survey found no archaeological or paleontological resources. A previous database search within 0.5 mile of the site, conducted in 1995 as part of a previous proposal for the ABP, did not reveal any known historical resources associated with the project area.

4.17 Recreation, Open Space, and Designated Wild/Scenic Rivers

Existing recreational facilities in the project area consist of bike trails along the San Gabriel River and Coyote Creek. No other recreational facilities occur in the project vicinity.

5.0 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED PROJECT

This section considers impacts of the proposed project, including short- and long-term impacts of project actions (construction and operation), and indirect (secondary) impacts from project actions. Impacts of alternatives to the proposed project are addressed in Section 6. Cumulative and growth-inducing impacts of the proposed project and alternatives are addressed in Section 7.

The analysis presented in this section evaluates whether or not there is potential for significant environmental impacts to occur as a result of the proposed project. This section, as with all sections in this document, is structured to conform to environmental documentation requirements of the California State Water Resources Control Board's Water Recycling Financial Assistance Application. This structure is slightly different from the structure of the CEQA checklist (Section 3), but includes all issue areas required under CEQA. Please refer to the Table of Contents for the sequence in which each issue is addressed.

For each issue area, a description of thresholds of significance is provided. These thresholds provide guidance in the Lead Agency's determination as to whether there is potential for significant effects on the environment. As stated previously in the introductory material for the checklist, one of the following four responses is provided for each issue with regard to the significance of any identified environmental effects:

- *No Impact.* The proposed project will not have any measurable impact on the environmental factor being analyzed (e.g., the project will not discharge into a municipal drinking water supply, therefore there will be no impacts on drinking water quality).

- *Less Than Significant Impact.* The proposed project will have the potential for impacting the environmental factor under consideration, although this impact will be below established thresholds (e.g. the project will result in discharge to surface waters, but it is not expected that such discharge will result in exceedance of established water quality standards).

- *Potentially Significant Impact Unless Mitigation Incorporated.* The proposed project will have the potential to generate impacts that result in exceedance of the threshold significance criteria, but measures such as a change in project design will mitigate such impacts to levels that are less than significant.

- *Potentially Significant Impact.* The proposed project will have impacts that are considered significant. Additional analysis is required to identify mitigation measures that could reduce these impacts to less than significant levels.

Generally, the above responses are considered only in relation to adverse impacts of a project. It is possible that a project may have one or more beneficial impacts on the resource in question, and discussion of mitigation is not meaningful. In such cases, beneficial impacts are identified in the analysis but are evaluated to be less than significant for purposes of the CEQA checklist.

Each impact analysis section addresses the proposed project first, followed by analysis of the alternatives (including No Action). As stated in the Project Description (Section 2), the only difference between the proposed project and the alternatives (except for No Action) is the method of discharge of the process residuals. Therefore, for most issues, the analysis of alternatives will refer to earlier discussion and not repeat what has already been stated in the analysis for the proposed project.

5.1 Water Resources

Significance Criteria

Impacts are considered in relation to the following criteria:

- Changes in absorption rates, drainage patterns, or the rate and amount of surface runoff;
- Exposure of people or property to water-related hazards such as flooding;
- Discharge into surface waters or other alteration of surface water quality, or contamination of a public water supply;
- Changes in the amount of surface water in any water body;
- Changes in currents, or the course or direction of water movements;
- Change in the quantity of ground waters, either through direct additions or withdrawals, or through interception of an aquifer by cuts or excavations, or through substantial loss of groundwater recharge capability;
- Altered direction or rate of flow of groundwater;
- Impacts to groundwater quality; or
- Substantial reduction in the amount of groundwater otherwise available for public water supplies.

Thresholds of significance with regard to water quality are typically interpreted in relation to specific water quality standards of regional, state, and/or federal agencies. However, the project site is located in an area where site-specific water quality objectives have not been determined due to insufficient data on natural background conditions. Instead, the Basin Plan for the project region recommends the following municipal drinking water standards, based on US Environmental Protection Agency standards specified in the Code of Federal Regulations (CFR § 141 et seq.; CH2M HILL, 1994, Exhibit 2B):

Total Dissolved Solids (TDS): 500 milligrams/liter (mg/L)
Chloride: 250 mg/L
Sulfate: 400-500 mg/L
Nitrogen: 10 mg/L

Impact Analysis

A. Would the project result in changes in absorption rates, drainage patterns, or the rate and amount of surface runoff?

Less Than Significant Impact. Development of the reclaimed water treatment plant would convert approximately 2 of the 4 acres of pervious surface area to impervious area, thus decreasing the absorption rate, and creating a slight increase in the surface runoff to local drainages (Coyote Creek and San Gabriel River). A drainage plan for the site will be developed to ensure that surface runoff will drain adequately from the site for discharge into the local storm drain system. The drainage plan would meet all drainage requirements of the City of Long Beach. No significant impacts are anticipated.

B. Would the project result in exposure of people or property to water-related hazards such as flooding?

Less Than Significant Impact. The reclaimed water treatment plan would be constructed in an existing flood control detention basin, above the peak storm high water level. The plant would use up some volumetric drainage storage capacity of the flood control basin. However, the project is not expected to have a significant effect on the storage capacity of the basin, and the City of Long Beach is not requiring any mitigation of lost storage capacity.

Development of the water reclamation plant would not raise the peak storm water surface significantly to affect development, provided that structures are built above the peak storm water surface. Current construction elevation is proposed at 30 feet msl, which is 11.5 feet above the 18.5-foot high water level. Since no significant storage capacity would be lost, and the project would be built above the high water level, no significant impacts related to flooding at the treatment plant or to the surrounding areas are anticipated.

C. Would the project result in discharges into surface waters or other alteration of surface water quality (e.g., temperature, dissolved oxygen, or turbidity?)

Less Than Significant Impact. The proposed project would discharge process residuals into the existing LACSD system for conveyance to the Joint Water Pollution Control Plant in Carson. No impacts to surface water or water quality would occur, although there would be an incremental increase in ocean disposal of treated wastewater.

D. Would the project result in changes in the amount of surface water in any water body?

Less Than Significant Impact. See response "C" above.

E. Would the project result in changes in currents, or the course or direction of water movements?

No Impact. See response "C" above.

F. Would the project result in changes in the quantity of ground waters, either through direct additions or withdrawals, or through interception of an aquifer by cuts or excavations or through substantial loss of groundwater recharge capability?

No Impact. The proposed project is expected to replace 50 percent of the existing potable water supply to the Alamitos Barrier with reclaimed water. The blending of reclaimed water with the existing potable water would be accomplished in the interceptor pipeline prior to conveyance to the Alamitos Barrier injection wells. No changes in existing conditions with respect to groundwater quantity is expected with the substitution of 50 percent reclaimed water in the groundwater basin served by the Alamitos Barrier.

G. Would the project result in altered direction or rate of flow of groundwater?

No Impact. The proposed project would replace 50 percent of the existing potable water supply to the Alamitos Barrier with reclaimed water. No changes in existing conditions with respect to the direction or rate of flow of groundwater are expected.

H. Would the project result in impacts to groundwater quality?

Less Than Significant Impact. The proposed project would result in the substitution of 50 percent reclaimed water for the 100 percent potable water currently being supplied to the Alamitos Barrier. The California Department of Health services (DOHS) has draft regulations on the use of reclaimed water for use in groundwater basins (Title 22, California Code of regulations, Division 4 Environmental health, Chapter 3 reclamation criteria). For the project to be acceptable under the proposed regulations, two threshold criteria must be met: 1) the minimum distance from the barrier to the closest potable water well must be 2,000 feet; and 2) the reclaimed water must have a minimum of one year of travel time prior to encountering a potable well.

An *Engineering Report* (Camp, Dresser & McKee, May 1992) and draft technical memorandum (Montgomery Watson, 1996) based on these regulations have been prepared and submitted to the DOHS. These reports are on file with the WRDSC. Based on the threshold criteria, the report concludes:

- The distance from the closest potable well to the injection barrier is approximately 4,300 feet, and therefore meets the first criterion;
- With regard to the second criterion, the three closest groundwater production wells to the barrier injection wells were examined. Based on available hydrogeological data, it is estimated that it would take 2.5 to 10 years for the front of reclaimed water to reach the closest well. However this estimate assumes no mixing would occur with the water in the aquifer, which is a likely worst case estimate. With mixing, the reclaimed water would be diluted and the travel time would decrease.

The reasonable worst case scenario for injecting reclaimed water into the barrier assumes that at the closest production well, the aquifer in which the water is injected would, after a sufficient interval, eventually contain 100 percent reclaimed water from the barrier (which is not actually the case). Based on the characteristics of the aquifers in the basin, there are no existing potable wells within a one-mile radius that would receive 100 percent barrier water after the 2.5 to 10 (worst case) years that it would take for the reclaimed water to reach the well.

The results of the *Engineering Report* indicate that the DOHS criteria would be met. The tertiary treated reclaimed water produced at the Long Beach Water Reclamation Plant has received adequate virus removal. However, the reverse osmosis units of the proposed project provide an additional barrier to potential viruses. Also, the length of time that the reclaimed water would travel through the soil layers to the nearest potable water supply well will significantly reduce the potential for any health impacts from active viruses. Thus, no significant groundwater impacts are anticipated. To provide a more accurate (non-worst case) prediction of when reclaimed water will reach domestic water supply wells, additional hydrogeological investigations, potentially including a groundwater model, are being conducted.

The project design incorporates reliability features and stringent operating protocols, including a contingency plan to ensure that the reclaimed water product meets or exceeds all water quality requirements of the permitting agencies. A comprehensive monitoring program has also been incorporated into the project to document project operation and compliance with permit requirements established to protect water quality in the groundwater basin.

With the above considerations it is concluded that the proposed project will have no significant adverse impact on groundwater quality.

I. Would the project result in substantial reduction in the amount of groundwater otherwise available for public water supplies?

No Impact. No changes in existing conditions with respect to groundwater quantity otherwise available for public water supplies is expected with the substitution of 50 percent reclaimed water in the groundwater basin served by the Alamitos Barrier. This project's creation of a more reliable supply for the Alamitos Barrier would help protect Central Basin potable water supplies from seawater intrusion during further imported water shortages.

5.2 Land Use and Zoning

Significance Criteria

Impacts of project actions are considered in relation to whether the action would result in one of the following:

- A conflict with general plan designation or zoning;
- A conflict with applicable environmental plans or policies adopted by agencies with jurisdiction over the project;
- Incompatibility with existing land uses in the vicinity;
- Affect agricultural resources or operations (e.g., impacts to soils or farmlands);
- A disruption or division of the physical arrangement of an established community.

Impact Analysis

A. Would the project conflict with the general plan designation or zoning?

Less Than Significant Impact. The reclaimed water treatment plant site is zoned primarily as Open Space Park District (P) corresponding General Plan designation of LUD NO. 11. A small portion of the site is zoned Institutional District –I(H). Water Treatment Plants are permitted uses in the Open Space Park District zone. The City of Long Beach will adjust the small portion zoned Institutional District to accommodate the proposed project use. Thus, no significant conflicts with the zoning or general plan designation are anticipated.

B. Would the project conflict with applicable environmental plans or policies adopted by agencies with jurisdiction over the project?

Less Than Significant Impact. The proposed project does not present any conflicts with applicable environmental policies or plans adopted by agencies with jurisdiction over the project, including the RWQCB's draft *Water Quality Control Plan for the Los Angeles Region,* June , 1994 (Basin Plan).

C. Would the project be incompatible with existing land uses in the vicinity?

Less Than Significant Impact. The reclaimed water treatment plant would be constructed in an open space area, adjacent the existing Long Beach Water Reclamation Plant and away from existing residential neighborhoods. There would be no significant impact on these land uses.

D. Would the project affect agricultural resources or operations?

No Impact. The project site is not located in an area of agricultural land uses, and thus would not affect agricultural resources or operations.

E. Would the project disrupt or divide the physical arrangement of an established community (including a low-income or minority community)?

No Impact. The project is not located within an established community which could be disrupted or divided.

5.3 Population and Housing

Significance Criteria

Impacts of project actions are considered in relation to whether the action would result in one of the following:

- Cumulative exceedance of official regional or local population projections;
- Substantial growth in an area, either directly (e.g., housing projects in an undeveloped area) or indirectly (e.g., extension of major infrastructure); or
- Displacement of existing housing, especially affordable housing.

Impact Analysis

A. Would the project cumulatively exceed official regional or local population projections?

No Impact. The project will not result in new residents to the area, and thus not affect population projections.

B. Would the project induce substantial growth in an area either directly or indirectly?

Less Than Significant Impact. The project would substitute reclaimed water for imported potable water from the Metropolitan Water District in the Alamitos Barrier. Although this substitution allows imported water to be made available for other potable uses, it will not induce substantial growth directly or indirectly; rather it represents an effort to conserve potable water in a water scarce, drought prone area, and reduce the reliance on imported water.

C. Would the project displace existing housing, especially affordable housing?

No Impact. The project will be constructed on an undeveloped site, and will not displace housing.

5.4 Geology, Seismicity, and Soils

Significance Criteria

Impacts of project actions are considered in relation to whether the action would result in one of the following:

- Exposure of people or occupied structures to geologic or soils hazards (including fault rupture, ground shaking, liquefaction, subsidence, landslides, erosion, expansive soils); or
- Damage or destruction of unique geologic features.

Impact Analysis

A. Would the project result in or expose people to potential impacts involving fault rupture?

Less Than Significant Impact. According to the *Geotechnical report for the Alamitos Barrier Reclaimed Water Project* (CH2M HILL, February, 1995-

on file with the WRDSC), the ABRWP site is not located within a special study zone under the Alquist-Priolo Special Studies Act. The City of Long Beach's Seismic Safety Element (1988) does not identify any active fault traces crossing the site. A similar Safety Element prepared for the County of Los Angeles (Los Angeles County, 1990) identifies the Los Alamitos Fault as a potentially active fault near the proposed plant site. The northwest-southwest running Los Alamitos fault is believed to be a concealed (buried) thrust fault, the active portion of which lies north of Willow Street, outside and north of the plant site boundary. The portion of the Los Alamitos Fault south of Willow Street is believed to be inactive. Based on these reports, the potential for ground rupture is considered low because no offsets of younger Quaternary-aged geologic units are known at the site.

B. Would the project result in or expose people to potential impacts involving seismic ground shaking?

Less Than Significant Impact. The project is designed in conformance with the Uniform Building Code, which requires structures to be designed for earthquake shaking commensurate with those of at least Seismic Risk Zone 4. Such design is considered to result in an acceptable level of risk for the Southern California region.

C. Would the project result in or expose people to potential impacts involving seismic ground failure, including liquefaction?

Less Than Significant Impact. Subsurface liquefaction potential of the site soils is estimated to be high given the presence of loose to medium dense sand and silty sands at the site and the presence of groundwater at shallow depths (*Geotechnical Report for the Alamitos Barrier Reclaimed Water Project,* CH2M HILL, February, 1995). However, surface manifestations of liquefaction other than settlement effects are considered unlikely, because the zones of potentially liquefiable loose to medium sands generally lie at depths greater than 30 feet from the proposed final ground surface, over which significant surface manifestations would not be observed. The potential for horizontal failure from lateral spreading as a result of liquefaction is not considered significant, since the zones of loose to medium dense sands are generally horizontal and discontinuous over the entire site.

D. Would the project result in or expose people to potential impacts involving seiche, tsunami or volcanic hazard?

No Impact. The ABRWP is located in the southern California coastal plain, and is not subject to volcanic activity. The ABWRP site is located approximately 5 miles from the coastline, and thus not anticipated to be affected by sieches or tsunamis. The injection wells of the ABRWP are located near the coastline; however, these wells are subsurface and would not be impacted by sieches or tsunamis.

E. Would the project result in or expose people to potential impacts involving landslides or mudflows?

No Impact. The ABRWP site is not located on any existing natural slopes with potential for landslides or mudflows.

F. Would the project result in or expose people to potential impacts involving erosion, changes in topography or unstable soil conditions from excavation, grading or fill?

Less Than Significant Impact. The ABWRP site is currently at approximately 13 feet mean sea level (msl), and is expected to be constructed at a final pad elevation of 30 feet msl. The project will require about 17 feet of fill material (approximately 100,000 cubic yards). The native in-grained sediments underlying the site are subject to moderate compression. Thus, consolidation of site soils under the proposed elevated areas for the ABRWP structures, access road and pipelines would be expected. Areal, engineered fills placed in advance construction may be used to limit settlements to within tolerable limits. With incorporation of the engineering recommendations outlined in the *Geotechnical Report for the Alamitos Barrier Reclaimed Water Project* (CH2M HILL, February, 1995) into the project design, no significant impacts associated with erosion, unstable soil conditions from grading, excavation or fill are anticipated.

G. Would the project result in or expose people to potential impacts involving subsidence of the land?

Less Than Significant Impact. According to the *Geotechnical Report for the Alamitos Barrier Reclaimed Water Project* (CH2M HILL, February, 1995), the site soils are not considered collapsible. Thus, subsidence typically associated with collapsible soils is not anticipated. However, because some fill materials will be required to elevate the building pad to above the flood elevation level, the project design anticipates that some consolidation of soils may occur. Therefore the design has incorporated geotechnical design and construction measures that will minimize settlement impacts. Thus, no significant impacts from land subsidence are anticipated.

H. Would the project result in or expose people to potential impacts involving expansive soils?

Less Than Significant Impact. The expansion potential of soils is low (*Geotechnical Report for the Alamitos Barrier Reclaimed Water Project* (CH2M HILL, February, 1995)). Significant expansion of soils is not expected since the site would be paved, and saturation of the soils with surface water would not be expected to occur.

I. Would the project result in or expose people to potential impacts involving unique geologic or physical features?

No Impact. No unique geologic or physical features exist at the site.

5.5 Air Quality

Significance Criteria

Project actions are evaluated in reference to the following:

- A violation of any ambient air quality standard, or contribute to an existing or projected air quality violation;
- Exposure of sensitive receptors to pollutants;
- Alter air movement, moisture, temperature, or cause any change in climate; or
- Create objectionable odors.

In addition, the South Coast Air Quality Management District (SCAQMD) has established emissions thresholds for a number of criteria pollutants. These thresholds apply to both short-term (construction-related) emissions and long-term (operational) emissions. They are:

- 550 pounds per day for carbon monoxide (CO);
- 55 pounds per day for nitrogen oxides (NO_x);
- 55 pounds per day for reactive organic gases (ROG);
- 150 pounds per day for sulfate oxides (SO_x);
- 150 pounds per day for particulates ten microns or less in size (PM_{10}).

Impact Analysis

A. Would the project violate any air quality standard or contribute to an existing or projected air quality violation?

Less Than Significant Impact. Construction of the project would generate short term exhaust emissions from construction equipment and motor vehicles, as well as fugitive dust from site preparation and grading activities. Operation of the project would generate minor long-term emissions from the reclaimed water treatment plant (specifically the decarbonators), and from employee motor vehicles. However, Best Management Practices (BMPs) for fugitive dust control are incorporated into the construction design, and the short term and long-term emissions are not expected to violate South Coast Air Quality Management District's existing or projected air quality standards.

B. Would the project expose sensitive receptors to pollutants?

No Impact. The project site is not located near any sensitive receptors.

C. Would the project alter air movements, moisture, or temperature, or cause any change in climate?

Less Than Significant Impact. The ABRWP treatment plant will be a one-story, partially enclosed facility, and is not expected to alter air movement (no wind jetting), moisture or temperature in the local area nor cause any change in climate.

D. Would the project create objectionable odors?

Less Than Significant Impact. Source water to the new reclaimed water treatment plant would be tertiary treated (Title 22) water from the Long Beach Water Reclamation Plant. No new wastewater sources would be associated with this project. In addition, the concentrate discharge has no detectable odor. Consequently, no objectionable odor impacts are anticipated.

5.6 Transportation and Circulation

Significance Criteria

Project actions are considered in reference to the following:

- Increased vehicle trips or traffic congestion;
- Hazards to safety from design features (e.g. dangerous intersections) or incompatible uses;
- Inadequate emergency access or access to nearby uses;
- Insufficient parking capacity on-site or off-site;
- Hazards or barriers for pedestrians or bicyclists;
- Conflicts with adopted policies supporting alternative transportation; or
- Rail, waterborne, or air traffic impacts.

Impact Analysis

A. Would the project result in increased vehicle trips or traffic congestion?

Less Than Significant Impact. During the one-year construction period, construction employees would generate approximately 20 to 40 additional 2-way vehicle trips per day. Project operation and maintenance would require two employees to visit the site per day. The increase in vehicle trips during construction and during the long term operation is considered minimal. Local street capacity would not be affected, and no traffic impacts are anticipated.

B. Would the project result in hazards to safety from design features (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?

No Impact. No hazards to safety are anticipated since the project would not involve construction at intersections or result in the development of new roads. The project would not introduce incompatible uses to the area because it would be built adjacent to the existing Long Beach Water Reclamation Plant.

C. Would the project result in inadequate emergency access or access to nearby uses?

No Impact. The proposed project would utilize the existing access road from Willow Street currently used by the Long Beach Water Reclamation Plant. No impacts related to emergency access are anticipated.

D. Would the project result in insufficient parking capacity on-site or off-site?

Less Than Significant Impact. The proposed project would include 10-15 parking spaces, which is well within the capacity to accommodate the two employees expected to be at the site daily. The extra spaces would be provided to accommodate visitors. Thus, no significant impacts to parking capacity onsite or offsite are anticipated.

E. Would the project result in hazards or barriers for pedestrians or bicyclists?

Less Than Significant Impact. The ABRWP site is not located within an existing pedestrian walkway, or bicyclist path. However, during connection of the supply pipeline to the MWD interceptor feeder, some temporary disruption to the bike path along the north side of the San Gabriel River could occur. If this construction causes the bike path to be closed temporarily, signs will be posted at appropriate locations to alert bicyclists. Given the short-term nature of a potential bike path closure, no significant impacts are anticipated.

F. **Would the project result in conflicts with adopted policies supporting alternative transportation (e.g., bus turnouts, bicycle racks)?**

No Impact. The proposed project has no relation to policies supporting alternative transportation. Thus, no impacts are anticipated.

G. **Would the project result in rail, waterborne, or air traffic impacts?**

No Impact. The proposed project has no relation to rail, waterborne, or air traffic. Thus, no impacts are anticipated.

5.7 Biological Resources

Significance Criteria

Project actions are considered in relation to whether one or more of the following impacts would occur:

- Loss of individuals, populations, or habitat of a federal or state designated threatened, endangered, or rare species;
- Loss of locally designated species, such as heritage trees;
- Loss of locally designated natural communities, such as coastal sage scrub;
- Loss of wetland habitat; or
- Interference with wildlife dispersal or migration corridors.

Project actions are also evaluated in terms of impacts to species that do not fall into one of the above categories, but which nevertheless are protected by federal or state regulations. Most often such cases involve nests of birds such as red-tailed hawks that are not rare, but are still protected under the federal Migratory Bird Treaty Act and the California Department of Fish and Game Code.

The term "rare" species is usually interpreted to mean species that are on lists prepared by federal, state, or private organizations but are of lower sensitivity status than threatened or endangered species. Thus, the term "rare" refers to species listed by the California Native Plant Society, federal/state Species of Special Concern, or species considered sensitive by a local jurisdiction.

Evaluation of significance is typically different between threatened/endangered species as compared to non-listed or rare species. Any loss of threatened or endangered species or their habitat is considered a significant impact in relation to federal and state endangered species regulations. However, thresholds of significance for loss of rare species have not been codified in federal or state regulations. Generally, the term is interpreted in terms of whether the project action would jeopardize the continued persistence or viability of individuals or populations of the species in question.

Impact Analysis

A. Would the project result in impacts to endangered, threatened, rare, or protected species or their habitats?

No Impact. No threatened, endangered, or rare species occur on the site. Also, no protected species would be impacted because the site is not occupied by any stands of shrubs or trees that would serve as potential nesting habitat. No nests of hawks or other protected species are present on the site.

B. Would the project result in impacts to locally designated species (e.g., heritage trees)?

No Impact. There are no locally designated species on the proposed treatment plant site.

C. Would the project result in impacts to locally designated natural communities (e.g., oak forest, coastal habitat, etc.)?

No Impact. The site is occupied by a disked field of non-native annual grassland. There would be no impacts to locally designated natural communities.

D. Would the project result in impacts to wetland habitat (e.g., marsh, riparian, and vernal pool)?

Less Than Significant Impact. There is a small (<<0.01 acre) area of freshwater marsh vegetation on the site, within an existing flood control channel and along an undefined narrow drainage that originates from a landscaped area adjacent to the existing treatment plant. Loss of this small amount of vegetation is well below the threshold acreage that is typically regulated by the Corps or the California Department of Fish and Game.

E. Would the project result in impacts to wildlife dispersal or migration corridors?

Less Than Significant Impact. The perimeter of the proposed project site is currently surrounded on three sides by a locked chain link fence. This fence is an existing barrier that would block any movement of large mammals, such as coyotes, dispersing between Coyote Creek and the San Gabriel River corridors. The fence is not a barrier to birds or small rodents. These conditions would not change significantly with construction or operation of the proposed facility.

5.8 Energy and Mineral Resources

Significance Criteria

Project actions are considered in relation to whether one or more of the following impacts would occur:

- Conflict with adopted energy conservation plans;
- The use of fuel or energy in a wasteful and inefficient manner; or
- Loss of availability of a known mineral resource that would be of future value to the region and the residents of the State.

Impact Analysis

A. Would the project conflict with adopted energy conservation plans?

Less Than Significant Impact. The proposed project will consume approximately 12,000 kilowatt hours per day, and will utilize high efficiency motors to conserve electricity. No conflicts with adopted energy conservation plans are predicted.

B. Would the project use non-renewable resources in a wasteful and inefficient manner?

No Impact. The project will be constructed with high efficiency motors to conserve electricity. No natural gas is used for the project. Thus, non-renewable resources will not be used in a wasteful and inefficient manner.

C. Would the project result in the loss of availability of a known mineral resource that would be of future value to the region and the residents of the State?

No Impact. The project does not involve development in an area of known mineral resources. Thus, no impacts to mineral resources would occur.

5.9 Hazards, Public Health and Safety

Significance Criteria

Project actions are considered in relation to whether one or more of the following impacts would occur:

- Risk of accidental explosion or release of hazardous substances (including, but not limited to: oil, pesticides, chemicals, or radiation);
- Interference with an emergency response plan or emergency evacuation plan;
- Creation of any health hazard or potential public health hazard;
- Exposure of people to existing sources of potential health hazards; or
- Increase in fire hazard in areas with flammable brush, grass, or trees.

Impact Analysis

A. Would the project involve a risk of accidental explosion or release of hazardous substances (including, but not limited to, oil, pesticides, chemicals, or radiation)?

Less Than Significant Impact. The proposed project would include the onsite storage of sodium hypochlorite, sulfuric acid, and sodium hydroxide. The sodium hypochlorite and sulfuric acid would be stored in above ground storage tanks, each about 5,000 gallons in size. All three chemicals will be provided with secondary containment. Given the relatively small amount of hazardous substance to be stored and that all local, state, and federal requirements for storage of hazardous materials are incorporated into the project design, risks associated with hazardous materials would not be significant.

B. Would the project involve possible interference with an emergency response plan or emergency evacuation plan?

Less Than Significant Impact. The proposed project is not expected to affect any emergency response or evacuation plans. The project is located adjacent to the existing Long Beach Water Reclamation Plant which has its own set of emergency response and evacuation plans. The proposed project would have its own emergency/evacuation plans and its own access to the plant, but would share the existing access road off Willow Street with the Long Beach Water Reclamation Plant. No significant impacts are anticipated.

C. Would the project involve the creation of any health hazard or potential health hazards?

Less Than Significant Impact. See response A, above.

D. Would the project involve exposure of people to existing sources of potential health hazards?

Less Than Significant Impact. The proposed project would not expose people to existing sources of potential health hazards, since no existing sources of potential health hazards are known to be associated with the project site or existing Alamitos Barrier Project. See also response A, above.

E. Would the project involve increased fire hazard in areas with flammable brush, grass, or trees?

Less Than Significant Impact. Although the project site is located within an open space area covered with grass, the grass is frequently disked and the existing fire hazard is not significant. These conditions would not change with the proposed project. Recommendations of the Long Beach Fire Department regarding fire safety are incorporated into the proposed project. Impacts regarding fire hazard will not be significant.

5.10 Noise

Significance Criteria

Project actions are considered in relation to whether there would be impacts to one or both of the following:

- Increases in noise levels; or
- Exposure of people to severe noise levels.

Impact Analysis

A. Would the project result in increases in existing noise levels?

Less Than Significant Impact. The proposed project would generate increases in noise levels from operation of the pumps for the reverse osmosis system. The pumps are expected to operate continuously, and would be equipped with motor noise muffling features to reduce noise levels consistent with levels at the project site and immediate surrounding area. The ambient noise levels in the project vicinity are currently dominated by traffic on the San Gabriel Freeway (I-605) and Willow Street. The proposed project is not expected to increase ambient noise levels along Willow Street or along the eastern bike path. The nearest residential street west of the San Gabriel Freeway is located approximately 0.5 miles south of the site. This distance to the nearest residential street would reduce potential noise impacts to insignificant levels.

B. Would the project result in exposure of people to severe noise levels?

Less Than Significant Impact. See response A, above.

5.11 Public Services

Significance Criteria

Project actions are considered as to whether there would be impacts to one or more of the following:

- Fire protection;
- Police protection;
- School facilities;
- Maintenance of public facilities, including roads; or
- Other government services.

Impact Analysis

A. Would the project have an effect upon, or result in a need for, new or altered government services in relation to fire protection?

Less Than Significant Impact. The proposed project would generate a slight increased need for fire protection in the project area given the existence of a new facility with minor potential hazards associated with chemical use (see response A in Section 5.9). However, fire safety requirements of the Uniform Building Code, as well as recommendations from the City of Long beach Fire Department regarding fire safety, are incorporated into the project design to minimize potential impacts requiring fire protection. Thus, impacts on fire protection will not be significant.

B. Would the project have an effect upon, or result in a need for, new or altered government services in relation to police protection?

No Impact. The proposed project would not increase population, nor be expected to affect crime rates in the area. Therefore, additional police protection is not needed.

C. Would the project have an effect upon, or result in a need for new or altered government services in relation to school services?

No Impact. The proposed project would not generate any additional population or students.

D. Would the project have an effect upon, or result in a need for new or altered government services in relation to the maintenance of public facilities, including roads?

No Impact. The proposed project would not require new roads, increased maintenance of existing roads, or other public facilities.

E. Would the project have an effect upon, or result in a need for new or altered government services in relation to other governmental services?

No Impact. The proposed project will not create demands for other additional governmental services.

5.12 Utilities and Service Systems

Significance Criteria

Project actions are considered in relation to whether there would be a need for new systems or supplies, or substantial alteration to the following utilities:

- Power or natural gas;
- Communications systems;
- Local or regional water treatment or distribution facilities;
- Sewer or septic tanks;
- Storm water drainage;
- Solid waste disposal; or
- Local or regional water supplies.

Impact Analysis

A. Would the project result in a need for new systems or supplies, or substantial alterations to power and natural gas services?

Less Than Significant Impact. Continuous operation of the proposed project would consume approximately 36,000 kilowatts per day. All equipment would use high-efficiency motors that would help reduce overall energy consumption. Thus, no significant impacts are anticipated.

B. Would the project result in a need for new systems or supplies, or substantial alterations to communication systems?

Less Than Significant Impact. The proposed project would require telephone and alert systems, but the addition of these systems is not expected to substantially alter existing communications systems or require significant new systems.

C. Would the project result in a need for new systems or supplies, or substantial alterations to local or regional water treatment or distribution facilities?

Less Than Significant Impact. The proposed project requires the construction of a reclaimed water supply pipeline to an existing potable water supply line operated by the Los Angeles County Department of Public Works. To avoid the potential for cross contamination between potable and reclaimed water supply pipelines, the American Water Works Association (AWWA) *Guidelines for the Distribution of Non-potable Water* will be followed. The DOHS guidelines require compliance with the AWWA guidelines for reclaimed water distribution and transmission system piping. Implementation of the AWWA guidelines will reduce the risk of cross connections. Therefore, no significant impacts to the local or regional water treatment or distribution facilities are anticipated.

D. Would the project result in a need for new systems or supplies, or substantial alterations to sewer services or septic tanks?

Less Than Significant Impact. The Los Angeles County Sanitation District's sewerage currently has sufficient capacity to handle the process residuals generated by the proposed treatment plant. No changes in the existing sewer system serving the Long Beach area are expected.

E. Would the project result in a need for new systems or supplies, or substantial alterations to storm water drainage?

Less Than Significant Impact. The proposed project is not expected to significantly increase storm water runoff. The development of the new treatment plant will generate minor increases in runoff, which will be conveyed to the local drainage system in accordance with an approved drainage plan. No significant impacts to the municipal storm drain system are anticipated.

F. Would the project result in a need for new systems or supplies, or substantial alterations to solid waste disposal?

Less Than Significant Impact. The project would not generate significant increases in solid waste above existing levels currently generated at the Long Beach Water Reclamation Plant. The reverse osmosis and microfiltration process will not generate solids requiring disposals at any landfills. Therefore, no significant impacts on existing local and regional solid waste services and facilities are predicted.

G. Would the project result in a need for new systems or supplies, or substantial alterations to local or regional water supplies?

Less Than Significant Impact. The proposed project is expected to create a beneficial impact by increasing local and regional potable water supplies and groundwater reliability in the area. The project will substitute 2,500 to 3,500 acre-feet per year of potable water currently used in the Alamitos Barrier (supplied by the Metropolitan water District) with reclaimed water produced at the proposed ABRWP treatment facility. Thus, more potable supply will become available to the region. No potable water is consumed to produce the reclaimed water, however some minor amount of potable water is used for irrigation and wash-down areas of the site. No significant adverse impacts to local or regional water supplies are anticipated.

5.13 Aesthetics

Significance Criteria

Project actions are considered in relation to whether there would be one or more of the following effects:

- Affect a scenic vista or scenic highway;
- Have a demonstrable negative aesthetic effect; or
- Create light or glare.

Impact Analysis

A. Would the project affect a scenic vista or scenic highway?

No Impact. The treatment plan site is not located in an area considered to be a scenic vista or along a scenic highway. Thus, no impacts to views are anticipated.

B. Would the project have a demonstrable negative aesthetic effect?

Less Than Significant Impact. The proposed treatment plant site will be constructed adjacent to the existing Long Beach Water Reclamation Plant. The primary views would be from along Willow Street and the bike paths located along the San Gabriel River and Coyote Creek. The proposed project includes landscape screening along the northern boundary to preserve views along Willow Street and along the western/eastern boundaries to protect views from the bike paths along the San Gabriel River/Coyote Creek. Thus, no significant adverse aesthetic effects are anticipated.

C. Would the project create light or glare?

Less Than Significant Impact. The project would result in an increase in night lighting from security lights provided around the proposed treatment plant. The lighting would be low-level and directed downward. There would be no substantive difference experienced in surrounding neighborhoods. No significant impacts are anticipated.

5.14 Cultural Resources

Significance Criteria

Project actions are considered in relation to whether there would be impacts to one or more of the following:

- Paleontological resources;
- Archeological resources;
- Unique ethnic cultural values; or
- Restrict existing religious or sacred uses within the potential impact area.

Impact Analysis

A. Would the project disturb paleontological resources?

No Impact. The project site is highly disturbed. The site was excavated in the 1960's to develop a storm water detention basin. A survey of the site and adjacent lands was conducted in 1975 for Los Angeles County in conjunction with the Long Beach Water Reclamation Plant development. The survey found no paleontological resources in this area, which includes the project site. Thus, no impacts to paleontological resources are anticipated.

B. Would the project disturb archaeological resources?

No Impact. See response A, above.

C. Would the project affect historical resources?

No Impact. Based upon a database search of historical resources within 0.5 mile of the site and the 1975 survey cited in response A, there are no known historical resources associated with the project area. Thus, no impacts to historical resources are anticipated.

D. Would the project have the potential to cause a physical change which would affect unique ethnic cultural values?

No Impact. The proposed project is not expected to cause a physical change which would affect unique cultural values because no significant cultural resources are known to be associated with the site, and project activities are restricted to the project site.

E. Would the project restrict existing religious or sacred uses within the potential impact area?

No Impact. The proposed project would not restrict existing religious or sacred uses within the potential impact area, because no significant cultural resources are known to be associated with the site, and the proposed project activities are restricted to the project site.

5.15 Recreation, Open Space, and Designated Wild/Scenic Rivers

Significance Criteria

Project actions are considered in relation to whether one or more of the following effects would occur:

- Increase in demand for neighborhood parks, regional parks, open space, or other recreational facilities;
- Affect existing recreational opportunities; or
- Affect designated wild or scenic rivers.

Impact Analysis

A. Would the project increase the demand for neighborhood or regional parks or other recreational facilities?

No Impact. The project would not result in an increase of recreational users in the area, and would not eliminate existing park space. The project would not impact demand on neighborhood or regional parks or other recreational facilities. Although the ABRWP treatment plant site is zoned as Open Space Park District, water treatment plants are permitted uses in this zone.

B. Would the project affect existing recreational opportunities?

Less Than Significant Impact. The existing bike path along the San Gabriel River may be temporarily obstructed during the one- to two-week period needed to construct conveyance facilities. During this time, information signs will be posted to inform bicyclists of this disruption and suggest alternative routes. Given the short-term nature of this disruption to this one bike path, no significant adverse impacts are anticipated. No other existing recreational facilities will be affected by the project.

C. Would the project affect designated wild or scenic rivers?

No Impact. No designated wild or scenic rivers are present on or downstream of the project area.

6.0 PROJECT ALTERNATIVES

Four major studies have been conducted for design of the Alamitos Barrier Reclaimed Water Project: CDM (1991), CH2M Hill (1994), WRD (1996), and Separation Processes, Inc. (1998). This section is based on the information contained in those reports. Please refer to Section 8 (References) for full citations of these documents.

Sections 6.1 and 6.2 below address options for individual components of the project and for various facility locations, along with environmental impact comparisons to the proposed project. Section 6.3 addresses various combinations of these individual component/siting options, and their collective environmental impacts, as project alternatives that would accomplish the same objectives as the proposed project. Section 6.4 discusses the No Project alternative, and Section 6.5 summarizes the reasons for considering the proposed project as the environmentally superior alternative.

6.1 Alternative Project Components

Treatment Processes

Alternative processes considered for treatment of the reclaimed water obtained from the Long Beach Water Reclamation Plant, prior to injection into the Alamitos Barrier, essentially fall into two categories: alternative blend proportions for reclaimed vs. potable water, and alternative materials used in treating the water itself.

The proposed proportion of reclaimed water for injection is 50%. Alternative blend percentages considered and their potential environmental effects are as follows:

1. Maximum reuse. Under this alternative, reclaimed water would make up 100% of the supply to the Alamitos Barrier. This alternative would require larger storage capacity and possibly a larger treatment facility size than the proposed project, in order to meet the full anticipated delivery rate of 8,000 acre-feet/year or 7 mgd (CDM 1991 p. 7-5). Construction of the larger facility could require an incrementally larger amount of land. Environmental impacts of this larger facility would not be expected to be significantly different from the proposed project, other than the benefit that a proportionally greater amount of potable water would be made available for domestic consumption.

2. Minimum reuse. Under this alternative, the amount of reclaimed water would be limited to 20% of the total injection. This alternative would require less storage capacity and possibly a smaller facility size than the proposed project. In addition, reverse osmosis as a treatment process would not be required, and could be replaced with a granular activated carbon (GAC) treatment system (CDM 1991 p. 5-24). The facility would be sized to meet an anticipated delivery rate of 2000 acre-feet/year of reclaimed water, or about 2 mgd (CDM 1991 p. 7-6). Construction of this facility could require an incrementally smaller amount of land than the proposed project, but overall environmental impacts would not be expected to be significantly less than the proposed project. A greater amount of imported potable water (30%) would be needed for this alternative compared to the proposed project, proportionally reducing the amount of potable water that would otherwise be available for domestic use.

Alternative reverse osmosis processes for the reclaimed water, prior to injection into the Alamitos Barrier, were investigated by Separation Processes, Inc. (1998). These alternatives consisted of different materials that would be used for the reverse osmosis membrane: cellulose acetate, and various types of composite polyamide membranes. Cellulose acetate was rejected as the membrane of choice because of its lower rejections of TDS, TOC, and nitrogen-bearing compounds as compared to the newer polyamide materials. Correspondingly, the process resulting from use of the polyamide materials tends to be higher in TDS, TOC, and nitrogen-bearing compounds than if cellulose acetate were used. The higher quality of the process residuals using cellulose acetate would result in less environmental impact than the proposed polyamide material, only if it was proposed that the process residuals be discharged directly into the San Gabriel River or Coyote Creek. With the proposed disposal into the existing sewage treatment system, no significant difference in environmental impacts between the various membrane material alternatives would be expected.

Storage

The supply of reclaimed water from the Long Beach Water Reclamation Plant will vary diurnally and with the daily pattern of supply for other reclaimed water uses. However, the demand for water to supply the Barrier is essentially continuous, and there would be economic and operational advantages to sizing any facility for average flow rather than peak flows. Therefore, two alternatives for balancing flows by means of an equalization storage basin were considered:

1. *Dedicated Storage*. This alternative would require construction of either an aboveground steel or reinforced concrete reservoir, or a below-ground

concrete reservoir. The area over a buried reservoir could be used for other purposes, and would eliminate odor problems, but is likely to be more expensive.

2. *Combined Storage with LBWRP Effluent.* If final effluent from the LBWRP were used as the source water for the Alamitos Barrier, it may be possible to combine the storage needs for other reclaimed water and the Barrier in the City of Long Beach reclaimed water distribution system.

In either case, the equalization storage facility will be constructed by others on the LBWRP property as part of a separate project. Neither storage alternative would differ significantly in their environmental impacts. However, regardless of which alternative is chosen, selection of the buried reservoir option within each alternative would have less potential for adverse visual impacts than the above-ground reservoir. Storage alternatives were also considered in terms of location.

Disposal Sites

Process residuals would be produced by the proposed project both as a result of microfiltration and reverse osmosis. The proposed project would convey the process residuals to the existing sewage system. Three alternatives to this disposal option and their environmental impacts are as follows:

1. *San Gabriel River or Coyote Creek.* Under this alternative, process residuals would be discharged via a short pipeline to the edge of one of the two channels. Economic costs of this option would be negligible, but environmental impacts to the San Gabriel River estuary downstream of both channels would be a potential issue. This alternative was considered part of the proposed project in the previous Initial Study/Negative Declaration for the Alamitos Barrier Reclaimed Water Project prepared in 1995 by CH2M Hill. However, while the 1995 study concluded that discharge of the process wastewater would not significantly impact water quality in the San Gabriel River estuary downstream, this finding was questioned by reviewers of the CEQA document and continued monitoring of receiving waters was proposed as mitigation. The ABRWP would generate two process streams; reverse osmosis concentrate and microfilter backwash. The previous 1995 Initial Study/Negative Declaration included disposal of these wastes into the San Gabriel River with continued monitoring proposed as mitigation. This finding was questioned by reviewers and as a result the reverse osmosis concentrate will be discharged to the Los Angeles County sewerage system for conveyance to the Joint Water Pollution Control Plant in Carson. Disposal options for the microfilter backwash are still under study and

would either involve delivery to the LBWRD outfall or Coyote Creek, where it would be co-mingled with LBRWD effluent.

2. *Settling Basin.* Under this alternative, microfiltration backwash would be clarified prior to disposal. However, experience at the microfiltration plant at Saratoga, California has shown that settling basins are unsuccessful, since the solids in the backwash are unsettleable. In addition, present day experience has shown that recovery of microfilter backwash may require conventional clarification and media filtration or another microfilter.

3. *Engineered Wetland.* Under this alternative, process residuals would be routed through a wetland area that could be constructed in the 80-foot wide Edison International right-of-way west of the LBWRP, the project area, and the City of Long Beach property to the north. This wetland could be an extension of the existing small wetland in the Edison right-of-way. Implementation of this alternative would increase the extent of wetland habitat in the project region. However, there would be costs associated with the additional engineering and design needed to determine the appropriate size of the wetland and the types of vegetation that would tolerate the brackish water. There would also be additional coordination and approvals required from Edison.

Conveyance

Three alternatives were considered for conveyance facilities. These facilities would deliver final treated water from the proposed treatment plant to the injection distribution header.

1. *New Dedicated Pipeline Option* – This option includes the construction of a pump station and approximately 11,100 linear feet of dedicated pipeline from the ABRWP to the Barrier header pipe. As shown in the site layout diagram (Figure 5), the alignment of the pipeline proposed would roughly parallel the existing LACDPW delivery pipeline and the western bank of the San Gabriel River and would also cross under the San Diego freeway. As a new dedicated pipeline is only being considered for the 100% reclaimed water option, the pump station must be sized to deliver 9 mgd (the ultimate ABRWP flow) at approximately 175 feet total dynamic head.

   Because there would be a direct connection to the Barrier header pipe from both reclaimed water and potable MWD water, there would need to be backflow prevention on the existing LACDPW delivery pipeline. Reduced pressure backflow preventors have been assumed for preliminary sizing and costing. DOHS has indicated, however; that such devices would not be acceptable. For the anticipated flows, three 10-inch backflow preventor units in parallel would be needed.

2. *Existing Pipeline, Direct Connection Option* – As with the new dedicated pipeline option, this option includes the construction of a pump station and a new pipeline. However, the pipeline would only be required to connect the pump station to a new connection with the existing 27-inch delivery pipeline near the treatment facilities, a reach of approximately 1,200 feet. Further, the new pipeline and pump station would be sized to deliver only reclaimed water (3.0 or 8.0 mgd depending on the treatment option), as any required blending would take place in the existing delivery pipeline. A backflow prevention facility similar to that described for the new dedicated pipeline option would be required on the existing pipeline upstream of the new connection. As with the new dedicated pipeline option, DOHS has indicated that this approach is not acceptable, but the evaluation has been included for comparison purposes.

3. *Existing Pipeline, Wet Well* – This option is similar to the existing pipeline, direct connection option, except that any MWD water required would be diverted through 1,200 feet of pipeline to a wet well of the pump station where it would be blended prior to pumping. The primary advantage of this option is that it provides an air gap to prevent any cross-contamination and simplifies the blending operation. There are two primary disadvantages associated with this option. First, the pump station and the new pipelines (2,400 feet total) must be sized to deliver the full 8.0 mgd demand of the barrier. Second, the available head in any MWD water used would be lost unless it could be recovered in an energy recovery station located at the pump station or at the connection to the MWD South Coast Feeder. This option becomes more advantageous as the ratio of reclaimed water to imported water gets higher, and is the only option the Public Health agencies will currently approve.

The third option (existing pipeline, wet well) would provide one air gap in the MWD supply pipeline. This satisfies public health concerns for preventing backflow of reclaimed water. Backflow prevention under the first two options would have to be accomplished with in-line reduced pressure backflow preventors. Subsequent to the preliminary analysis, the Department of Health Services has indicated that only an air gap separation is acceptable. The air gap between the treated imported potable water and the ABRWP effluent would be provided by the differential pressure maintained by two structures. The structures include: 1) the pressure reducing station (located at the intersection of Wardlow Road and Woodruff Avenue); and 2) the double check valves and a reverse flow switch which would be installed between the pressure reducing station and the reclaimed water interconnection.

6.2 Alternative Projects Which Could Accomplish the Project Objectives

There are numerous possible combinations of the alternatives discussed previously in Section 6.1. Seven of these combinations were identified and discussed in an economic feasibility study for this project (CDM 1991). Four of the seven alternatives assumed delivery systems (new dedicated pipeline or existing pipeline/direct connection) that have subsequently been rejected by the Department of Health Services as unacceptable. One of the previously analyzed alternatives (50% reclaimed water use with reverse osmosis as the treatment process) is currently the proposed project. The two remaining alternatives, listed below, assume construction of an above-ground reservoir for storage and a delivery system consisting of the existing pipeline/wet well connection.

1. *Maximum Reclaimed Water Use with Reverse Osmosis.* The principal difference between this alternative and the proposed project, other than the greater use of reclaimed water, is the requirement for about 4 MG greater storage capacity of the equalization basin. The capacity of the booster pump station would also be proportionally greater.

2. *Twenty Percent Reclaimed Water Use with Granular Activated Carbon.* This alternative would entail a smaller equalization basin and less pump station capacity than the proposed project.

With one exception, environmental impacts of each alternative would not differ significantly from the proposed project because the site locations for each of these alternative facilities, and features of the facilities, would be similar to that of the proposed project. The exception is that alternative 2 would entail greater use of imported potable water than the proposed project, alternative 1, or the No Action Alternative. In addition, these alternatives include less efficient technology and are considered more susceptible to future environmental impacts.

6.3 No Project Alternative

Under the No Project alternative, the Alamitos Barrier would continue to be maintained with 100% imported potable water. The project site would remain undeveloped, and weed abatement actions would continue on the site.

7.0 CUMULATIVE AND GROWTH – INDUCING IMPACTS

The CEQA Guidelines require a discussion of potential cumulative impacts that could result from a proposed project in conjunction with others in the vicinity. The cumulative impact of several projects is the change in the environment that results from the incremental impact of the project when added to other, closely related past, present or reasonably foreseeable projects. (Guidelines Section 15355).

The vicinity is defined by the immediate areas surrounding the proposed project site, specifically the Long Beach Water Reclamation Plant (LBWRP). Based on the current environmental analysis prepared for the LBWRP, as a separate document, the project will not result in any potentially significant impacts. Therefore, the combination of the Alamitos Barrier Reclaimed Water Project and LBWRP would not result in any cumulative impacts.

8.0 REFERENCES

Camp, Dresser and McKee, 1992. Engineering Report, May
CFR 141

CH2M Hill, 1995. Initial Study and Mitigated Negative Declaration for: Alamitos Barrier Reclaimed Water Project, November.

Montgomery Watson, 1996, Draft Technical Memorandum No. 1 Alamitos Barrier Reclaimed Water Project for Water Replenishment District of Southern California and Orange County Water District.

Separation Processes, Inc., 1998. A Re-evaluation of the Alamitos Barrier Reclaimed Water Project for the Water Replenishment District of Southern California, April.

9.0 RESPONSE TO COMMENTS

Governmental agency coordination and public participation were conducted in order to define environmental and engineering issues for evaluation during the environmental review process and to provide an opportunity for agencies and residents within the proposed project area to become informed of the project. A notice of completion and availability was published on October 9, 1998 to solicit comments from agencies and the public. The document was made available for review and comment for the required 30-day period.

9.1 Agency Consultation

The Draft Initial Study/Negative Declaration for the Alamitos Barrier Reclaimed Water Project was mailed to elected officials and local state and federal agencies having jurisdiction or discretionary approval within the project area. A copy of the letter and the Initiation of Studies mailing list are attached in Section 12.0.

The following agencies provided comments on the Draft document during the 30-day period. Responses to these comments were mailed to the contact person. Copies of the comment letters and response are included in this section.

	AGENCY	CONTACT
A.	Central Basin Municipal Water District 17140 South Avalon Boulevard, Suite 210 Carson, CA 90746	Paul D. Jones II
B.	City of Long Beach Planning Department 333 W. Ocean Boulevard Long Beach, CA 90802	Gerhardt H. Felgemaker
C.	Orange County Water District P.O. Box 8300 Fountain Valley, CA 92728-8300	Steven R. Conklin
D.	State Water Resources Control Board P.O. Box 944212 Sacramento, CA 94244-2120	Diane Edwards
E.	State Clearinghouse Office of Planning and Research 1400 Tenth Street Sacramento, CA 95812	Antero A. Rivasplata

PSOMAS & ASSOCIATES

3187 RED HILL AVE. SUITE 250

COSTA MESA, CA. 92626

Affidavit of Publication

-of-

CLASSIFIED ADVERTISING

State of California, } ss.
County of Los Angeles

TROY CHERRY *of said County and State, being duly sworn, says:*

That he is and at all times herein mentioned was a citizen of the United States, over 21 years of age, and not a party to nor interested in the above entitled matter; that he is a principal clerk of the printers and publishers of the LOS ANGELES TIMES a newspaper printed and published daily in the said Los Angeles County; that the

LEGAL NOTICE

in the above entitled matter of which the annexed is a printed copy, was published in said newspaper

LOS ANGELES TIMES

TIMES MIRROR SQUARE
LOS ANGELES CA. 90053

on the following days, to-wit:

SATURDAY OCTOBER 3, 1998

Troy Cherry

Subscribed and sworn to before me, this 9th *day of* October 1998

Debra L Beavers Notary Public

Notary Public in and for the County of Los Angeles, State of California

DEBORAH L. BEAVERS
Comm. # 1092768
NOTARY PUBLIC - CALIFORNIA
Los Angeles County
My Comm. Expires March 28, 2000

NOTICE OF COMPLETION AND AVAILABILITY OF THE INITIAL STUDY/PROPOSED NEGATIVE DECLARATION FOR THE ALAMITOS BARRIER RECLAIMED WATER PROJECT

The Water Replenishment District of Southern California (WRD) has completed the Initial Study for the Alamitos Barrier Reclaimed Water Project (ABRWP). The WRD, proposes to replace 50% of the potable water currently used in the Alamitos Barrier with treated reclaimed water obtained from the Long Beach Water Reclamation Plant (LBWRP). The objective of the proposed project is to reduce dependence of the barrier on imported water, while maintaining the seawater barrier. A Copy of the IS/ND is available for review at:

The City of Long Beach
333 West Ocean Boulevard
Long Beach, CA 90802

Water Replenishment District of Southern California,
12601 East 160th Street,
Cerritos, CA 90703

Written comments must be received by November 3, 1998. All written responses to this notice should be sent to:

James R. Leserman
Water Replenishment District of Southern California,
12601 East 160th Street,
Cerritos, CA 90703

OCT 29 1998

A

Central Basin Municipal Water District
17140 S. Avalon Blvd • Suite 210 • Carson, CA 90746-1296
telephone 310-217-2222• fax 310-217-2414

October 23, 1998

Mr. James R. Leserman, P.E.
Water Replenishment District
of Southern California
12621 E. 166th Street
Cerritos, CA 90703

Dear Mr. Leserman:

Comments on Negative Declaration
Alamitos Barrier Reclaimed Water Project

Central Basin Municipal Water District (CBMWD) appreciates the opportunity to comment on the Negative Declaration for the above mentioned project. CBMWD supports the use of recycled water. The use of recycled water is viewed by CBMWD as an alternative water supply, and consistent with our objective to drought-proof our service area. At this time CBMWD has determined that the above mentioned project would not have any environmental impacts within our service area.

If you have any questions, please contact Lucia M. McGovern at (310) 660-6245.

Sincerely,

II

Paul D. Jones II, P.E.
General Manager

LMMc:sfb f:\users\shared\628cb023

WRD

WATER REPLENISHMENT DISTRICT
OF SOUTHERN CALIFORNIA

November 9, 1998

Mr. Paul D. Jones II, P.E.
Central Basin Municipal Water District
17140 South Avalon Boulevard, Suite 210
Carson, California 90746-1296

Subject: Alamitos Barrier Reclaimed Water Project

Dear Mr. Jones:

Thank you for your comments, dated October 23, 1998, in regards to the Draft Initial Study/ Negative Declaration for the Alamitos Barrier Reclaimed Water Project. The final decision on this project will be made in late December 1998.

Sincerely,

Hoover Ng
Project Manager

OCT 22 1998

B

CITY OF LONG BEACH

DEPARTMENT OF PLANNING AND BUILDING

333 W. Ocean Boulevard, 5th Floor • Long Beach, CA 90802 • (562) 570-6894 FAX (562) 570-6068

COMMUNITY AND ENVIRONMENTAL PLANNING DIVISION

October 20, 1998

James R. Leserman
Water Replenishment District of Southern California
12601 E. 160th Street
Cerritos, CA 90703

Subject: Alamitos Barrier Reclaimed Water Project

Dear Mr. Leserman:

Thank you for the Notice of Completion and the proposed Negative Declaration. In discussing this matter with the Zoning Administrator, it was determined that the Water Replenishment District is not subject to local land use regulations; consequently, a rezoning is not necessary.

Sincerely,

Gerhardt H. Felgemaker
Environmental Planning Officer

GHF:jm

WRD
WATER REPLENISHMENT DISTRICT
OF SOUTHERN CALIFORNIA

November 9, 1998

Mr. Gerhardt H. Felgemaker
City of Long Beach
Department of Planning and Building
333 W. Ocean Boulevard, 5th Floor
Long Beach, CA 90802

Subject: Alamitos Barrier Reclaimed Water Project

Dear Mr. Felgemaker:

Thank you for your comments, dated October 20, 1998, in regards to the Draft Initial Study/ Negative Declaration for the Alamitos Barrier Reclaimed Water Project. The final decision on this project will be made in late December 1998.

Sincerely,

Hoover Ng
Project Manager

Printed on Recycled Paper

12621 E. 166th Street, Cerritos, California 90703 Phone (562) 921-5521 Fax (562) 921-6101

OCT 14 1998

C

SINCE 1933 ORANGE COUNTY WATER DISTRICT A TRADITION OF INNOVATION

ORANGE COUNTY WATER DISTRICT

October 13, 1998

Mr. James R. Leserman
Water Replenishment District
of Southern California
12601 East 160th Street
Cerritos, CA 90703

Dear Mr. Leserman:

DRAFT IS/ND FOR THE ALAMITOS BARRIER RECLAIMED WATER PROJECT

Thank you for providing a copy of the subject document for the Orange County Water District. We have reviewed it and have no comments.

The Orange County Water District has long been a supporter of reclaimed water use and supports WRD's plan to proceed with the Alamitos Barrier Reclaimed Water Project. We look forward to assisting you in bringing this project to fruition.

Very truly yours,

Steven R. Conklin, P.E.
Associate General Manager
Engineering and Construction

P.O. Box 8300, Fountain Valley, CA 92728-8300 • 10500 Ellis Avenue, Fountain Valley, CA 92708
Telephone (714) 378-3200 FAX (714) 378-3373 Web Page www.ocwd.com

WRD

WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA

November 9, 1998

Mr. Steven R. Conklin, P.E.
Orange County Water District
P.O. Box 8300
Fountain Valley, CA 92728-8300

Subject: Alamitos Barrier Reclaimed Water Project

Dear Mr. Conklin:

Thank you for your comments, dated October 13, 1998, in regards to the Draft Initial Study/ Negative Declaration for the Alamitos Barrier Reclaimed Water Project. The final decision on this project will be made in late December 1998.

Sincerely,

Hoover Ng
Project Manager

D NOV C 2 1998

State Water Resources Control Board

John P. Caffrey, Chairman

Peter M. Rooney
Secretary for Environmental Protection

Division of Clean Water Programs
2014 T Street • Sacramento, California 95814 • (916) 227-4400 FAX (916) 227-4595
Mailing Address: P.O. Box 944212 • Sacramento, California • 94244-2120
Internet Address: http://www.swrcb.ca.gov

Pete Wilson
Governor

NOV - 2 1998

Mr. James R. Leserman
Water Replenishment District
of Southern California
12621 East 166th Street
Cerritos, CA 90703

Dear Mr. Leserman:

NEGATIVE DECLARATION/INITIAL STUDY (ND/IS) FOR THE WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA (DISTRICT) - ALAMITOS BARRIER RECLAIMED WATER PROJECT - STATE REVOLVING FUND (SRF) LOAN NO. C-06-4317-110 (SCH # 98101009)

Thank you for the opportunity to review the above document. We understand that the District will be seeking an SRF or Water Reclamation Loan (WRL) from the State Water Resources Control Board (SWRCB), Division of Clean Water Programs (Division) for the above project. As a funding agency, the SWRCB will be a responsible agency under CEQA, and will consider the District's Environmental Document when deciding whether to issue the loan.

If the District will be seeking a WRL or an SRF loan from the SWRCB to assist in financing the proposed project, the SWRCB will be a responsible agency under CEQA and will use the approved ND/IS when deciding whether to approve a loan for the project. If this is the case, please provide us with a copy of: (1) an approved Negative Declaration (ND), (2) the resolution approving the ND, (3) all comments received during the review period and your responses to those comments, and (4) the Notice of Determination filed with the Governor's Office of Planning and Research, when they become available. In addition, we would appreciate notices of any hearing or meeting held regarding environmental review of the project.

The Division is required to consult directly with federal agencies responsible for implementing federal environmental laws and regulations for projects that involve an SRF loan, since it is partially funded by the U.S. Environmental Protection Agency. Accordingly, copies of your document will be distributed to appropriate federal agencies. Federal agencies are given 30 calendar days to review and comment on your environmental document plus six days mailing time. We will send you copies of any comments we receive during the review period and request your responses.

SRF loan projects also need to be cleared with the State Historic Preservation Officer (SHPO) for compliance with Section 106 of the National Historic Preservation Act. The Section 106 process includes: (1) background research for cultural resources -- including a records search with the California Historical Resources Information System; (2) consultation with interested Native Americans, local historical societies, etc.; (3) a field survey by a qualified archaeologist and, possibly, other specialists; and (4) an inventory of all cultural resources in the project's Area of Potential Effects. Please see Section 13b of the SRF Environmental Guidelines for more details about the required items. A copy of your environmental document has been provided to the Division's Cultural Resources

Officer, Ms. Susan Wilcox, for review for Section 106 compliance. She will contact you regarding any additional required documentation. Once all required information has been submitted, she will forward approved documents to the SHPO. The SHPO has a 30 day review period in which to comment or concur that the process is complete. Please contact Ms. Wilcox at (916) 227-4410 with any questions regarding cultural resources studies and/or required documentation.

SRF projects are also subject to Section 7 of the Federal Endangered Species Act and must obtain clearance from the U.S. Fish and Wildlife Service (FWS). Accordingly, a copy of the ND/IS will be forwarded to the FWS for their review.

The document is adequate for our purposes. We appreciate your efforts to prepare a document that follows our environmental guidelines and meets our requirements for the SRF and WRL programs.

Please contact me at (916) 227-4572 if you have any questions regarding the environmental review of this project.

Sincerely,

Diane Edwards

Diane Edwards
Environmental Services Unit

Enclosure

cc: Governor's Office of Planning and Research
State Clearinghouse
1400 Tenth Street
Sacramento, CA 95814

Ms. Wendy Phillips
Los Angeles Regional Water
Quality Control Board
101 Centre Plaza Drive
Monterey Park, CA 91754-2156

WRD
WATER REPLENISHMENT DISTRICT
OF SOUTHERN CALIFORNIA

November 10, 1998

Ms. Diane Edwards
Environmental Services Unit
State Water Resources Control Board
P.O. Box 944212
Sacramento, California 94244-2120

Subject: Alamitos Barrier Reclaimed Water Project

Dear Ms. Edwards:

Thank you for your comments, dated November 2, 1998, in regards to the Draft Initial Study/ Negative Declaration for the Alamitos Barrier Reclaimed Water Project. The final decision on this project will be made in late December 1998.

Sincerely,

Hoover Ng

Hoover Ng
Project Manager

12621 E. 166th Street, Cerritos, California 90703 Phone (562) 921-5521 Fax (562) 921-6101

E

STATE OF CALIFORNIA

Governor's Office of Planning and Research

1400 TENTH STREET SACRAMENTO, CALIFORNIA 95812-3044

Pete Wilson
GOVERNOR

Paul F Miner
DIRECTOR

November 4, 1998

Mr. James Leserman
Water Replenishment District of Southern California
12621 East 166th Street
Los Angeles, CA 90703

RE: Alamitos Barrier Reclaimed Water Project
SCH #98101009

Dear Mr. Leserman:

The State Clearinghouse submitted the referenced project environmental document to selected state agencies for review. The review period for the above referenced project ended November 2, 1998. No comments were received from the state agencies consulted by the State Clearinghouse.

This letter acknowledges that you have complied with the State Clearinghouse review requirements, pursuant to the California Environmental Quality Act.

If you have any questions about this, call the State Clearinghouse staff at (916) 445-0613. When contacting the Clearinghouse, please reference the SCH number.

Sincerely,

Antero A. Rivasplata

ANTERO A. RIVASPLATA, AICP
Deputy Director

CEQA: California Environmental Quality Act

Notice of Completion

Mail to: State Clearinghouse, 1400 Tenth Street, Sacramento, CA 95814 916/445-0613

SCH # 98101009

Project Title: Alamitos Barrier Reclaimed Water Project

Lead Agency: Water Replenishment District of Southern California
Street Address: 12621 E. 166th Street
City: Cerritos Zip: 90703

Contact Person: James R. Leserman
Phone: 562/921-5521
County: Los Angeles

Project Location

County: Los Angeles City/Nearest Community: Long Beach
Cross Streets: Willow Street Zip Code: Total Acres:
Assessor's Parcel No. 605 Section: Twp. Range: Base:
Within 2 Miles: State Hwy #: Waterways: San Gabriel River, Coyote Creek
Airports: Railways: Schools:

Document Type

CEQA: ☐ NOP ☐ Early Cons ☑ Neg Dec ☐ Draft EIR ☐ Supplement/Subsequent ☐ EIR (Prior SCH No.) ☐ Other

NEPA: ☐ NOI ☐ EA ☐ Draft EIS ☐ FONSI

Other: ☐ Joint Document ☐ Final Document ☐ Other

Local Action Type

☐ General Plan Update
☐ General Plan Amendment
☐ General Plan Element
☐ Community Plan
☐ Specific Plan
☐ Master Plan
☐ Planned Unit Development
☐ Site Plan
☐ Rezon
☐ Prezone
☐ Use Permit
☐ Land Division (Subdivision, Parcel Map, Tract Map, etc.)
☐ Annexation
☐ Redevelopment
☐ Coastal Permit
☑ Other Alamitos Barrier

Development Type

☐ Residential: *Units* *Acres*
☐ Office: *Sq.ft.* *Acres* *Employees*
☐ Commercial: *Sq.ft.* *Acres* *Employees*
☐ Industrial: *Sq.ft.* *Acres* *Employees*
☐ Educational
☐ Recreational
☐ Water Facilities: *Type* Reclamation *MGD*
☐ Transportation: *Type*
☐ Mining: *Mineral*
☐ Power: *Type* *Watts*
☐ Waste Treatment: *Type*
☐ Hazardous Waste: *Type*
☐ Other:

Project Issues Discussed in Document

☑ Aesthetic/Visual
☐ Agricultural Land
☑ Air Quality
☑ Archeological/Historical
☐ Coastal Zone
☐ Drainage/Absorption
☐ Economic/Jobs
☐ Fiscal
☐ Flood Plain/Flooding
☐ Forest Land/Fire Hazard
☑ Geologic/Seismic
☐ Minerals
☑ Noise
☐ Population/Housing Balance
☑ Public Services/Facilities
☐ Recreation/Parks
☐ Schools/Universities
☐ Septic Systems
☑ Sewer Capacity
☑ Soil Erosion/Compaction/Grading
☐ Solid Waste
☐ Toxic/Hazardous
☑ Traffic/Circulation
☑ Vegetation
☑ Water Quality
☑ Water Supply/Groundwater
☑ Wetland/Riparian
☑ Wildlife
☑ Growth Inducing
☑ Land Use
☐ Cumulative Effects
☐ Other

Present Land Use/Zoning/General Plan Use

Project Description

Replace 50% of the potable water currently used in the Alamitos Barrier with treated and reclaimed water obtained from the Long Beach Water Reclamation Plant (LBWRP).

Note: Clearinghouse will assign identification numbers for all new projects. If a SCH number already exists for a project (e.g. from a Notice of Preparation or previous draft document) please fill in.

Reviewing Agencies

- ☑ Resources Agency
- ☐ Boating / Waterways
- ☑ Coastal Conservation
- ☑ Fish and Game, Region 5
- ☐ Forestry
- ☐ Colorado River Board
- ☑ Dept. Water Resources
- ☐ Reclamation
- ☐ Parks and Recreation
- ☐ Office of Historic Preservation
- ☑ Native American Heritage Commission
- ☐ S.F. Bay Cons. And Dev't. Commission
- ☑ Coastal Commission
- ☐ Energy Commission
- ☑ State Lands Commission
- ☐ Air Resources Board
- ☐ Solid Waste Management Board
- ☐ SWRCB: Sacramento
- ☑ RWQCB: Region # 4
- ☐ Water Rights
- ☐ Water Quality
- ☑ Caltrans District #7
- ☐ Dept. of Transportation Planning
- ☐ Aeronautics
- ☐ California Highway Patrol
- ☐ Housing and Community Dev't
- ☐ Statewide Health Planning
- ☐ Health
- ☐ Food and Agriculture
- ☐ Public Utilities Commission
- ☐ Public Works
- ☐ Corrections
- ☐ General Services
- ☐ OLA
- ☐ Santa Monica Mountains
- ☐ TRPA
- ☐ OPR – OLGA
- ☐ OPR – Coastal
- ☐ Bureau of Land Management
- ☐ Forest Service
- ☐ Other ____________________
- ☐ Other ____________________

For SCH Use Only:

Date Received at SCH ____________
Date Review Starts ____________
Date to Agencies ____________
Date to SCH ____________
Clearance Date ____________
Catalog Number ____________
Applicant ____________
Consultant ____________
Contract ____________ Phone ____________
Address ____________

Notes: ____
____
____

10.0 ORGANIZATIONS/PERSONS CONSULTED

Mr. Kris Helm; Post, Buckley, Schuh & Jernigan, Inc.
714/660-8600

Mr. Jim Leserman; Water Replenishment District
562/921-5521

Mr. Richard G. Sudak; Separation Processes, Inc.
760/599-4554

11.1 LIST OF PREPARERS AND COMMENTERS

Mr. Kris Helm; Post, Buckley, Schuh & Jernigan, Inc.
714/660-8600

Ms. Kathleen M. Hughes; Psomas and Associates, Project Hydrogeologist
714/751-7373

Mr. Jim Leserman; Water Replenishment District
562/921-5521

Mr. Ken MacDonald; Post, Buckley, Schuh & Jernigan, Inc.
702/263-7275

Mr. Dennis Papilion; Psomas and Associates, Director of Natural Resources and Environmental Planning
714/751-7373

Ms. Edith Read; Psomas and Associates, Manager of Biological Resources
714/751-7373

WRD
WATER REPLENISHMENT DISTRICT
OF SOUTHERN CALIFORNIA

Interested Agencies, Organizations and Individuals

NOTICE OF COMPLETION AND AVAILABILITY OF THE INITIAL STUDY/PROPOSED NEGATIVE DECLARATION FOR THE ALAMITOS BARRIER RECLAIMED WATER PROJECT

The Water Replenishment District of Southern California (WRD) has completed the Initial Study for the Alamitos Barrier Reclaimed Water Project (ABRWP). The Alamitos Barrier is an engineered freshwater pressure ridge and seawater trough located in the City of Long Beach, California. The Barrier is designed to protect the Central Groundwater Basin of Los Angeles County and the Orange County Groundwater Basin from seawater intrusion. Currently, the Barrier is maintained through injection of treated, imported potable water.

The WRD, proposes to replace 50% of the potable water currently used in the Alamitos Barrier with treated reclaimed water obtained from the Long Beach Water Reclamation Plant (LBWRP). The objective of the proposed project is to reduce dependence of the Barrier on imported water, while maintaining the seawater barrier.

The proposed project site is 4 acres in size and located between the San Gabriel River and Coyote Creek, just north of the LBWRP. Project facilities would consist of a treatment plant, with microfiltration and reverse osmosis units, a booster pump station, pipelines, and associated electrical/communication connections to existing utilities. Residuals from the reverse osmosis and microfiltration process would be discharged into the existing trunk sewer that conveys LBWRP solids to the County Sanitation District's Joint Water Pollution Control Plant in Carson.

Written comments must be received by November 3, 1998. All written responses to this notice should be sent to:

James R. Leserman
Water Replenishment District of Southern California
12621 East 166th Street
Cerritos, CA 90703

12.0 CEQA DOCUMENT DISTRIBUTION LIST

Board of Supervisors
County of Los Angeles
822 Kenneth Hahn Mall of Administration
Los Angeles, CA 90012
Attn.: Don Knabe

California Department of Fish & Game
Region 5
330 Golden Shore, Suite 50
Long Beach, CA 90802
Attn.: Patricia Wolf

California Department of Health Services
Los Angeles District
1449 Temple Street, Room 202
Los Angeles, CA 90026

California Regional Water Quality Control Board
Santa Ana Region
3737 Main Street, Suite 500
Riverside, CA 92501-33391

California State Water Resources Control Board
901 P Street
Sacramento, CA 95814
Attn.: Walt Petitt

Central Basin Municipal Water District
17140 South Avalon Boulevard, Suite 210
Carson, California 90746

City of Long Beach
Planning Department
333 West Ocean Boulevard
Long Beach, California 90802

County Sanitation District of Los Angeles
P.O. Box 4998
Whittier, CA 90607
Attn.: Paul Martyn

Friends of the Los Angeles River
P.O. Box 292134
Los Angeles, CA 90029
Attn.: Jacqueline Lambrichts

Los Angeles County Department of Public Works
900 South Fremont Avenue
Alhambra, California 91803

Orange County Water District
P.O. Box 8300
Fountain Valley, California 92728-8300

State Clearinghouse
Office of Planning & Research
1400 Tenth Street
Sacramento, CA 95814
Attn.: Mr. Mark Goss

The Los Angeles & San Gabriel Rivers Watershed Council
801 Holmby Avenue
Los Angeles, CA 90024
Attn.: Dorothy Green

U.S. Department of the Interior
Bureau of Reclamation
c/o Dave Curtis
P.O. Box 61470
Boulder City, NV 89006-1470

Water Replenishment District of Southern California
12601 East 160th Street
Cerritos, California 90703

APPENDIX B

RESOLUTION TO THE BOARD OF DIRECTORS OF THE WATER REPLENISHMENT DISTRICT (1998)

RESOLUTION NO. 98-564

A RESOLUTION OF THE BOARD OF DIRECTORS OF THE WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA AFFIRMING THE DISTRICT'S READINESS TO PROCEED WITH THE ALAMITOS BARRIER RECLAIMED WATER PROJECT AND MAKING A FURTHER APPROPRIATION THEREFOR

WHEREAS, The Water Replenishment District of Southern California (WRD) bears primary responsibility for maintaining the integrity of the Central and West Coast Groundwater Basins;

WHEREAS, an integral part of WRD's strategy for protecting those groundwater basins involves appropriate maintenance of certain seawater intrusion barriers, including the Alamitos Barrier;

WHEREAS, it is the best interests of all water consumers in the Southern California area to reduce reliance on imported sources of supply, and to develop local water resources;

WHEREAS, technology is available to produce recycled water at a competitive cost, such that recycled water can be substituted for imported water for injection into the Alamitos Barrier;

WHEREAS, WRD has performed the studies and analysis necessary to conclude that the Alamitos Barrier Reclaimed Water Project provides a feasible and cost-effective means to maintain protection against seawater intrusion utilizing recycled water;

WHEREAS, WRD wishes to formally indicate its readiness to proceed with the Alamitos Barrier Reclaimed Water Project, subject to certain conditions, at to set aside appropriate funding, in order to allow the project to qualify for consideration under Metropolitan Water District of Southern California's Local Resources Program.

NOW, THEREFORE, IT IS RESOLVED:

The Water Replenishment District affirms its immediate readiness to proceed with the design and construction of the Alamitos Barrier Reclaimed Water Project, consisting of a treatment plant and delivery system to deliver recycled water to the Alamitos Seawater Intrusion

Barrier. Proceeding with the project is conditioned upon compliance with the California Environmental Quality Act and upon receipt of approval from the Metropolitan Water District under its Local Resources Program for recycled water and groundwater recovery projects. Staff is directed to prepare an Initial Environmental Study for consideration by the Board, and to submit an application to the Metropolitan Water District for consideration under that agency's Local Resources Program.

IT IS FURTHER RESOLVED

The Board hereby modifies the amount previously appropriated to complete the project to sixteen million eight hundred thousand dollars ($16,800,000.00), and directs that such sum and any income thereon be segregated and established as The Alamitos Barrier Reclaimed Water Project Construction Fund.

PASSED, APPROVED AND ADOPTED this 17th day of September, 1998.

Robert W. Goldsworthy

Robert Goldsworthy
President

Kenneth M. Orduña

Kenneth M. Orduña
Vice President

Leo J. Vander Lans

Leo J. Vander Lans
Treasurer

M. Susan Carrillo
Secretary

Albert Robles
Director

United States Department of the Interior

BUREAU OF RECLAMATION
PO Box 25007
Denver, Colorado 80225-0007

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:
84-52000
ADM-13.00

JUL 0 2 2009

VIA ELECTRONIC MAIL ONLY

Water Replenishment District of Southern California
Attn: Robb Whitaker
4040 Paramount Blvd.
Lakewood, CA 90712

Subject: Request for American Recovery and Reinvestment Act of 2009 (ARRA) Funding of the **Alamitos Barrier Recycled Water Project Expansion—Long Beach Area Water Reclamation** under the Bureau of Reclamation's Water Reclamation and Reuse Program, Title XVI of P.L. 102-575, as amended (Title XVI)

Dear Mr. Whitaker:

Thank you for submitting a request for ARRA funding of your Title XVI water reclamation and reuse project. Reclamation has conducted a review of requests for funding based on the prioritization criteria announced on March 16, 2009, and posted at www.grants.gov. We are pleased to inform you that your project has been ranked among those scheduled to receive funding from the $135 million of ARRA monies allocated to Title XVI projects.

Reclamation anticipates that **$403,750** in Federal funds will be available to you for the project described in your request. This amount is based upon consideration of the amount requested, the appropriations ceiling on Federal cost-share, and the need to set aside approximately $75,000 for Reclamation to ensure the project's Federal regulatory and statutory compliance as well as to ensure adherence to ARRA goals. Therefore, for purposes of Federal cost-share calculation, the total ARRA funding amount anticipated for this project is $478,750. Please note that this amount may require adjustment if necessary to comply with statutory requirements as further information about your project is developed.

A cooperative agreement will not be executed, nor funds awarded, until all ARRA and Title XVI pre-construction requirements have been met, including the following: (1) a finding that the feasibility study meets the requirements of Title XVI; (2) compliance with the National Environmental Policy Act and other environmental laws; and (3) an approved determination of financial capability. Once these requirements have been met, a cooperative agreement will be executed and funds will be disbursed.

The purposes of the ARRA are, among others, to quickly and prudently commence activities that preserve and create jobs and to promote economic recovery, and to invest in infrastructure that will provide long-term economic benefits. ARRA funding must be obligated by September 30, 2010. If compliance with the National Environmental Policy Act and other environmental laws cannot be completed **by February 28, 2010**, Reclamation may re-allocate funding to another project to ensure compliance with statutory requirements and the intent of the ARRA.

Your project has been ranked, in part, based upon the schedule included with your request, which indicated your timetable for expending funding and completing work. That schedule will be used to develop milestones, in consultation between you and Reclamation staff, to be included in the cooperative agreement as terms of the award. Because you submitted a schedule based on a May 2009 allocation of funding by Reclamation, milestones will be adjusted slightly from the dates listed in your funding request (up to 60 days) if necessary. The cooperative agreement will contain standard terms that address remedies for noncompliance, including wholly or partly suspending or terminating award, as appropriate under the circumstances.

Finally, your project will be subject to other ARRA-specific requirements. Many of these requirements will be assigned to sub-contracts and sub-grants issued by the recipient and may require modification of the terms for any current contracts or grants administered by the recipient for project completion.

Specific ARRA requirements that must be addressed as part of the cooperative agreement include the following, along with others: wage rate requirements, i.e., compliance with the Davis-Bacon Act (ARRA Section 1605); limit on use of funding for prohibited activities (ARRA Section 1604); required use of American iron, steel, and manufactured goods (ARRA Section 1605); reporting requirements; requirements for schedules of expenditures; and responsibilities for informing sub-recipients and sub-contractors. Reclamation has developed a financial assistance agreement template for awards made under the Recovery Act. The template is available at http://www.usbr.gov/mso/aamd/doing-business-financial-asistance.html for your information and use.

We look forward to working with you to develop the cooperative agreement for this award. If you have questions concerning the next steps in awarding this agreement, please contact your Title XVI Coordinator, Mr. Dennis Wolfe of Reclamation's Southern California Area Office, at 951-695-5310, or contact me at 303-445-2780.

Sincerely,

Roseann Gonzales

Roseann Gonzales
Director, Policy and Program Services

U.S. Department of the Interior

OFFICE OF THE SECRETARY
U.S. Department of the Interior

www.doi.gov
News Release

Date: July 1, 2009
Contact: Joan Moody
(202) 208-6416

Secretary Salazar Announces $134.3 Million in Economic Recovery Investments to Improve Water Reclamation and Reuse in the West

WASHINGTON, D.C. –Secretary of the Interior Ken Salazar announced today that the Bureau of Reclamation has identified 27 water reclamation and reuse projects that will share in a total of $134.3 million under the American Recovery and Reinvestment Act of 2009 (ARRA).

These water projects – known as "Title XVI" projects for the title of Public Law 102-575 that established the program – facilitate the reclamation and reuse of wastewater and naturally impaired ground and surface waters.

The $134.3 million for these projects is part of President Barack Obama's $1 billion investment of ARRA funding provided by the Department of the Interior for water projects across the West. In April, Secretary Salazar announced an additional $260 million in ARRA funding to address California's current drought conditions and to meet the state's long-term water supply infrastructure needs. Today's announcement brings total funding for California water-related activities funding under the Interior portion of ARRA to $381 million.

These 27 projects will team non-federal sponsors with local communities and the federal government to provide growing communities with new sources of clean water while promoting water and energy efficiency and environmental stewardship. Federal funding will be leveraged to construct a total of more than $675 million in Title XVI projects.

"The Bureau of Reclamation is known for its forward-looking partnerships with local communities and governments to provide reliable, efficient water across 17 Western states," Secretary Salazar said. "These ARRA funds will continue that tradition – creating economic opportunities and local jobs while infusing some of the nation's most drought- ravaged areas with expanded water supplies and a brighter outlook for the future."

In order to fulfill the intent of ARRA to rapidly create jobs and provide stimulus to the economy, the Bureau of Reclamation sent a letter to potentially eligible project sponsors to explain how to request federal funds provided under ARRA and to outline the associated requirements, responsibilities, and criteria. All requests for funds on behalf of Title XVI projects were submitted to Reclamation. Reclamation developed a team to review submittals, score requests and prioritize Title XVI projects for funding.

"President Obama's economic recovery plan is meant to quickly aid Americans by providing jobs, improving infrastructure and paving the way for tomorrow's success," Secretary Salazar said today. "We CAN do this if we work together—it is a great investment in our future."

Of the nearly $135 million in funding announced by the Department today, the Bureau of Reclamation will utilize about $4.2 million – or 3 percent – to ensure the projects' compliance with federal regulations and statutes as well as adherence to the Recovery Act goals.

Recipients of the Title XVI funding announced today must meet specific requirements such as demonstrating complete compliance with the National Environmental Policy Act and other environmental laws; have an approved determination of financial capability; a feasibility study that meets the established requirements of Title XVI; an approved determination of financial capability; and an executed cooperative agreement for financial assistance.

Secretary Salazar has pledged quick and responsible implementation of the $3 billion in Recovery funds that will be used by the Department of the Interior and its agencies.

“President Obama and this Department have ambitious goals to build America’s new energy future, to protect and restore our treasured landscapes and to create a 21st Century Youth Conservation Corps,” added Salazar. “These Bureau of Reclamation projects will help us fulfill these goals while helping American families and their communities prosper again.”

The public will be able to follow the progress of each project on www.recovery.gov and on www.interior.gov/recovery. Secretary Salazar has appointed a Senior Advisor for Economic Recovery, Chris Henderson, and an Interior Economic Recovery Task Force. Henderson and the Task Force will work closely with the Department of the Interior’s Inspector General to ensure that the recovery program is meeting the high standards for accountability, responsibility and transparency that President Obama has set.

###

[Editor’s Note: A state-by-state listing of the 27 projects selected for funding under the Bureau of Reclamation’s Title XVI program is attached.]

— DOI —

U.S. Department of the Interior

1849 C Street, NW

Washington, DC 20240

feedback@ios.doi.gov

Last Updated on 07/01/09

5. UV/Advanced Oxidation

5.1 Existing UV Equipment

UV is currently provided at the existing LVL for photolysis of n-nitrosodimethylamine (NDMA); however, hydrogen peroxide is not being added and therefore advanced oxidation is not provided. A Trojan UVPhox system was installed in 2003 as part of the original plant construction. The design was based on reducing an average NDMA UV influent concentration of 420 nanograms per liter (ng/L) to a target concentration of 10 ng/L, which equates to a 1.62-log reduction of NDMA photolysis. Seven online reactors with two redundant units were provided in a tower series arrangement to meet the NDMA design condition at a maximum design flow of 3 mgd. However, operation of all nine reactors is often required because of NDMA influent concentrations exceeding the 420-ng/L design condition.

5.2 Regulatory Requirements

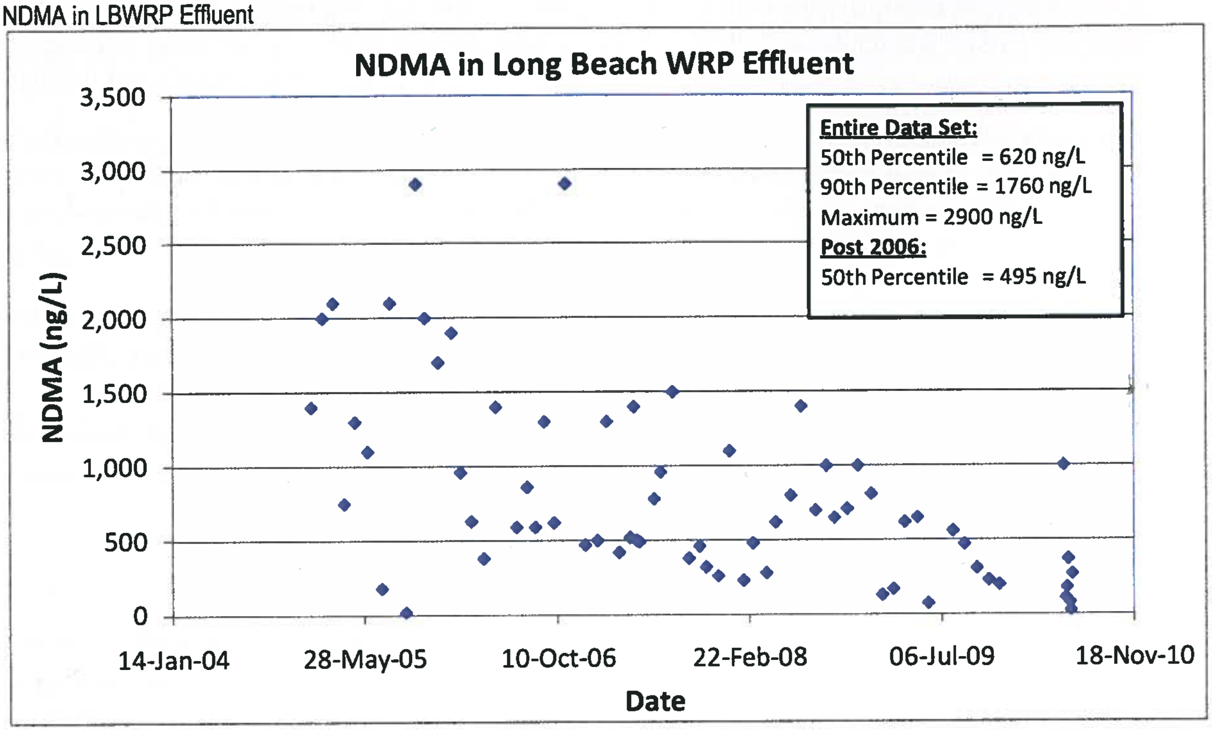
Design of the original LVL AWTF did not require an advanced oxidation process according to the regulations at that time. However, since 2008, advanced oxidation has been required for all groundwater injection projects. The California Department of Public Health (CPDH) indicated at a meeting on May 11, 2010, that the following design criteria would be required for the UV/AOP process at LVL AWTF:

- A finished water NDMA concentration of less than 10 ng/L and a minimum NDMA reduction of 1.2-log (higher log reduction required if necessary to meet 10 ng/L effluent limit)
- 0.5-log reduction of 1,4-dioxane, regardless of whether or not it is present in the influent water.

5.3 NDMA Concentration in Source Waters

Defining the NDMA concentration in the source waters is necessary for design of the UV/AOP system. As stated previously, water will eventually be provided from both the LBWRP and LCWRP. Since NDMA data from LCWRP has not been historically collected, grab sampling was done in May and June 2010 to determine the expected concentration in the plant effluent. The NDMA concentrations in the chlorine contact basin (CCB) influent and CCB effluent at each plant are shown in Table 8. Although the results from both plants are highly variable from day to day, the range and maximum value in each data set are similar. Consequently, since NDMA formation at both plants appears similar and long-term NDMA data is not available from the LCWRP, long-term NDMA data from the LBWRP will be used to establish the design condition for sizing of the UV/AOP system. Figure 3 shows the long-term NDMA data at the LBWRP. Maximum, 50th percentile, and 95th percentile values for the data set are also included on the graph. Post-2006 statistics are also provided because plant modifications at the LBWRP reduced NDMA concentrations after 2006.

FIGURE 3
NDMA in LBWRP Effluent



The NDMA influent design concentration selected for this project is the post-2006 90th percentile LVL AWTF influent value of 1,070 ng/L. This is a conservative selection for the following three reasons:

- All the grab samples collected from the LBWRP and LCWRP from May 2010 to June 2010 had NDMA concentrations of 1,000 ng/L or less.
- The expected NDMA reduction across RO was not considered even though industry research suggests that RO will likely remove some NDMA (< 50 percent).
- The 90th percentile influent historical value was used in lieu of the average. This approach will increase the likelihood of meeting the 10-ng/L limit in ***each*** quarterly sample, which is WRD's goal, rather than meeting the 10-ng/L limit in the annual average of the quarterly samples.

5.4 Design Criteria

The following two UV/AOP layout options were considered for the LVL plant expansion:

- Option 1: Two new triple-stacked UV/AOP trains in addition to the existing train. This option provides reactor redundancy in each train.
- Option 2: Two new double-stacked UV/AOP trains in addition to the existing train. This option does not provide reactor redundancy in each train, but failure of an entire reactor is unlikely.

After discussion with WRD, Option 2 was ultimately selected because of the advantages it offered at lower cost. Option 1 was not selected because providing redundant reactors in each train was considered overly conservative; failure of a single reactor is very unlikely.

The more likely failure mechanism is a lamp failure and Option 2 provides greater than 5 percent extra lamps while still meeting the end of lamp life, electrical energy per order (EEO) for NDMA reduction of 0.27.

Therefore, the UV/AOP system will include the existing UV system piped in parallel with two new, double-stacked Trojan UVPhox reactor chambers for the 8-mgd case and one new, triple-stacked Trojan UVPhox reactor chambers (outfitted for five reactors) for the 6-mgd case. UV/AOP design criteria for both the 6- and 8-mgd scenarios are shown in Table 9.

TABLE 9
Regulatory Requirements and Key Design Criteria for UV/AOP Technology and UV/AOP Chemical Delivery Systems

Parameter	6.0 mgd	8.0 mgd
Proposed Regulatory Requirements		
NDMA[a] Effluent Concentration	10 ng/L	10 ng/L
NDMA Removal Required[b]	2.03-log (based on 1,070 ng/L in influent)	2.03-log (based on 1,070 ng/L in influent)
1,4-dioxane, log removal	0.5-log	0.5-log
Design Criteria for UV/AOP Technology		
Max Flow Rate, mgd	6	8
UVT, %	95% (1 cm path length)	95% (1 cm path length)
Source Water	MF, RO treated secondary effluent	MF, RO treated secondary effluent
Source Water Turbidity, NTU	<0.2 NTU	<0.2 NTU
Water Temperature, °C	20 to 30°C	20 to 30°C
Lamp Output (due to aging and fouling), %	90	90
Electrical Energy per Order for NDMA Reduction	0.27 kilowatt-hours (kWh)/1,000 gallons for NDMA reduction	0.27 kWh/1,000 gallons for NDMA reduction
Redundancy	Not required	Not required
Cleaning System	Not required	Not required
Number of Existing UV/AOP Trains	1	1
Number of New UV/AOP Trains	1	2
Total Number of UV/AOP Trains	2	3
New UV/AOP Train Configuration	Triple-stacked Trojan UVPhox Model D72AL75 reactor chambers	Double-stacked Trojan UVPhox Model D72AL75 reactor chambers
Number of 72-Lamp Reactors per Train	5	4
Total Number of Lamps	630	846
Total Connected Electrical Load, kW	162	217
Lamps per Ballast	2	2
Capacity of Each New Train to Meet NDMA-Reduction Requirement at Design EEO at End of Lamp Life	3.75 mgd	2.67 mgd

TABLE 9
Regulatory Requirements and Key Design Criteria for UV/AOP Technology and UV/AOP Chemical Delivery Systems

Parameter	6.0 mgd	8.0 mgd
Capacity of Existing Train with All Nine Reactors in Service to Meet NDMA-Reduction Requirement at Design EEO at End of Lamp Life	2.74 mgd	2.67 mgd
Secondary Design Point (allows NDMA destruction at max flow when one train is out of service)	At 4 mgd through one train and the other train out of service, minimum NDMA destruction shall be 1.85-log at an EEO of 0.27 with an end of lamp life of 0.90.	At 4 mgd per train and two trains operating, minimum NDMA destruction shall be 1.39-log at an EEO of 0.27 with an end of lamp life of 0.90.
Headloss through New Double-Stack Train at 4 mgd	N/A	20 inches (to be confirmed)
Headloss through Existing Train at 4 mgd	29 inches (to be confirmed)	29 inches (to be confirmed)
Valves and Flowmeters	Modulating valve and flow meter upstream of each reactor	Modulating valve and flow meter upstream of each reactor
Chemical Delivery System		
Type	Hydrogen peroxide	Hydrogen peroxide
Concentration, %	50	50
Density, pounds per gallon	10.0	10.0
Average Dose, mg/L	3.5	3.5
Number of Metering Pumps	2 (1 duty + 1 standby)	2 (1 duty + 1 standby)
Average Pump Rate, gph	1.46	1.94
Maximum Pump Rate, gph	2.08	2.78
Min Pump Rate, gph	0.5	0.5
Pump Capacity, gph	5	5
Estimated Daily Usage, gallons	52	69
Number of Storage Tanks	1	1
Days of Storage, days	38	28
Tank Diameter, feet	7.0	7.0
Tank Height, feet	10.0	10.0

Notes:

[a] CDPH Notification Level for NDMA is 10 ng/L (Dec 14, 2007)

[b] The minimum log removal required per the California DRAFT Recharge Regulations is 1.2-log; however, because of the elevated influent NDMA concentration, meeting the effluent NDMA concentration of 10 ng/L controls sizing of the UV/AOP process.

2009 Water Quality Table

	B	C	D	F	G	H					I
						Treatment Plant Effluent					
	Parameter	Units	State MCL [MRDL]	PHG (MCLG) [MRDLG]	Range Average	Weymouth Plant	Diemer Plant	Jensen Plant	Skinner Plant	Mills Plant	Major Sources in Drinking Water
A	Percent State Project Water	%	NA	NA	Range Average	0 - 34 12	3 - 34 14	100 100	6 - 52 20	100 100	NA
E	**PRIMARY STANDARDS - Mandatory Health-Related Standards**										
	CLARITY										
	Combined Filter Effluent Turbidity	NTU %	0.3 95 (a)	NA	Highest **% < 0.3**	0.06 100	0.06 100	0.06 100	0.08 100	0.18 100	Soil runoff
	MICROBIOLOGICAL										
	Total Coliform Bacteria (b)	%	5.0	(0)	Range **Average**	**Distribution System-wide:** 0 - 0.2 **Distribution System-wide:** 0					Naturally present in the environment
	Heterotrophic Plate Count (HPC) (c)	CFU/mL	TT	NA	Range **Average**	**Distribution System-wide:** TT **Distribution System-wide:** TT					Naturally present in the environment
	ORGANIC CHEMICALS										
	Acrylamide	NA	TT	(0)	Range **Average**	TT TT	TT TT	TT TT	TT TT	TT TT	Water treatment chemical impurities
	Epichlorohydrin	NA	TT	(0)	Range **Average**	TT TT	TT TT	TT TT	TT TT	TT TT	Water treatment chemical impurities
	INORGANIC CHEMICALS										
	Aluminum (d)	ppb	1,000	600	Range **Highest RAA**	110 - 240 160	100 - 230 170	ND - 100 76	ND ND	ND - 160 96	Residue from water treatment process; natural deposits erosion
	Arsenic	ppb	10	0.004	Range **Highest RAA**	ND - 2.5 2.2	ND - 2.6 2.3	2.5 - 3.9 3.1	ND ND	ND - 3.4 2.6	Natural deposits erosion; glass and electronics production wastes
	Barium	ppb	1,000	2,000	Range **Average**	110 - 140 120	120 - 140 130	ND ND	ND - 110 ND	ND ND	Oil and metal refineries discharge; natural deposits erosion
					Control Range **Optimal Fluoride Level**	0.7 - 1.3 0.8	0.7 - 1.3 0.8	0.7 - 1.3 0.8	0.7 - 1.3 0.8	0.6 - 1.2 0.7	
	Fluoride (e) (treatment-related)	ppm	2.0	1	Range **Average**	0.7 - 0.9 0.8	0.7 - 0.9 0.8	0.6 - 0.9 0.8	0.7 - 1.0 0.8	0.5 - 0.9 0.7	Water additive for dental health
					Range	**Distribution System-wide:** 0.6 - 1.0					
	Nitrate (as N) (f)	ppm	10	10	Range **Highest RAA**	ND - 0.4 0.4	ND - 0.4 0.4	0.6 - 0.9 0.8	ND - 0.4 ND	ND - 0.8 0.6	Runoff and leaching from fertilizer use; sewage; natural deposits erosion
	RADIONUCLIDES (g)										
	Gross Alpha Particle Activity	pCi/L	15	(0)	Range **Average**	ND - 7.6 5.2	3.8 - 9.3 5.6	ND - 7.3 3.4	3.3 - 4.3 3.6	ND - 5.5 ND	Erosion of natural deposits
	Gross Beta Particle Activity (h)	pCi/L	50	(0)	Range **Average**	ND - 9.7 4.2	ND - 6.4 4.3	ND - 5.2 ND	ND - 8.8 ND	ND - 7.5 ND	Decay of natural and man-made deposits
	Uranium	pCi/L	20	0.43	Range **Average**	2.4 - 3.4 2.9	2.9 - 3.7 3.3	1.6 - 2.0 1.8	2.3 - 2.7 2.5	1.5 - 2.8 2.1	Erosion of natural deposits
	DISINFECTION BY-PRODUCTS, DISINFECTANT RESIDUALS, AND DISINFECTION BY-PRODUCTS PRECURSORS (i)										
	Total Trihalomethanes (TTHM) (j)	ppb	80	NA	Range **Average**	25 - 67 43	26 - 56 43	17 - 33 28	26 - 56 41	20 - 33 25	By-product of drinking water chlorination
	Total Trihalomethanes (TTHM) (j)	ppb	80	NA	Range **Highest RAA**	**Distribution System-wide:** 15 - 81 **Distribution System-wide:** 39					By-product of drinking water chlorination
	Haloacetic Acids (five) (HAA5) (k)	ppb	60	NA	Range **Average**	5.6 - 20 11	7.3 - 12 10	2.0 - 3.2 2.5	9.9 - 15 12	2.3 - 7.0 4.3	By-product of drinking water chlorination
	Haloacetic Acids (five) (HAA5) (k)	ppb	60	NA	Range **Highest RAA**	**Distribution System-wide:** 1.5 - 30 **Distribution System-wide:** 14					By-product of drinking water chlorination
	Total Chlorine Residual	ppm	[4.0]	[4.0]	Range **Highest RAA**	**Distribution System-wide:** 1.5 - 3.0 **Distribution System-wide:** 2.4					Drinking water disinfectant added for treatment
	Bromate (l)	ppb	10	0.1	Range **Highest RAA**	NA NA	NA NA	4.2 - 12 6.9	NA NA	3.9 - 12 8.0	By-product of drinking water ozonation
	DBP Precursor Control (TOC)	ppm	TT	NA	Range **Average**	TT TT	TT TT	TT TT	TT TT	TT TT	Various natural and man-made sources
E	**SECONDARY STANDARDS - Aesthetic Standards**										
	Aluminum (d)	ppb	200	600	Range **Highest RAA**	110 - 240 160	100 - 230 170	ND - 100 76	ND ND	ND - 160 96	Residue from water treatment process; natural deposits erosion
	Chloride	ppm	500	NA	Range **Highest RAA**	89 - 100 98	89 - 99 97	77 - 82 79	93 - 100 97	67 - 99 85	Runoff/leaching from natural deposits; seawater influence
	Color	Units	15	NA	Range **Highest RAA**	1 - 2 2	1 - 2 2	1 - 2 2	1 - 2 2	1 - 2 2	Naturally occurring organic materials
	Odor Threshold (m)	TON	3	NA	Range **Average**	2 2	2 2	2 2	**12 - 24** **18**	2 2	Naturally occurring organic materials
	Specific Conductance	µS/cm	1,600	NA	Range **Highest RAA**	850 - 1,100 1,000	880 - 1,100 1,000	570 - 610 590	760 - 1,100 960	460 - 670 590	Substances that form ions in water; seawater influence
	Sulfate	ppm	500	NA	Range **Highest RAA**	180 - 260 240	190 - 250 240	56 - 70 66	130 - 250 220	32 - 77 68	Runoff/leaching from natural deposits; industrial wastes
	Total Dissolved Solids (TDS)	ppm	1,000	NA	Range **Highest RAA**	510 - 660 620	530 - 640 610	310 - 340 330	440 - 640 580	250 - 380 330	Runoff/leaching from natural deposits; seawater influence
	Turbidity (a)	NTU	5	NA	Range **Highest RAA**	0.05 - 0.06 0.06	0.04 - 0.05 0.04	0.04 - 0.05 0.04	0.04 - 0.05 0.05	0.05 - 0.08 0.06	Soil runoff

ABBREVIATIONS AND DEFINITIONS

CFU/mL	Colony-Forming Units per milliliter	pCi/L	picoCuries per liter
DBP	Disinfection By-Products	PHG	Public Health Goal - The level of a contaminant in drinking water below which there is no known or expected risk to health. PHGs are set by the California Environmental Protection Agency.
MCL	Maximum Contaminant Level - The highest level of a contaminant that is allowed in drinking water. Primary MCLs are set as close to the PHGs (or MCLGs) as is economically and technologically feasible. Secondary MCLs are set to protect the odor, taste, and appearance of drinking water.	ppb ppm	parts per billion or micrograms per liter (µg/L) parts per million or milligrams per liter (mg/L)
MCLG	Maximum Contaminant Level Goal - The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs are set by the U.S. Environmental Protection Agency (USEPA).	RAA	Running Annual Average
MRDL	Maximum Residual Disinfectant Level - The highest level of a disinfectant allowed in drinking water. Addition of a disinfectant is necessary for control of microbial contaminants.	TOC	Total Organic Carbon
MRDLG	Maximum Residual Disinfectant Level Goal - The level of a drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.	TON	Threshold Odor Number
N	Nitrogen	TT	Treatment Technique - A required process intended to reduce the level of a contaminant in drinking water.
NA	Not Applicable	µS/cm	microSiemen per centimeter; or micromho per centimeter (µmho/cm)
ND	Not Detected		Primary Standards (Primary Drinking Water Standards) - MCLs and MRDLs for contaminants that affect health along with their monitoring and reporting requirements, and water treatment requirements.
NTU	Nephelometric Turbidity Units		Secondary Standards - Requirements that ensure the appearance, taste and smell of drinking water are acceptable.

FOOTNOTES

(a) The turbidity level of the filtered water shall be less than or equal to 0.3 NTU in 95% of the measurements taken each month and shall not exceed 1 NTU at any time. Turbidity is a measure of the cloudiness of the water and is an indicator of treatment performance. The averages and ranges of turbidity shown in the Secondary Standards were based on the treatment plant effluent.

(b) Total coliform MCLs: No more than 5.0% of the monthly samples may be total coliform-positive. Compliance is based on the combined distribution system sampling from all the treatment plants. In 2009, 8116 samples were analyzed and 66 samples were positive for total coliforms. The MCL was not violated.

(c) All distribution system samples collected had detectable total chlorine residuals and no HPC was required. HPC reporting level is 1 CFU/mL.

(d) Aluminum has both primary and secondary standards.

(e) Metropolitan was in compliance with all provisions of the State's Fluoridation System Requirements.

(f) State MCL is 45 mg/L as nitrate, which is the equivalent of 10 mg/L as N.

(g) Data collected from four consecutive quarters of monitoring in 2008.

(h) The gross beta particle activity MCL is 4 millirem/year annual dose equivalent to the total body or any internal organ. The screening level is 50 pCi/L.

(i) Metropolitan was in compliance with all provisions of the Stage 1 Disinfectants/ Disinfection By-Products (D/DBP) Rule. Compliance was based on the RAA.

(j) Reporting level is 0.5 ppb for each of the following: bromodichloromethane, bromoform, chloroform, and dibromochloromethane.

(k) The detection limit for purposes of reporting is 1.0 ppb for each of the following: dichloroacetic acid, trichloroacetic acid, monobromoacetic acid, and dibromoacetic acid; and 2.0 ppb for monochloroacetic acid.

(l) Bromate reporting level is 3 ppb.

(m) Data based on the State-required quarterly monitoring following MCL exceedance. Metropolitan utilizes a flavor-profile analysis (FPA) method that can detect odor occurrences more accurately and found the FPA samples from this location acceptable. No taste and odor event was observed and no complaints were received during the period.

APPENDIX L

Whittier Narrows Conservation Pool Project

**US Army Corps
of Engineers**
Los Angeles District

General Investigations

LOS ANGELES COUNTY DRAINAGE AREA (LACDA) WATER CONSERVATION AND SUPPLY SANTA FE - WHITTIER NARROWS DAMS FEASIBILITY STUDY

FINAL REPORT
WITH
ENVIRONMENTAL IMPACT STATEMENT
AND
ENVIRONMENTAL IMPACT REPORT

AUGUST 2000

LOS ANGELES DISTRICT, CORPS OF ENGINEERS
PLANNING DIVISION, WATER RESOURCES BRANCH
P.O. BOX 532711
LOS ANGELES, CALIFORNIA 90053-2325

CESPD-ET-P (September 1998) (1105) 1st End Mr. Frentzen/415-977-8164
SUBJECT: Feasibility Report for Los Angeles County Drainage Area Water Conservation and Supply at Santa Fe - Whittier Narrows Dams, California

DA, South Pacific Division, Corps of Engineers, 333 Market Street, Room 923
San Francisco, CA 94105-2195 30 September 1998

FOR CDR USACE, (CECW-AR), 7701 Telegraph Road, Alexandria, VA 22315-3861

I concur in the conclusions and recommendations of the District Commander.

PETER T. MADSEN
COL (P), EN
Commanding

EXECUTIVE SUMMARY

The ***Los Angeles County Drainage Area (LACDA) Water Conservation and Supply, Santa Fe-Whittier Narrows Dams Feasibility Study*** is a cost-shared Feasibility Study conducted by the Corps of Engineers and the Los Angeles County Department of Public Works (LACDPW). The study investigates the water conservation potential at the two dams by identifying alternatives for study and recommending a plan for implementation. The report balances the water conservation benefits that may be realized by reoperating the dam with construction costs, requirements of flood control, real estate issues, land use, recreation, and environmental and cultural resource issues.

The primary objective of this study is to investigate the feasibility of reoperating Santa Fe and Whittier Narrows Dams so water may be stored until the downstream spreading grounds can accept it, thereby increasing water conservation yields. Stored water would be released for groundwater recharge at a rate matching the downstream recharge capacity. This water would then be available for withdrawal during the peak demand periods of summer and drought years. The previously existing overdraft condition in the basins has been stabilized due to control of pumping and increased water conservation efforts including introduction of imported and recycled water. The expected increase in groundwater recharge from local runoff will primarily offset increased purchase of costly imported water and/or allow increased pumping to occur while maintaining basin levels.

The study analyzes the area's water demands, water supplies, and the potential for water conservation to meet supply deficiencies for both the existing and future conditions. Current water needs for Los Angeles County are met through local water supply and imported water. It is estimated that currently one-third of this need is met through local supply (storm runoff) and reclaimed water; the remaining two-thirds is imported water. As water demand increases through growth in population and industry, demand for water will also grow. The LACDA project will lessen the region's reliance on imported water by increasing local supply, improving water supply reliability for the region as a whole.

The plan formulation process investigated four alternatives including a no-action plan for both Santa Fe and Whittier Narrows Dam. The no-action plan represents the condition that would be expected to occur during the project life (50 years) in lieu of project implementation, and it constitutes the basis against which all alternative plans are evaluated. The alternatives evaluated for both dams are shown on the table on the next page.

Water Conservation Alternatives Evaluated for Each Dam

	No-Project Alternative	Alternative 2	Alternative 3	Alternative 4
Santa Fe Dam				
Year-round storage elevation of existing debris pool ("water conservation pool")	456 ft (139.8 m)	456 ft (139.8 m)	456 ft (139.8 m)	456 ft (139.8 m)
Storage elevation during flood season ("buffer pool")	n/a	n/a	463 ft (141.9 m)	475 ft (145.6 m)
Storage elevation during non-flood season ("seasonal pool")	n/a	n/a	463 ft (141.9 m)	475 ft (145.6 m)
Incremental Increase in Average Annual Water Yield (ac-ft)	n/a	700	2,400	4,200
Whittier Narrows Dam				
Year-round storage elevation of existing debris pool ("water conservation pool")	201.6 ft (62.2 m)	201.6 ft (62.2 m)	201.6 ft (62.2 m)	201.6 ft (62.2 m)
Storage elevation during flood season ("buffer pool")	n/a	209 ft (64.4 m)	215 ft (66.2 m)	215 ft (66.2 m)
Storage elevation during non-flood season ("seasonal pool")	n/a	209 ft (64.4 m)	215 ft (66.2 m)	215 ft (66.2 m)
Incremental Increase in Average Annual Water Yield (ac-ft)	n/a	2,900	5,500	5,300

The Selected Plan for Santa Fe Dam (Alternative 3B) is the **Locally-Preferred Plan** and would allow for storage of water to elevation 463.0 ft NGVD (141.9 m NAVD). Alternative 3 has two solutions for drainage behind the levee (Alternatives 3A and 3B, which differ in how ponded water is drained behind the levee, protecting the recreation area). Alternative 3B was selected as the preferred alternative. Releases would occur at a rate equivalent to the San Gabriel River channel recharge capacity downstream of the dam. The annual increase in water conservation yield over the no-project alternative is 2,400 acre-feet per year.

A levee approximately 1,269 ft (387 m) long would be constructed to protect the recreation area, including the lake, from inundation. The borrow area for the levee would be located in the southeastern corner of the basin in an area currently undeveloped. Following excavation, the area would be graded to support quality riparian habitat as mitigation for any adverse inundation impacts. The levee would also protect scarce alluvial fan scrub habitat located north of the lake.

Total first costs of the selected plan are $4,285,000 with $63,000 in annual operation and maintenance costs for a total annual cost of $460,500. Total average annual economic benefits associated with the increases in water yield provided by the selected plan are approximately $594,000. This results in a benefit/cost ratio of 1.3 with $132,800 of net benefits.

The Selected Plan for Whittier Narrows Dam (Alternative 2), which is the **NED Plan** and **Locally Preferred Plan,** would allow for storage of water to elevation 209 NGVD (64.4 m NAVD). Releases would occur at the recharge rate of the downstream spreading grounds. The annual increase in water conservation yield over the no-project alternative is 2,900 acre-feet per year.

San Gabriel boulevard/Durfee Avenue and Rosemead Boulevard would have to be raised to a minimum of 212 feet NGVD (65.3 m NAVD) in order to both (1) protect the recreational facilities when the seasonal/buffer pool is at its maximum water surface elevation of 209 feet, and (2) allow uninterrupted use of the road. The additional 3 feet (0.9 m) provides overtopping protection. Lincoln boulevard would also be raised to 212 feet NGVD to allow uninterrupted use of the road. A ring levee would be constructed to elevation 212 feet NGVD (65.3 NAVD) around the Whittier Narrows Water Treatment Plant to maintain operations during periods of water conservation storage. The borrow area for the levees would be located in a grasslands area between the Rio Hondo Channel and Rosemead Boulevard south of the Pomona Freeway. Following excavation, the area would be graded to support quality riparian habitat as mitigation for any adverse inundation impacts.

Inundation impacts to oil wells within the basin could be mitigated by a variety of methods including capping and plugging well heads, relocating well heads, raising well heads above the water surface level, and/or water proofing the well heads. The most conservative estimate was used in the economic analysis.

Total first costs of the selected plan are $6,731,000 with $46,700 in annual operation and maintenance costs for a total annual cost of $631,300. Total average annual economic benefits associated with the increases in water yield provided by the selected plan are approximately $702,000. This results in a benefit/cost ratio of 1.1 with $70,500 of net benefits.

The proposed cost-sharing for the recommended plans, per Federal guidelines for Corps of Engineers' water supply projects, is that non-Federal interests provide 100 percent of all costs associated with a recommended water conservation project. The Los Angeles County Department of Public Works (LACDPW) has indicated their willingness to assume these costs.

Based on the results of this feasibility study, **it appears that the addition of water conservation consistent with the Selected Plans would be acceptable for approval**. It is expected that the Corps of Engineers will accomplish the following: (1) review final design and further analysis if needed to demonstrate that there would be no significant impacts on the flood control capabilities of the project, (2) revise the water control manuals to include operation of the dams for flood control and water conservation, (3) prepare any supplemental NEPA documents, and (4) complete other requirements for implementing water conservation such as arrangements with the

Los Angeles County Department of Parks and Recreation (LACDPR) and approvals from the California Department of Dam Safety. The final approval is by the authority of the Chief of Engineers of the Corps.

A Draft EIS/EIR accompanies this document in accordance with the requirements of the National Environmental Policy Act (NEPA) of 1969, as amended and the California Environmental Quality Act (CEQA), amended January 1995.

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EXHIBITS

(EXHIBITS FOLLOW THE MAIN TEXT)

TABLES

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TECHNICAL APPENDICES

(the Technical Appendices are under separate cover)

I. STUDY AUTHORITY

1.1 Study Authority

This feasibility study was directed by the Energy and Water Development Appropriations Act of 1993 (Public Law 102-377, dated 2 October 1992) under the authority of the following Congressional resolution approved 25 June 1969, reading in part:

> *"Resolved by the Committee on Public Works of the United States Senate, that the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act, approved June 13, 1902, be, and is hereby requested to review the report of the Chief of Engineers on the Los Angeles and San Gabriel Rivers and Ballona Creek, California, published as House Document Numbered 838, Seventy-sixth Congress, and other pertinent reports, with a view to determining whether any modifications contained therein are advisable at the present time, in the resources in the Los Angeles County Drainage Area."*

The Los Angeles County Drainage Area Authorization also states "...and plans for any reservoir project, may, on recommendation of the Chief of Engineers, be modified to provide additional storage capacity for domestic water supply or other conservation, storage, on condition that the cost of such increased storage capacity is contributed by local agencies..."

In addition, Section 308 of the Water Resources Development Act of 1996 (dated 12 October 1996) states:

> *"The non-Federal share for a project to add water conservation to the existing Los Angeles County Drainage Area, California, project, authorized by section 101(b) of the Water Resources Development Act of 1990 (104 Stat. 4611), shall be 100 percent of separable first costs and separable operation, maintenance, and replacement costs associated with the water conservation purpose."*

1.2 Local Sponsorship

This Feasibility Study is cost-shared on a 50/50 basis with the Los Angeles County Department of Public Works which represents local interests in pursuing additional water supply opportunities for local aquifer recharge through conservation of local flood runoff, reclaimed water and imported water when available. In accordance with Federal regulations and guidelines summarized by Corps Planning Guidance (ER 1105-2-100), the local sponsor would be responsible for providing 100% of the incremental cost associated with implementing water conservation activities found to be feasible at Santa Fe and Whittier Narrows Flood Control Basins.

II. STUDY PURPOSE AND SCOPE

2.1 Study Purpose

This study investigates the feasibility of modifying the operations of Santa Fe and Whittier Narrows Dams for water conservation purposes. The specific purpose of this feasibility study is to develop alternatives and recommend an implementable solution to the identified water conservation opportunities. This report is intended to be a complete decision document that presents the results of both the Reconnaissance and Feasibility phases of the General Investigation effort. This Feasibility Report is intended to accomplish the following tasks:

(1) Provide a complete presentation of study results and findings, including those developed in the reconnaissance phase so that readers can reach independent conclusions regarding the reasonableness of recommendations;

(2) Indicate compliance with applicable statutes, guidelines, executive orders and policies; and

(3) Provide a sound and documented basis for decision makers at all levels to judge the recommended alternatives for each dam.

2.2 Specific Study Purpose

This report presents the findings of the feasibility study conducted in response to local concerns regarding water conservation and supply within the Los Angeles County Drainage Area (LACDA). The *Los Angeles County Drainage Area Water Conservation and Supply, Final Reconnaissance Report* was published in May 1994 and investigated increases in water supply that could be implemented through modifications of the water control operation of the existing LACDA system.

The current study defines and evaluates alternatives that would provide increased local water supply through groundwater recharge due to modified activities at Santa Fe and Whittier Narrows basins. Modifications to the current operating procedures, such as releases of the water stored behind the dams, equal to the intake capacity of the spreading facilities, could greatly increase the amount of water allowed to infiltrate. Potential water sources include local flood water, reclaimed water, and water from county-owned dams upstream of the study area. Imported surplus water from outside of the region was not included in this analysis. This report will determine if alternatives exists that maximize net economic benefits while addressing optimal water storage at each dam for conservation and other needs identified during the planning process.

The results presented herein were developed in accordance with Federal water resources planning principles, guidelines, procedures, and policies.

2.3 Study Scope

This study evaluates the potential benefits, impacts, and mitigation measures that may be associated with water conservation storage practices at the Santa Fe and Whittier Narrows study sites. This study also performs an economic analysis of the costs associated with the water conservation components of the dams' operations, including costs of imported water, potential mitigation, additional operation and maintenance, and any necessary structural modifications to the dams.

The study is conducted under the assumption that authorized improvements to the Lower Rio Hondo and the Los Angeles River would be in place at the time a water conservation plan is implemented. Therefore, the without-project condition assumes that reservoir operating procedures reflect the construction of parapet walls and other channel improvements recommended within the LACDA Feasibility Report, 1994. The modified operation plans will not be allowed to be implemented until all of the channel improvements have been completed.

The study was conducted in coordination with public agencies, organizations, and concerned individuals within the realm of the Federal participation as defined by law and current planning regulations. This report considers potential impacts on water and land resources due to water conservation practices. Environmental and recreational considerations, as well as potential mitigation measures, and the non-Federal sponsor's views and preferences were considered. Any proposed water conservation practice must not compromise the primary purpose of Santa Fe and Whittier Narrows Dams, that of flood control.

2.4 Study and Report Process

This is the final Feasibility Report following the completion of public review period of the Draft EIS/EIR phase of study. During the feasibility phase preliminary alternatives developed in the reconnaissance phase are refined, additional alternatives developed in this phase of the study are investigated, and a plan is selected for recommendation. While the Reconnaissance Study was 100% Federally funded, the Feasibility Study is cost-shared 50%-50% with the Los Angeles County Department of Public Works (LACDPW), the non-Federal sponsor. This phase of the study also includes a EIS/EIR.

This report identifies the alternative that has the greatest contribution to National Economic Development (NED) as well as the plan preferred by the local sponsor if such a locally-preferred plan exists. In depth investigation of the alternatives has been performed by the US Army Corps of Engineers (USACE) South Pacific Division. This document and the Draft EIS/EIR have been presented for public review. Comments and concerns expressed during the period of public review have been addressed in the Feasibility Report and the EIS/EIR, and are presented in the EIS/EIR under Appendix K. Upon review, the Division Engineer will sign the Notice of Decision.

III. PRIOR STUDIES, REPORTS, EXISTING WATER PROJECTS, AND WATER AGENCIES

3.1 Reports by the Corps of Engineers

Reports previously prepared by the Corps provide a background of the development of water resources in the Los Angeles County Drainage Area (LACDA) through flood control design reports, water control manuals, hydraulic and hydrology reports, drought contingency plans, flood reports, and previous feasibility studies relating to the LACDA and the current study area. Reports have been prepared documenting events and changes in the system as new resources have been developed since as early as 1939. Below is a list of the documents that are of interest to this study.

1. Flood Control in the Los Angeles County Drainage Area. LA District, Corps of Engineers, 1939.

2. Hydrology in the Los Angeles County Drainage Area. LA District, Corps of Engineers, 1939.

3. Hydrology, San Gabriel River and the Rio Hondo Above Whittier Narrows Flood Control Basin. LA District, Corps of Engineers, 1944.

4. DPR-Whittier Narrows Flood Control Basin. LA District, Corps of Engineers, 1945.

5. San Gabriel River Valley Basin, California, Reservoir Regulation Manual for Whittier Narrows Flood Control Reservoir. LA District, Corps of Engineers, 1957.

6. Los Angeles County Drainage Area, California, San Gabriel River, Reservoir Regulation Manual for Santa Fe Flood Control Basin. LA District, Corps of Engineers, 1967.

7. Operations and Maintenance Manual, Los Angeles County Drainage Area. LA District, Corps of Engineers, 1975.

8. Plan of Study, Review Report for Flood Control and Allied Purposes, Los Angeles County Drainage Area. LA District, Corps of Engineers, 1976.

9. Interim Report on Hydrology and Hydraulic Review of Design Features of Existing Dams for LACDA Dams. LA District, Corps of Engineers, 1978.

10. Report on Floods of February and March 1978 in Southern California. LA District, Corps of Engineers, 1978.

11. Reconnaissance Report on Landslide Study, Baldwin Hills Area, LA County, CA. LA District, Corps of Engineers, 1981.

12. Baldwin Hills, Los Angeles, CA: A Geotechnical Supplement to the Landslide Study. Portland District, Corps of Engineers, 1981.

13. Interim Feasibility Report for Landslide Study: Baldwin Hills, CA. LA District, Corps of Engineers, 1982.

14. Interim Feasibility Report for Ballona Creek and Tributaries. LA District, Corps of Engineers, 1982.

15. Final Report, Review of Water Resources within the Los Angeles County Drainage Area. LA District, Corps of Engineers, 1985.

16. Los Angeles County Drainage Area Review, Final Feasibility Report LA District, Corps of Engineers, 1991.

17. Reservoir Regulation Manual for Whittier Narrows Flood-Control Reservoir. LA District, Corps of Engineers, 1957.

18. Water Control Drought Contingency Plan, Sepulveda Dam & Reservoir, Los Angeles River, *CA*. LA District, Corps of Engineers, 1992.

19. Water Control Drought Contingency Plan, Whittier Narrows Dam & Reservoir, San Gabriel River, Rio Hondo, & Los Angeles River, *CA*. LA District, Corps of Engineers, 1992.

20. Water Control Drought Contingency Plan, Santa Fe Dam & Reservoir, San Gabriel River, *CA*. LA District, Corps of Engineers, 1992.

21. Water Control Manual, Santa Fe Dam & Reservoir, San Gabriel River, CA. LA District, Corps of Engineers, 1991.

22. Draft Environmental Assessment for the Santa Fe Water Control Manual. LA District, Corps of Engineers, 1993.

23. Draft Santa Fe Dam Master Plan and Environmental Assessment, LA District, Corps of Engineers, 1995.

24. Whittier Narrows Dam Master Plan and Environmental Assessment, LA District, Corps of Engineers, 1996.

3.2 Reports by Others

Reports by others include reports prepared by other Federal agencies and local agencies documenting flood and water related resources in the LACDA over the last 80 years.

1. Reports of the Board of Engineers, Flood Control to the Board of Supervisors: LA County, *CA*. Los Angeles County, 1915.

2. Review Report and Environmental Assessment with Technical Appendices for the Los Angeles River Flood Prevention Program. US Department of Agriculture, Forest Service, Angeles National Forest, 1980.

3. Review Report for the Los Angeles River Flood Prevention Program. US Department of Agriculture, Forest Service, Angeles National Forest, 1982.

4. Hydrologic Report 1993-94. Los Angeles County Department of Public Works, 1995.

5. Final Groundwater Recharge Engineering Report, East Valley Water Reclamation Project. City of Los Angeles, Department of Water & Power, 1993.

6. Final EIS/EIR for the San Gabriel Canyon Sediment Management Plan. LACDPW and Los Angeles District, Corps of Engineers, 1997

7. Site Characterization Report, Whittier Narrows Operable Unit, San Gabriel Basin, Los Angeles County, CA. Environmental Protection Agency, Region 9, 1998

3.3 Existing and Proposed Water Projects

The LACDA watershed includes numerous Federal and non-Federal facilities[1]. Five Federal dams exist in Los Angeles County. Two of these dams, Santa Fe and Whittier Narrows are the subject of this study (the additional three are Lopez, Hansen, and Sepulveda Dams). The reservoirs associated with the Santa Fe and Whittier Narrows Dams have a combined capacity of over 65,000 acre-feet (AF) (80 million m^3) at spillway crest elevations. In addition to the five Federal dams mentioned above, the LACDA watershed contains 15 local flood control and water conservation dams, 114 debris basins, and over 100 miles (161 km) of mainstem channel, with over 370 miles (596 km) of tributary channels.

[1] For a complete listing of all flood control facilities including detailed design data, see the *Los Angeles County Drainage Area (LACDA) Review Feasibility Report*, dated June 1992.

The fifteen flood control and water supply reservoirs in the upper watershed are operated by the Los Angeles County Department of Public Works (LACDPW). These include the reservoirs associated with Big Tujunga, Cogswell, Morris, Puddingstone, and San Gabriel Dams. Combined, they have a maximum capacity of 102,000 AF (126 million m^3). LACDPW utilizes the space in their reservoirs for whichever purpose(s) best suits the current conditions in the watershed.

LACDPW operates 114 debris basins in the canyons above the San Fernando and San Gabriel Valleys. These basins reduce the amount of debris that reaches the lower reservoirs and channels.

LACDPW has also constructed a comprehensive underground storm drain system with approximately 2,000 miles (3219 km) of conveyance. The system is very effective in delivering local runoff to the major flood control channels. The County also operates 28 groundwater recharge basins with a combined surface area of approximately 2,700 acres (1093 hectares).

The San Gabriel Canyon Sediment Management Plan includes long-term sediment activities at Cogswell, San Gabriel and Morris Reservoirs which would be implemented by LACDPW. The project purpose is to maintain the current level of flood protection and water storage by periodic removal of sediments entering the system of reservoirs.

Santa Fe Dam

Santa Fe Dam is located on the San Gabriel River approximately 16 miles (26 km) east-northeast of the Los Angeles Civic Center and about 3 miles (4.8 km) west-southwest of the town of Azusa. The drainage area above the dam is 237 square miles (614 km^2) with the majority of flows originating in the San Gabriel Mountains (see **Exhibit 1**, "Regional Map"). The surrounding area includes the cities of Azusa, Irwindale, Duarte and Baldwin Park. Construction of Santa Fe Dam was authorized by the Flood Control Act of 22 June 1936, as amended (Public Law 738, 74th Congress). Construction was completed in 1949.

The primary authorized purpose of Santa Fe Dam is to provide flood protection to downstream communities along the San Gabriel River between the Santa Fe Dam and Whittier Narrows Dam, and, in conjunction with Whittier Narrows Dam, provide flood protection along the Rio Hondo Channel, the Los Angeles River, and the San Gabriel River. The second authorized purpose of Santa Fe Dam is to provide recreation opportunities. Recreation facilities have been developed in the southeastern area of the basin above the dam. The Santa Fe basin also includes a Wildlife Management Area, a designated sensitive habitat area.

Whittier Narrows Dam

Whittier Narrows Dam spans both the San Gabriel River and the Rio Hondo. The dam is located 10 miles (16 km) east of downtown Los Angeles, between the Puente and Merced Hills. Whittier Narrows Dam borders the Cities of El Monte, Rosemead, Industry, Pico Rivera, and Montebello. The dam is 21 miles (34 km) upstream from the point where the San Gabriel River enters the Pacific Ocean and 7 miles (11 km) downstream from the Santa Fe Dam (see **Exhibit 1**, "Regional Map"). Construction of Whittier Narrows Dam was authorized by the Flood Control Act of 1941. Construction was completed in 1957.

The primary authorized purpose of Whittier Narrows Dam is flood control. Subsequent Acts of Congress authorized the development of Whittier Narrows Flood Control Reservoir for park and recreational purposes. Recreation facilities have been developed throughout the basin by the Corps of Engineers and non-Federal sponsors, the Los Angeles County Department of Parks and Recreation and the City of Pico Rivera. There is also a Nature Area located in the southeast area of the basin which was developed as mitigation for the established recreation facilities. The third authorized purpose of water conservation was granted through approval by the 2nd endorsement from the Office, Chief of Engineers, dated 18 October 1956. The water conservation pool was set at 1,000 acre-feet (1.2 million m^3) at elevation 195.5 ft NGVD (60.3 m NAVD[2]) and expanded in 1977 to 2,500 AF (3.1 million m^3) at elevation 201.6 ft NGVD (62.2 m NAVD).

Whittier Narrows Dam receives flows from both the Rio Hondo and the San Gabriel River. The main tributaries to the San Gabriel River are San Jose and Walnut Creeks, and the washes that flow into the Rio Hondo are the Sawpit, Santa Anita, Arcadia, Eaton and Rubio. Alhambra Wash flows directly into Whittier Narrows basin. Under flood control operations, controlled releases up to 40,000 cubic feet per second (cfs) (1133 m^3/s) can be made to the Rio Hondo. Controlled releases up to a maximum of 5,250 cfs (149 m^3/s) can be made to the San Gabriel River when the conservation pool on the Rio Hondo side is exceeded or the San Gabriel pool is between elevation 213.5 and 228.5 ft NGVD (65.8 and 70.4 m NAVD). When the latter elevation is exceeded, the automatic spillway gate operation commences by releasing larger flows to the San Gabriel River. All outflow to the San Gabriel River from Whittier Narrows Dam is through or over the spillway gates. Whittier Narrows currently provides greater than 100-year protection to areas downstream from the spillway on the San Gabriel River.

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[2] *NGVD* is the National Geodetic Vertical Datum of 1929. Elevations relative to this datum are expressed in feet (ft) in this report. *NAVD* is the North American Vertical Datum of 1988. Elevations relative to this datum are expressed in meters (m) in this report.

Groundwater in certain areas of the San Gabriel Basin has been impacted by volatile organic compounds attributable to widespread industrial land use and associated contaminant releases in the San Gabriel Basin over the past several decades. Whittier Narrows is one of the areas where contamination has been detected. The Environmental Protection Agency under authority of CERCLA is conducting a variety of response actions in the San Gabriel Basin, including within Whittier Narrows as a result of this contamination.

3.4 Local Agencies

The agencies listed below have a vested interest in water resources in southern California. They provide a variety of services and functions including controlling and conserving flood water, providing water to their constituencies, and participating in existing water conservation operations. These agencies through their interest and participation in existing water resource conservation would benefit from additional water conservation via groundwater recharge.

- **Los Angeles County Department of Public Works** - Los Angeles County Flood Control District was created in 1915 by the State legislature with the charge to control and conserve flood, storm, and other waste waters. Since 1985 LACDPW has been performing the functions of the Los Angeles County Flood Control District (LACFCD). Under its conservation mission, LACDPW owns or operates 29 water spreading areas where groundwater is recharged to replenish the County's underground water supply. Several dams and reservoirs, including the Corps' Whittier Narrows Dam, are operated to store water for post storm releases to downstream spreading areas. Water conservation practices such as these are not practical during larger storms when the dams must be operated for flood control purposes.

- **Metropolitan Water District of Southern California** - MWD is a public agency and quasi-municipal corporation. Currently the MWD imports water from two sources, the Colorado River via the Colorado River Aqueduct and Northern California via the State Water Project and its California Aqueduct. MWD's primary purpose is to develop, store, and distribute water at wholesale rates to its member agencies for domestic and municipal purposes. MWD is composed of 27 member agencies, including 14 cities, 12 municipal water districts, and one county water authority. For some member agencies, MWD supplies all the water used within the agency's service area, while others obtain varying amounts of water from MWD to supplement local supplies. MWD provides approximately 55% of the water needs of its service area which extends from Ventura County south to San Diego County.

- **Department of Water and Power, City of Los Angeles** - The City of Los Angeles uses an average of 695,686 acre-feet (858 million m^3) of water annually. The DWP imports 328,205 acre-feet (405 million m^3) from the Owens Valley and Mono Basin through the Los Angeles Aqueducts. The remainder of the City's water needs are supplied by local groundwater supplies, which account for 137,333 acre-feet (169 million m^3), and imported water deliveries from the MWD which total 230,148 acre-feet (234 million m^3) [Data from 1988-1989].

- **Water Replenishment District of Southern California** - The primary objectives of the Water Replenishment District of Southern California (WRD) are to provide high quality water to its users, minimize the adverse effects produced by years of groundwater pumping, and to oversee groundwater recharge operations in the Central and West Coast Basins. The goals of WRD are to maximize transmission of water to pumping areas, minimize loss of local water supplies, maintain water reserves at optimum levels, and halt the further intrusion of seawater into the basin. WRD supports recharge operations to offset current water demands in the basins. WRD purchases water imported through the State Water Project or the Colorado River Project to supplement the storm runoff to replenish the groundwater basins. Direct groundwater recharge is accomplished through percolation at the spreading grounds adjacent to the Rio Hondo and the San Gabriel River; further replenishment is accomplished by injecting water at three fresh water barriers (West Coast Basin, Dominguez Gap, and Alamitos Barriers).

- **San Gabriel Valley Municipal Water District** - The San Gabriel Valley Municipal Water District (SGVMWD) is composed of four cities for a total of 27.1 square mile (70 km^2) service area. The SGVMWD imports water to the San Gabriel Basin via the East Branch of the State Water Project.

- **West Basin and Central Basin Municipal Water Districts** - The West Basin and Central Basin provide service to more than 40 cities, with an overall population of 2.3 million. The Districts distribute wholesale water to approximately 50 separate water utilities. The Districts are involved in water conservation programs, water quality improvement projects, recycled water projects, and brackish groundwater desalting.

- **Upper San Gabriel Valley Municipal Water District** - The Upper San Gabriel Valley Municipal Water District was incorporated in 1960 by popular referendum and was annexed to the Metropolitan Water District in March 1963. The District was formed to help solve water supply problems of the rapidly developing San Gabriel Valley. The

District includes 144 square miles (373 km^2) and currently serves more than a million people. Approximately 60,000 acre-feet (740 million m^3) of water is provided each year by the District. Communities within the service area include Arcadia, Bradbury, Duarte, Glendora, Monrovia, South Pasadena, Temple City, San Gabriel, South El Monte, El Monte, Baldwin Park, Covina, Industry, Irwindale, La Puente, West Covina, and Rosemead.

- **Three Valleys Municipal Water District**- The Three Valleys Municipal Water District was formed in January 1950 by popular referendum and was annexed to the Metropolitan Water District of Southern California in November 1950. The District was formed to provide supplemental imported water to serve growing needs of orchards and communities in the Pomona, Walnut, and eastern San Gabriel Valleys. The service area is approximately 133 square miles (345 km^2) and includes the Cities of Charter Oak, Claremont, Diamond Bar, La Verne, Pomona, Rowland Heights, San Dimas, Walnut, and portions of Covina, West Covina, Glendora and Industry.

IV. PLAN FORMULATION

The objective of the plan formulation phase of this feasibility study is to identify alternatives which provide water conservation opportunities at Santa Fe and Whittier Narrows Flood Control Basins. The following items were identified and evaluated during plan formulation:

(a) problems and opportunities related to water conservation in the study area;
(b) planning objectives and constraints;
(c) existing and future without-project conditions;
(d) alternatives which address the problems and opportunities within the study area; and
(e) anticipated impacts and conditions associated with implementation of each alternative.

The plan formulation phase culminates with a presentation and evaluation of an array of alternatives and the selection of the National Economic Development (NED) plan and/or selection of the local sponsor's preferred plan. The report/Draft EIS/EIR are then offered for public review. The final document is forwarded to the District Engineer to complete the Final Report/District Engineer's Public Notice.

4.1 Location and Extent of Study Area

The study area is located within Los Angeles County. Los Angeles County is located in the South Coastal Basin of the Pacific slope, which has varied terrain consisting of precipitous mountains, low-lying foothills, valleys, and coastal plains. The general area, referred to as the Los Angeles County Drainage Area (LACDA) basin, is bounded by the San Gabriel Mountains on the north, and on the east and southeast by the Chino, San Jose, and Puente Hills. The project sites are located in the San Gabriel Valley, to the east of the City of Los Angeles Civic Center. **Exhibit 1**, "Regional Map," shows the study area.

4.1.1 Drainage Basin Description

The LACDA watershed covers 1,459 square miles (3779 km^2), a large percentage of which is urbanized flatlands and valleys. The watershed is crossed by the Los Angeles River, San Gabriel River, and the Rio Hondo. The watershed for the San Gabriel River is approximately 635 square miles (1645 km^2) and drains the eastern San Gabriel Mountains and portions of the Chino, San

Jose, and Puente Hills. The main upstream tributaries merge above Santa Fe Dam. Two major tributaries, Walnut Creek and San Jose Creek, flow into the San Gabriel River upstream of Whittier Narrows Dam. Washes that drain into the Rio Hondo are Sawpit, Santa Anita, Arcadia, Eaton, Rubio, San Pasqual, and Alhambra. On the east side of Whittier Narrows Dam, the San Gabriel River continues to the south. Coyote Creek flows into the San Gabriel River downstream of the Whittier Narrows Dam. The San Gabriel River discharges into Alamitos Bay six miles (9.7 km) east of the mouth of the Los Angeles River. The drainage area for the Santa Fe Dam is 237 square miles (614 km^2) and Whittier Narrows Dam is 547 square miles (1417 km^2).

Santa Fe Basin

The Santa Fe Basin is located on the upper San Gabriel River in the eastern San Gabriel Valley. The dam is located 16 miles (25.8 km) east-northeast of the Los Angeles Civic Center and four miles (6.4 km) downstream of the mouth of San Gabriel Canyon. There are three large multi-purpose dams upstream of Santa Fe Dam. They are; Cogswell Dam on the West Fork of the San Gabriel River, and San Gabriel and Morris Dams on the San Gabriel River. LACDPW operates these dams for flood control and water conservation. Flood control allocation space at Cogswell and San Gabriel dams is approximately 52,000 AF (64 million m^3). Flood Control space at Morris Dam is approximately 13,000 AF or 16 million m^3 (LACDA Review Study, 1991). The Foothill Freeway (State Highway 210) crosses the river channel at the north end of the basin, and the San Gabriel River Freeway (State Highway 605) runs along the western edge of the basin, between the basin and the spreading facilities. Access to the interior basin is possible via Arrowhead Highway which runs east-west on the downstream side of the dam. There are no local roads within the basin itself. **Exhibit 2** shows the Santa Fe Dam study area.

Whittier Narrows Basin

The Whittier Narrows Basin is located in the southwestern San Gabriel Valley. The dam is located in the gap between the Puente and Merced Hills, 10 miles (16 km) east of the Los Angeles Civic Center. Upstream structures affecting runoff include the Santa Fe Dam, Cogswell Dam, San Gabriel Dam, Morris Dam, and Puddingstone Reservoir on upper Walnut Creek. Flood control by these dams is described in the discussion of Santa Fe Dam, above. Puddingstone Reservoir is operated for flood control, water conservation, and recreation with a relatively small flood control allocation. Flows from the San Gabriel River and Rio Hondo merge at the Whittier Narrows during larger flood events. Flood control releases from Whittier Narrows Dam are primarily made to the Rio Hondo, which is also referred to as the Rio Hondo Diversion Channel.

The major east-west highways through the basin are the Pomona Freeway (State Highway 60), San Gabriel Boulevard, and Durfee Avenue. The main north-south highway within the basin is Rosemead Boulevard which crosses the dam south of San Gabriel Boulevard. The San Gabriel River Freeway (State Highway 605) runs north-south along the eastern edge of the basin (see **Exhibit 3,** "Whittier Narrows Flood Control Basin Plan View").

4.1.2 Description of Dams

Santa Fe Dam

The Santa Fe Dam embankment is a zoned earth filled structure approximately 23,800 ft (7254 m) in length. The elevation of the top of the embankment is 513 ft NGVD (157.1 m NAVD) with a maximum height above the original stream bed of 92 ft (28 m). The upstream slope is 1H:3.1V and the downstream slope varies from 1H:3V at the top and 1H:5.5V at the toe. Both the upstream and the downstream slopes are protected with cobbles six inches (15 cm) or greater in diameter. The pool surface area and gross capacity (August 1995) at the spillway crest elevation (496 ft NGVD or 152.0 m NAVD) is 1,073 acres (434 hectares) and 30,713 AF (37 million m^3) respectively. At the top of the dam the pool surface area would be 1,316 acres (533 hectares) and the capacity would be 50,876 AF (63 million m^3).

The outlet works are located near the center of the dam and the outflow is directed into the San Gabriel River through 16 gated outlets. Each outlet is 6 feet (1.8 m) wide and 9 feet (2.7 m) high, with an invert elevation of 421.0 ft NGVD (129.1 m NAVD). The gates are hydraulically operated, and can move at about one foot per minute (0.30 m/min).

The spillway is located in the northwest abutment of the dam. It has a concrete ogee overflow section roughly 1200 feet (366 m) in length at crest elevation of 496.0 ft NGVD (152.0 m NAVD). Spillway flow enters a stilling basin before entering the unpaved spillway channel which is about 1200 feet (366 m) wide and 5,000 feet (1524 m) long.

Pertinent information for Santa Fe Dam is shown in **Table 4.1**.

Table 4.1 Pertinent Information, Santa Fe Dam

Drainage Area		237 mi^2 (614 km^2)[1]
Gated Outlets	Number	16
	Size	6 ft (1.8 m) wide x 9 ft (2.7 m) height
	Invert Elevation	421.0 ft NGVD (129.1 m NAVD)
Embankment Height		92 ft (28 m)
Top of Embankment Elevation		513.0 ft NGVD (157.1 m NAVD)
Top of Spillway Elevation		496.0 ft NGVD (152.0 m NAVD)
Embankment Length		23,800 ft (7254 m)
Storage Volume		30,713 ac-ft (38 million m^3)[2]

1 Includes 209 mi^2 (541 km^2) controlled by LACDPW's Cogswell, San Gabriel, and Morris Dams. Elevation-area-storage based on September 1982 survey.

2 August 1995 survey

Whittier Narrows Dam

The Whittier Narrows Dam is an earth (rolled fill) structure with a total length of 16,960 ft (5169 m), a top of embankment elevation of 239 ft NGVD (73.6 m NAVD), and a maximum height of 56 ft (17 m) above the Rio Hondo Channel stream bed. The water surface area and capacity of the reservoir (August 1995) at elevation 229.0 ft NGVD or 70.5 m NAVD (top of spillway with the spillway gates closed) are 2,375 acres (961 hectares) and 34,269 AF (42 million m^3) respectively. At the top of the dam, the area is 3,563 acres (1442 hectares) and the capacity is 63,114 AF (78 million m^3).

The Whittier Narrows Dam can discharge water to both the Rio Hondo and the San Gabriel River. The outlet works are located near the west abutment of the dam to direct the outflow to the Rio Hondo Channel. Four radial gates, 30 feet (9.1 m) wide and 20 feet (6.1 m) tall, seal the gate openings. The gate openings are 30 feet (9.1 m) wide and 19 feet (5.8 m) tall. Gate sills are at elevation 184.0 ft NGVD (56.8 m NAVD).

The spillway structure, further eastward along the dam embankment, consists of nine radial gates that discharge outflow into the San Gabriel River. These gates are 50 feet (15.2 m) wide and 29 feet (8.8 m) high. The gate sills are at elevation 200.0 ft NGVD (61.7 m NAVD).

Pertinent information for Whittier Narrows Dam is shown in **Table 4.2**.

Table 4.2 Pertinent Information, Whittier Narrows Dam

Drainage Area		547.0 mi^2 (1417 km^2)[1]
Gated Outlets	Number Size Invert Elevation	4 30 ft (9.1 m) wide x 20 ft (6.1 m) high 184.0 ft NGVD (56.8 m NAVD)
Embankment Height		56 ft (17.1 m)
Top of Embankment Elevation		239.0 ft NGVD (73.6 m NAVD)
Top of Spillway Elevation		229.0 ft NGVD (70.5 m NAVD)
Embankment Length		16,960 ft (5169 m)
Storage Volume		34,269 acre-ft (42 million m^3)[2]

[1] Includes 237 mi^2 (614 km^2) controlled by Santa Fe Dam. Elevation-area-storage based on 1987 survey.
[2] August 1995 survey

4.2 Problems and Opportunities

The study was authorized to examine water conservation opportunities that would augment local water supplies. Water conservation efforts would attempt to ameliorate the severe impacts associated with the drought experienced in California from 1987 through 1991, and to avoid such impacts in the future. Increased water demand in the last decade, in conjunction with legal/environmental actions that reduced allotment of water from Mono Lake and Owens Valley as well as from the San Francisco Bay/Delta area, has resulted in less available water. This has led to water rationing and higher water costs.

Southern California has experienced a high rate of population growth since the turn of the century. Water has always been scarce in southern California, but high rates of development have resulted in water demands that greatly exceed the available local water supply. Water has been imported to southern California since as early as the 1910's.

When the Secretary of War authorized the channelization of the Los Angeles River in the mid-1930's, water conservation was considered in the preliminary design but was not authorized at the time. At public meetings in the 1930's, the problems of water supply and water conservation were identified as important issues. The Corps of Engineers was encouraged to considered these issues in the design implementation of the proposed projects on the Los Angeles and San Gabriel

Rivers. Reports to the Secretary of War from the Chief of Engineers mentions the issue of water conservation, but these concepts were not included in project design or implementation at that time. The Pomona Water Reclamation Plant was built in 1926 to provide tertiary treatment of sewage discharge. The effluent was then used to recharge the local aquifer, indicating a need or a desire to conserve water as much as 70 years ago.

The LACDA authorization currently encourages the Corps to investigate the potential for water conservation at existing Corps water projects. The need to store the water for releases to spreading grounds for groundwater recharge, combined with limited land resources, favors the use of existing facilities over developing other land to achieve water supply benefits.

The Central, West and Main Basins located in Los Angeles County were in overdraft condition before the basins were adjudicated by the State of California. Court appointed Watermasters were created with authority and responsibility to manage the individual groundwater basins. The previously existing overdraft condition in the basins has been stabilized due to control of pumping and increased water conservation efforts including introduction of imported and recycled water. The expected increase in groundwater recharge from local runoff will primarily offset increased purchase of imported water and/or allow increased pumping to occur while maintaining basin levels.

Water conservation presents the opportunity to capture storm water runoff that would otherwise be lost to the ocean. The term "lost water" is commonly used by water supply entities to refer to water released to the ocean rather than being stored to serve as area water supply. This water could potentially be stored until the downstream facilities could accommodate it. The stored water could then be released at a relatively lower rate to maximize recharge ability at the existing recharge facilities. The result would be increased groundwater supplies.

Los Angeles County is currently supplied with water from both local and external sources. It is estimated that 30% of this need is currently met through local supply (storm runoff and reclaimed water recharged to the aquifer) and the remaining 70% is imported from external sources. The local water supply is estimated to remain stable through 2020, and the need for additional water would have to be met by imported water. Water conservation efforts could decrease the amount of water that is currently lost to the ocean during and after storm events, and increase the amount of this water that infiltrates into local groundwater supplies. This water could then be used to satisfy the increasing demand for water.

The ability to obtain imported water is based on priority, allotment, and availability of surplus water in wet years. Metropolitan Water District (MWD) has high priorities with water suppliers, Colorado River, the State Water Project and the Los Angeles Aqueduct. These allotments currently augment local water supply to meet local demands. During wet years surplus water is available and MWD can obtain additional water for groundwater recharge. The local water demand is projected to increase by 300,000 acre-feet (370 million m^3) by the year 2020. This amount of water could not be obtained under current conditions.

The amount of water available through the Owens Valley aqueduct has been reduced by approximately 15% to 20 %, when compared to the amount of water available 20 years ago. The reduction in available water is due to a number of court decisions restricting groundwater pumping in the Owens Valley and diversion of streams in the Mono Basin.

In the past, California has had the option of utilizing water resources from the Colorado River that were excesses from other states within the Colorado River Basin. Population growth within some of the other states, most notably Nevada and Arizona, has resulted in the total use of the state's allotments. This has impacted southern California in the short-term and will have an increasing impact in the long-term, as state populations throughout the western states continue to rise.

In virtually all cases where southern California water purveyors have sought additional import resources, responses through the courts and regulatory agencies have mandated that need would be established only after all local means for increasing water supply have been exhausted. Water conservation through capture of additional flood runoff that encourages greater groundwater recharge is one such local means of increasing the supply of available water. This increase would be small when compared to the total water demand, but would be significant nonetheless.

The Los Angeles Department of Water and Power has also undertaken a controversial study to examine the feasibility of purchasing water rights and land in the San Joaquin Valley and removing it from agriculture production in order to obtain additional future water resources.

Unlike other flood control basins within the upper Los Angeles River system, Santa Fe and Whittier Narrows Dams have a very high potential for groundwater recharge. The basins are well placed within the range of alluvial outwash sorting; specifically, the sands and gravel underlying the basins are ideally suited for a high rate of recharge. Very few impediments to infiltration, such as clay lenses, exist within these areas. Several large recharge facilities can be found in the vicinity of these dams. The Montebello Forebay is one such recharge facility. It is immediately downstream of Whittier Narrows Dam and allows infiltration into the Central Basin aquifer. Soft-bottomed reaches of the San Gabriel River and the Rio Hondo also provide excellent recharge potential downstream of the dams.

The local sponsors' desire to optimize water conservation opportunities has led to the addition of the concept of flood forecasting to the plan formulation process. *Flood forecasting* involves the use of weather forecasting and rainfall/runoff models to estimate the inflow volumes of flood events. Flood forecasting would allow for water to be stored within the area currently reserved for the flood control pool. When a flood event is forecast, the water conservation pool could be drawn down to below the level of the flood control pool in order to provide flood protection to the downstream reaches. The water conservation pools at COE reservoirs can be evacuated within 24 hours to restore the required flood control capacity of the reservoir.

With the development of flood forecasting, water can be stored at any time during the year. This has led to the use of three terms to describe various water surface elevations for water conservation activities. These are (1) the Water Conservation Pool, (2) the Buffer Pool and (3) Seasonal Pool.

4.3 Planning Objectives and Constraints

4.3.1 Project-Specific Planning Objective

The intent of this feasibility study is to identify and recommend the plan which provides for optimal water conservation benefits at Santa Fe and Whittier Narrows basins while balancing requirements of flood control, legal issues, land use, recreation, environmental and cultural resources. LACDPW requested the Corps use the alternatives from the Reconnaissance Report as a basis to optimize water surface elevations.

The project-specific objective is to increase the amount of water that is available for infiltration into the regional groundwater basins. This can be accomplished by storing the local storm runoff and releasing the water at a lower rate depending on the inflow capability of the recharge facilities. Water conservation practices such as this would reduce the amount of water that is lost to the ocean, and increase the local water supplies. Impacts to existing environmental resources must be considered and when impacts are unavoidable, mitigation measures must be implemented. Existing water supply projects may potentially be impacted by new opportunities and are considered.

An array of potential alternatives for water conservation were investigated. The most significant opportunities for water conservation were found to be at existing Federal Dams and flood control basins. Due to urban growth there is very little available open space that could provide for new additional water storage. Although modifications may be required to existing structures to provide water conservation, these modifications would be far less costly than developing new water storage areas.

The Federal objective of water and related land resources project planning is to contribute to the National Economic Development (NED). Potential NED contributions can be expressed in both monetary and non-monetary units. NED contributions include those items that are consistent with protecting the Nation's environment pursuant to national environmental statutes, applicable executive orders, other Federal planning requirements and state and local statutes.

Future without-project conditions are used to establish the baseline condition against which alternatives can be compared. Comparisons will include all potential impacts associated with the project.

4.3.2 Applicable Laws and Regulations

The opportunity for water conservation to provide significant National and regional benefits is recognized and supported by Federal water supply laws and policies. The Corps of Engineers, as a Federal agency with the authority to regulate reservoir storage and release, is urged to maximize water conservation of provisions of 33CFR 222.7 (f) (4), as follows:

> *"Development and execution of water control plans will include appropriate consideration for efficient water management in conformance with the emphasis on water conservation as a national priority. The objectives of efficient water control management are to produce beneficial water savings and improvements in the ability and quality of water resulting from project regulation and operation. Balanced resource use through improved regulation should be developed to conserve as much water as possible and maximize all project functions consistent with project management. Continuous examination should be made of regulation schedules, possible need for storage reallocation (within existing authority and constraints) and to identify needed changes in normal regulation. Emphasis should be placed on evaluating conditions that could require deviation from normal release schedules as part of drought contingency plans."*

Section 301(a) of the Water Supply Act of 1958, as amended (43 U.S.C. 390b) established a policy of cooperation in developing water supplies for domestic, municipal, industrial, and other purposes. Section 301(b) is the authority for the Corps to include municipal and industrial water storage in reservoir projects. The terms "municipal and industrial," while not defined in the legislative history of the Water Supply Act, have been defined by the Corps to mean supply for uses customarily found in the operation of municipal water systems, and in uses in industrial processes.

Clean Water Act

Any project involving the waters of the United States requires preparation of an application for Water Quality Certification under section 401 of the Clean Water Act. The 401 application is then submitted to the California Regional Water Quality Control Board, requesting either state Certification or a waiver thereof, pursuant to Section 401 of the Clean Water Act. The Federal Environmental Protection Agency has delegated authority to the individual states oversight and veto authority over the application review process. As this project would discharge water into the waters of the United States, the proposed action must comply with established effluent limitations and water quality standards.

National Environmental Policies Act

Any Federal project must comply with the National Environmental Policies Act for 1969 (NEPA) as well as subsequent legislation. An Environmental Impact Statement/ Environmental Impact Report (EIS/EIR) in compliance with NEPA and the California Environmental Quality Act (CEQA) respectively is also being developed for this study to fully document existing resources in the study area and address the impacts of the alternatives examined. The EIS/EIR also lists and documents compliance with additional legislative acts. In coordination with the National Environmental Policies Act, a public notice must be prepared and circulated affording public comment on the evaluation for this project.

National Historic Preservation Act

The cultural resources study is conducted in accordance with the requirements of Section 106 of the National Historic Preservation Act of 1966, as amended, 36 CFR 800 "Protection of Historic Properties, (NRHP)" and Corps Engineering Regulation 1105-2-100. The EIS/EIR contains a detailed description of the cultural resources in the study area and assesses the impacts of each alternative on these resources. If any of the historic sites within the project area are determined to be eligible for listing on the National Register of Historic Sites, the Corps will provide this information to the California State Historic Preservation Officer for further consultation. If cultural resources are discovered during construction and cannot be avoided, work will be suspended in that area until the properties are evaluated for eligibility for listing in the NRHP in consultation with the California State Historic Preservation Officer (SHPO). If the properties are determined to be eligible for the NRHP, the effects of the proposed construction will be taken into consideration in consultation with the SHPO; and the Advisory Council on Historic Preservation would be provided the opportunity to comment in accordance with 36 CFR 800.11.

Fish and Wildlife Service Coordination Act

The Coordination Act Report prepared by the Fish and Wildlife Service will assist the Corps of Engineers in determining a viable preferred plan. In compliance with the requirements of Fish and Wildlife Coordination Act, the U.S. Fish and Wildlife Service (FWS) has been funded for this study by the Corps to prepare a Coordination Act Report (CAR).

Statutory requirements of Section 7 of the Endangered Species Act would be completed during the feasibility phase. This includes formal and informal consultation with FWS. Formal consultation includes the Corps preparing and submitting to the FWS a Biological Assessment. The FWS formally responds with a Biological Opinion. Any remaining differences are resolved through discussion with FWS. If it is determined that the project would impact biological resources, mitigation alternatives including monitoring and avoidance measures which may include changes to the project would be developed in coordination with the FWS.

Because biological information is limited, it is important to ensure that the water conservation measures are implemented in compatible manner with the existing environmental resources.

Executive Orders and Regulations

Adherence to and compliance with the requirements of Executive Orders and regulations are noted in the EIS/EIR. These include Executive Order 11990, "Protection of Wetlands," which requires avoidance to maximum extent possible of adverse impacts to wetlands; Executive Order 11988, "Floodplain Management" requires avoidance of development in 100-year floodplain to reduce hazards and risks associated with floods on human safety, health, and welfare, and to restore and/or preserve the natural and beneficial value of the base floodplain.

The study was conducted using procedures set forth in the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (Principles and Guidelines) prepared by the Water Resources Council. The Principles and Guidelines define four criteria against which alternatives are evaluated. They are completeness, effectiveness, efficiency, and acceptability.

Other Laws and Regulation

Pertinent regional and local planning policy documents would be examined during the feasibility phase and compliance with their requirements, where appropriate, would be noted in the EIS/EIR. Federal regulations which have been delegated to the state include compliance with the Regional Water Quality Control Board for a Section 401 (b) certification under the Clean Water Act as stated above, and Safety of Dams which regulates dam construction standards. Additional review of local regulations is being performed by LACDPW.

California Environmental Quality Act

The California Environmental Quality Act is a companion vehicle to the NEPA requirement of an Environmental Impact Statement (EIS) that requires preparation of a Environmental Impact Report (EIR) for projects within the State when non-Federal land or agencies are involved. The Corps is preparing both, as a combined document, in coordination with the LACDPW.

4.3.3 Planning Constraints

Planning constraints are legal, institutional, and policy issues, as well as physical limitations that restrain or limit the project in some way. Potential project constraints include authorized basin and dam purposes, laws and regulations which may govern the project, concerns of the local sponsor, the physical environment of the project areas, and existing uses. Review of existing uses included current recharge operations and facilities, available water supply for recharge, and recreation features.

Plan formulation and the evaluation of alternatives were both conducted in accordance with existing laws, policies, environmental regulations, and the authorizing resolutions which limit the study to water conservation.

Water conservation must be accomplished in a manner compatible with other authorized project uses of the basins. Since the primary authorized use of the basins is flood control, the level of flood protection cannot be compromised by secondary purposes. The second authorized use of the basins is recreation. Impacts to land use in the basin must be consistent with the terms of current leases for recreation; otherwise they must be mitigated for accordingly. This could be possible through adjustments in the leases at time of renewal. In addition flowage easements and legal stipulations for oil and gas development, water reclamation, mitigation and habitat areas, and other specified purposes must be considered. Specific issues for each basin are discussed below.

Physical limitations include those set by the dam, basin, and other existing facilities. The elevation of the top of the spillway is the ultimate limiting elevation for water conservation. Physical limitations are determined by existing facilities, the availability of water which varies from year to year, by the inflow capacity of the recharge facilities, environmental limitations in the form of the desire to limit adverse impacts to high value habitat and the designated Wildlife Management Area, and existing recreation facilities.

4.3.4 Project-Specific Constraints

Constraints specific to each basin are identified below. These constraints place limitations on the proposed water conservation potential. The constraints discussed below include the authorized purposes of the basin, the availability of water through releases of stored and imported water, and capacity of groundwater recharge facilities.

The primary purpose of the Santa Fe Basin is for flood control. Any proposed water conservation practices must not compromise the flood control capabilities of the basin. Gate openings are set in accordance with the 1982 Santa Fe Dam Water Control Plan. Any additional storage proposed for water conservation must either be below the elevation of the flood control pool, or else it must be able to be drawn down below this elevation quickly enough to provide for the necessary storage of flood water. The lowest invert elevation of the Santa Fe Spreading Basins (elev 475.0 ft NGVD or 145.6 m NAVD) was identified as the highest possible water surface elevation for water conservation. If this elevation were exceeded the lowest spreading basin would be impacted, which would impede water percolation and impact recharge.

The existing Wildlife Management Area in the Santa Fe Basin was established as mitigation for past recreation development. The Wildlife Management Area includes important and sensitive habitat areas or vegetative resources that require protection from further degradation or custodial enhancement if possible.

The primary authorized purpose of the Whittier Narrows Basin is flood control. For this study, it was assumed the completed LACDA project would be in place before the water conservation project is implemented, therefore the gate regulation schedule used in the study has a maximum scheduled release of 40,000 cfs (1133 m^3/s) for flood control. The current operation schedule calls for controlled releases up to 1430 cfs (41 m^3/s) until the reservoir reaches elevation 201.6 ft NGVD (62.2 m NAVD). Above this elevation the reservoir is put in full flood control mode. Gate openings are set in accordance with the 1990 Whittier Narrows Dam Water Control Plan. Any additional storage proposed for water conservation must either be below the elevation of the flood control pool, or else it must be able to be drawn down below this elevation quickly enough to provide the necessary storage of flood water.

The Whittier Narrows Water Treatment Plant was constructed to be fully functional during flood events. To allow for operations to proceed while the facilities are flooded, major electrical, mechanical and control equipment is housed on the second floor of the control building. One building is built on pilings and the other on a concrete slab foundation. As-built plans show a ground floor finish grade of 208.5 ft NGVD (64.3 m NAVD). The upper walkways above the tanks are at elev 220.0 ft NGVD (67.8 m NAVD) and the top of the treatment tanks is at elev 218.5 ft NGVD (66.6 m NAVD). Inundation for longer periods for water conservation could impact the ability of crews to perform the required daily water quality testing. These tests are required to maintain the discharge permit issued by the Regional Water Quality Control Board.

The major roads found within the Whittier Narrows Basin are Rosemead Blvd, the major north-south road, San Gabriel Boulevard, the major east-west road and Durfee Avenue east of Rosemead Boulevard. The State of California Safety of Dams agency considers any levee higher than 6 ft (1.8 m) and 15 AF (18,500 m^3) storage to be a dam. State law requires the agency to enforce the requirement of 100-yr protection on new roads and may be subject to a three-foot (0.9 m) freeboard. The Corps has determined that the raised roads and berm require slope protection both upstream and downstream to preclude erosion and failure. The raised roads would impede surface runoff on the upstream side from draining as per the original design. The 20-year frequency inflow was used to design the upstream side of the road for interior drainage. Design considerations should satisfy Safety of Dams and CalTrans requirements. Discussion of Hydrologic Design of interior levees and roads is presented in the Hydrology Appendix. Hydraulic structures are discussed in the alternative evaluation section of this report as well as in the Hydraulics Appendix. Any reservoir storage lost due to the construction of internal levees and raising the roads must be mitigated according to Corps' Reservoir Regulation requirements.

Inflow to the Santa Fe Dam includes water from storm runoff, releases from LACDPW operated upstream reservoirs (Cogswell, San Gabriel, and Morris Dam), and imported water. Whittier Narrows Dam receives local runoff, flows from the Santa Fe Dam, imported water, and the Rio Hondo. The quantity of inflow would determine the amount of water conservation that is possible. Current operations make no attempt to adjust the inflows to account for variations in the flood control space upstream. The maximum amount of reclaimed water that is allowed for spreading is currently 60,000 AF (74 million m^3) per year, and cannot exceed 150,000 AF (185 million m^3) over three years. This limit is set by the permit issued by the Regional Water Quality Board for recharge of reclaimed water in the Central Basin to the partnership formed by LACDPW, the Water Replenishment District, and the Los Angeles County Sanitation Districts. An engineering study that investigates the possibility of increased reclaimed water recharge is being prepared as part of the Regional Water Quality Control Board review of the existing permit.

Seismic concerns include the potential for the foundation to liquefy if the dam is subjected to strong seismic shaking while the foundation and embankment are saturated due to water conservation operations. The Geotechnical Appendix indicates that this is not a project constraint.

The Master Plan for each dam was developed to guide in the use and development of all resources within the basin. Land and other resources are put to the best possible use in accordance with the requirements of flood control, water conservation, site conditions, the recreation needs of the community, and the protection and maintenance of environmentally sensitive areas.

One month is required to provide a window of opportunity for dam outlet maintenance. A drying time of two months is preferred to allow the area to dry sufficiently for the ground to support equipment to clear debris from the approach to the outlet gates. October is generally reserved for maintenance to ensure the capacity of the flood control pool would be available at the start of the flood season. Maintenance is done in the fall to avoid the spring and summer nesting season. In addition, maintenance for all Corps projects is currently performed by one crew and this further limits the possible maintenance in the Santa Fe Basin.

With the addition of the water conservation project, the LACDPW would be responsible for maintenance associated with the project. This could provide the opportunity for the LACDPW to perform general maintenance thereby reducing the impact on the Corps maintenance crew and the length of the required maintenance window.

4.4 Definitions

The flood season is generally defined as the period from the beginning of November to the beginning of March. March is considered the transitional month between the flood season and non-flood season which is also a transitional month for biological resources. The basis for the determination of the flood season is documented in the "Hydrology Appendix, Santa Ana River Basin, Prado Dam and Reservoir, Orange County, California, Prado Dam Water Conservation Study, June 1988." From historical data, the threat of serious flooding diminishes around the beginning of March. The non-flood season is considered to be the remainder of the year (first of March until the end of October). However, since October is typically reserved for reservoir maintenance, water conservation operations in the non-flood season could extend from early March until early October, depending on inflow.

The Debris Pool is the storage volume that is lowest in elevation and allocated for the purposes of collecting debris and sediment. The size of the Debris Pool was determined in the original design of Santa Fe Dam. It is based on the estimated 50-year debris volume, and the elevation was set according to the volume. No debris pool was included in the original design of Whittier Narrows Dam. If this elevation is exceeded at any time, normal flood control operations begin and water is released according to the gate operation schedule. Water conservation practices can typically take place below the debris pool elevation with very limited impacts to the area or to operating procedures.

The Water Conservation Pool defines the storage volume allocated for water conservation on a nearly year-round basis and released at a rate that the downstream recharge facilities can accommodate. The water conservation pool occupies the same area/volume as the debris pool.

The Buffer Pool describes the storage volume allocated during flood season up to a specific elevation, over and above the designated Water Conservation Pool. The buffer pool would only be used if weather conditions are favorable. Releases from the reservoir are limited to the recharge capacity of the downstream spreading facilities. If it is determined from weather forecasts that an impending storm would bring significant inflow into the reservoir, the Buffer Pool is emptied by an amount equal to the estimated inflow volume; this may require that the Buffer Pool be completely evacuated.

The Seasonal Pool is the storage volume allocated up to a specific elevation over and above the designated Water Conservation Pool during the non-flood season. Releases from the reservoir would be limited to the recharge capacity of the downstream spreading facilities. It has been determined that the threat of flooding diminishes towards the beginning of March, so any water conservation practices during the non-flood season would not significantly impact the flood protection provided by the dam. The outlet capacity and downstream channel capacity of both dams would allow the Seasonal Pool to be emptied in less than one day, if necessary, in the event a significant storm event should occur. The seasonal pool elevations for both dams was determined to be the same as the Buffer Pool elevations.

Flood forecasting involves the use of weather forecasting and rainfall/runoff models to estimate the inflow volume of flood events. Flood forecasting would allow for conservation water to be stored within the area currently reserved for flood control. When a flood event is forecast, the water conservation pool could be drawn down to below the level of the flood control pool, in order to provide flood protection to the downstream reaches. The water conservation pools at all COE reservoirs can be evacuated within 24 hours to restore the required flood control capacity of the reservoir.

An Acre-foot is the volume of water that would cover one acre to a depth of one foot. An acre-foot of water would typically support two families of four for one year. An acre-foot is equivalent to 1233.5 m^3.

NGVD is the National Geodetic Vertical Datum of 1929. Elevations relative to this datum are expressed in feet (ft) in this report.

NAVD is the North American Vertical Datum of 1988. Elevations relative to this datum are expressed in meters (m) in this report. Previous topographic maps and surveys were created in August 1938, April 1943, November 1949, and June 1961. Area-capacity curves were derived from the 1961 survey and are a part of the Water Control Manual. Elevations at that time were based upon the M.S.L. datum of 1929 (NGVD). Present topographical information is based upon a different datum, the North American Vertical Datum of 1988 (NAVD 88). The North American Vertical Datum is offset from NGVD by 2.54 feet (0.77 m) at Santa Fe Dam, and by 2.32 feet (0.71 m) at Whittier Narrows Dam.

Maximum Credible Earthquake (MCE) is the largest earthquake which might reasonably be expected to occur. As used in this report, the MCE is that earthquake which will induce the largest ground acceleration at the dam site.

Overtopping protection is used for the additional height of the levee at Santa Fe and road embankments at Whittier Narrows needed for wave runup and wind setup allowance protection to meet CalTrans and other standards.

4.5 Without-Project Conditions

The without-project condition is defined as the baseline condition that will be the basis against which the proposed alternatives are measured to identify impacts, avoidance measures, mitigation, and benefits. The without-project condition is assessed in terms of the present (existing) and future conditions.

4.5.1 Authorized Purpose of the Basins

<u>Santa Fe Dam</u>

The primary authorized purpose of the Santa Fe Dam is flood control, as set forth by the Flood Control Act of 1941. The purpose of the San Gabriel River channel north of the reservoir area is to convey the flow of water from the mouth of San Gabriel Canyon to the basin. The dam, in conjunction with the downstream San Gabriel River channel, protects areas along the floodplain between Santa Fe Dam and Whittier Narrows basin from flood flows.

The secondary purpose of Santa Fe Dam is recreation, as authorized by the Flood Control Act of 1944. Demand for recreation resources in the area exceeds the current supply. Facilities have been developed by the Corps and the Los Angeles County Department of Parks and Recreation (LACDPR) under the Santa Fe Master Plan. Population in the surrounding communities is expected to continue its heavy utilization of recreation facilities, and in fact, increase the need for additional facilities. The existing facilities include a swimming/fishing lake with beach, an open grass area, and nature/walking trails.

Santa Fe has no formal storage allocation for water supply. However the authorization of LACDA states "...and plans for any reservoir project, may, on recommendation of the Chief of Engineers, be modified to provide additional storage capacity for domestic water supply or other conservation, storage, on condition that the cost of such increased storage capacity is contributed by local agencies..."

Whittier Narrows Dam

The primary purpose of Whittier Narrows Dam is flood control as authorized by the Seventy-seventh Congress in the Flood Control Act of 1941, 18 August 1941 (Public Law 228). The project report "Definite Project Report on Los Angeles County Drainage Area, California, Whittier Narrows Flood Control Basin" dated April 1945 established the location and design of the dam and appurtenant facilities. Construction of the dam was completed in March 1957.

The second authorized purpose is recreation, as authorized by the Flood Control Act of 1944. The Act as amended (Public Law 78-534), authorizes the Corps of Engineers to construct, maintain and operate public park and recreational facilities at water-resource development projects. The Corps of Engineers also encourages local interests to construct, maintain, and operate recreational facilities. Recreation facilities currently within the basin include sports fields, fishing/boating lakes, picnic areas, open sports fields, several shooting ranges, a model airplane field, and other specialty areas.

The third authorized purpose of the Whittier Narrows Dam is for water conservation. This was approved by the Chief of Engineers via a letter dated 18 October 1956. The water conservation pool was established at elevation 195.5 ft NGVD (60.3 m NAVD) with corresponding storage of 1,000 AF (1.2 million m^3). The maximum conservation release was 600 cfs (17 m^3/s). LACDPW proposed to enlarge the conservation storage to elev 201.6 ft NGVD (62.2 m NAVD) with corresponding storage of 2,500 AF (3.1 million m^3), via letter in June 1977 with a maximum release of 750 cfs (21 m^3/s) for water conservation. The plan was approved subject to USACE South Pacific Division comments. The current operation schedule allows for impounding water up to elev 201.6 ft which currently corresponds to 2519 AF (3.1 million m^3) according to a August 1995 Survey. Up to this elevation water is released based on the infiltration rate of the Rio Hondo Coastal Basin spreading grounds. The long-term infiltration rate was set to 150 cfs (4.3 m^3/s) based on information provided by LACDPW. Flood control releases are made when the water surface elevation is above 201.6 ft on the Rio Hondo side and/or above elev 213.5 ft NGVD (65.8 m NAVD) on the San Gabriel River side.

4.5.2 Dam Operations

The design memorandum for construction of each dam defined a reservoir design flood as the flood event expected to occur from the most severe combination of meteorological and hydrologic conditions that are reasonably characteristic of the area. The flood control outlets in conjunction with the constructed flood control channels downstream of the dams are sized to enable the design flood pool to be emptied withing one day (in the absence of additional inflow) in order to recover the flood control space for the next storm.

Santa Fe Dam

The Santa Fe Dam flood pool size, outlet configuration, and downstream channel were sized based on a reservoir design flood with a peak inflow of 96,000 cfs (2718 m^3/s) and a 4-day volume of 171,400 AF (144 million m^3).

The dam tender operates the gates upon instructions by the Corps of Engineers' Los Angeles District Office. Gate operations are set in accordance with the 1982 Santa Fe Dam Water Control Plan. The current operation schedule establishes a debris pool (4,351 AF or 5.4 million m^3) with maximum releases of 130 cfs (3.7 m^3/s). When the water surface elevation reaches elev 456.0 ft NGVD (139.8 m NAVD), flood control operations commence. As the water surface elevation continues to rise above spillway crest, the outlet gates are gradually closed to maintain the allowable discharge. The Water Control plan used for the study has a maximum scheduled release of 41,000 cfs (1161 m^3/s) for flood control.

The historic maximum water surface elevation was 473.9 ft NGVD (145.2 m NAVD) on December 19, 1966 (1967 water year) when the water surface elevation was above elevation 470.0 ft NGVD (144.0 m NAVD) for 11 days.

Whittier Narrows Dam

The flood pool size, outlet configuration, and downstream channel were sized based on a reservoir design flood with a peak inflow of 70,000 cfs (1982 m^3/s) and a 4-day volume of 250,000 AF (308 million m^3). The dam tender operates the gates upon instructions by the Corps of Engineers' Los Angeles District Office. Gate operations are set in accordance with the 1992 Whittier Narrows Water Control Plan.

The existing operation schedule calls for controlled releases up to 1,430 cfs (41 m^3/s) until the reservoir reaches elevation 201.6 ft NGVD (62.2 m NAVD). Above this elevation the reservoir is put in flood control mode and outflows are made up to the downstream channel capacity of the Rio Hondo Diversion Channel. The maximum regulated flood control release to the Rio Hondo of 40,000 cfs (1133 m^3/s) is reached (with the gates fully opened) when the water surface reaches the elevation of 208.7 ft NGVD (64.1 m NAVD). As the water surface elevation continues to rise, the outlet gates are gradually closed to maintain the allowable discharge. Since the without-project condition for this study assumes the authorized parapet walls and bridge improvements would be constructed on the lower Los Angeles River and Rio Hondo, the Water Control plan used for the study has a maximum scheduled release of 40,000 cfs for flood control. If required, damtenders can also release controlled flows to the San Gabriel River at a maximum discharge rate of 5,250 cfs (149 m^3/s). Water conservation operations are performed under direction from LAD or LACDPW.

4.5.3 Existing Water Conservation Practices

Water conservation, with the goal of increasing the amount of water that infiltrates into the local groundwater basins, is possible through the storage and lower release of flood water. Increased water storage behind the Santa Fe and Whittier Narrows Dams would result in longer durations of elevated water surface levels. Existing water conservation efforts occur only when the primary objective of flood control is not compromised. Currently, stored waters are released at rates equivalent to the infiltration rates of downstream spreading facilities. Water used in water conservation is primarily from stored flood flows, but can also include imported and reclaimed water. The spreading facilities have been sited in areas where the underlying soils are conducive to rapid and unimpeded water infiltration.

Santa Fe Dam

Santa Fe Dam has no formal authorized storage allocation for water conservation or supply. To date, no modifications have been made to the dam for water conservation. The existing average annual water conservation yield is approximately 17,300 acre-feet (21.2 million m^3).

Whittier Narrows Dam

The operation of Whittier Narrows Dam for water conservation increases the amount of available groundwater within the Central and West Groundwater Basins of Los Angeles County. The current operation schedule allows for impounding water up to elev 201.6 ft NGVD (62.2 m NAVD), with associated volume of 2,519 AF (3.1 million m^3), which is then released based on the ability of the Rio Hondo Coastal Basin Spreading Grounds to receive inflow. The long-term infiltration rate is 150 cfs (4.3 m^3/s). The maximum release for water conservation purposes is currently set to 750 cfs (21 m^3/s). Water conservation operations are performed under direction from LAD or LACDPW. The average annual quantity of reclaimed and imported water used for groundwater recharge is 76,000 AF (94 million m^3).

No modifications have been made to the dam itself for the purposes of water conservation, with the exception of a small by-pass gate which was installed to release flows from the water conservation pool to downstream spreading basins. A levee was also built within the basin by LACDPW to protect the oil wells from inundation by water in the conservation pool.

4.5.4 Spreading Facilities

Water for groundwater recharge comes from local runoff, water released by upstream flood control facilities, reclaimed water, and imported water. The existing recharge facilities that can receive discharges from Santa Fe and Whittier Narrows are shown on **Exhibit 4**, "Existing Spreading Facilities." The estimated average-annual water conservation yield from operations at Santa Fe and Whittier Narrows Dams is 77,900 AF (95.3 million m^3). Groundwater recharge of reclaimed water is limited to 60,000 AF (74 million m^3) per year and cannot exceed 150,000 AF (185 million m^3) in three years.

Additional data for spreading facilities in Los Angeles County, including size, percolation rate, storage capacity, location, and source of water are included in the Hydrology Appendix.

<u>Santa Fe Dam</u>

The Santa Fe Reservoir Spreading Grounds are located in the Santa Fe Basin and spillway channel. As of 1989, there are six large basins east of the San Gabriel River Freeway and eleven smaller basins on the west side of the freeway upstream of the spillway. The Santa Fe Spillway Basin is subdivided into twelve basins, but currently only three are being used by the LACDPW to percolate water for groundwater recharge.

Environmental resources have been affected in the past due to releases of winter storm flood water that is stored in Morris Dam and released by LACDPW after the flood season for groundwater recharge into the Santa Fe Reservoir Spreading Grounds. This has occurred 2-3 times, up to 2 weeks at a time, approximately every 3 to 5 years during the last fifteen years. Records indicate that these releases have created inundation pools up to elev 440.0 ft NGVD (134.9 m NAVD) and 450.0 ft NGVD (137.9 m NAVD) through June.

The Peck Road Spreading Basin is located within the Sawpit Wash. The spreading grounds use local storm runoff, water purchased from MWD, or water released from upstream LACDPW reservoirs.

The San Gabriel River Channel between Santa Fe Dam and the Whittier Narrows Basin is soft-bottomed with riprap sides. LACDPW has constructed a rubber dam in the San Gabriel River channel just downstream of the Walnut Creek confluence which can impound up to 400 AF (0.5 million m^3) of water in a 60 acre (24 hectares) area.

Whittier Narrows Dam

The Rio Hondo Coastal Basin Spreading Grounds are located on the banks of the Rio Hondo south of Whittier Boulevard, 2 miles (3.2 km) downstream from Whittier Narrows Dam. The basins cover approximately 570 acres (231 hectares) and have a long-term infiltration rate of about 150 cfs (4.3 m^3/s). The spreading grounds are owned and operated by LACDPW. LACDPW utilizes three large tainter gates across the Rio Hondo to divert flow to three separate intake structures. In addition, smaller flows are diverted via a small rising water sluice gate on the upstream side of the Rio Hondo outlets at Whittier Narrows Dam to divert flows to spreading facilities. Flow is released to a spreading area along the east bank of the Rio Hondo. The terminal basin at the end of the spreading basin empties to a siphon which delivers water to spreading basins on the other side of the Rio Hondo. Further information on operations of the basins can be found in the Hydrology Appendix.

The San Gabriel River Coastal Spreading Basins are operated by the LACDPW. They are located on the west side of the San Gabriel River between Whittier Boulevard and Washington Boulevard. This spreading facility has a surface area of 128 acres (52 hectares) and as intake capacity of 350 cfs (10 m^3/s). Water is diverted to the grounds by way of a two rubber dams across the soft-bottomed river channel. For the most efficient infiltration rates, LACDPW alternates between the basins. This allows the water in the basins to percolate completely in each basin on a regular basis.

4.5.5 Climate

The San Gabriel Valley experiences typical Southern California weather. Summers are warm with highs normally in the 80's but can reach into the low 100's. Winters are mild with highs in the 60's and 70's with occasional warming by Santa Ana winds from the northeast. Winter nighttime temperatures can dip to the low 30's, but usually remain in the high 40's.

Average annual precipitation is 15.6 inches (39 cm) at Santa Fe and 13.5 inches (34 cm) at Whittier Narrows. The wettest year of record was 1993 with Santa Fe receiving 29.5 inches (75 cm) and Whittier Narrows receiving 24 inches (61 cm) of rainfall.

4.5.6 Geology

Santa Fe

The San Gabriel Mountains are part of the Transverse Range Province, a system of east-west trending mountain ranges and valleys found along the coastal western U.S. These mountains are generally composed of Mesozoic and pre-Mesozoic, igneous and metamorphic rocks. Structurally, the range is a great up-thrown block, bounded by the San Gabriel Fault and the Sierra Madre-Cucamonga fault zone at its south edge and the San Andreas fault zone to the north and east.

The Santa Fe Dam is founded on recent alluvium, underlain by bedrock at an undetermined depth. Water wells drilled in the immediate vicinity were not deep enough to encounter bedrock. The nearest available bedrock data is from two distant water wells, one is about 3 miles (4.8 km) northeast of the dam and the other is located 2 miles (3.2 km) southwest of the dam. Based upon the information from these wells, the depth to bedrock is estimated to be at least 800 feet (244 m) near the upstream edge of the flood control basin and at least 1100 feet (335 m) at the downstream edge of the flood control basin.

Whittier Narrows

The Whittier Narrows Dam is located in an alluvial filled valley between the Puente Hills to the southeast and the Merced Hills to the northwest. The San Gabriel Valley is located to the north of the site, and the Los Angeles Basin is to the south. The elevation of the valley floor ranges from 180 to 250 feet (54.9 to 76.2meters) above sea level.

Whittier Narrows is a relatively thin valley (roughly 2 miles or 3.2 km wide) that was formed by erosion as the San Gabriel River cut through rocks that were lifted across its path. The Puente and Merced Hills were raised in part as a result of thrusting of the Whittier Fault along the south side of the hills. The Whittier Fault is not exposed in the alluvium in the site vicinity.

Bedrock of the Puente Hills and Merced Hills includes crystalline rocks of Mesozoic and pre-Mesozoic age overlain by sedimentary and volcanic rocks that range in age from Eocene to Pliocene. The Pliocene Fernando Formation is the bedrock immediately underlying the Pleistocene and Holocene sediments in Whittier Narrows. The recent sediments above the bedrock are about 800 feet (244 m) thick in the area of the dam.

4.5.7 Land Use

The Federal Government through the Corps of Engineers, owns the land on which the dams and reservoirs are located. The land was acquired after dam construction was authorized. The Corps of Engineers currently leases parcels of land for specific uses. Existing land uses within the basins include recreation areas, a water reclamation plant, agricultural lands, and utilities. Flow easements have also been acquired by the Corps over pre-dam facilities at Whittier Narrows including the oil research plant and utilities. Development within the basins includes recreation facilities, wildlife areas, and water conservation facilities. Current land use is show on Exhibits 5 and 6.

The Corps of Engineers and several non-Federal sponsors, under the Corps' Section 710 cost sharing program for recreation, have developed recreation areas within the reservoirs. Recreation facilities at Corps of Engineers' projects were determined to be in the public interest to meet recreational demands since the Los Angeles area has very few recreation facilities per capita when compared to the rest of the nation. The need for additional recreation facilities and open space is documented in the Los Angeles County Recreation Plan 2000. The non-Federal sponsor for most of the cost-shared recreation development is the Los Angeles County Department of Parks and Recreation (LACDPR). Additional information on recreation facilities at each basin can be found in the Recreation Appendix.

Wildlife areas have been developed at each facility on land that was originally set aside as mitigation for recreation development. These areas have established high value habitat with diverse wildlife populations. These areas also have the potential for use by several endangered species including the least Bell's vireo.

Other land uses within the basins include utility leases, flow easements for utilities, and pre-dam construction uses including oil wells in Whittier Narrows. Many of these leases are long term and continue for the next 25 to 50 years. A complete list of outgrants is provided in the Real Estate Appendix.

<u>Santa Fe Basin</u>

The Santa Fe basin mostly consists of open space reserved for Corps of Engineers' operations, recreation facilities, and an extensive network of connected spreading basins built and maintained by LACDPW.

The LACDPR leases 836 acres (338 hectares) out of a total of 1,730 acres (700 hectares) in the basin. Approximately 400 acres (162 hectares) have been developed for recreation. Development includes extensive park landscaping and picnic areas, a 70-acre (28 hectares) lake with swimming beach, boat docks and a fishing pier, group tent camping areas, a wildlife interpretive center, general parking areas, and park maintenance facilities. The northern shore of the recreation lake is designated as a limited use Wildlife Management Area. Bicycle and equestrian trail linkages can be found throughout the basin. These trails also provide access to the Los Angeles River/Rio Hondo (LARRIO) and San Gabriel River trail systems.

Whittier Narrows Basin

The major land uses within the Whittier Narrows Basin are recreation, water treatment plants, and oil extraction facilities.

Whittier Narrows recreation facilities have been developed in compliance with the existing master plan. Whittier Narrows Basin includes approximately 2,470 acres (1000 hectares) of land. Approximately 1,331 (539 hectares) acres are leased by LACDPR and another 40 acres (16 hectares) are leased by the City of Pico Rivera. Recreation development includes picnic areas, a fishing lake, a golf course, sports fields (organized and open space), equestrian trails, shooting ranges, and tennis and other sports courts. LACDPR also operates the existing wildlife sanctuary and nature center.

The Whittier Narrows Water Treatment Plant is located within the basin on the west side of Rosemead Boulevard, between the Pomona Freeway and San Gabriel Boulevard. The water reclamation plant discharges 12 to 13 million gallons per day (mgd) (45 to 49 million liters per day) of tertiary water into the Rio Hondo for groundwater recharge in downstream spreading grounds. Reclaimed water is also used to irrigate recreation areas in the basin.

The plant was constructed to be fully functional during flood events. At the 500-year flood water elevation, 22 feet (6.7 m) of water would inundate the plant site. To allow for this condition, major electrical, mechanical, and control equipment is housed on the second floor of the control building. As built plans show a ground floor finish elevation of 208.9 ft NGVD (64.4 m NAVD). The upper walkways above the tanks are at elev 220.0 ft NGVD (67.8 m NAVD) and the top of the treatment tanks is at elev 218.5 ft NGVD (67.3 m NAVD). Water quality testing is performed daily as specified by the plant's water discharge permit.

Two other water reclamation plants, the Pomona Water Reclamation Plant and the San Jose Reclamation Plant, discharge water into the San Gabriel River. Both are owned and operated by the Los Angeles Sanitation District. The Pomona Plant discharges about 2,000 AF (2.5 million m^3) per year to San Jose Creek and flows enter the Whittier Narrows basin via the San Gabriel River. The San Jose plant has three outlets, two to San Jose Creek and a pipeline to the San Gabriel River Coastal Spreading Grounds. The annual discharge is approximately 20,800 AF (26 million m^3).

Approximately 70 oil wells are located in Whittier Narrows below elevation 230.0 ft NGVD (70.8 m NAVD). The wells pre-date the construction of the dam and are part of the Montebello Oil Field discovered in 1918. During field surveys in January 1997 of the 33 oil wells located at or below elevation 215.0 ft NGVD (66.2 m NAVD), only 18 of these wells were actively pumping.

When water conservation practices began in 1956, none of the oil wells were impacted by the elevated water level. In 1977 when the water conservation pool was raised to elevation 201.6 ft NGVD (62.2 m NAVD), earthen berms were constructed to elevation 206.0 ft NGVD (62.5 m NAVD) by LACDPW to protect the oil wells. A preliminary review of the oil well leases and other documentation by the Corps of Engineers Real Estate Division indicates that the Corps reserved the right to inundate the wells with water for flood control operations when the dam was constructed. No allowance was made for inundation for water conservation purposes. Consultation with Office of Counsel indicates concurrence, based on similar leases at Prado Dam. LACDPW will follow up on mitigation requirements and determine implementation to suit their goals.

A review of historical land use in the Whittier Narrows basin area is included in the HTRW Appendix.

4.5.8 Biological Resources

The discussion of existing environmental resources is based on searches of existing literature, site visits, surveys, and meetings between the Fish and Wildlife Service (FWS) and the Corps of Engineers. Areas of particular concern include the high value habitats. Coordination with the FWS is required to establish the avoidance and mitigation measures to protect these habitats. The endangered least Bell's vireo was identified as the primary species of concern in the basins. A vireo was heard at each of the established riparian habitats at both Whittier Narrows and Santa

Fe Dams in the late spring 1996. Vireos typically inhabit riparian areas such as is found at both Santa Fe and Whittier Narrows as well as in a portion of the San Gabriel River Channel.

Santa Fe Basin

Habitat found within the Santa Fe basin can be categorized into six relatively distinct biological communities. They are: (1) riparian, (2) ephemerally inundated, (3) landscaped, (4) highly disturbed wash, (5) Intermediate alluvial fan scrub, and (6) mature alluvial fan scrub. The landscaped recreation area also has limited biological significance providing forage areas for local birds.

The eastern portion of Santa Fe basin includes a Wildlife Management Area (see **Exhibit 5**). A Wildlife Management Area designation denotes important and sensitive habitat areas or vegetative resources that are rare and extremely scarce in California. These areas require protection from further degradation or custodial enhancement if possible. The Wildlife Management Area and large undeveloped area of the flow channel attracts a variety of species from the surrounding foothills. The riparian habitat in the channel has the potential for use by the endangered least Bell's vireo. There is evidence that these birds are using the area; a male was heard in the spring of 1996, but no evidence of nesting was found. The Wildlife Management Area currently consists primarily of mature alluvial fan scrub habitat. This type of habitat, once widespread in southern California, is now confined to a few isolated locations due to urban development. The relative isolation of the basin has allowed the development and preservation of this habitat area. Local chapters of several national environmental organizations monitor these areas with the objective of preventing loss or degradation of the habitat. To preserve and maintain the high value of the area, vehicle access is limited to maintenance vehicles. The Visitor Center and parking lot are located near the southern edge of the Management Area.

Table 4.3 shows Federally-listed endangered and threatened species that are known to occur or could potentially occur in the Santa Fe Basin.

Table 4.3 Species of Concern Within the Study Area

Species	Known	Potential
Mammals:		
Sensitive:		
San Diego black-tailed jackrabbit	*	
California leaf-nosed bat		*
Greater mastiff bat		*
San Diego desert woodrat		*
Los Angeles pocket mouse		*
Birds:		
Endangered:		
Least Bell's vireo		*
Threatened:		
Southwestern willow flycatcher		*
Sensitive:		
California gnatcatcher		*
California horned larks	*	
San Diego cactus wren	*	
Southern California rufous-crowned sparrow		*
Reptiles:		
Sensitive:		
San Diego horned lizard	*	
Coastal western whiptail lizard	*	
Bernardino ring-necked snake		*
Two striped garter snake		*
Plants:		
Endangered:		
Slender-horned spineflower		*
Threatened:		
Thread-leaved brodiaea		*
Sensitive:		*
San Gabriel Mountain dudleya		*
Many-stemmed dudleya		*
San Gabriel bedstraw		

Whittier Narrows Basin

Vegetation within the Whittier Narrows basin includes several valuable wildlife habitats. These include an extensive riparian area due primarily to revegetation efforts within the Nature Area. The Nature Area and the open operations area behind the dam currently attract a variety of wildlife. The Nature Area was developed in cooperation with the Audubon Society as mitigation for recreation development in the basin. The nature area and adjacent riparian habitat has the potential for use by the endangered least Bell's vireo. A least Bell's vireo was heard in the area during mating season (spring 1996), but further evidence of nesting was not found. The area is also potential habitat for the threatened southwestern willow fly catcher and other sensitive species listed in **Table 4.3**. Riparian habitat has developed in and adjacent to the San Gabriel River, the diversion channel to the Rio Hondo, the soft-bottomed reaches of the Rio Hondo and several outflow creeks within the basin. Over 200 species of birds including migratory waterfowl have been identified in the area. There are several areas of baccharis scrub habitat at higher elevations in the undeveloped areas adjacent to the riparian habitat but these areas are somewhat disturbed and are considered low in value. No alluvial fan scrub exists within the basin. Freshwater marsh areas are located near the outlet works to the Rio Hondo where current water conservation operation provides habitat water requirements. The value of this area is potentially compromised by the expanding patches of the *Arundo donax*, an invasive, exotic giant reed.

No coastal sage or alluvial fan scrub remain within the basin. Areas of baccharis scrub can be found adjacent to riparian habitat in the operations area south of San Gabriel Boulevard. Other vegetated areas include the open non-native grasslands and landscaped recreation areas used as foraging areas by local birds. The area near Legg Lake is one of the most frequently visited bird watching areas in Southern California.

4.5.9 Cultural Resources

Under criteria established in the National Historic Preservation Act, cultural resources are considered to be any historic or prehistoric relics, artifacts, sites, monuments, and other properties on, or determined eligible for listing on, the National Register of Historic Places (NRHP). Eligibility for the National Register of Historic Places can be based on (a) an important event in history, (b) association with important people, © important building design or landscape, or (d) of scientific value. Sites that are less than 50 years of age must be of significant or remarkable importance to be eligible. Cultural resource preservation regulations prescribe detailed procedures for related activities, which include reconnaissance surveys, literature searches, site delineation, subsurface testing, extensive data recovery excavation, photometric mapping, documentation, and curation.

Santa Fe Basin

Surveys of the Santa Fe basin conducted in 1984 produced four flakes (debris of lithic tool manufacturing). Three were determined to be associated with each other, but with no other discernable archeological features. The fourth was determined to be an isolated find. There are several historic sites within the basin including the railroad bridge north of the Foothill Freeway and gabions located to the east side of the existing channel constructed during the 1930's under auspices of the WPA. An Historic Properties Management Plan for Santa Fe Dam is currently being prepared. This plan will include a complete summary of previous investigations.

Whittier Narrows Basin

A 1996 evaluation of historic properties within the basin revealed three previously recorded sites. One of the sites has been determined to be eligible for listing on the Nation Register of Historic Places. The other two sites require further investigation before eligibility can be determined. None of the sites would be effected by the proposed water conservation alternatives. A Historic Properties Management Plan for Whittier Narrows is currently being prepared. This plan will include a complete summary of previous investigations as well as recommendation for future management of resources in the basin.

4.5.10 Water Quality

Santa Fe Dam

The Santa Fe Dam is operated primarily for flood control and is not normally used to impound water for significant periods of time. Due to the relatively undeveloped nature of the watershed upstream of the dam, runoff entering the reservoir is generally of good quality. There are no water quality stations in the Santa Fe basin.

Whittier Narrows Dam

The Whittier Narrows Dam is operated for flood control and water conservation, if water is available and weather is permitting. Water quality of the San Gabriel River north of Whittier Narrows is considered to be good. LACDPW routinely conducts conventional analyses of area water for minerals, dissolved solids, and pH. These tests are conducted at monitoring wells within and downstream of the basin. Water quality monitoring is conducted as a condition of the existing groundwater recharge permit. Both surface and groundwater are considered to be good quality and currently neither exceeds Federal or State standards for drinking water. Further discussion is presented in the Hydrology Appendix.

The Environmental Protection Agency is currently working on a plan to deal with a plume of contaminants in the shallow aquifer upstream of Whittier Narrows Dam. No data currently exists to indicate that implementation of the water conservation plan would adversely effect the planned clean-up action. However, the potential exists that increased incidental infiltration behind the dam from the water conservation pool could result in impacts to the proposed clean-up

4.5.11 Air Quality

Both Santa Fe and Whittier Narrows are located in the South Coast Air Basin which is under the jurisdiction of the South Coast Air Quality Management District. Air quality is often poor with high levels of ozone from late spring through early fall. Infrequent Santa Ana winds in the fall and winter result in generally good air quality. Air quality has generally improved over the last few years, due to stricter pollution control; however, ozone still often exceeds Federal and State standards. A further discussion of air quality conditions is presented in the Draft EIS/EIR.

4.5.12 Groundwater Quality

Groundwater quality is considered to be good within the project area. Water releases following storm events reduce the concentration of total dissolved solids (TDS) in the groundwater downstream of the dams. The Environmental Protection Agency monitors several wells in the project area. Elevated nitrate levels that did not exceed Federal or State drinking water standards were found in these wells. Monitoring has also found volatile organic compounds in the groundwater basin outside of the project area. Groundwater quality would be improved through additional infiltration of high quality water due to water conservation and slow release of captured and imported water to recharge facilities. The Main San Gabriel Water Quality Authority currently develops and implements water quality improvement plans and projects as well as coordinating on-going testing and any necessary clean-up with the Environmental Protection Agency.

4.5.13 Hazardous, Toxic and Radioactive Waste (HTRW)

<u>Santa Fe Basin</u>

No HTRW materials are known to exist in the Santa Fe Basin.

Whittier Narrows Basin

There are over 70 oil wells located at or below elevation 230.0 ft NGVD (70.8 m NAVD) within the basin. There are 18 active oil wells at or below elevation 215.0 ft NGVD (66.2 m NAVD) that would be impacted if the water was raised to this higher elevation. The well-head cellars are typically pumped dry prior to the beginning of flood season. The State of California Department of Oil and Gas inspects the wells yearly to ensure compliance with department regulations. Currently, inundation due to flood events is not considered a problem as water could be drawn down within several days and the wells restarted. The Department of Oil and Gas has issued several Notices of Violation in the last few years for oil spillage around the well sites and cellars full of water or oil that needed to be emptied. Further discussion is presented in the HTRW Appendix.

The Whittier Narrows Water Reclamation Plant (located south of the Pomona Freeway on the west side of Rosemead Boulevard) houses tanks for chlorine, sulfur dioxide, liquid cationic polymer, aluminum sulfate, dry polymer, and waste oil. Storage capacity is limited to a one week supply to minimize potential accidental spills. The plant currently has a Los Angeles County Fire Department Hazardous Materials Business Plan, a South Coast Air Quality Management District permit for wastewater discharge of greater than 50,000 gallons per day (190,000 liters per day), and a National Pollutant Discharge Elimination System (NPDES) permit.

4.5.14 Recreation

Santa Fe Basin

Recreation facilities have been developed by the Corps of Engineers and the Los Angeles County Department of Parks and Recreation (LACDPR) under the Santa Fe Master Plan. The LACDPR leases 836 acres (338 hectares) out of a total of 1,730 acres (700 hectares) in the basin. Approximately 400 acres (162 hectares) have been developed for recreation. Development includes extensive park landscaping and picnic areas, a 70-acre (28 hectares) lake with swimming beach, boat docks and a fishing pier, group camping areas, a wildlife interpretive center, general parking areas, and park maintenance facilities. The north shore of the recreation lake is designated as a limited use Wildlife Management Area. Bicycle and equestrian trail systems and/or linkages occur throughout the reservoir as well as access to the Los Angeles River/Rio Hondo and San Gabriel River trail systems.

Whittier Narrows Basin

Whittier Narrows recreation facilities have been developed in compliance with the existing master plan. Whittier Narrows Basin includes approximately 2,470 acres (1000 hectares) of land. Approximately 1,331 acres (539 hectares) are leased by LACDPR and another 40 acres (161 hectares) are leased by the City of Pico Rivera. Recreation development includes picnic areas, Legg Lake, a golf course, sports fields (organized and open space), equestrian trails, shooting ranges, and tennis and other sports courts. LACDPR also operates the existing wildlife sanctuary and nature center.

4.6 Future Without-Project Conditions

Future without-project conditions reflect future conditions such as population changes and changes in water supply and demand, and future environmental conditions that could be reasonably expected in the absence of any proposed water conservation project. Projections from local agencies were used to determine infrastructure needs and costs.

4.6.1 Basin Population

Population projections by the Southern California Association of Governments (SCAG) and the San Diego Association of Governments (SANDAG), within the Los Angeles Basin serviced by the Metropolitan Water District of Southern California (MWD) indicate that the population in Los Angeles County will increase from the current 8.7 million to 9.9 million by the year 2010. Expected population growth is shown in **Table 4.4**.

Table 4.4 Residential Population in LA County, FY97 and 2010 [1]

FY97	2010	Change, 1989-2010	% Change, 1989 to 2010
8,690,000	9,890,000	+1,200,000	14.1

[1] Source: SCAG, 1990, Integrated Resource Plan

4.6.2 Water Supply and Demand

Water supplies for the Los Angeles County area are currently comprised of local and imported water. According to information provided by the MWD, local groundwater, surface water, and reclaimed wastewater supplies approximately 30% of the area's current water needs. Imported water from the Colorado River and from northern California currently provide the remaining 70% of regional needs. This includes imported water used in the artificial recharge of the local groundwater supply.

Future water demands have been forecast by the MWD through the year 2010. Water demand projections beyond the year 2010 are currently under study by SCAG and by MWD.

Increased municipal and industrial water demands account for most of the projected increase in demand. **Table 4.5** shows a summary of current urban water use in southern California. Approximately 66% of all urban water use occurs in the residential sector. Non-residential uses account for 26%. The remaining 8% is unaccounted for, and is most likely lost through evaporation and leakage.

Table 4.5. Municipal and Industrial Water Use by Sector

Sector	Percentage
Residential	66
Commercial	17
Industrial	6.0
Public/Municipal	3
Other/Losses	8

Source: Integrated Resources Plan-1996

The projected municipal and industrial water demands in MWD's service area were generated by incorporating population and other demographic projections made by SCAG and the San Diego Association of Governments (SANDAG) into the Municipal and Industrial Needs (MAIN) Water Demand Model developed by the U.S. Army Corps of Engineers' Institute of Water Resources (IWR). The model was used to project municipal and industrial water use for the MWD service area through the year 2010. The results, shown in **Table 4.6**, indicate that municipal water demand in Los Angeles County area will increase by 9.5% by the year 2010. Water purveyors are currently studying potential sources of water to meet future demands. Additional water supplies are being sought through additional groundwater recharge, increased importation of water from northern California, and potentially purchasing water rights and land in the San Joaquin Valley.

Table 4.6 Projected Municipal and Industrial Water Needs of the MWD Service Area in Los Angeles County

Water Needs, FY97 (acre-feet/year)	Projected Water Demand 2010 (acre-feet/year)	% Change
1,690,000	1,850,000	9.5

Source: Integrated Resource Plan-1996

4.6.3 Biological Resources

Santa Fe Basin

Flood water inundation could impact vegetation in the future. The impacts would depend on the magnitude of the flood event and the length of time the habitat remains inundated. The presence of Arundo (*Arundo donax*) in the river channel above the Foothill (210) Freeway remains a threat to existing habitat. Arundo is an invasive exotic species that provides little habitat benefits. The existing Arundo could spread below the freeway into the river channel of the basin. This could severely impact the more valuable habitat currently found in this area.

Clearing for maintenance and debris removal in the operations area behind the dam occurs yearly. This limits the potential expansion of current habitat areas.

Whittier Narrows Basin

Flood water inundation could impact vegetation in the future. The impacts would depend on the magnitude of the flood event and the length of time the habitat remains inundated. These areas currently have little to no habitat value. Existing riparian areas of the river channel and small creeks within the basin will continue to experience periodic loss due to scour during high water flood events.

Flood water inundation could also impact the existing oil wells in the basin. A levee was constructed by the County to protect the oil wells for current water conservation practices. While designed to be inundated to a certain degree, there is the potential for the oil wells to be flooded in the future with potential impacts to the surrounding area.

Clearing for maintenance and debris removal in the operations area behind the dam occurs yearly. This limits the potential expansion of current habitat areas.

4.6.4 Land Use

Santa Fe Basin

The LACDPR does not currently have any plans for additional recreation development in the Santa Fe Basin. Limiting factors include the presence of high value habitat areas such as the Wildlife Management Area, the need to mitigate any additional development, existing recharge practices, and Corps of Engineers operations areas. The LACDPR has considered the construction of a golf course on the west side of the basin, but since this would be constructed by a concessionaire, plans have been abandoned due to lack of interest. The basin will continue to be operated primarily for flood control and recreation purposes.

Whittier Narrows Basin

The LACDPR capital investment program calls for additional recreational facilities to be built at Whittier Narrows to meet existing and future recreation demands. With the projected changes in population demographics in the area, different types of facilities are required to meet recreation demands. The 5-year plan of development identifies the desire to construct a new soccer complex including a field with permanent seating, concession areas, additional fields and parking. An amphitheater with parking at the north end of the basin with seating for 5,000 people is also a component of the 5-year plan. Preliminary public review of these potential projects has raised the issues of increased traffic through the basin and the need of the LACDPR to provide a flood evacuation plan for the amphitheater proposal.

The basin will continue to be operated primarily for flood control, recreation, and existing water conservation operations as authorized.

4.7 Study Methodology

Plan formulation included the application of hydrologic, civil design, economic, geotechnical, environmental, and hydraulic analyses to the specific problem of developing water conservation opportunities at each reservoir. Each respective discipline identified needs and constraints associated with each alternative. Reconnaissance phase alternatives were further refined and evaluated. The LACDPW request to maximize water conservation presented the opportunity to develop additional alternatives which could provide greater benefits than those alternatives considered previously. Coordination between disciplines provided opportunities to improve and refine solutions.

4.7.1 Hydrologic Studies

The Hydrology Study investigated available water conservation opportunities at Santa Fe and Whittier Narrows Dams. The Hydrology Appendix provides analysis of the surface water yield, groundwater conditions, requirements and impacts in the alternative selection process, groundwater and surface water quality, and selected water conservation alternatives at Santa Fe and Whittier Narrows Dams. Flood forecasting was incorporated to provide the opportunity to store water above the debris pool level during the flood season to increase water yield.

The Hydrology Study was conducted under the assumption that all authorized improvements to the Rio Hondo and the Los Angeles River would be in place at the time a water conservation plan is implemented. The hydrology for the LACDA Review Study (1991) assumed the debris pool at Santa Fe would be filled at the start of any flood. Hence, modifications to the operating plan for water conservation within the debris pool at Santa Fe or the existing water supply pool at Whittier Narrows would not have any significant impact on the downstream discharge-frequency relationships for any location in the LACDA basin. There would be no decrease or increase in the level of flood protection provided by either of the dams. Elevation-frequency-duration relationships for current conditions and for the selected alternatives have also been determined for both reservoirs.

The operations for Santa Fe and Whittier Narrows were modeled using the HEC-5 computer program (Simulation of Flood Control and Conservation Systems). The current approved operation plan for each basin was modeled to estimate the current water conservation yields at the downstream groundwater recharge facilities. August 1995 surveys were used to estimate current storage/elevation relationships for the base condition. Average annual yields were determined for each alternative. In addition, elevation-frequency-duration curves were developed for each basin in order to assess environmental and recreation impacts. Refer to Hydrologic Appendix for additional information.

4.7.2 Hydraulic Studies

The focus of the hydraulic study was on the water conservation alternatives identified in the feasibility stage of the study. Hydraulic structure requirements are based on discharges either identified as the original project flood event or quantities from hydrologic analyses performed for this feasibility study.

Topographic maps from aerial photos taken in 1995 were used to establish the existing conditions. A digital terrain model file was developed using Inroads software. Horizontal surfaces were created at one meter intervals to determine a volume vs. elevation relationship for each of the flood basins.

Estimates for sedimentation were obtained from previous surveys. Sediment deposition was estimated by comparing the available storage volumes at a certain "benchmark" elevations and trapped sediment volumes.

Interior hydraulic structures were designed based on an estimated intercept surface runoff volume at the 20-year interval flood and the reservoir design flood event. Further information is discussed in the Hydraulics Appendix.

4.7.3 Geotechnical Studies

Studies were conducted in order to evaluate the geotechnical impacts of the proposed water conservation operations. The most critical issue was the seismic stability of the existing embankments. The following procedure was used in order to evaluate seismic stability:

1. Ground motions at the sites due to postulated earthquake events were estimated.
2. Based on the results of field and laboratory investigations and construction records, representative cross sections of the embankment, to be used for analysis, were developed.
3. Pre-earthquake initial stresses within the embankment and foundation using static stress analysis procedures were determined.
4. Earthquake-induced accelerations and stresses within the embankment and foundation using dynamic analysis procedures were evaluated.
5. The cyclic strength of the embankment and foundation soils using in-situ test results were evaluated.
6. The potential for liquefaction and the potential for reduction in undrained strength

(if any) and/or the residual strength of soils comprising the embankment and foundation were evaluated.

7. The post-earthquake stability of the embankment and foundation using either the reduced undrained strength or residual strength established in Step 6 were evaluated.
8. If the embankment section was found to be stable, the corresponding value of the yield acceleration and the magnitude of permanent deformation were estimated.

Other issues addressed include the adequacy of downstream wells and the design for interior levees and modification to the roads.

4.7.4 Civil Design

The design work included the design of raised roads, levee alignments, drainage structures through levees, and modifications and replacement required for mechanical and electrical systems for each alternative. Preliminary designs and cost estimates for each alternative plan have been developed.

The work effort included field reconnaissance and review of existing data pertinent to analyzing each alternative. Results of Hydraulic and Geotechnical investigations have been incorporated into each alternative. A description of the design features required to provide water conservation for the water elevation proposed was developed for each alternative.

Quantities and cost estimates for each alternative include present worth computations for future maintenance and replacement costs. The selected plan has been developed to the required level of detail for a feasibility report.

4.7.5 Real Estate Studies

Real estate studies provided information regarding land use including a review of existing leases, flow easements, and legal stipulations. The value of land required for the various alternatives was estimated. The loss of value associated with inundation was calculated based on the sale price of similarly developed land. Preliminary value of the oil reserves and potential mitigation measures were calculated based on the oil field reserves value and comparisons with mitigation from previous projects. A review of the legal documents pertaining to certain oil wells was performed to determine the Corps potential right to inundate the oil wells for the purposes of water conservation.

4.7.6 Environmental Studies

A Draft Environmental Impact Study/Environmental Impact Report (EIS/EIR) is being prepared to identify and document potential environmental impacts associated with water conservation opportunities at Santa Fe and Whittier Narrows Basins.

The F3 phase of the feasibility study defined the without-project or existing conditions of the study areas. The F4 phase of the study develops and evaluates the alternative plans. This F5 document refines the alternative plans and the potential effects on the resources associated with each of the alternatives developed in F4 phase of the study, and, from these alternatives, a selected plan is identified.

The factors considered include biological resources, cultural resources, land use, recreation, water and air quality, noise, and hazardous, toxic, and radioactive waste. Personnel from the Corps, Fish and Wildlife Service and a private environmental consulting firm collected and evaluated data. Data from new and existing literature was evaluated, including completed inventories of listed and candidate plant and animal species, field reconnaissance surveys, and coordination with other agencies including the U.S. Fish and Wildlife Service.

The Fish and Wildlife Service has provided a Planning Aid Report identifying specific impacts of individual alternatives to existing biological resources. In addition this report recommends how these impacts could be avoided, and any mitigation measures that would need to be implemented.

The Fish and Wildlife Service has also provided a Draft Coordination Act Report to assist the Corps in determining a preferred plan. This is included as an Appendix in the EIS/EIR.

4.7.7 Cultural Resources

Sites within the Area of Potential Effect (APE) which may be eligible for inclusion in the National Register of Historic Places will be identified. This determination has been submitted to the State Historic Preservation Officer (SHPO) for their concurrence prior to the completion of the EIS/EIR. If impacts are likely or unavoidable, a mitigation plan would be developed through coordination with the SHPO and, if necessary, the Advisory Council of Historic Preservation (ACHP). The cultural resource studies are being conducted in accordance with the requirements of Section 106 of the National Historic Preservation Act (36 CFR 800).

4.7.8 Economic Studies

Benefits for each alternative are calculated as the difference in the average annual cost of municipal and industrial water with and without the proposed water conservation plans. According to ER 1105-2-100, page 6-5, paragraph 6-7, benefits for a particular plan are measured by the resource cost of the alternative most likely to be implemented in the absence of that plan.

Water demand was forecast and compared to available local groundwater supply under without-project conditions. Additional sources of supply in the study area include imported water (both seasonal storage, and treated non-interruptible) from the Metropolitan Water District (MWD). The resource cost per acre-foot of water from these sources is identified. The cost of meeting the anticipated water deficit was projected by ranking the available alternatives by cost, and selecting the least costly. Under with-project conditions, conserved water would be an additional local source of water to help meet urban demand.

This report is done in conformance with all applicable regulations. Average annual costs and benefits are calculated using a 7⅛ percent discount rate (as dictated by the water resource council) and a 50 year project life. Backup data is on file in the Los Angeles District. The price level is October 1997.

The economic analysis presents a feasibility level evaluation of the National Economic Development (NED) plan benefits and costs associated with water conservation alternatives at Santa Fe and Whittier Narrows. For this study, this analysis assumes water conservation would provide benefits equal to the cost forgone of obtaining the water from MWD to replenish the groundwater supply. The NED plan uses the least-cost alternative approach. In addition, a Locally-Preferred Plan may be identified and selected even though it may not provide the greatest net benefits or have the largest benefit/cost ratio of all of the alternatives investigated. This is especially true since water conservation-associated modifications to the dams and/or operations are fully non-Federally funded. Additional information on assumptions and criteria under which alternatives were evaluated and costs assigned is located in the Economic Appendix.

4.7.9 Recreation Analysis

The purpose of the recreation analysis is to assess the impacts of water conservation alternatives on existing recreation facilities. The process includes identifying existing facilities, the recreation market, evaluation criteria, accessability, potential recreation "supply" opportunities within the reservoir and associated carrying capacities, "demand" factors including environmental and population demographics, conditions, and overall evaluation of impacts to the recreation experience.

Results are evaluated in monetary value, including the loss of recreation benefits due to water conservation inundation of facilities. The average number of users multiplied by the unit day value produces a monetary value. Impacts and user value are identified in the discussion of recreation impacts under each alternative.

4.8 Formulation of Alternative Plans

In scoping meetings following the F3 phase, the non-Federal sponsor (LACDPW) requested that the Corps investigate the optimal water storage level at each basin. Since that time, the Corps has reviewed the potential associated impacts to the existing resources and facilities at each basin. Optimization of water conservation levels was also performed.

Flood forecasting during the flood season was also incorporated into the alternative plans. Flood forecasting would allow for water to be stored within the area currently reserved for the flood control pool. When a flood event is forecast, the water conservation pool could be drawn down to below the level of the flood control pool, in order to provide flood protection to the downstream reaches. The alternative plans were developed in such a way that any water used for water conservation above the elevation reserved for flood control would be evacuated if a storm is forecast. Flood forecasting would alert the reservoir operation center personnel of approaching storms far enough in advance to allow for the flood control pool to be emptied.

To optimize water storage for water conservation purposes at Whittier Narrows, average annual yields were developed for water surface elevations of 209.0 and 215.0 ft NGVD (64.4 and 66.2m NAVD) as proposed in the Reconnaissance Report and during the F4 phase. At Santa Fe Dam average annual yields were developed for water surface elevations 456, 463 and 475 ft NGVD (139.8, 141.9, and 145.6 m NAVD).

Alternatives were developed based on information gathered during the reconnaissance and feasibility phases of this study. Water conservation alternatives were evaluated on their cost, benefits, and relative ability to respond to the identified project opportunities within the identified project constraints.

The alternatives within each dam differ primarily in the elevation of water impounded for conservation purposes. As described in Section 4.7, "Definitions," there are several terms used depending on the season of the year in which conservation activities take place. All alternatives will use the described nomenclature. The assumption is made that the water surfaces indicated are maximum elevations for each conservation scenario; therefore, the ability of conservation activities to maintain these elevations is based on an adequate amount of inflow.

4.8.1 Santa Fe Dam

<u>ALTERNATIVE 1: No-Action Alternative</u>

This alternative does not involve any changes to existing facilities or operations at Santa Fe Dam for the purpose of water conservation. The average annual yield is 17,300 AF.

<u>ALTERNATIVE 2: Water Conservation Pool Only</u>

- Water Conservation Pool: 456 ft NGVD (139.8 m NAVD)
- Buffer Pool: none
- Seasonal Pool: none

This alternative results in an overall water conservation yield of 18,000 AF (22 million m^3). This alternative involves performing reservoir maintenance during October to ensure that the capacity of the flood pool would be available at the start of flood season. This alternative does not include flood forecasting because the water level would never encroach upon the flood control capacity.

Since this is the elevation of the existing debris pool, there would be no need for additional approval to modify the authorized function of the basin.

<u>ALTERNATIVE 3: Maximum Pools at 463 ft NGVD (141.9 m NAVD)</u>

- Water Conservation Pool: 456 ft NGVD (139.8 m NAVD)
- Buffer Pool: 463 ft NGVD (141.9 m NAVD)
- Seasonal Pool: 463 ft NGVD (141.9 m NAVD)

This alternative results in an overall water conservation yield of 19,700 AF (24 million m^3). Flood forecasting would be utilized; no additional gages would be required.

Elevation 463 ft NGVD (141.9 m NAVD) was identified since it is the maximum elevation that may be inundated without causing adverse impacts to the mature alluvial fan scrub in the Wildlife Management Area north of the recreation lake.

Alternative 3 would also involve the addition of a levee to elevation 466 ft NGVD (142.8 m NAVD) within the Santa Fe Basin to protect adjacent recreation facilities from inundation. Two alternatives to provide interior drainage to the area upslope of the levee were carried forward to the economic evaluation. These variations would affect the cost of the alternative, but not the benefits. The two options examined were as follows:

- **Option A:** This option would involve the construction of two-3 foot (0.9 m) diameter reinforced concrete pipe (RCP) culverts through the proposed levee. These culverts would drain ponded water on the upslope side of the levee when no water is impounded for conservation. Each culvert would be the width of the levee, approximately 80 feet (24.4 meters). In order to drain water ponded behind the levee during water conservation operations, an additional RCP storm drain measuring 7 feet (2.1 meters) in diameter would be constructed through the proposed levee, underground for approximately 4,790 feet (1460 m) to the dam, and finally through the easternmost cell of the dam's outlet works. The inlet for all three pipes would be at the lowest point upstream of the proposed levee. This option would allow the recreation area to drain while maintaining the elevation of the water conservation pool. This option is examined as Alternative 3A in the economic evaluation.

- **Option B:** This option includes the two-3 foot (0.9 meter) diameter reinforced concrete pipe (RCP) culverts described in Option A for drainage of ponded water when a lower water conservation pool exist within the basin. During conservation operations, however, this option would use a pump station located on a pad on the top of the proposed levee which would lift the ponded water and release it into the conservation pool area. The pump station would include three impeller-type pumps powered by a 250 horse-power electric motor. This option would allow the recreation area to drain while maintaining the elevation of the water conservation pool. This option will be examined as Alternative 3B in the economic evaluation.

ALTERNATIVE 4: Maximum Pools at 475 ft NGVD (145.6 m NAVD)

- Water Conservation Pool: 456 ft NGVD (139.8 m NAVD)
- Buffer Pool: 475 ft NGVD (145.6 m NAVD)
- Seasonal Pool: 475 ft NGVD (145.6 m NAVD)

This alternative results in an overall water conservation yield of 21,500 AF (27 million m^3). Flood forecasting would be utilized; no additional gages or services would be required.

Elevation 475 ft NGVD (145.6 m NAVD) is the lowest invert elevation of the Santa Fe Basin Spreading Facilities to the west of the flow channel. Project alternatives with higher elevations would impact existing groundwater recharge activities in the spreading facilities. The inflow to these basins is from County-operated dams upstream of Santa Fe Dam.

4.8.2 Whittier Narrows Dam

ALTERNATIVE 1. No-Action Alternative

This alternative does not involve any changes to existing facilities or operations at Whittier Narrows Dam for the purpose of water conservation. Existing water conservation storage to elevation 201.6 ft NGVD (62.2 m NAVD) would continue. The average annual yield is 60,600 AF.

ALTERNATIVE 2: Maximum Pools at 209.0 ft NGVD (64.4 m NAVD)

- Water Conservation Pool: 201.6 ft NGVD (62.2 m NAVD)
- Buffer Pool: 209.0 ft NGVD (64.4 m NAVD)
- Seasonal Pool: 209.0 ft NGVD (64.4 m NAVD)

This alternative results in an overall water conservation yield of 63,500 AF (78 million m^3). This is the highest pool elevation that can be attained with minimal impacts to existing roads and recreation facilities. An additional levee around the water reclamation plant to protect it from inundation would be constructed. The levee would provide protection against inundation of chemical tanks and thereby would preclude the need for additional mitigation measures. Public perception regarding the quality of reclaimed water outflow was also taken into consideration. Oil wells would be inundated as well, without mitigation measures to protect them.

ALTERNATIVE 3: Maximum Pools at 215.0 ft NGVD (66.2 m NAVD)

- Water Conservation Pool: 201.6 ft NGVD (62.2 m NAVD)
- Buffer Pool: 215.0 ft NGVD (66.2 m NAVD)
- Seasonal Pool: 215.0 ft NGVD (66.2 m NAVD)

This alternative results in an overall water conservation yield of 66,100 AF (82 million m^3). A pool elevation of 215 ft NGVD (66.2 m NAVD) would flood the lower level of the water treatment plant. Even though the plant was constructed to be operational during flood conditions, a number of mitigation measures would need to be implemented to provide protection to keep the plant operable. Oil wells would be inundated as well, without mitigation measures to protect them.

ALTERNATIVE 4: Maximum Pools at 215.0 ft NGVD (66.2 m NAVD)

- Water Conservation Pool: 201.6 ft NGVD (62.2 m NAVD)
- Buffer Pool: 215.0 ft NGVD (66.2 m NAVD)
- Seasonal Pool: 215.0 ft NGVD (66.2 m NAVD)

This alternative results in an overall water conservation yield of 65,900 AF (81 million m^3). This alternative would include the same measures as Alternative 3 and would also include an additional levee around the water reclamation plant to protect it from inundation. The levee would provide protection against inundation of chemical tanks and thereby would preclude the need for additional mitigation measures. Public perception regarding the quality of reclaimed water outflow was also taken into consideration.

4.9 Evaluation of Alternatives Plans

The alternatives described above are evaluated on how well they meet the following criteria:

(1) feasibility of modifications to the dam that would be required,
(2) demonstration of federal interest based on economic and environmental criteria,
(3) support of the non-federal sponsor, and
(4) consistency with current policies and budgetary priorities.

A detailed engineering, economic, environmental, and real estate analysis was performed in order to identify the required dam modifications, costs of modifications, real estate requirements, and the benefits resulting from the water conservation yields of the various alternatives. The following sections summarize information from the technical appendices that are part of this Feasibility Report (the appendices are printed under separate cover).

4.9.1 Santa Fe

Four alternatives were evaluated for water conservation at Santa Fe Dam including the no-action plan. For each alternative, impacts were evaluated on their economic, environmental, and engineering affects. Many of the environmental and engineering impacts were similar or shared among the alternatives, regardless of pool elevations. On the other hand, certain physical impacts are very alternative-dependent; these include impacts to environmental resources, the existing recreation facilities, and the existing recharge facilities.

Economic affects of the alternatives are displayed immediately below, followed by a discussion of the potential impacts and mitigation design features for each respective alternative.

Economic Affects

Water yield for Santa Fe Dam water conservation operations is an estimate of the amount of water that could be spread in the soft bottom San Gabriel Channel, between Santa Fe and Whittier Narrows Dams, if a particular alternative is implemented. Water would be released at the recharge capacity of the San Gabriel River Channel, and does not include flow diversion to the Peck Road Spreading Basin. The economic appendix has established that demand will exceed supply throughout the life of the project; therefore, project benefits are derived if the project augments water supply and precludes the need to purchase MWD water. The value of water used in the analysis is $242 per acre-foot.

Costs shown in **Table 4.7**, "Economic Evaluation of Alternatives, Santa Fe Dam," were derived during alternative evaluation as described in the design and cost appendix. The total annual cost is based on costs required to implement the project, including mitigation, construction and operation and maintenance costs. The costs for project features depend on the respective requirements for each alternative, as described below.

Table 4.7 Economic Evaluation of Alternatives, Santa Fe Dam [1]

	Alt 1	Alt 2	Alt 3A	Alt 3B	Alt 4
Annual Water Yield (ac-ft)	17,300	18,000	19,700	19,700	21,500
Incremental Increase in Annual Water Yield (ac-ft)	n/a	700	2400	2400	4200
Annual Water Supply Value of Yield	n/a	$169,400	$580,800	$580,800	$1,016,400
Total First Cost of Alternative	n/a	$100,000	$6,835,000	$4,285,000	$8,255,000
Annual Cost (50 yr@7-1/8%)	n/a	$7,400	$503,000	$315,000	$606,000
Annual Environmental Costs	n/a	$82,500	$82,500	$82,500	$100,000
O & M Costs	n/a	$10,000	$63,000	$63,000	$78,000
Total Annual Cost	n/a	$99,900	$648,500	$460,500	$784,000
Annual Benefits [2]	n/a	$169,500	$593,000	$593,300	$1,028,900
Net Benefits	n/a	$69,500	($55,200)	$ 132,800	$244,900
Benefit/Cost Ratio	n/a	1.7	0.9	1.3	1.3

Alternative 1: No-Action Alternative
Alternative 2: Water Conservation Pool Only at 456 ft NGVD (139.8 m NAVD)
Alternative 3: Maximum Pools at 463 ft NGVD (141.9 m NAVD)
Alternative 4: Maximum Pools at 475 ft NGVD (145.6 m NAVD)

[1] Costs and benefits based on a 50-year project life @ 7⅛% interest rate
[2] Includes $12,500 in pre-project benefits for Alts 3 and 4 (benefits accrued prior to completion of project construction yet subsequent to project authorization).

Flood Protection

Flood control protection would be maintained by drawing down stored water to achieve flood control capacity. All flood control storage space that would be lost due to implementation of an alternative would be regained when necessary in this manner.

Geotechnical

Geotechnical investigations into the modeling of the foundation and embankment response to the design earthquake (the Maximum Credible Earthquake) indicated that the Santa Fe embankment is stable and permanent deformation is estimated to be less than 0.5 ft (15 cm) when subjected to the design earthquake with every water surface, for all alternatives, even at 475 ft NGVD. These deformations would not adversely impact the structural integrity of the dam.

Sediment Deposition

An important consideration in conserving water in the reservoir is the impact on expected annual sediment deposition rates and associated maintenance costs for removing the deposited sediment. To evaluate this, sediment trap efficiency and average annual sediment inflow for both the without- and with-project conditions were investigated, as discussed in detail in the Hydraulic Appendix.

As **Table 4.8** below shows, an insignificant increase in sediment deposition occurs as the water surface of impounded water increases in elevation. Reducing the outflow of material from the reservoir would have a beneficial impact in terms of a slight reduction in operation and maintenance costs at downstream water recharge facilities, yet the associated increase in costs for periodic removal of sediment within the reservoir would likely offset these benefits. Relative to the basin's maintenance itself, sediment removal would need to be performed on a more frequent basis and would be part of the additional operation and maintenance costs of the project's implementation.

Table 4.8 Sediment Deposition Analysis, Santa Fe Dam

	Alt 1	Alt 2	Alt 3	Alt 4
Average Annual Sediment Inflow (ac-ft/yr)	154	154	154	not analyzed
Trap Efficiency	81%	82%	85%	not analyzed
Average Annual Sediment Deposition (ac-ft)	125	127	131	not analyzed

Alternative 1: No-Action Alternative
Alternative 2: Water Conservation Pool Only at 456 ft NGVD (139.8 m NAVD)
Alternative 3: Maximum Pools at 463 ft NGVD (141.9 m NAVD)
Alternative 4: Maximum Pools at 475 ft NGVD (145.6 m NAVD)

Hydraulic Structures

Alternative 1: No-Action Alternative - No impact.

Alternative 2: Water Conservation Pool Only at 456 ft NGVD (139.8 m NAVD) - No impact.

Alternative 3: Maximum Pools at 463 ft NGVD (141.9 m NAVD) - The levee constructed to protect the recreational resources during water conservation activities has to be constructed to allow drainage of upstream water to avoid ponding on its upslope side. Such ponding could occur from either a flood event that results in water surface elevations above the top-of-levee elevation, or from upstream inflow significant enough to pond water behind the levee during water conservation activities. Culvert drains that would convey inflow through the levee structure would not function against the hydraulic pressure of a water conservation pool. Therefore, alternative means of draining water that would become trapped behind the levee would be necessary. The Hydraulic Appendix discusses several alternatives that have been formulated to mitigate this interior drainage problem, which include potential storm drains from the upstream side of the levee through the dam embankment, and a pump station to lift the ponded water over the levee into the water conservation pool.

Alternative 4: Maximum Pools at 475 ft NGVD (145.6 m NAVD) - Same as Alternative 3. Sides of levee would be armored.

Levee and Borrow Area

Alternative 1: No-Action Alternative - No impact.

Alternative 2: Water Conservation Pool Only at 456 ft NGVD (139.8 m NAVD) - No impact.

Alternative 3: Maximum Pools at 463 ft NGVD (141.9 m NAVD) -The borrow area for construction of the levee would be located in the southeast corner of the basin between the levee and the dam (shown on Exhibit 9). Calculations of cut and fill material for the borrow area are given in the General Design Appendix. The area would be encouraged to develop as riparian habitat including its emergent edge and understory. Top soil would be replaced after fill material is removed, and the area would then be graded to allow surface runoff to flow towards the dam and the outlet works and thereby provide water required by the habitat. The area would be used as mitigation of adverse impacts to habitat is such mitigation is determined to be necessary by ongoing coordination with resource agencies and monitoring. The borrow area would be supplemented with plantings of native riparian species if natural establishment does not occur within a reasonable amount of time, such as one to two years.

Alternative 4: Maximum Pools at 475 ft NGVD (145.6 m NAVD) - Same as Alternative 3.

Recreation Facilities

Alternative 1: No-Action Alternative - No impacts to recreation facilities are anticipated except by expected flood events.

Alternative 2: Water Conservation Pool Only at 456 ft NGVD (139.8 m NAVD) - There are no significant impacts to the recreation lake and facilities because they are above the inundation level. However minor impacts to parking and access include about 40 acres (16 hectares) of undeveloped open space leased by LACDPR that would be inundated. In addition, approximately 20 acres (8 hectares) used for overflow parking for special events would be inundated as would a 75 foot (23 m) length of the parking access road. Regular day-use parking would not be impacted.

These impacts have been resolved through coordination between the Los Angeles County Department of Parks and Recreation (LACDPR) and the Los Angeles County Department of Public Works (LACDPW). LACDPR and LACDPW agreed on two-way coordination of recreation events and water conservation. Since the anticipated time of water conservation would extend into early spring, the potential end of flood season storage of water would be coordinated with timing of special events. Additional water could be released to an elevation of approximately elevation 450.0 ft NGVD (137.9 m NAVD) if an upcoming event would require the use the overflow parking area to ensure that parking is available during peak events.

Alternative 3: Maximum Pools at 463 ft NGVD (141.9 m NAVD) - Alternative 3 would have significant inundation impacts to the recreational facilities within the basin. These could not be mitigated through coordination of the timing of special events, because they include facilities beyond parking areas and access roads. Impacts would be avoided by the construction of a levee to protect the affected recreation facilities. The overflow parking area for approximately 910 cars, which is utilized for peak events would be on the upstream side of the levee. Thus there would be no impacts to the recreation area nor any need to coordinate special events.

Alternative 4: Maximum Pools at 475 ft NGVD (145.6 m NAVD) - As with Alternative 3, impacts would be avoided by the levee constructed to protect the existing recreation facilities. Thus there would be no impacts to the recreation area.

Environmental Resources

Alternative 1: No-Action Alternative - No impacts are expected to environmental resources other than potential impacts from expected flood events.

Alternative 2: Water Conservation Pool Only at 456 ft NGVD (139.8 m NAVD) - The following impacts would occur to the major habitat types within the basin.

- Riparian Habitat - Approximately 108 acres (44 hectares) of riparian habitat is located below elevation 456 ft NGVD (139.8 m NAVD). Impacts are not expected to be significant as this area is currently inundated on a regular basis and is tolerant of this level of inundation.

- *Baccharis* spp. scrub - Approximately 97 acres (39 hectares) are located below elev 456 ft NGVD (139.8 m NAVD). No significant impacts are expected because increased inundation over existing conditions would be short, and the depth of inundation would be five feet (1.5 meters) or less.

- Introduced Grasslands - Approximately 88 acres (36 hectares) would be inundated. Increased inundation is expected to convert grasslands at elevation 450.0 ft NGVD (137.9 m NAVD) or below to other habitats associated with wetter conditions such as riparian, *Baccharis* spp. scrub, and fresh water marsh, all of which have higher habitat values.

- Seasonal Marsh - Approximately 66 acres (27 hectares) would be inundated. Increased inundation would be minor over existing conditions and could potentially improve quality and acreage.

- Pioneer Alluvial Fan Scrub - Approximately 5 acres (2 hectares) would be inundated, but no significant impacts are expected as this area is inundated during current flood control conditions.

Potential impacts to biological resources are being coordinated with the resource agencies to identify appropriate mitigation that may be necessary. Also, monitoring during project operation would indicate whether additional mitigation is necessary. Mitigation would likely occur in the area of the borrow site behind the dam, which would be graded to maximize riparian growth and could be supplemented with plantings of native riparian species if natural establishment does not occur within a reasonable amount of time, such as one to two years.

Immediately prior to releasing water for impoundment during the least Bell's vireo nesting season, potential habitat would be monitored up to the proposed level of inundation. If nesting is occurring, water releases would be regulated to remain below the elevation of the lowest nest. Permanent loss of habitat would be mitigated with additional habitat and/or cowbird trapping within existing habitat.

Alternative 3: Maximum Pools at 463 ft NGVD (141.9 m NAVD) - The following impacts would occur to the major habitat types within the basin.

- Riparian Habitat - Approximately 108 acres (44 hectares) would be inundated. Impacts are most likely to occur after inundation for more than 30 days to the riparian habitat in the lower elevations where the understory, less tolerant of prolonged inundation, would be impacted. With a higher water surface level inundation, there is the potential for riparian habitat and its associated emergent edge to expand into higher elevations replacing *Baccharis* spp. scrub which is of lesser value.

- *Baccharis* spp. scrub -Approximately 113 acres (46 hectares) would be inundated. As inundation would be longer and more frequent than currently experienced, some degradation of the habitat is expected. Mitigation could include removal of exotic species and monitoring. However, there is the potential for inundation-tolerant riparian habitat to expand into this area which would result in an increase of habitat values.

- Introduced Grasslands - Approximately 88 acres (36 hectares) would be inundated. Increased inundation is expected to convert grasslands at elevation 450.0 ft NGVD (137.9 m NAVD) or below to other habitats associated with wetter conditions such as riparian, *Baccharis* spp. scrub, and fresh water marsh, all of which have higher habitat values.

- Seasonal Marsh - Approximately 66 acres (27 hectares) would be inundated. More frequent and longer inundation could increase the acreage, improve quality and expand into existing grassland areas. Perennial marsh could develop and be maintained within the area.

- Pioneer Alluvial Fan Scrub - Approximately 53 acres (22 hectares) would be inundated. With increased inundation any loss of habitat would be offset by the conversion of this habitat to riparian or *Baccharis* spp. scrub and would be considered more beneficial than adverse.

- Intermediate Alluvial Fan Scrub - Approximately 51 acres (21 hectares) would be inundated. Any loss or degradation would be significant since this habitat is difficult to replace. On the west side of the channel, removal of debris and exotic species could improve habitat quality and potentially expand it. Relocation of the levee to run west of the area adjacent to the Wildlife Management Area would avoid impacts to this alluvial fan scrub area.

Potential impacts to biological resources would be mitigated as discussed under Alternative 2.

Alternative 4: Maximum Pools at 475 ft NGVD (145.6 m NAVD) - The following impacts would occur to the major habitat types within the basin.

- Riparian Habitat - Approximately 108 acres (44 hectares) would be inundated. Impacts are most likely to occur after inundation for more than 30 days to the riparian habitat in the lower elevations where the understory, less tolerant of prolonged inundation, would be impacted. With longer and higher inundation, riparian habitat with higher value could replace *Baccharis* spp. scrub at higher elevations.

- *Baccharis* spp. scrub -Approximately 113 acres (46 hectares) would be inundated. As inundation would be longer and more frequent, it would not be expected to survive at its current elevation between 440 and 455.0 ft NGVD (134.9 to 139.5 m NAVD), but could become established at higher elevations in the area of elevation 470.0 ft NGVD (144.0 m NAVD). Existing areas of *Baccharis* spp. scrub would most likely be replaced with riparian and/or fresh water marsh habitats. Since these habitats are considered to be of higher value, the loss would not be adverse.

- Introduced Grasslands - Approximately 88 acres (36 hectares) would be inundated. Increased inundation is expected to convert grasslands at elevation 450.0 ft NGVD (137.9 m NAVD) or below to other habitats associated with wetter conditions such as riparian, *Baccharis* spp. scrub, and fresh water marsh, all of which have higher habitat values.

- Seasonal Marsh - Approximately 66 acres (27 hectares) would be inundated. More frequent and longer inundation could increase the acreage, improve quality and expand into existing grassland areas. Perennial marsh could develop and be maintained within the area.

- Pioneer Alluvial Fan Scrub - Approximately 150 acres (61 hectares) would be inundated. With increased inundation any loss of habitat would be offset by the conversion of this habitat to riparian or *Baccharis* spp. scrub and would be considered more beneficial than adverse.

- Intermediate Alluvial Fan Scrub - Approximately 154 acres (62 hectares) would be inundated. Any loss or degradation would be significant since this habitat is difficult to replace. On the west side of the channel, removal of debris and exotic species could improve habitat quality and potentially expand it. Relocation of the levee to run west of the area adjacent to the Wildlife Management Area would avoid impacts to this alluvial fan scrub area.

Potential impacts to biological resources would be mitigated as discussed under Alternative 2.

Wildlife Management Area

Alternative 1: No-Action Alternative - No impacts expected to the Wildlife Management Area other than potential impacts from expected flood events.

Alternative 2: Water Conservation Pool Only at 456 ft NGVD (139.8 m NAVD) - No impacts expected other than potential impacts from expected flood event which would also occur under the future without project condition.

Alternative 3: Maximum Pools at 463 ft NGVD (141.9 m NAVD) - The levee constructed for this alternative would protect the area from inundation. No impacts anticipated other than potential impacts from expected flood events which would occur under the future without project condition.

Alternative 4: Maximum Pools at 475 ft NGVD (145.6 m NAVD) - The levee constructed for this alternative would protect the area from inundation. No impacts anticipated other than potential impacts from expected flood events which would occur under the future without project condition.

Cultural Resources

No known cultural resource sites would be impacted by the alternatives.

Operation and Maintenance

Operation and maintenance attributable to water conservation activities must be reimbursed by LACDPW either in money or services. Sediment and debris removal especially around gates may be required annually. Reservoir maintenance would continue to be performed during October to ensure the capacity of the flood pool would be available at the start of flood season. Coordination of reservoir releases can be preformed by LACDPW utilizing COE damtenders when the water surface is below the debris pool level and no impending inflow is forecast.

4.9.2 Whittier Narrows

Four alternatives were evaluated for water conservation at Whittier Narrows including the without project condition. For each alternative, impacts were evaluated on their economic, environmental, and engineering affects. Many of the environmental and engineering impacts were similar or shared among the alternatives, regardless of pool elevations. On the other hand, certain physical impacts are very alternative-dependent; these include impacts to the oil wells, water reclamation plant, the existing recreation facilities and the nature area.

Economic affects of the alternatives are displayed immediately below, followed by a discussion of the potential impacts and mitigation design features for each respective alternative.

Economic Affects

Water yield for Whittier Narrows Dam water conservation operations is an estimate of the amount of water that could be spread in the Rio Hondo Coastal Basin Spreading Grounds just downstream of the dam. The without-project condition average annual water yield of 60,600 AF/year (75 million m^3/year) was determined based on records from LACDPW for the existing spreading grounds. This does not include water spread in the Lower San Gabriel River or the San Gabriel River Coastal Basin Spreading Grounds. The with-project water yield estimates shown are based on a release equal to the rate of the inflow capacity of the Rio Hondo spreading grounds. The economic appendix has established that demand will exceed supply throughout the life of the project; therefore, project benefits are derived if the project augments water supply and precludes the need to purchase MWD water. The value of water used in the analysis, as with recharge downstream of Santa Fe Dam, is $242 per acre-foot.

Costs shown in **Table 4.9**, "Economic Evaluation of Alternatives, Whittier Narrows Dam," were derived during alternative evaluation as described in the design and cost appendix. The total annual cost is based on costs required to implement the project, including real estate (capping of oil wells and loss of future income), mitigation, construction and operation and maintenance costs. The costs for project features depend on the respective requirements for each alternative, as described below.

Table 4.9 Economic Evaluation of Alternatives, Whittier Narrows Dam [1]

	Alt 1	Alt 2	Alt 3	Alt 4
Annual Water Yield (ac-ft)	60,600	63,500	66,100	65,900
Incremental Increase in Annual Water Yield (ac-ft)	n/a	2,900	5,500	5,300
Annual Water Supply Value of Yield	n/a	$701,800	$1,383,000	$1,334,000
Total First Cost of Alternative	n/a	$6,731,000	$25,663,400	$28,984,600
Operation and Maintenance	n/a	$46,700	$298,000	$298,000
Total Annual Cost	n/a	$631,300	$2,187,000	$2,432,000
Annual Benefits [2]	n/a	$702,000	$1,383,000	$1,334,300
Net Benefits	n/a	$70,500	($804,000)	($1,098,000)
Benefit/Cost Ratio	n/a	1.1	0.6	0.5

Alternative 1: No-Action Alternative
Alternative 2: Water Conservation Pool Only at 209 ft NGVD (64.4 m NAVD)
Alternative 3: Maximum Pools at 215 ft NGVD (66.2 m NAVD), with lower level flooding of water treatment plant
Alternative 4: Maximum Pools at 215 ft NGVD (66.2 m NAVD), with levee protecting reclamation plant

[1] Costs and benefits based on a 50-year project life @ 7⅛% interest rate

[2] Includes $51,700 in pre-project benefits for Alts 3 and 4 (benefits accrued prior to completion of project construction yet subsequent to project authorization).

Flood Protection

Flood control protection would be maintained by drawing down stored water to achieve flood control capacity. All flood control storage space that would be lost due to implementation of an alternative would be regained when necessary in this manner.

Geotechnical

Investigations indicate that the central and east embankments of the dam are stable, and permanent deformations are estimated to be less than 0.5 feet (15 cm) when subjected to the maximum credible earthquake (MCE) with the proposed water conservation pool at elevation 215 ft NGVD (66.2 m NAVD). It was determined in 1997 through field testing that the west embankment could become unstable for both the proposed water conservation pool at elevation 215 ft and flood control when subjected to the MCE. While instability of the west embankment is not an impact caused by the proposed operation, it is nevertheless a consideration for both water conservation and flood control operations. Money was programed for FY 98 to identify specific areas where remedial work would be necessary along the three mile (4.8 km) long dam; however, money to construct any required modifications was not programmed. A Phase II Seismic Evaluation Report was performed to address Whittier Narrows Dam seismic stability. The investigations and analysis of the foundation and embankment have been completed and the Dam Safety Assurance Program (DSAP) Evaluation Report is being prepared. The report will show that the problem area identified in the foundation of the west embankment at Whittier Narrows during the water conservation study is isolated and will have no affect on the safety or operation of the dam. There is no concerns about the effect of water conservation on the seismic stability of the Whittier Narrows embankment.

Sediment Deposition

An important consideration in conserving water behind the reservoir is the impact on expected annual sediment deposition rates and associated maintenance costs for removing the deposited sediment. To evaluate this, sediment trap efficiency and average annual sediment inflow for both the without- and with-project conditions were investigated, as discussed in detail in the Hydraulic Appendix.

As **Table 4.10** below shows, a small increase in sediment deposition occurs as the water surface of impounded water increases in elevation. Reducing the outflow of material from the reservoir would have a beneficial impact in terms of a slight reduction in operation and maintenance costs at downstream water recharge facilities, yet the associated increase in costs for periodic removal of sediment within the reservoir would likely offset these benefits. Relative to the basin's maintenance itself, sediment removal would need to be performed on a more frequent basis and would be part of the additional operation and maintenance costs of the project's implementation.

Table 4.10 Sediment Deposition Analysis, Whittier Narrows Dam

	Alt 1	Alt 2	Alt 3	Alt 4
Average Annual Sediment Inflow (ac-ft/yr)	146	146	not analyzed	not analyzed
Trap Efficiency	70%	82%	not analyzed	not analyzed
Average Annual Sediment Deposition (ac-ft)	102	120	not analyzed	not analyzed

Alternative 1: No-Action Alternative
Alternative 2: Water Conservation Pool Only at 209 ft NGVD (64.4 m NAVD)
Alternative 3: Maximum Pools at 215 ft NGVD (66.2 m NAVD), with lower level flooding of water treatment plant
Alternative 4: Maximum Pools at 215 ft NGVD (66.2 m NAVD), with levee protecting reclamation plant

Hydraulic Structures

Alternative 1: No-Action Alternative - No impact.

Alternative 2: Water Conservation Pool Only at 209 ft NGVD (64.4 m NAVD) - Durfee Avenue would have to be raised to 212 feet NGVD since an increase in water surface elevation would result in interior flooding of the Legg Lake drainage area, which is the area bounded by Rosemead Boulevard, the Pomona Freeway and Durfee Avenue. Once raised, increased ponding on the upstream side of the road could occur from either a flood event that results in overall water surface elevations above the top-of-road elevation, or from upstream inflow significant enough to pond water behind the road during water conservation activities. Existing culvert drains that would convey inflow through the road would not function against the hydraulic pressure of a water conservation pool. The Hydraulic Appendix discusses several alternatives that have been formulated to mitigate this interior drainage problem, which include (1) potential storm drains from the upstream side of the levee through the dam embankment and ultimately into the Rio Hondo or San Gabriel River, (2) a pump station to lift the ponded water over the levee into the water conservation pool, and (3) an open channel and concrete box culvert through the road that would convey water to an elevation above 209 feet.

A levee has been proposed to protect the Los Angeles Count Sanitation Districts' Water Treatment Plant located on the west side of Rosemead Blvd, north of San Gabriel Blvd. from water being held at elevation 209.0ft. The levee would encircle the plant and tie into Rosemead Blvd at the north and south ends. Drawings for the levee are found in the Engineering Design Appendix.

Drainage of the plant area would be conducted in two manners. First, a culvert would be installed through the levee to drain local rainfall and when the levee is overtopped during a flood event. The culvert would have a flap gate on the downstream side to prevent leakage during a storm. The culvert is designed to drain the area in 24 hours. Second, a pump station would be located on top of the levee to drain the area during a storm event when water is being held for conservation. Water from the plant side would be pumped over the levee into the water conservation pool.

Alternative 3: Maximum Pools at 215 ft NGVD (66.2 m NAVD), with lower level flooding of water treatment plant - As the water treatment plant would be inundated, this alternative is not viable.

Alternative 4: Maximum Pools at 215 ft NGVD (66.2 m NAVD), with levee protecting reclamation plant - Same as Alternative 2.

Road Design/Levee and Borrow Area

Alternative 1: No-Action Alternative - No impact.

Alternative 2: Water Conservation Pool Only at 209 ft NGVD (64.4 m NAVD) -

Three peripheral roads are identified to be impacted as recommended for improvement to meet the objective of this study. This includes a 2,559 ft length of San Gabriel and Durfee Avenue, 211 feet of Rosemead Boulevard and 1,509 feet of Lincoln Avenue will need to be raised from 3 ft to 6 ft. The finished grade will achieve a minimum elevation of 212.0 ft. Slope protection would be provided with grouted riprap.

A ring levee is proposed to enclose the Water Treatment Plant to ensure minimal impact and continuous operation of the plant when water conservation pool reaches 209.0 ft. The top of the levee would be 212.0 ft with a 12 ft wide road on top to accommodate maintenance vehicles. The levee elevation includes 3 ft for overtopping protection. The length of the levee is 3,507 ft. With slope protection on both sides of grouted riprap. A pad for the pump station would be located atop the levee on the south side .

The borrow area for the roads and levee would be located northwest of the water treatment plant. Calculations of cut and fill material for the borrow area are given in the General Design Appendix. This area is currently disturbed grassland. The area would be encouraged to develop as riparian habitat including its emergent edge and understory. Top soil would be replaced after fill material is removed, and the area would then be graded to allow surface runoff to flow towards the dam and the outlet works and thereby provide water required by the habitat. The area would be used as mitigation of adverse impacts to habitat is such mitigation is determined to be necessary by ongoing coordination with resource agencies and monitoring. The borrow area would be supplemented with plantings of native riparian species if natural establishment does not occur within a reasonable amount of time, such as one to two years.

Alternative 3: Maximum Pools at 215 ft NGVD (66.2 m NAVD), with lower level flooding of water treatment plant - Increased road elevations, to elevation 218.0 ft NGVD (67.2 m NAVD) would occur for the same reasons as Alternative 2, with associated borrow sites identified. For this alternative, however, the increased road embankment would exceed 6 feet (1.8 m), and therefore falls under the jurisdictional and approval authority of the State of California's Division of Safety of Dams.

Borrow area details are the same as Alternative 2.

Alternative 4: Maximum Pools at 215 ft NGVD (66.2 m NAVD), with levee protecting reclamation plant - Same as Alternative 3.

Recreation Facilities

Alternative 1: No-Action Alternative - No impacts to recreation facilities are anticipated other than expected flood events.

Alternative 2: Water Conservation Pool Only at 209 ft NGVD (64.4 m NAVD) - Impacts to Legg Lake Area recreation facilities would be avoided since raising Rosemead Boulevard and Durfee Avenue to elev 212.0 ft NGVD (65.3 m NAVD) would protect the Legg Lake area from inundation.

Impacts to other recreation facilities would be minor. The archery range and a portion of the bicycle path located south of the Pomona Freeway on the west side of Rosemead Boulevard, and several acres of open space adjacent to the model airplane field would be inundated. Bicycle and equestrian trails in adjacent to Rosemead Blvd. in the southwest portion of the basin and along the San Gabriel River overflow channel would be impacted for short periods of time. A large portion of Bosque del Rio Hondo would be inundated and unusable. The impact to recreation facilities is estimated by loss of recreation days and identified as a monetary value of $16,300 per year.

Alternative 3: Maximum Pools at 215 ft NGVD (66.2 m NAVD), with lower level flooding of water treatment plant - Impacts to Legg Lake Area recreation facilities would be avoided as raising Rosemead Boulevard and Durfee Avenue to elev 218.0 ft NGVD (67.2 m NAVD) would protect the Legg Lake area from inundation.

All of the archery range would be inundated, including one restroom and the adjacent parking lot. The Pachmayr Shooting Range is located north of the archery range and approximately two-thirds of the area would be inundated including the target houses, storage building, parking lot and shooting areas, making the range unusable while inundated. A portion of the bicycle path along Rio Hondo south of the Pomona Freeway and west of Rosemead Boulevard would be inundated and unusable. Also, the equestrian trail on the west side of the Rio Hondo would be inundated and unusable. Bosque del Rio Hondo would be unusable. Open fields adjacent to the model airplane, car facilities, the Los Angeles Rifle Club, and the paved area of the tether model race car would also be inundated.

Recreation impacts expressed in monetary value for this alternative are $27,555 per year.

Alternative 4: Maximum Pools at 215 ft NGVD (66.2 m NAVD), with levee protecting reclamation plant - Same as Alternative 3.

Environmental Resources

Alternative 1: No-Action Alternative - No impacts are expected to environmental resources other than potential impacts from expected flood events.

Alternative 2: Water Conservation Pool Only at 209 ft NGVD (64.4 m NAVD) - Storage of water would affect riparian and freshwater marsh habitats which are adapted to inundation, so that impacts are expected to be minimal depending on length and duration of inundation. Areas of introduced grasslands would be inundated. Although less tolerant of inundation, habitat value is relatively low and therefore not considered significant. With higher inundation there is potential for emergent riparian habitat to develop adjacent to existing riparian habitat, thereby improving overall habitat value.

The following impacts would occur to the major habitat types within the basin.

- Riparian Habitat - Approximately 117 acres (47 hectares) of riparian habitat is located below elevation 209 ft NGVD (64.4 m NAVD). More frequent and longer inundation may cause expansion into existing introduced grasslands and baccharis scrub habitats which would be beneficial as riparian habitat has a higher value.

- *Baccharis* spp. scrub - Approximately 70 acres (28 hectares) would be inundated. The 35 acres (14 hectares) located below elevation 201.6 ft NGVD or 62.2 m NAVD (current water conservation operations) are already frequently inundated. The 35 acres above elevation 201.6 ft would be inundated more often but this is not expected to cause a significant impact. In addition, *Baccharis* spp. scrub could develop at higher elevations that are currently grasslands, with an associated beneficial increase in habitat value.

- Introduced Grasslands - Approximately 77 acres (31 hectares) would be inundated. Longer inundation could cause a shift towards species adapted to wetter conditions, including *Baccharis* spp. as mentioned above. Loss or conversion of the grasslands of the Raptor Management Area would be of concern, as this is located in the designated mitigation area for a portion of the existing recreation development.

- Seasonal Marsh - Approximately 126 acres (51 hectares) would be inundated, although they are currently within the existing conservation pool. More frequent and longer inundation could improve the quality and expand into surrounding areas. Perennial marsh could develop and be maintained within the area.

Potential impacts to biological resources are being coordinated with the resource agencies to identify appropriate mitigation. Monitoring during project construction and operation would provide data to indicate biological gains or losses, and the need for reassessment of further mitigation. Mitigation would occur in the area of the borrow site behind the dam, which would be graded to maximize riparian growth and could be supplemented with plantings of native riparian species if natural establishment does not occur within a reasonable amount of time. In addition, weed eradication to remove *Arundo donax* will be done and continued as necessary if it becomes established due to increased inundation.

If water from LACDPW reservoirs is to be released during the least Bell's vireo nesting season, potential habitat would be monitored up to the proposed level of inundation. If nesting is occurring, water releases would be regulated to remain below the elevation of the lowest nest.

Permanent loss of habitat would be mitigated with additional habitat and/or cowbird trapping within existing habitat.

Alternative 3: Maximum Pools at 215 ft NGVD (66.2 m NAVD), with lower level flooding of water treatment plant - Water storage to this elevation could have potentially significant impacts on riparian, freshwater marsh, and introduced grassland habitats. Although riparian and freshwater marsh are adapted to inundation, loss of habitat at lower elevations due to the likely increase in the frequency and duration of inundation could occur. Associated with this would be an expansion of the freshwater marsh, riparian, and emergent edge habitats that would expand along higher elevations along the Rio Hondo channel and creeks leading to the Rio Hondo.

Portions of the west end of the Nature Area would be inundated affecting the lakes within this area. Additional sedimentation would decrease capacity of the lakes and would require increased sediment and debris removal O&M as mitigation to maintain lake capacity.

The following specific impacts would occur to the major habitat types within the basin.

- Riparian Habitat - Approximately 135 acres (55 hectares) of riparian habitat is located below elevation 209 ft. More frequent and longer inundation may cause expansion into existing introduced grasslands and baccharis scrub habitats which would be beneficial as riparian habitat has a higher value.

- *Baccharis* spp. scrub - Approximately 90 acres (36 hectares) would be inundated. There are 35 acres (14 hectares) located below elevation 201.6 ft (current water conservation operations) that are already frequently inundated. The 55 acres above elevation 201.6 ft would be inundated more often but this is not expected to cause a significant impact. In addition, *Baccharis* spp. scrub could develop at higher elevations that are currently grasslands, with an associated beneficial increase in habitat value.

- Introduced Grasslands - Approximately 150 acres (61 hectares) would be inundated. Longer inundation could cause a shift towards species adapted to wetter conditions, including *Baccharis* spp. as mentioned above. Loss or conversion of the grasslands of the Raptor Management Area would be of concern, as this is located in the designated mitigation area for a portion of the existing recreation development.

- Seasonal Marsh - Approximately 126 acres (51 hectares) would be inundated, although they are currently within the existing conservation pool. More frequent and longer inundation could improve the quality and expand into surrounding areas. Perennial marsh could develop and be maintained within the area.

Potential impacts to biological resources are being coordinated with the resource agencies to identify appropriate mitigation. Monitoring during project construction and operation would provide data to indicate biological gains or losses, and the need for reassessment of further mitigation. Mitigation would occur in the area of the borrow site behind the dam, which would be graded to maximize riparian growth and could be supplemented with plantings of native riparian species if natural establishment does not occur within a reasonable amount of time. In addition, weed eradication to remove *Arundo donax* will be done and continued as necessary if it becomes established due to increased inundation.

Immediately prior to releasing water for impoundment during the least Bell's vireo nesting season, potential habitat would be monitored up to the proposed level of inundation. If nesting is occurring, water releases would be regulated to remain below the elevation of the lowest nest. Permanent loss of habitat would be mitigated with additional habitat and/or cowbird trapping within existing habitat.

Ongoing coordination with the resource agencies, including mitigation planning if necessary, would be similar to Alternative 2.

Alternative 4: Maximum Pools at 215 ft NGVD (66.2 m NAVD), with levee protecting reclamation plant - Same as Alternative 3.

Cultural Resources

No known cultural resource sites would be impacted by the alternatives. All known sites are located at higher elevations.

Operation and Maintenance

Sediment and debris removal especially around gates may be required more frequently. Reservoir maintenance would continue to be performed during October to ensure the capacity of the flood pool would be available at the start of flood season. Coordination of reservoir releases can be preformed by LACDPW utilizing COE damtenders when the water surface is below the debris pool level and no impending inflow is forecast. Operation and maintenance attributable to water conservation activities must be reimbursed by LACDPW either in money or services. The local sponsor is responsible for all water supply costs aallocated to operation and maintenance. These costs would be paid yearly in advance, based on estimated expenditures. Appropriate adjustments would be made at the end of each year.

Oil Wells

Alternative 1: No-Action Alternative - No impacts.

Alternative 2: Water Conservation Pool Only at 209 ft NGVD (64.4 m NAVD) - There are 33 oil wells at or below elevation 209 ft, but only 18 were observed to be active during field surveys conducted in January 1997. As stated earlier, the oil wells pre-date construction of the dam. Berms were built by LACDPW to elevation 206 ft NGVD (63.5 m NAVD) to protect the oil wells during water conservation operations. Since it is desirable to maintain dry land access to the oil wells for potential spill or leak repair and safe operation of the wells, measures may be taken to maintain this access during water conservation operations.

Several options have been investigated to determine mitigation of inundation of the oil wells at or below the water conservation elev 209.0 ft NGVD (64.4 m NAVD). These include (1) buying-out the oil reserves, and capping and plugging the wells, (2) raising the finish grade of the well heads to above the inundation level and providing access roads, (3) converting the wells to off-shore/water proof facilities, (4) capping and plugging existing wells and relocating the wells to an area higher than the inundation level for potential slant drilling. These options are discussed further in the HTRW Appendix. If the local sponsor pursues water conservation storage to this elevation, the local sponsor would be responsible for cleanup of the oil wells and surrounding areas as part of the local sponsor's cost of implementation. This is pursuant to Corps policy as contained in ER 1165-2-132, the local sponsor will be solely responsible for all costs related to HTRW response or remediation costs.

Alternative 3: Maximum Pools at 215 ft NGVD (66.2 m NAVD), with lower level flooding of water treatment plant - There are 33 oil wells at or below elevation 215 ft NGVD (66.2 m NAVD), but only 18 were observed to be in operation during field visits conducted in January 1997. The options described in Alternative 2 apply to this alternative as well.

Alternative 4: Maximum Pools at 215 ft NGVD (66.2 m NAVD), with levee protecting reclamation plant - Same as Alternative 3.

Water Treatment Plant

The Whittier Narrows Water Treatment Plant was constructed to be fully functional during flood events. To allow for operations to proceed while the facilities are flooded, major electrical, mechanical and control equipment is housed on the second floor of the control building. One building is built on pilings and the other on a concrete slab foundation. As built plans show a ground floor finish grade of 208.5 ft NGVD (64.3 m NAVD). The upper walkways above the tanks are at elev 220.0 ft NGVD (67.8 m NAVD) and the top of the treatment tanks is at elev 218.5 ft NGVD (67.3 m NAVD). Inundation for longer periods for water conservation could affect the ability of crews to perform the required daily water quality testing.

Alternative 1: No-Action Alternative - No impacts.

Alternative 2: Water Conservation Pool Only at 209 ft NGVD (64.4 m NAVD) - Although the plant would remain operable during flood inundation, discussion with Los Angeles County Sanitation Districts personnel indicated that day-to-day operation of the plant would be impacted. To insure minimal impact and continuous operation of the plant when the water conservation level reaches 209 ft, a ring levee would be constructed around the leased area of the water treatment plant. This would include drainage features so that any runoff accumulated behind the levee during storm events can be drained. The top-of-levee elevation would be elev 212.0 ft NGVD (65.32 m NAVD), and the length of the levee would be 3,507 ft. It would have grouted riprap on the upstream and downstream sides, with 2H:1V sideslopes.

LACDPW forsees no problems to utilizing Zone 1 outfall as an emergancy outlet, and is willing to work out operational and access detatils with County Sanitation Districts during development of the implementation plan.

Alternative 3: Maximum Pools at 215 ft NGVD (66.2 m NAVD), with lower level flooding of water treatment plant - Although the plant would remain operable during flood inundation, modifications to the equipment and facilities of the plant would still be desirable to insure minimal impact and continuous operation of the plant when the water conservation level reaches 215 ft.

At this water surface elevation, potential hydraulic impacts to plant outflows could be mitigated by construction of new culverts to the Zone 1 Ditch maintained by LACDPW.

Alternative 4: Maximum Pools at 215 ft NGVD (66.2 m NAVD), with levee protecting reclamation plant - The construction of a levee protecting the inundation of the similar to the one proposed in Alternative 2—would preclude inundation impacts for this alternative. The top-of-levee elevation would be elev 218.0 ft NGVD (67.2 m NAVD), and the length of the levee would be 3507 ft (1,069 m). It would have grouted riprap on the upstream and downstream sides, with 2H:1V sideslopes.

At this water surface elevation, potential hydraulic impacts to plant outflows could be mitigated by construction of culverts diverting water to the Zone 1 Ditch maintained by LACDPW.

4.9.3 NED Accounts

This Feasibility Study investigates alternatives for operating Santa Fe and Whittier Narrows Dams to provide water conservation storage, and determines whether a National Economic Development (NED) Plan exists for implementation in accordance with Federal water resources planning principles, guidelines, procedures, and policies. This section examines the various costs and benefits of each alternative to determine whether an economically-justified, optimal water conservation pool elevation exists.

Benefits of water conservation at the Santa Fe and Whittier Narrows Dams are based upon the difference in costs of urban water supply under the with- and without-project conditions. Costs include (1) any required construction, (2) operations and maintenance, (3) compensation or renegotiation of existing leases, (4) value of any impacted recreation areas, and (5) environmental mitigation costs.

Santa Fe Dam

Water Conservation Yield- The average annual water conservation yield was determined for each alternative's specific operation according to the hydrologic methodology identified in Section 4.7, "Study Methodology." The analysis resulted in average annual yields as shown below in **Table 4.11**.

Table 4.11 Water Conservation Yield, Santa Fe Dam

	Alt 1	Alt 2	Alt 3A	Alt 3B	Alt 4
Average Annual Water Yield (ac-ft)	17,300	18,000	19,700	19,700	21,500
Incremental Increase in Average Annual Water Yield (ac-ft)	n/a	700	2400	2400	4200

Alternative 1: No-Action Alternative
Alternative 2: Water Conservation Pool Only at 456 ft NGVD (139.8 m NAVD)
Alternative 3: Maximum Pools at 463 ft NGVD (141.9 m NAVD)
Alternative 4: Maximum Pools at 475 ft NGVD (145.6 m NAVD)

Benefits- Benefits are expressed as average annual values at the current Federal discount rate of 7⅛% with a projected economic life of 50 years. The price level for the analysis is October 1997.

The economic analysis considered the true water conservation for each alternative as determined by the hydrologic analysis. It was assumed that 100% of all increases in yield would be used to meet local water demands. The water supply provided by water conservation practices would be the next least expensive source of water after locally-available groundwater and surface water supplies.

The value of the water conserved at the dam is measured by the opportunity cost of supplying water from the next least-costly alternative to the project. This would be the cost to satisfy the water demand that the project beneficiaries would otherwise have to pay if water were not conserved at the dam. The next least-costly water supply source would be imported water, followed by reclaimed water. It was determined that conserved water provides an average annual benefit of approximately $242 per acre-foot.

Pre-project benefits may also be realized by certain alternatives. Alternatives 3 and 4 conserve water up to elevation 463 ft NGVD (141.9 m NAVD) and 475 ft NGVD (145.55 m NAVD), respectively, when the levee is completed and the project is in operation. However, before the project is complete, the debris pool can be used for water conservation as completion of the project may take a year or more. Therefore, benefits accrue prior to the operation of the project. Benefits for one year ($150,600) were compounded to the base year and amortized over the life of the project. Pre-project benefits amount to an additional $12,500 of average annual benefits for both Alternatives 3 and 4.

Table 4.12 shows the total average annual benefits provided by the alternatives for water conservation at Santa Fe Dam.

Table 4.12 Average Annual Benefits, Santa Fe Dam [1]

	Alt 1	Alt 2	Alt 3A	Alt 3B	Alt 4
Incremental Increase in Average Annual Water Yield (ac-ft)	n/a	700	2400	2400	4200
Annual Water Supply Value of Yield	n/a	$169,500	$571,500	$571,500	$1,260,500
Pre-Project Benefits	n/a	$0	$12,500	$12,500	$12,500
Total Annual Benefits	n/a	$169,500	$594,000	$594,000	$1,273,000

[1] Costs and benefits based on a 50-year project life @ 7⅛% interest rate

Costs- The cost of the alternatives were amortized over the 50 year project life. Interest during construction (IDC) and gross investment is shown in the following table. IDC is taken for construction costs, planning, engineering and design (PE&D) costs, and supervision and administration (S&A) costs, but is not taken on real estate costs. Gross investment is then amortized at 7⅛% over a period of 50 years to calculate the expected annual cost. Operation and maintenance cost is then added to arrive at total annual cost. **Table 4.13** shows the estimated total annual costs for the alternatives.

Table 4.13. Total Annual Costs, Santa Fe Dam

Cost	Alternative 2	Alternative 3A	Alternative 3B	Alternative 4
Mitigation [1]	$100,000	$210,000	$210,000	$850,000
Construction	$0	$6,401,000	$3,971,000	$7,154,600
Interest (IDC)	$0	$224,000	$104,000	$250,400
Total First Cost:	$100,000	$6,835,000	$4,285,000	$8,255,000
Annual Cost (50yr @ 7⅛%)	$7,400	$503,000	$315,000	$606,000
Annual Environmental Costs	$82,500	$82,500	$82,500	$100,000
O & M Cost:	$10,000	$63,000	$63,000	$78 ,000
Total Annual Cost:	$99,900	$648,500	$460,500	$784,000

[1] Mitigation costs are estimates pending coordination with resource agencies.

Benefit/Cost Analysis- The total annual costs for each alternative were compared to the expected annual benefits to determine a benefit-cost ratio. The alternative that produces the greatest net benefits is considered the NED plan. **Table 4.14** shows the net benefits and the benefit-cost ratio for each alternative. As shown in the table, the NED plan is Alternative 4 because it has the highest net annual benefits, totaling $244,900.

Table 4.14. Benefit / Cost Ratio, Santa Fe Dam

	Alt. 2	Alt. 3A	Alt. 3B	Alt. 4
Avg Annual Benefits	$169,400	$593,300	$593,300	$1,028,900
Avg Annual Costs	$99,900	$648,500	$460,500	$784,000
Net Annual Benefits	$69,500	($55,200)	$132,800	$244,900
B / C Ratio	1.7	0.9	1.3	1.3

Whittier Narrows Dam

Water Conservation Yield- The average annual water conservation yield was determined for each alternative's specific operation according to the hydrologic methodology identified in Section 4.7, "Study Methodology." The analysis resulted in average annual yields as shown below in **Table 4.15**.

Table 4.15 Water Conservation Yield, Whittier Narrows Dam

	Alt 1	Alt 2	Alt 3	Alt 4
Average Annual Water Yield (ac-ft)	60,600	63,500	66,100	65,900
Incremental Increase in Average Annual Water Yield (ac-ft)	n/a	2,900	5,500	5,300

Alternative 1: No-Action Alternative
Alternative 2: Water Conservation Pool Only at 209 ft NGVD (64.4 m NAVD)
Alternative 3: Maximum Pools at 215 ft NGVD (66.2 m NAVD), with lower level flooding of water treatment plant
Alternative 4: Maximum Pools at 215 ft NGVD (66.2 m NAVD), with levee protecting reclamation plant

Benefits- Benefits are expressed as average annual values at the current Federal discount rate of 7⅛% with a projected economic life of 50 years. The price level for the analysis is October 1997.

The economic analysis considered the true water conservation for each alternative as determined by the hydrologic analysis. It was assumed that 100% of all increases in yield would be used to meet local water demands. The water supply provided by water conservation practices would be the next least expensive source of water after locally-available groundwater and surface water supplies.

The value of the water conserved at the dam is measured by the opportunity cost of supplying water from the next least-costly alternative to the project. This would be the cost to satisfy the water demand that the project beneficiaries would otherwise have to pay if water were not conserved at the dam. The next least-costly water supply source would be imported water, followed by reclaimed water. It was determined that conserved water provides an average annual benefit of approximately $242 per acre-foot.

Pre-project benefits may also be realized by certain alternatives. Alternatives 3 and 4 conserve water up to elevation 215 ft NGVD (66.2 m NAVD) when the project is completed and in operation. However, before the project is complete, water can be held behind the Dam at a lower elevation during the construction phase. Therefore, benefits accrue prior to the operation of the project. Benefits for one year ($702,000) were compounded to the base year and amortized over the life of the project. Pre-project benefits amount to an additional average annual benefit of $51,700 for Alternatives 3 and 4.

Table 4.16 shows the total average annual benefits provided by the alternatives for water conservation at Whittier Narrows Dam.

Table 4.16 Average Annual Benefits, Whittier Narrows Dam [1]

	Alt 1	Alt 2	Alt 3	Alt 4
Incremental Increase in Annual Water Yield (ac-ft)	n/a	2,900	5,500	5,300
Annual Water Supply Value of Yield	n/a	$702,000	$1,331,300	$1,282,600
Pre-Project Benefits	n/a	$0	$51,700	$51,700
Annual Benefits	n/a	$702,000	$1,383,000	$1,334,300

[1] Costs and benefits based on a 50-year project life @ 7⅛% interest rate
Alternative 1: No-Action Alternative
Alternative 2: Water Conservation Pool Only at 209 ft NGVD (64.4 m NAVD)
Alternative 3: Maximum Pools at 215 ft NGVD (66.2 m NAVD), with lower level flooding of water treatment plant
Alternative 4: Maximum Pools at 215 ft NGVD (66.2 m NAVD), with levee protecting reclamation plant

Costs- The cost of the alternatives were amortized over the 50 year project life. Interest during construction (IDC) and gross investment is shown in the following table. IDC is taken for construction costs, planning, engineering and design (PE&D) costs, and supervision and administration (S&A) costs, but is not taken on real estate costs. Gross investment is then amortized at 7⅛% over a period of 50 years to calculate the expected annual cost. Operation and maintenance cost is then added to arrive at total annual cost. **Table 4.17** shows the estimated total annual costs for the alternatives.

Benefit/Cost Analysis- The total annual costs for each alternative were compared to the expected annual benefits to determine a benefit-cost ratio. The alternative that produces the greatest net benefits is considered the NED plan. **Table 4.18** shows the net benefits and the benefit-cost ratio for each alternative. As shown in the table, the NED plan is Alternative 2 because it has the highest net annual benefits, totaling $70,500.

4.9.4 Additional Evaluation Criteria

In addition, criteria for evaluation of alternatives followed procedures set forth in the Water Resources Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (Principles and Guidelines). Principles and Guidelines defines four criteria, completeness, effectiveness, efficiency, and acceptability against which alternatives are evaluated.

Table 4.17
Whittier Narrows Water Conservation Study
Total Annual Costs

Cost	Alternative 2	Alternative 3	Alternative 4
Real Estate*	$2,276,600	$2,276,600	$2,276,600
Mitigation***	$109,900	$2,000,000	$4,000,000
Construction	$4,198,000	$1,940,700	$21,968,000
Interest (IDC) - 1 Yr	$146,900	$679,200	$1,768,400
Total First Cost:	$6,731,400	$24,362,800	$30,013,000
Annual Cost (50yr @ 7 1/8%)	$495,500	$1,793,300	$2,209,200
Annual Environmental Costs+	$72,800	$72,800	$72,800
Recreation**	$16,300	$28,500	$28,500
O & M Cost:	$46,700	$46,700	$46,700
Total Annual Cost:	$631,300	$1,941,300	$2,357,200

* Real Estate cost includes cost of capping oil wells and loss of future income (899,000 + 1,377,600).

** See Recreation appendix for details.

***Mitigation costs over project life are brought to present value

\+ Other annual Environmental costs include cowbird trapping and exotics removal

Table 4.18 Whittier Narrows Water Conservation Study Benefit / Cost Ratio			
	Alternative 2	**Alternative 3**	**Alternative 4**
Avg Annual Benefits	$701,800	$1,382,700	$1,334,300
Avg Annual Costs	$631,300	$1,941,300	$2,357,200
Net Benefits	$70,500	$(558,600)	$(1,022,900)
B / C Ratio	1.1	0.7	0.6

As shown above, Alternative 2 has the highest net benefits.

Completeness is the extent to which the plan includes all elements and accounts for all necessary investments to achieve the national objectives of the plan. All alternatives for both dams may be considered as satisfying this criterion except for the no-action alternatives, which would not result in actual increases in water yield due to operational changes.

Effectiveness is the extent to which an alternative plan alleviates the specified problems and achieves the specified opportunities. Again, all alternatives for both dams may be considered as satisfying this criterion except for the no-action alternative, but the degree to which the plans address an increase in water conservation yield differs. For both dams, Alternative 4 is the most effective alternative.

Efficiency is the cost effectiveness of the plan expressed in net economic benefits. For Santa Fe Dam, Alternative 3B results in the highest net annual benefits of $124,000 while for Whittier Narrows Dam, Alternative 2 provides the greatest net annual benefits of $70,500.

Acceptability is defined as acceptance of the plan by the non-Federal sponsor, the concerned public, and State and local entities, as well as its compatibility with existing laws, regulations and public policies. In the current study, the non-Federal sponsor has determined that Alternative 3B for Santa Fe Dam and Alternative 2 for Whittier Narrows Dam are the most acceptable alternatives. Release and circulation of this Draft report is intended to provide comments related to acceptability from the concerned public, State and local entities, special interest groups, and affected businesses.

4.9.5 Plan Selection

Santa Fe Dam

The **NED Plan, Alternative** 4 with a maximum pool at 473 ft NGVD, is not the plan preferred by the non-Federal sponsor and is not being recommended for selection for the following reasons. First, while it does provide the non-Federal sponsor with a significant increase in realizable water conservation yield compared to Alternative 3 (average annual increase of 2400 acre-feet/year compared to 4,200 acre-feet per year). The reason that it has the highest amount of net benefits even though the NED Plan requires major construction investment and water to this elevation could significantly impact the biological resources. Finally, it does not meet the *acceptability* criterion since the non-Federal sponsor prefers Alternative 3. Based on new planning guidance[3] that recognizes that additional water supply at Federal dam facilities is a fully non-Federal expense, the identification of an NED Plan—normally an indication of the maximum amount of Federal participation that the non-Federal sponsor may expect—is no longer required. Therefore, the plan selected for recommendation at Santa Fe Dam is the **Locally-Preferred Plan** which is **Alternative 3B** having a maximum pool at 463 ft NGVD (141.9 m NAVD). The plan is discussed in Chapter V,"Description of the Selected Plans," below.

Whittier Narrows Dam

The **NED Plan** and the **Locally-Preferred Plan** for water conservation at Whittier Narrows Dam as presented in the Plan Formulation chapter of this report is **Alternative 2** with a seasonal/buffer water conservation pool elevation of 209 feet NGVD (64.4 m NAVD).

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[3] Planning Guidance Letter 97-10 entitled *Shortening the Planning Process,* and recent guidance issued for the Prado Dam Water Conservation Study being conducted concurrently.

V. DESCRIPTION OF THE SELECTED PLANS

5.1 Santa Fe Dam

Alternative 3 has two solutions for drainage behind the levee (Alternatives 3A and 3B, which differ in how ponded water is drained behind the levee, protecting the recreation lake). **Alternative 3B** was selected as the Locally-Preferred Plan for water conservation at Santa Fe Dam, and provides for a seasonal/buffer water conservation pool elevation of 463 feet NGVD (141.9 m NAVD). This plan would utilize the existing debris pool, up to elevation 456 ft NGVD (139.8 m NAVD), for water conservation during the flood season. During the flood season, impounded water could be allowed to encroach upon the flood pool—up to 463 ft—for water conservation purposes; this is termed the buffer pool. During the non-flood season, water could be held up to elevation 463 ft for water conservation purposes; this is termed the seasonal pool. Flood forecasting would be used to ensure that enough conservation water is evacuated from the flood control pool prior to forecasted events. The buffer and seasonal pools would have a storage volume of approximately 6,016 acre-feet (7.4 million m^3) at elev 463 ft. The selected plan would result in an increase of 2,400 acre-feet (2.9 million m^3) in the average annual water yield compared to the no-action alternative. Elevation 463 ft represents a holding capacity of 15 percent of the flood control capacity of the reservoir.

5.1.1 Operation, Maintenance, Replacement, and Rehabilitation Requirements

Operation of the Santa Fe Dam for water conservation would at no time compromise the flood control capacity of the dam since the water stored for conservation purposes could be completely evacuated within 24 hours. When a flood event is forecast, the reservoir would be drawn down to accommodate the anticipated inflow volume from the event. No additional gages or services would be required. The seasonal pool would be drawn down, as well, if an unseasonable flood event is forecast. October would be used for reservoir maintenance if necessary to ensure the capacity of the flood pool would be available at the start of the flood season. Water stored for conservation purposes would be released at a rate which will evacuate the pool with sufficient time to perform the required maintenance prior to the start of flood season.

The water control manual for flood control operations, as well as guidelines provided by, or approved by the Corps of Engineers for operation, maintenance, replacement, and rehabilitation of the Santa Fe Dam, would need to be revised to incorporate the water conservation operations of the selected plan. The development of the water control manual and revised guidelines would include the additional monitoring and evaluation of reservoir impacts. The frequency of maintenance performed on the outlet structures, electrical and mechanical parts and motors, and control gates and valves is also expected to increase due to the additional wear from water conservation discharge.

Additional costs are based on past costs as Santa Fe and other Corps dams where similar costs have been identified.

Non-routine costs consist of the need to refurbish the outlet gates much more frequently. The rate of deterioration is related to the number of days in which the gates are inundated, based on past experience with Prado Dam and Painted Rock Dam. Under a scenario of 120 days annual inundation, the frequency of rust removal, priming, repainting, and other corrosion control measures will be necessary every five years on average (without water conservation, the work would only be necessary an estimated once every 30 years). Average annual cost for this and the pump station is included in the cost estimate.

Removal of sediment has been done at a profit at other Corps dams due to sand and gravel being sold for local use. The potential exists that this can be done again; nevertheless, there is also the potential that sediment removal will have to be performed at a cost. Sediment removal costs of $3 per cubic yard was used in the estimate as the sand and gravel at Santa Fe has previously been sold.

Recreation costs are based on the frequency of the overtopping of the levee and the cleanup of the overflow parking area. Weeds and grass are normally removed each year to accommodate special event parking. This maintenance cost was estimated on one additional cleanup per year.

5.1.2 Plan Features

A levee would be required to protect a portion of the adjacent recreation area from inundation when water is being held at the maximum water conservation level of 463.0 feet NGVD (141.9 m NAVD). The minimum elevation of the top of the levee is the elevation of the seasonal/buffer pool (463 feet NGVD) plus three feet, or 466-feet NGVD (142.8 m NAVD), to allow for wave runup and wind setup. The levee would be armored with grouted riprap on both sides throughout its length to provide erosion protection, particularly for protection from overtopping during a large flood.

This levee would run in a north-south direction and have a length of 4,164 ft (1,269 m). The proposed levee is shown on **Exhibit 9**. The levee would impound a storage volume of 8,161,600

yd^3 (6.2 million m^3). It is estimated that the levee would require approximately 1,080 yd^3 (826 m^3) of cut and 34,005 yd^3 (26,000 m^3) of fill. The top width of the levee would be 12 ft (3.7 m) to accommodate maintenance vehicles. The proposed levee would connect to natural bank, bridge abutments or adjoining improvements with transitions designed to ease differentials in alignment, grade, and slope. The side slope of the levee would be maintained at a ratio of two-to-one.

To provide for the drainage of the area upslope of the levee, two 3-foot (0.9 meter) diameter reinforced concrete pipe (RCP) culverts would convey water through the proposed levee for a distance equal to the width of the levee, approximately 80 feet (24.4 meters). A pump station would be located on a pad on the top of the proposed levee. The pump station would include three impeller-type pumps powered by a 250-horsepower electric motor. This option would not require the reservoir to be lowered below the water conservation pool elevation in order to drain the ponded area, nor would it require alteration of the existing dam embankment.

5.1.3 Project Costs

A detailed cost estimate has been developed using M-CACES procedures in accordance with Corps of Engineers regulations. **Table 5.1** presents a summary of the costs of implementing the selected plan for Santa Fe Dam. The costs are based on October 1997 price levels.

Table 5.1. Costs of the Selected Plan, Santa Fe Dam

Cost	Alternative 3B
Mitigation	$210,000
Construction	$3,971,000
Interest (IDC)	$103,600
Total First Cost:	$4,285,000
Annual Cost (50yr @ 7 1/8%)	$315,000
Annual Environmental Costs	$82,500
O & M Cost:	$63,000
Total Annual Cost:	$460,500

[1] Mitigation costs are estimates pending additional coordination with resource agencies

5.1.4 Project Benefits

The selected plan would yield an increase of 2,400 AF (2.9 million m^3) of water per year. Average annual economic benefits associated with the increases in water yield provided by the selected plan are approximately $594,000. Even before the construction of project features is complete, water could be held behind the dam up to elevation 456 ft NGVD (139.8 m NAVD). This is the elevation of the existing debris pool. Therefore, benefits also accrue prior to the operation of the project. Benefits for one year ($169,400) were compounded to the base year and amortized over the life of the project. Pre-project benefits amount to an additional average annual amount of $12,500 for the selected plan. Therefore, the total average annual economic benefit of the selected plan is $594,000.

5.1.5 Cost Saving Opportunities

The design elevation of the top of the levees and roads within the Santa Fe Basin was determined by adding the elevation of the seasonal/buffer pool, plus three feet (0.9 meters) to allow for overtopping protection. The additional three feet for overtopping protection was calculated from a 200-year wind event—the only event for which data was available at this location. Since a higher frequency event such as a 20- or 50-year event would offer an acceptable design level of protection, additional efforts at identifying the design wind conditions would be made during the design phase. Cost savings would result from a reduction in the elevation allowance for overtopping protection.

5.1.6 Economic Analysis

Table 5.2 presents the economic analysis of the selected plan. The analysis is based on October 1997 price levels, and an interest rate of 7⅛% over a 50-year period. The analysis shows that the selected plan is economically justified, with an estimated $132,800 in net annual NED benefits and a benefit-cost ratio of 1.3.

Table 5.2. Economic Analysis of the Selected Plan, Santa Fe Dam

Item	Alternative 3B
Avg Annual Benefits	$593,300
Avg Annual Costs	$460,500
Net Benefits	$132,800
B / C Ratio	1.3

5.1.7 Recreation Impacts

A levee would be built to protect recreation from inundation. There would be no impact on recreation under this alternative.

5.1.8 Evacuation Plan

The current Santa Fe Dam Evacuation Plan is implemented in the event that there is a grave emergency necessitating a park closure and evacuation. The park personnel will handle the execution of this plan with the assistance of the Park Police units and surrounding police agencies. Park Management will revise the evacuation plan prior to implementation of any water conservation plans.

5.1.9 Environmental Effects and Mitigation Requirements

This report includes a combined Environmental Impact Statement/Environmental Impact Report (EIS/EIR), prepared in full compliance with the requirements and guidelines of the national Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). The combined EIS/EIR also includes documentation in compliance with other Federal and State laws, policies, and procedures including the Fish and Wildlife Coordination Act, Clean Air Act, Clean Water Act, National Historic Preservation Act, Endangered Species Act, and other requirements.

The findings of the environmental studies as documented in the EIS/EIR indicate that there may be adverse but not significant impacts to some riparian habitat that could be mitigated upon coordination with the resource agencies and monitoring during project operation. Further, significant adverse impacts are expected to affect intermediate and mature alluvial scrub; however, these impacts would be mitigated.

It is expected that any construction impacts would be minimized by complying with measures included in the Corps of Engineers' specifications and local ordinances associated with environmental protection, such as monitoring, cleaning up spills, watering and grading controls, and equipment air quality standards.

5.2 Whittier Narrows Dam

The NED Plan and the Locally-Preferred Plan for water conservation at Whittier Narrows Dam as presented in the Plan Formulation chapter of this report is **Alternative 2** with a seasonal/buffer water conservation pool elevation of 209 feet NGVD (64.4 m NAVD). The plan would utilize the existing water conservation pool, up to elevation 201.6 ft NGVD (62.2 m NAVD), for water conservation during the flood season. During the flood season, impounded water would be allowed to encroach upon the flood pool—up to elevation 209 ft—for water conservation purposes; this is termed the buffer pool. During the non-flood season, water would be held up to elevation 209 ft for water conservation purposes; this is termed the seasonal pool. Flood forecasting would be used to ensure that enough conservation water is evacuated from the flood control pool prior to forecast flood events. The buffer and seasonal pools would have a storage volume of approximately 5,777 acre-feet (7.1 million m^3) at elev 209 ft. The selected plan would result in an increase of 2,900 acre-feet (3.6 million m^3) in the average annual water yield compared to the no-action alternative. Elevation 209 ft. represents a water storage capacity of 13 percent of the flood control capacity of the reservoir.

5.2.1 Operation, Maintenance, Replacement, and Rehabilitation Requirements

Operation of the Whittier Narrows Dam for water conservation would at no time compromise the flood control capacity of the dam since the water stored for conservation purposes could be completely evacuated within 24 hours. When a flood event is forecast, the reservoir would be drawn down to accommodate the anticipated inflow volume from the event. No additional gages or services would be required. The seasonal pool would be drawn down, as well, if an unseasonable flood event is forecast. October would be used for reservoir maintenance to ensure the capacity of the flood pool would be available at the start of the flood season. Water stored for conservation purposes would be released at a rate which will evacuate the pool with sufficient time to perform the required maintenance prior to the start of the flood season.

The water control manual for flood control operations, as well as guidelines provided by, or approved by the Corps of Engineers for operation, maintenance, replacement, and rehabilitation of the Whittier Narrows Dam would need to be revised to incorporate the water conservation operations of the selected plan. The development of the water control manual and revised guidelines would include the additional monitoring and evaluation of reservoir impacts. The frequency of maintenance performed on the outlet structures, electrical and mechanical parts and motors, and control gates and valves is also expected to increase due to the additional wear from water conservation discharge.

Additional costs are based on past costs as Santa Fe and other Corps dams where similar costs have been identified.

Non-routine costs consist of the need to refurbish the outlet gates much more frequently. The rate of deterioration is related to the number of days in which the gates are inundated, based on past experience with Prado Dam and Painted Rock Dam. Under a scenario of 120 days annual inundation, the frequency of rust removal, priming, repainting, and other corrosion control measures will be necessary every five years on average (without water conservation, the work would only be necessary an estimated once every 30 years).

Removal of sediment has been done at a profit at Corps dams as sand and gravel were for local use. The potential exists that this can be done again; nevertheless, there is also the potential the sediment removal will have to be performed at a cost as it was in 1994 when LACDPW paid to have the sediment removed due to the presence of alligator weed. Sediment removal costs of $3 per cubic yard (based on previous removal cost) was used in the estimate due to the vegetation (alligator weed) in the sediment.

The proposed recreation costs are based on the frequency of the overtopping of the roads and the cleanup of the archery range, trails, and other amenities. This maintenance cost was estimated at one additional cleanup per year.

5.2.2 Plan Features

To protect existing facilities such as the Water Treatment Plant and roads that would otherwise be impacted by the water conservation plan, modifications would be made to ensure continuous operation. San Gabriel/Durfee Avenue and Rosemead Boulevards would have to be raised to 212 feet NGVD (65.3 m NAVD) in order to both (1) protect the recreational facilities when the seasonal/buffer pool is at its maximum water surface elevation of 209 feet, and (2) allow traffic continuous use of the road. The additional 3 feet (0.9 m) provides freeboard for overtopping protection. Lincoln Boulevard would be raised to allow traffic continuous use of the road. A ring levee would be constructed around the water treatment plant.

San Gabriel/Durfee Ave Improvement

San Gabriel Boulevard to the west of Rosemead Blvd becomes Durfee Avenue as it crosses its intersection with Rosemead Boulevard. These two roads make up a continuous section impacted by the water conservation operation. The horizontal alignment of the road would remain unchanged. The total length of the road to be raised is 2,559 ft. Approximately 12,684 cubic yards (cy) of fill and 7 cy of cut would be required for earth work. The upstream and downstream sides would be protected by grouted riprap whose weight is comprised of 2,265 metric tons of stone and 574 cy of concrete.

Rosemead Boulevard Improvement

The improvement of San Gabriel/Durfee Ave requires the re-alignment of a 211 ft. length of Rosemead Boulevard at the intersection to provide a gradual transition onto existing grade. Approximately 768 cy of cut would be required. It is estimated that for new pavement 203 cy of asphalt and 441 cy of aggregate base will be required.

Lincoln Boulevard Improvement

A section of Lincoln Boulevard 1,509 ft in length would have to be raised to 212 ft. for wave runup and wind setup. The horizontal alignment of the road would remain unchanged or in conformance with the existing right-of-way. Approximately 10,292 cy of fill and no cut would be required for earthwork. While the upstream side is laying against the side of the hill, the downstream slope would be protected by grouted stone with a volume of 538 cy of riprap and 177cy of concrete.

Borrow Area

The borrow area for the roads and levee would be located northwest of the water treatment plant. Calculations of cut and fill material for the borrow area are given in the General Design Appendix. This area is currently disturbed grassland. The area would be encouraged to develop as riparian habitat including its emergent edge and understory. Top soil would be replaced after fill material is removed, and the area would then be graded to allow surface runoff to flow towards the dam and the outlet works and thereby provide water required by the habitat. The area would be used as mitigation of adverse impacts to habitat is such mitigation is determined to be necessary by ongoing coordination with resource agencies and monitoring. The borrow area would be supplemented with plantings of native riparian species if natural establishment does not occur within a reasonable amount of time, such as one to two years.

Interior Drainage

For interior drainage control, as mentioned above, a double-cell, 12 ft wide by 4 ft high inside dimension (for a combined 24 ft wide by 4 ft high) reinforced concrete box (RCB) culvert would be constructed under Durfee Avenue approximately 1,750 ft (534 m) east of the intersection of Rosemead and San Gabriel Boulevard/Durfee Avenue. As a result, 1,296 feet (395 m) Durfee Avenue would be raised to a maximum elevation of 219.5 ft NGVD (67.7 m NAVD) to maintain a minimum of 3 ft cover over the RCB culvert. The actual elevation, determined during preparation of plans and specifications, would be based on the utility requirements under the road surface. The new alignment would provide a smooth transition onto the existing grades at both ends. It is estimated the required quantities would be 332 yd^3 (254 m^3) of asphalt concrete, 425 yd^3 (325 m^3) of aggregate base, and 1,474 yd^3 (1,127 m^3) of sub-base.

Modifications to Whittier Wastewater Reclamation Plant

The Whittier Wastewater Reclamation Plant is located within the seasonal/buffer pool with a ground floor finish grade of 208.5 ft NGVD (64.3 m NAVD). Although the plant would remain operable during flood inundation, discussion with Los Angeles County Sanitation Districts personnel indicated that day-to-day operation of the plant would be impacted. To insure minimal impact and continuous operation of the plant when the water conservation level reaches 209 ft, a ring levee would be constructed around the leased area of the water treatment plant. This would include drainage features so that any runoff accumulated behind the levee during storm events can be drained. The top-of-levee elevation would be elev 212.0 ft NGVD (65.32 m NAVD), and the length of the levee would be 3,507 ft. It would have grouted riprap on the upstream and downstream sides, with 2H:1V sideslopes.

LACDPW forsees no problems to utilizing Zone 1 outfall as an emergancy outlet, and is willing to work out operational and access detatils with County Sanitation Districts during development of the implementation plan.

5.2.3 Project Costs

A detailed cost estimate has been developed using M-CACES procedures in accordance with Corps of Engineers regulations. **Table 5.3** presents a summary of the costs of implementing the selected plan for the Whittier Narrows Dam. The costs are based on October 1997 price levels.

Table 5.3. Total Annual Costs of the Selected Plan, Whittier Narrows

Cost	Alternative 2 [1]
Real Estate *	$2,276,600
Construction	$4,198,000
Interest (IDC)	$146,900
Total First Cost:	$6,731,400
Annual Environmental Costs+	$72,800
Annual Cost (50yr @ 7 1/8%)	$421,000
Mitigation ***	$8,800
Recreation **	$16,300
O & M Cost:	$46,700
Total Annual Cost:	$631,300

* Real Estate cost includes cost of capping oil wells and loss of future income (899,000 + 1,377,600).
** See Recreation appendix for details.
***Mitigation costs over project life are brought to present value
+ Other annual Environmental costs include cowbird trapping and exotics removal

5.2.4 Project Benefits

This alternative yields increased water supply of 2,900 AF (3.6 million m^3) per year. Average annual economic benefits associated with the increases in water yield provided by the selected plan are approximately $702,000.

5.2.5 Cost Saving Opportunities

An opportunity for cost savings exists if an existing levee currently located to the east of Lincoln Avenue were raised instead of raising Lincoln Avenue. This option would be more cost effective and less disruptive to the traffic than raising Lincoln Avenue. The impacts that the proposed project would have on recreation could also be reduced with this option. An existing bike path that would be inundated by the water conservation pool could be placed on top of the levee if it were raised. The new bike path would follow the horizontal alignment of the existing bike path, and would be improved for two-way traffic along the 3,635 ft (1,108 m) length that would be raised. The levee would also protect the oil wells located between the levee and Lincoln Avenue from inundation.

However, this option would change the configuration of the water conservation pool, resulting in less available storage. A revised water yield analysis would be needed to quantify the reduction in average annual yield benefits.

5.2.6 Economic Analysis

Table 5.4 presents the economic analysis of the selected plan. The analysis is based on October 1997 price levels, and an interest rate of 7⅛% over a 50-year period. The analysis shows that the selected plan is economically justified, with an estimated $70,500 in net annual NED benefits and a benefit-cost ratio of 1.1.

Table 5.4. Economic Analysis of the Selected Plan, Whittier Narrows Dam

Item	Alternative 2
Avg Annual Benefits	$701,800
Avg Annual Costs	$631,300
Net Benefits	$70,500
B / C Ratio	1.1

5.2.7 Recreation Impacts

The selected plan would result in impoundments for water conservation to elevation 209 ft NGVD (64.4 m NAVD). This would have a minor impact on some recreation facilities. Providing protection for the treatment plant and raising Durfee Avenue would offset any significant adverse impacts.

Impacts that would still occur to recreational facilities in the Whittier Narrows Basin include inundation of the archery range, equestrian trail, and bicycle path. No structures would be affected at this level. Total impact on recreation for the selected plan would be $16,300.

<u>Archery Range</u>

Implementation of the selected plan would result in inundation of the archery range for an additional 30 days per year when compared to the existing conditions. The range has a unit day value of $5.78.

According to the park superintendent, approximately 2 people, on average, use the archery range daily. This would amount to an impact on recreation of $347 per year.

Bicycle Path

A portion of the bicycle path that runs along the Rio Hondo would be inundated and unusable for approximately 30 additional days per year if the selected plan is implemented. The bike path has a unit day value of $5.78 . On average approximately 50 people use the bicycle path each day. This would amount to an annual impact on recreation of $8,670. A portion of the mitigation cost could be used to mitigate this recreation impact if it were determined that bike path closure during these 30 days of inundation is unacceptable.

Equestrian Trail

The equestrian trial running along the western side of the Rio Hondo River Channel would be inundated and unusable for approximately 30 additional days, if the selected plan is implemented. The equestrian trail has a unit day value of $5.78. The trail has an average of 36 daily users according to park officials. The annual impact on recreation amounts to $6,242. A portion of the mitigation cost could be used to mitigate this recreation impact if it were determined that equestrian trail closure during these 30 days of inundation is unacceptable.

Bosque del Rio Hondo

A large portion of Bosque del Rio Hondo would be inundated and unusable. On average 6 people use thhe area daily. The difference between the average days of inundation under with and without project conditions is 30 days. Annual impact on recreationamounts to $1,040.

5.2.8 Evacuation Plan

The current Whittier Narrows Evacuation Plan calls for park personnel to direct people in the park to higher ground if flooding is anticipated. When the public has been evacuated, the park would be locked up by means of traffic gates There are two rowboats for rescue operations. Park Management will review and revise their evacuation plans prior to implementation of any water conservation plans.

5.2.9 Environmental Effects and Mitigation Requirements

This report includes a combined Draft Environmental Impact Statement/Environmental Impact Report (EIS/EIR), prepared in full compliance with the requirements and guidelines of the national Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). The combined document also includes documentation in compliance to other Federal and State laws, policies, and procedures including the Fish and Wildlife Coordination Act, Clean Air Act, Clean Water Act, National Historic Preservation Act, Endangered Species Act, and other requirements.

The findings of the environmental studies as documented in the EIS/EIR indicate that there may be adverse but not significant impacts to some riparian habitat that could be mitigated upon coordination with the resource agencies and monitoring during project operation.

It is expected that any construction impacts would be minimized by complying with measures included in the Corps of Engineers' specifications and local ordinances associated with environmental protection, such as monitoring, cleaning up spills, watering and grading controls, and equipment air quality standards.

Inundation impacts to oil wells within the basin could be mitigated by a variety of methods including capping and plugging well heads, relocating well heads, raising well heads above the water surface level, and/or water proofing the well heads.

VI. PLAN IMPLEMENTATION

This chapter summarizes procedures necessary to implement the Selected Plans including cost-sharing requirements. Information presented includes a review of Federal laws and policies related to the Federal interest in implementation of water conservation projects and its applicability to the Selected Plans. This chapter will also present the expected procedures for implementing the requirements.

6.1 Study Recommendation

The Selected Plans include water conservation features that would encourage increased infiltration of surface water to local groundwater basins. Because of their positive contribution to regional water supply, the selected plans are recommended for implementation.

6.2 Corps Approval Authorities

Federal laws and U.S. Army Corps of Engineers' policies and regulations were reviewed with respect to the Federal interest and responsibilities in implementing the Recommended Plans. Pertinent laws and guidelines as contained in Corps of Engineer's regulations are summarized below.

1. The Corps of Engineers, especially as a Federal agency with the authority to regulate reservoir storage and releases, is urged to maximize water conservation in provisions of 33CFR 222.7(f)(4) as follows:

   "Development and execution of water control plans will include appropriate consideration for efficient water management in conformance with the emphasis on water conservation as a national priority. The objectives of efficient water control management are to produce beneficial water savings and improvements in the availability and quality of water resulting from project regulation and operation. Balanced resource use through improved regulation should be developed to conserve as much water as possible and maximize all project functions consistent with project/system management. Continuous examinations should be made of regulation schedules, possible need for storage reallocation (within existing authority and constraints) and to identify needed changes in normal regulation. Emphasis should be placed on evaluating conditions that could require deviation from normal release schedules as part of drought contingency plans."

2. Section 301(a) of the Water Supply Act of 1958, as amended (43 U.S.C. 390b), established a policy of cooperation in developing water supplies for domestic, municipal, industrial and other purposes. Section 301(b) is the authority for the Corps to include municipal and industrial storage in reservoir projects.

3. Engineering Regulation 1105-2-100, paragraph 4-30a(3) provides for seasonal water conservation in a dam operated by the Federal Government.

4. Study of water conservation on the Los Angeles and San Gabriel Rivers was directed by the Energy and Water Development Appropriations Act of 1993 (Public Law 102-377, dated 2 October 1992) under the authority of the following Congressional resolution approved 25 June 1969, reading in part:

   "Resolved by the Committee on Public Works of the United States Senate, that the Board of Engineers for Rivers and Harbors, created under Section 3 of the River and Harbor Act, approved June 13, 1902, be, and is hereby requested to review the report of the Chief of Engineers on the Los Angeles and San Gabriel Rivers and Ballona Creek, California, published as House Document Numbered 838, Seventy-sixth Congress, and other pertinent reports, with a view to determining whether any modifications contained therein are advisable at the present time, in the resources in the Los Angeles County Drainage Area."

5. The LACDA Authorization also states "...plans for any reservoir project, may, on recommendation of the Chief of Engineers, be modified to provide additional storage capacity for domestic water supply or other conservation, storage, on condition that the cost of such increased storage capacity is contributed by local agencies..."

ER 1105-2-100, paragraph 4-32d (1) on page 4-54 pertains to the approval authority for the reallocation of storage. It provides that Congressional approval is necessary for any such reallocation or addition of storage if same "would have a severe effect on other project purposes" or "would involve major structural or operational changes". It goes on to provide that if these "criteria are not violated", the Chief of Engineers can authorize an additional 15% of total storage capacity allocated to all project purposes or 50,000 AF, whichever is less. The Assistant Secretary of the Army for Civil Works can authorize greater amounts, as long as the above criteria are not violated.

The Federal Government can approve a non-Federal request to modify features or operations of a Federal dam for other purposes including water conservation as long as such modifications do not impact the authorized flood control purpose.

6.3 Cost-Sharing

The proposed Federal and non-Federal cost-sharing for the Recommended Plans is that non-Federal interests provide 100 percent of all separable first costs and separable operation, maintenance, replacement, and rehabilitation. The local sponsor is responsible for all water supply costs allocated to operation and maintenance. These costs must be paid yearly in advance, based on estimated expenditures. Appropriate adjustments will be made at the end of each year. The Los Angeles County Department of Public Works (LACDPW) is the non-Federal sponsor for the proposed project.

Section 308 of the Water Resources Development Act of 1996 (dated 12 October 1996) states:

> *"The non-Federal share for a project to add water conservation to the existing Los Angeles County Drainage Area, California, project, authorized by section 101(b) of the Water Resources Development Act of 1990 (104 Stat. 4611), shall be 100 percent of separable first costs and separable operation, maintenance, and replacement costs associated with the water conservation purpose."*

6.4 Federal Responsibilities for Implementing the Recommended Plans

The Federal Government would be responsible for approving any modifications to the Santa Fe and Whittier Narrows Dams' flood control features for the purpose of adding water conservation. Based on the results of this feasibility study, the addition of water conservation consistent with the Selected Plans would be acceptable for approval. It is expected that the Corps of Engineers would be responsible for ensuring the following take place as non-Federal costs; either the non-Federal sponsor or the Federal government may actually perform the work, depending on the item:

(1) review final design and further analysis to demonstrate that there would be no impacts on the flood control purpose of the project;
(2) revise the water control manual for operation of the dams for flood control and water conservation; and
(3) prepare any supplemental NEPA documents.

The U.S. Army Corps of Engineers may provide technical assistance to the non-Federal sponsor in completing design, plans and specifications, environmental documentation, construction management, and other work as needed to complete the implementation of the Recommended Plans under the Corps of Engineers *Work For Others Program* at 100 percent non-Federal cost. The Government shall also conduct periodic inspections with the non-Federal sponsor to determine adherence to the post-construction maintenance requirements.

The Corps will identify funds to be provided to the Corps to complete required reviews for approval and to inspect the constructed modifications.

6.5 Non-Federal Responsibilities For Implementing the Selected Plans

In order to implement the selected plans, the Los Angeles County Department of Public Works (LACDPW) would be required to:

A) The non-Federal sponsor would be responsible for complying with the Whittier Narrows and Santa Fe Dams Water Control Plan Implementation Additional Water Conservation Engineering Study Plan, 1998, prepared by the Los Angeles District. This plan is summarized as follows and is included as Appendix K of this report:

1) Identify detailed water control plans for each dam that will make appropriate use of meteorological forecasting, rainfall-runoff modeling, direct measurements of stream flow, and precipitation and reservoir inflow determination to achieve the following goals;

a) Make maximum use of seasonal water conservation/buffer pools to achieve water conservation;
b) Do not significantly alter the frequency of inundation of the reservoirs above the seasonal water conservation/buffer pools;
c) Provide for scheduled maintenance of project during non-flood season;
d) Do not increase the frequency of accedence of channel capacity down stream of the projects;
e) Provide rate of change of release restrictions that ensure parties who may be in the channels downstream unbeknownst to the operators have adequate opportunity to escape the channels;
f) Provide adequate time to make notification prior to making release reaching critical elevations within the reservoirs;

2) Perform preliminary investigations including initial preparation/coordination with agencies with which coordination is needed, review existing design documents, obtain hydrologic data, scope major hydrologic activities including choosing models to be used and prepare detailed HEMP.

3) Develop Study Models to evaluate specific water control plans.

4) Formulate and evaluate water control plan alternatives using standard models, previously developed.

5) Develop forecast model if required for selected plan including selecting computer model to be used, review historic and real-time data, choose likely hydromet station candidates for real-time application, configure model for operational forecast application, perform calibration simulations with model with proposed operational data and model, set up procedure for preparing forecast in real-time, test application of forecast model with Reservoir Regulation personnel.

6) Develop Flood Control Operation Guidance to assist regulator and project operators in making regulating decisions for regulating outlet and spillway gate opening sequences and limitations, spillway gate regulation procedures, miscellaneous guidance curves for flood control operations, examples of flood regulation to provide a useful form of guidance for water control manuals, emergency instructions to dam tenders when communication is lost as a mandatory requirement.

7) Develop guidance for conservation operation as there may be special procedures which are required for low-flow operations. This activity might be part of the Drought Contingency Study. This includes:

a) determine need for guidance;
b) perform hydrologic study using models or manual procedures;
c) test guidance on varying hydrologic conditions, prepare plots; and
d) prepare description for water control manual.

8) Develop Drought Contingency Plan as required in Water Control Manual.

9) Prepare Water Control Plan and Manual including:

a) Ascertain need for public meeting on water control plan and if required, prepare briefing material and hold meeting;
b) Establish Manual content, organization and work program;
c) Prepare revised Water Control Manual.

B) Assume all costs associated with implementation of the joint use plan for seasonal expansion of the water conservation pool, including construction costs, compensation costs and increased Federal operation and maintenance costs. In addition, LACDPW shall pay to the Government a share of joint-use operation and maintenance (including repair, replacement, and rehabilitation). The share shall be based on the percent of the allowable conservation storage compared to the total useable storage in the reservoirs for the portion of the year in which water conservation is in effect.

C) Undertake to save and hold harmless the Government against all claims related to the expansion of the water conservation pool and operation of the reservoirs for water conservation purposes.

D) Provide all lands, easements, and rights-of-way, including suitable borrow ans dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation, and maintenance of the project.

E) Obtain and secure all water rights necessary to utilize the increased safe yields created by the projects.

F) Enter into an agreement which provides, prior to construction, 100 percent of all costs relating to preconstruction requirements including Water Control Manual, Design Memorandum, preconstruction engineering and design, (PED) costs, and provide, during construction, any additional funds need to cover the non-Federal share of PED.

G) For so long as the project remains authorized, operate, repair, replace, rehabilitate and maintain the completed project and hydraulic integrity of the system related to water conservation, along with any required long-term dredged or excavated material disposal areas, in a manner compatible with the project's authorized purposes, at no cost to the Government, and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government. The non-Federal sponsor shall provide 100 percent of all separable costs for Operation, Maintenance, Replacement, and Rehabilitation required for implementation of the recommended plans, presently estimated to be $109,700 annually. This cost includes $63,000 at Santa Fe Dam and $46,700 at Whittier Narrows Dam;

H) Complete Supplemental NEPA/CEQA documents as necessary to address impacts associated with changes resulting from final design or construction plans for the project or changed conditions;

I) Approvals and if necessary executed arrangements between Los Angeles County Department of Parks and Recreation (LACDPR) and CALTRANS for modifications;

J) Approvals from California Department of Dam Safety;

K) Obtain Section 404 permit, if needed, and all other regulatory or state dam safety requirements for implementation of the project;

L) Complete Plans and Specifications for construction and future OMRR&R&R associated with implementing the Recommended Plans;

M) Provide funds needed by the Corps of Engineers for review and approval of modifications and any required Corps of Engineers inspections of modifications during and after construction is completed;

N) Documentation that water rights have been arranged.

O) Keep and maintain books, records, documents, and other evidence pertaining o costs and expenses incurred pursuant to the projects to the extent and in such detail as will properly reflect total project costs;

P) Grant the Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for the purpose of completing, operating, maintaining, repairing, replacing, or rehabilitating the project;

Q) Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;

R) Perform, or cause to be performed, any investigations for hazardous substances as are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, and maintenance of the project. However, for lands that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigation unless the Federal Government provides the non-Federal sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigations in accordance with such written direction;

S) Assume complete financial responsibility, as between the Federal Government and the non-Federal sponsor, for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, or maintenance of the project;

T) To the maximum extent practicable, operate, maintain, repair, replace, and rehabilitate the project in a manner that would not cause liability to arise under CERCLA;

U) Prevent future encroachments on project lands, easements, and rights-of-way which might interfere with the proper functioning of the project;

V) Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, required for construction, operation, and maintenance of the project, including those necessary for relocations, borrow materials, and dredged or excavated material disposal, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act;

W) Comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 USC 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army, and Section 402 of the Water Resources Development Act of 1986, as amended(33 U.S.C. 701b-12) requiring non-Federal preparation and implementation of flood plain management plans;

X) Provide cultural resource preservation mitigation and alternative recovery costs attributable to the projects purposes that are in excess of one percent of the total amount authorized to be appropriated for the projects purposes;

Y) Do not use Federal funds to meet non-Federal sponsor's share of the total project costs unless the Federal granting agency verifies in writing that the expenditures of such funds is expressly authorized by statute;

Z) Provide and maintain necessary access roads, parking areas and other public use facilities, open and available to all on equal terms;

AA) Inform affected interests, at least annually regarding the limitations of the protection afforded by the projects.

6.6 Procedures for Implementation

Future actions necessary for authorization and implementation of the recommended plan are summarized as follows:

Upon review of the above items, the Corps of Engineers will reach a decision on final approval for implementing the recommended plans. A Memorandum of Agreement between the Assistant Secretary of the Army for Civil Works, or his delegate, and the non-Federal sponsor will be executed indicating approval and any requirements associated with that approval. The Memorandum of Agreement will identify requirements and responsibilities of the parties. The agreement will include a scope of services for negotiated Value Engineering activities to be accomplished by the Corps for the Local Sponsor.

The non-Federal sponsor would arrange for completion of all requirements as listed above including Plans and Specifications and submit them to the Corps for review and approval. The Corps would approve Plans and Specifications, and advise the non-Federal sponsor of funds needed by the Corps for inspection during construction.

The non-Federal sponsor would be responsible for award and management of construction contracts. Any major modifications during construction to be submitted for Corps approval.

Upon completion of construction, the non-Federal sponsor would submit any final revisions to the water control manual and other OMRR&R&R guidelines and directions for Corps approval.

The non-Federal sponsor would perform OMRR&R&R responsibilities as required.

VII. SUMMARY OF COORDINATION, PUBLIC VIEWS, AND COMMENTS

7.1 Non-Federal Views and Preferences

The non-Federal views and preferences regarding the water supply and conservation project were obtained through coordination with the non-Federal sponsor, with various local and regional agencies, and the general public. These coordination efforts consisted of public meetings held during the reconnaissance and feasibility study phases.

7.2 Summary of Study Management and Coordination

The study team is a multi-disciplinary group that consisted of several functional elements of the Corps and the non-Federal Sponsor. The study team includes study and project managers, hydrologic and hydraulic engineers, groundwater specialists, environmental specialists, cost estimators, designers, economists, geotechnical specialists and real estate specialists.

7.3 Public Views and Comments

The study was coordinated with a variety of agencies, local interest groups and individuals. Comments from the groups and individuals were incorporated in the plan formulation process and evaluation process.

Public Meetings

A public scoping meeting for the Los Angeles Area Water Conservation and Supply at Santa Fe and Whittier Narrows Dams, Feasibility Study, was held on 23 March 1995 in South El Monte, CA. A project overview and description of the proposed projects, background and history, and the need and purpose for the projects was presented at the meeting, including findings of the one-year Reconnaissance Study completed by the Corps in May 1994. A transcript of the Public Scoping Meeting, including comments and responses during the meeting may be found in Appendix H if the EIS/EIR.

A Public Meeting was held 17 August 1998 at the El Monte Community Center in El Monte, California, in order to hear public comments on the Feasibility Study and the Draft EIS/EIR. Colonel Robert L. Davis, District Engineer, presided at the meeting. Approximately 25 members of the public attended the meeting. A court recorder recorded the proceedings verbatim and submitted to the District a transcript of the proceedings. A transcript of the Public Meeting can be found in Appendix H of the EIS/EIR.

Letters of Public Comment

Letters of comment were received by the Los Angeles District and by the Corps' Headquarters in Washington D.C. after the closure of the public comment period. They are included in this chapter with letters of response prepared by the Los Angeles District.

Comments by the Environmental Protection Agency

Letter of Comments was received by the Los Angeles District after the close of the public review period. The Environmental Protection Agency's letter and the District's responses to their comments are included in this chapter.

Final Coordination Act Report

The Los Angeles District received the final Coordination Act Report from the U. S. Fish and Wildlife Service in late February 1999. The Report and the District's comments to the report's recommendations are included in this chapter.

Biological Opinion/Section 7 Consultation

The Los Angeles District received the Biological Opinion from the U.S. Fish and Wildlife Service on 12 April 1999. The Environmental Coordinator and the Study Manager reviewed the report and found several inaccuracies in the report. These comments are included with the report in this chapter.

7.4 Views of the Non--Federal Sponsor

The Los Angeles County Department of Public Works has expressed willingness in continuing to be the non-Federal sponsor for the implementation of the proposed water supply and conservation projects. The local sponsor has indicated their support for the project and willingness to assume the financial obligations for its implementation including additional future planning, analysis, engineering, and implementation of the recommended plan. Included in this chapter are the District Commander's Assessment of Financial Capability and the local sponsor's Statement of Financial Capability.

VIII. RECOMMENDATIONS

I recommend that the Selected Plans, to modify and operate the Santa Fe and Whittier Narrows Dam Facilities for water conservation as described as the Selected Plans herein, be considered for future approval through the execution of a Memorandum of Agreement between the Assistant Secretary of the Army for Civil Works and the non-Federal sponsor, the Los Angeles County Department of Public Works (LACDPW). This recommendation is based on the findings and conclusions of this study that indicate the Selected Plans would result in significant net water conservation benefits without adversely impacting the flood control purpose of Santa Fe and Whittier Narrows Dam Facilities, and that the plans would not result in any significant adverse impacts to the environment.

I further recommend that all separable costs for implementation of the Recommended Plan be a 100 percent non-Federal responsibility.

This recommendation is made with the provision that prior to implementation, non-Federal interests will in accordance with the general requirements of law for this type of project, agree to comply with the Plan Implementation as described in Chapter VI.

The plans presented herein are recommended with such further modifications thereto as in the discretion of the Chief of Engineers may be advisable.

Robert L. Davis
Colonel, Corps of Engineers
District Engineer

IX. REPORT PREPARERS

The following people participated in the preparation of this document and the Appendices of the companion volume.

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Scott Stonestreet	Hydraulics
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James Chieh	Water Quality
Doug Chitwood	Soils Design/Geotechnical Studies
Lois Goodman	Environmental Resources
Pam Maxwell	Cultural Resources
Richard Grover	Recreation/Operations
Theodore Carr	Recreation/Operations
Lowell Flannery	Operations and Maintenance
Carvel Bass	Environmental/Operations
Richard Vaughn	Operations
Debbie Castens	Installation Support/HTRW
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JoAnn Piszker	Dam Safety
Dan Sulzer	Economics
Michael Green	Economics
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Al Rosen	Real Estate
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Ruh-Ming Li	Hydraulics
Ira Mark Artz	Report Preparation
Anna Lantin	Report Preparation/Hydraulics
Patty Sexton	Hydraulics
Josha Crowley	Report Preparation

X. REFERENCES

USACE, 1984. *Hansen Dam Preliminary Formulation Report*. Los Angeles District, Corps of Engineers, September 1984.

USACE, 1991a. *Final Hansen Dam Master Plan and Environmental Impact Statement*, LACDA, CA. Los Angeles District, Corps of Engineers, December 1991.

USACE, 1992a. *Los Angeles County Drainage Area Review - Final Interim Report and Environmental Impact Statement*. Los Angeles District, Corps of Engineers, June, 1992.

USACE, 1992b. *Review of Prado Dam Operation for Water Conservation, Final Report and Environmental Impact Statement*. Los Angeles District, Corps of Engineers, October 1992.

USACE, 1992c. *Seven Oaks and Prado Dams Water Conservation Study, Final Reconnaissance Report*. Los Angeles District, Corps of Engineers, October 1992.

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USFWS, 1993. Letter from Peter Stine, dated December 8, 1993, subject: "Species List Request for the Los Angeles County Drainage Area, Environmental Evaluation/Reconnaissance Study, Los Angeles County, California.

SLA, 1994. *Preliminary Water Conservation Evaluation for Santa Fe and Whittier Narrows Dams*. Prepared by Simons, Li & Associates for the Water Replenishment District of Southern California, January 18, 1994.

USACE, 1997. *Seven Oaks Dam Water Conservation Study, Feasibility Report*. Los Angeles District, Corps of Engineers, June 1997

EXHIBITS

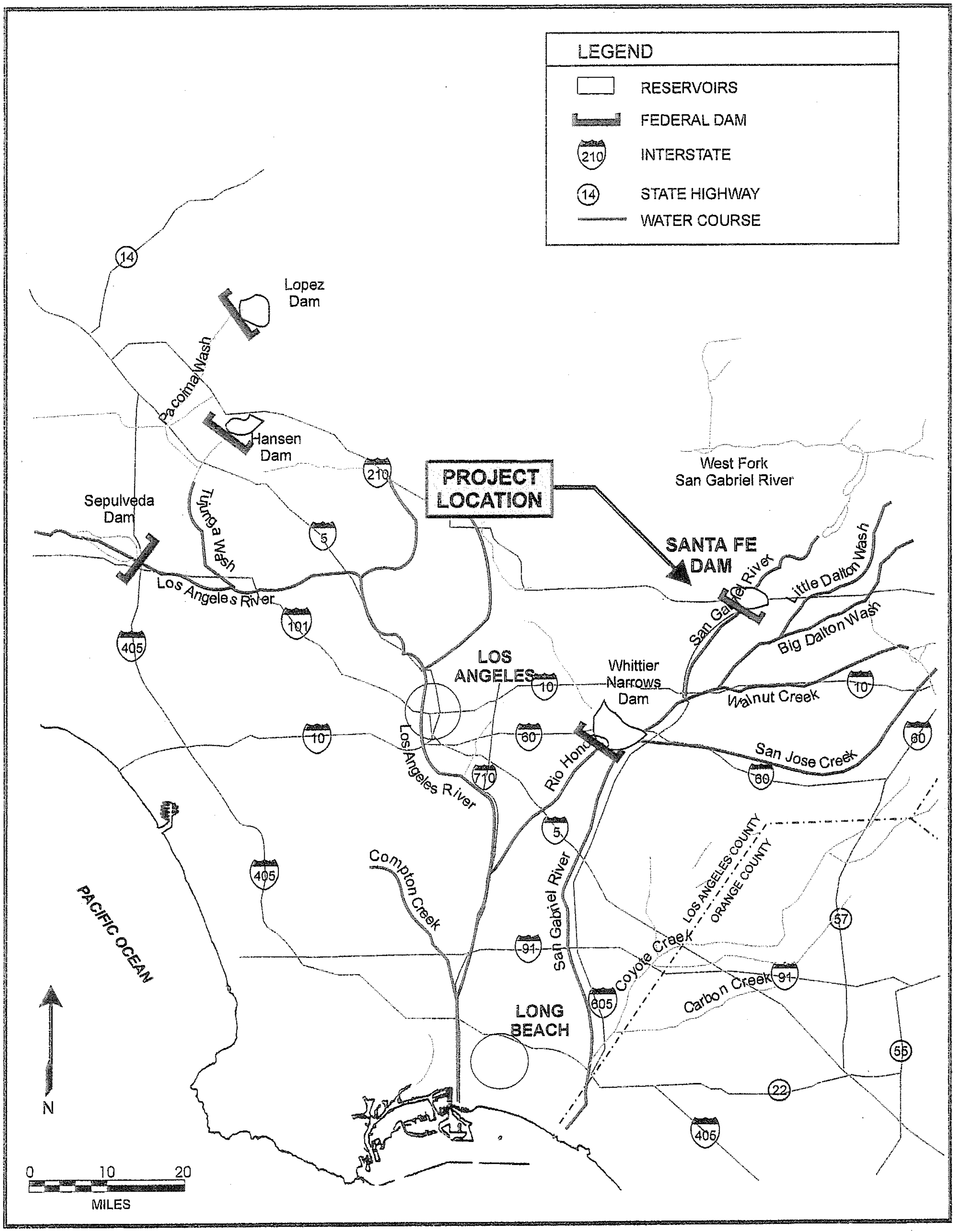


EXHIBIT 1. Project Location Map.

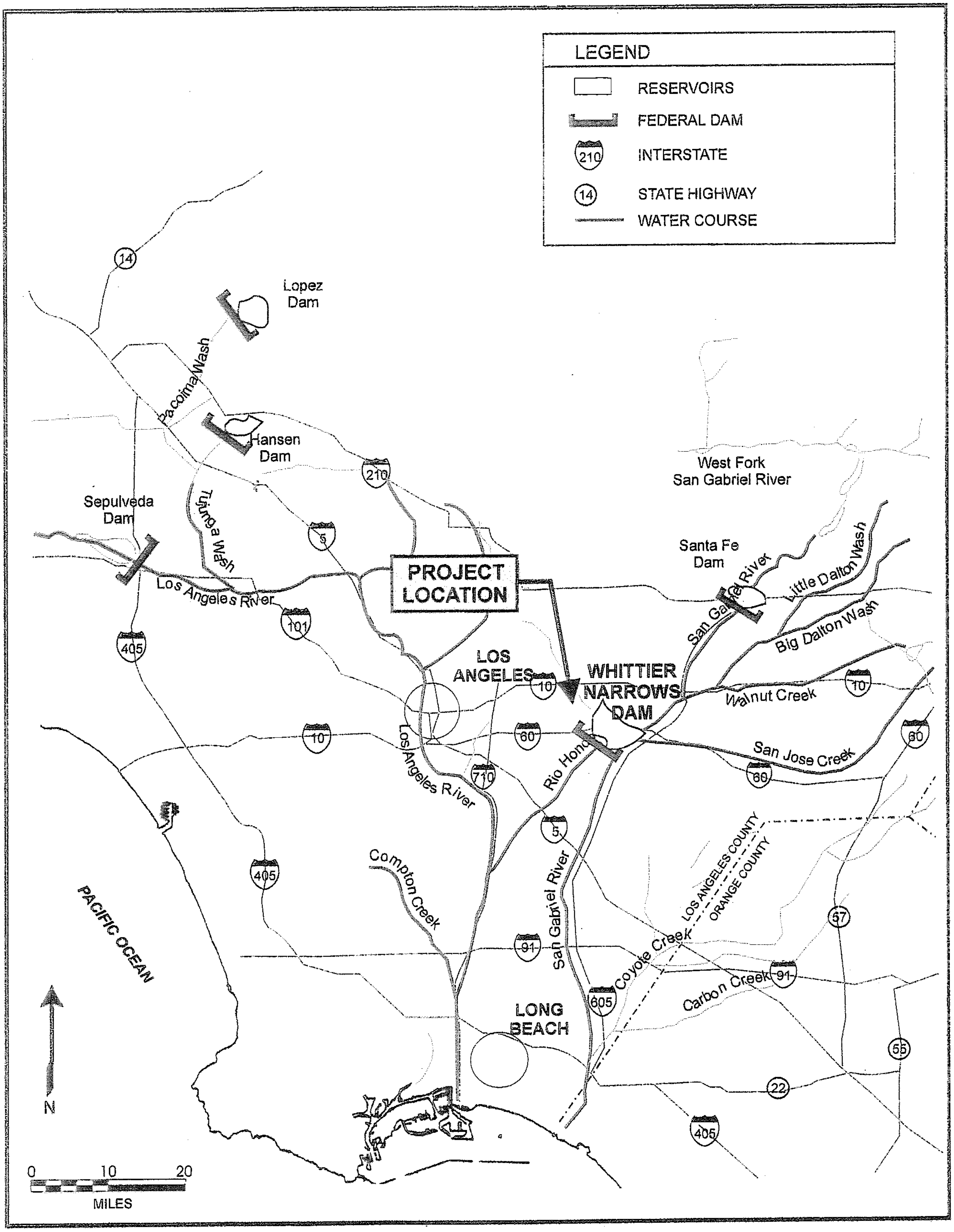
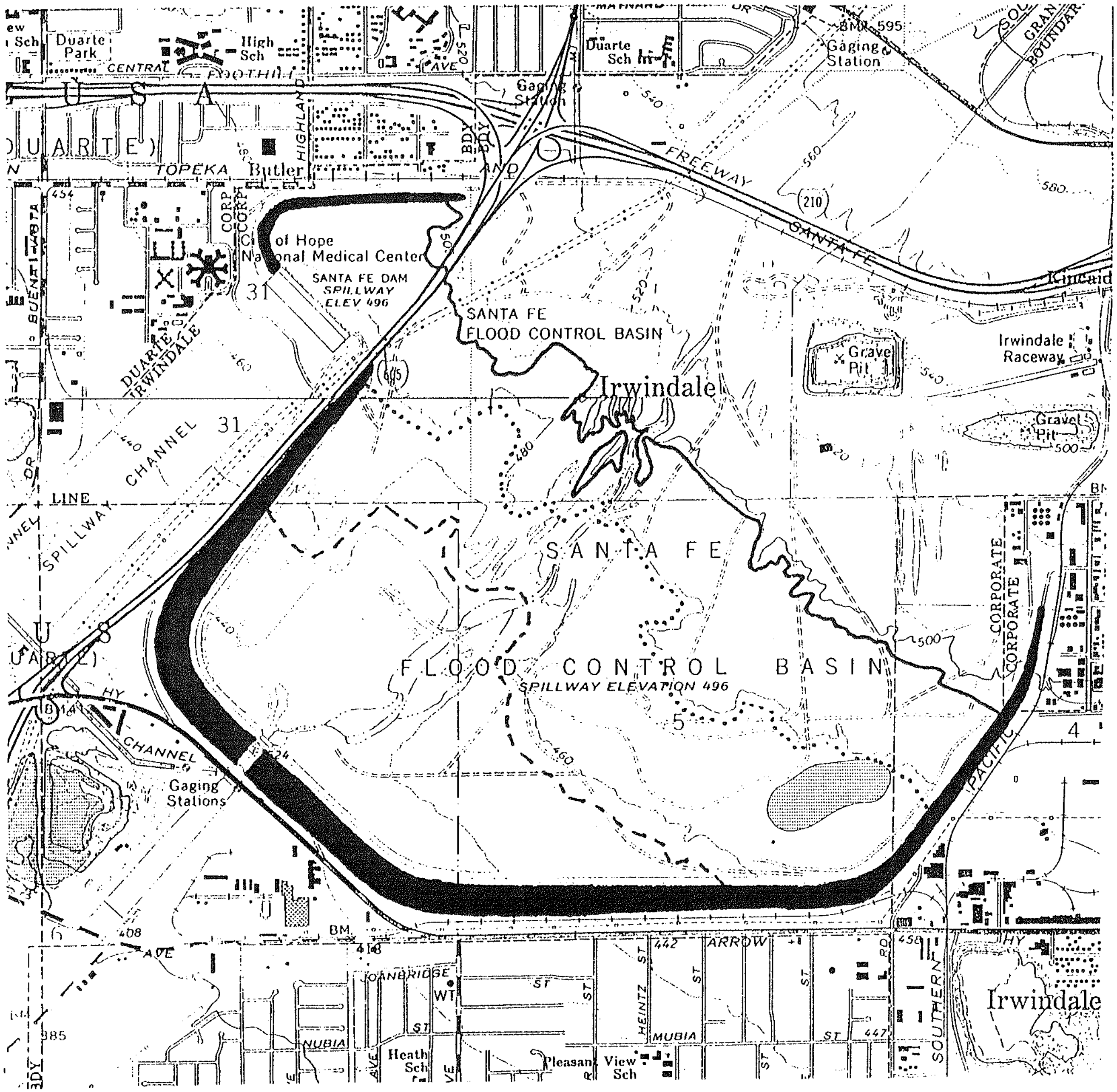


EXHIBIT 1. Project Location Map.

134



Pertinent Data	
Drainage Area	237 mi²
River / Wash	San Gabriel River
Outlet Invert Elevation (Gated 16 - 6'W x 9'H)	421.0 ft
Top of Existing Debris Pool	456.0 ft
Spillway Crest	496.0 ft
Top of Dam	513.0 ft

– – – – Debris Pool
. . . . Max. 100-yr flood elevation
——— Spillway Crest

SCALE 1:24000

0 1/2 1

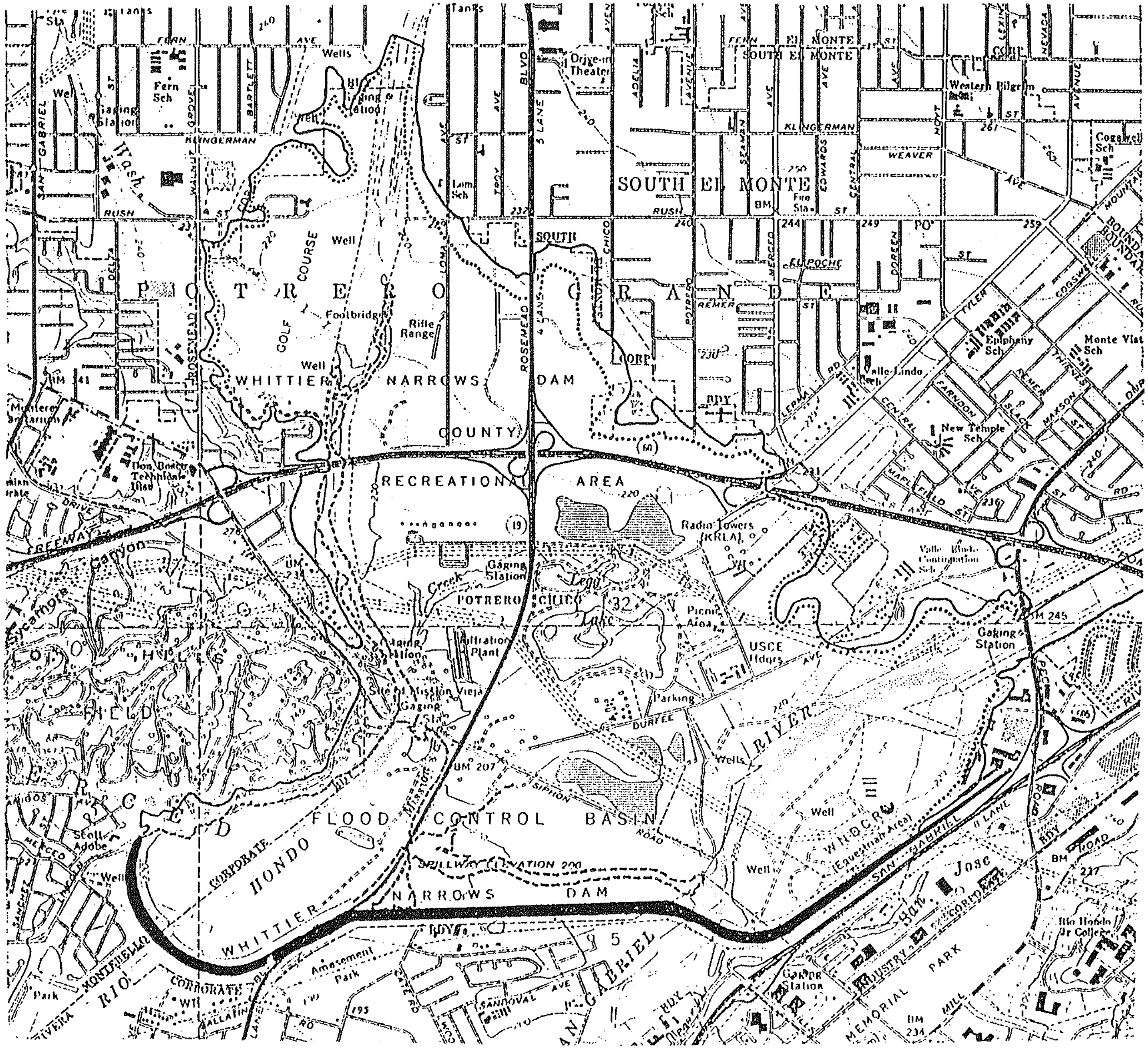
MILES

LOS ANGELES COUNTY
WATER CONSERVATION & SUPPLY STUDY

SANTA FE FLOOD CONTROL BASIN PLAN VIEW

U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Exhibit 2



Pertinent Data	
Drainage Area	547.0 mi^2
River / Wash	San Gabriel River/ Rio Hondo
Outlet Invert Elevation (Gated 4 - 30' W x 19'H)	184.0 ft
Top of Existing Water Conservation Pool	201.6 ft
Spillway Crest (Spillway Gates Closed)	229.0 ft
Top of Dam	239.0 ft

Existing Water Conservation Pool

Max. 100-yr Flood Elevation

Spillway Crest

0 1/2 1

MILES

LOS ANGELES COUNTY

WATER CONSERVATION & SUPPLY STUDY

WHITTIER NARROWS FLOOD CONTROL BASIN PLAN VIEW

U.S. ARMY CORPS OF ENGINEERS

LOS ANGELES DISTRICT

Exhibit 3

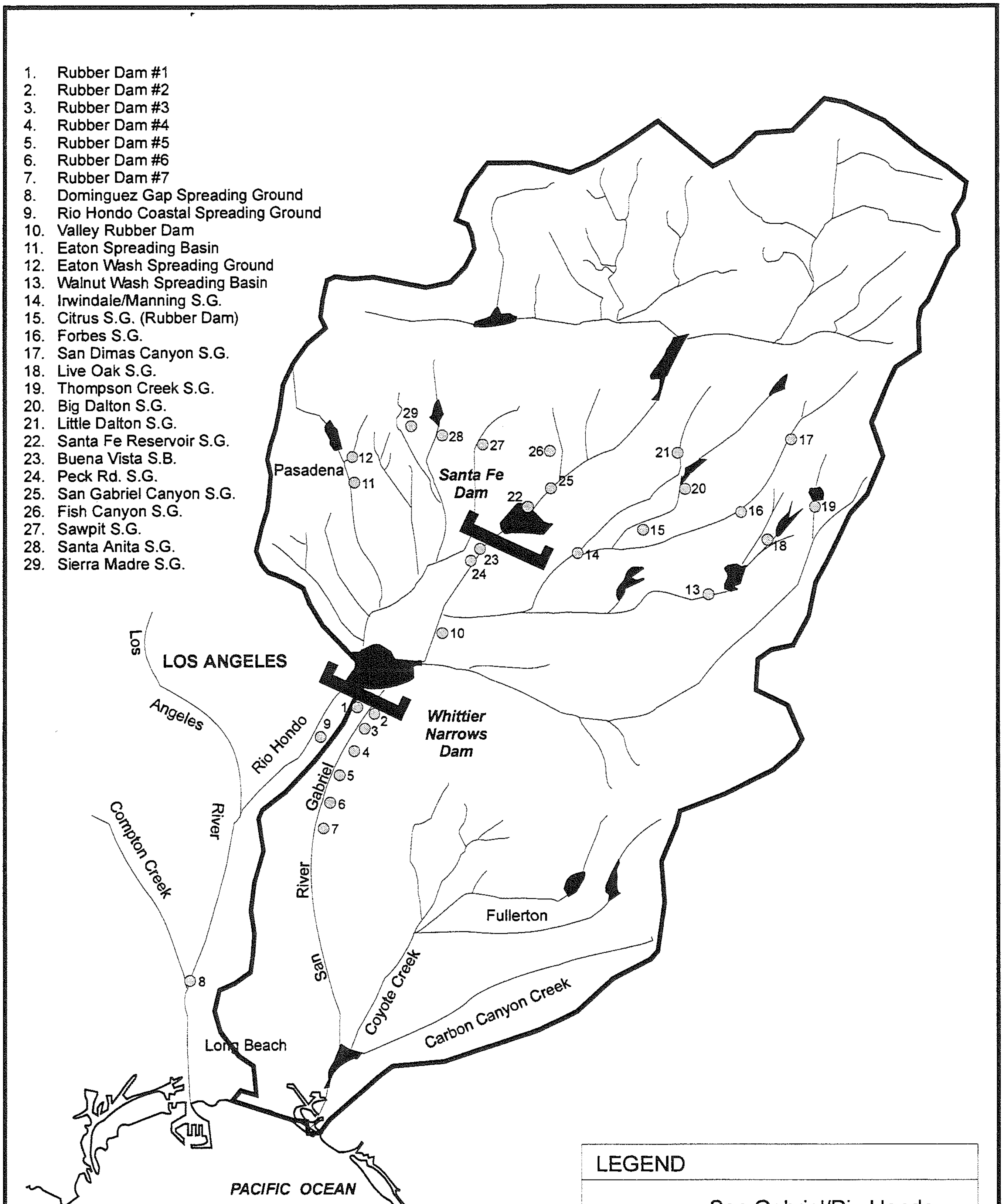
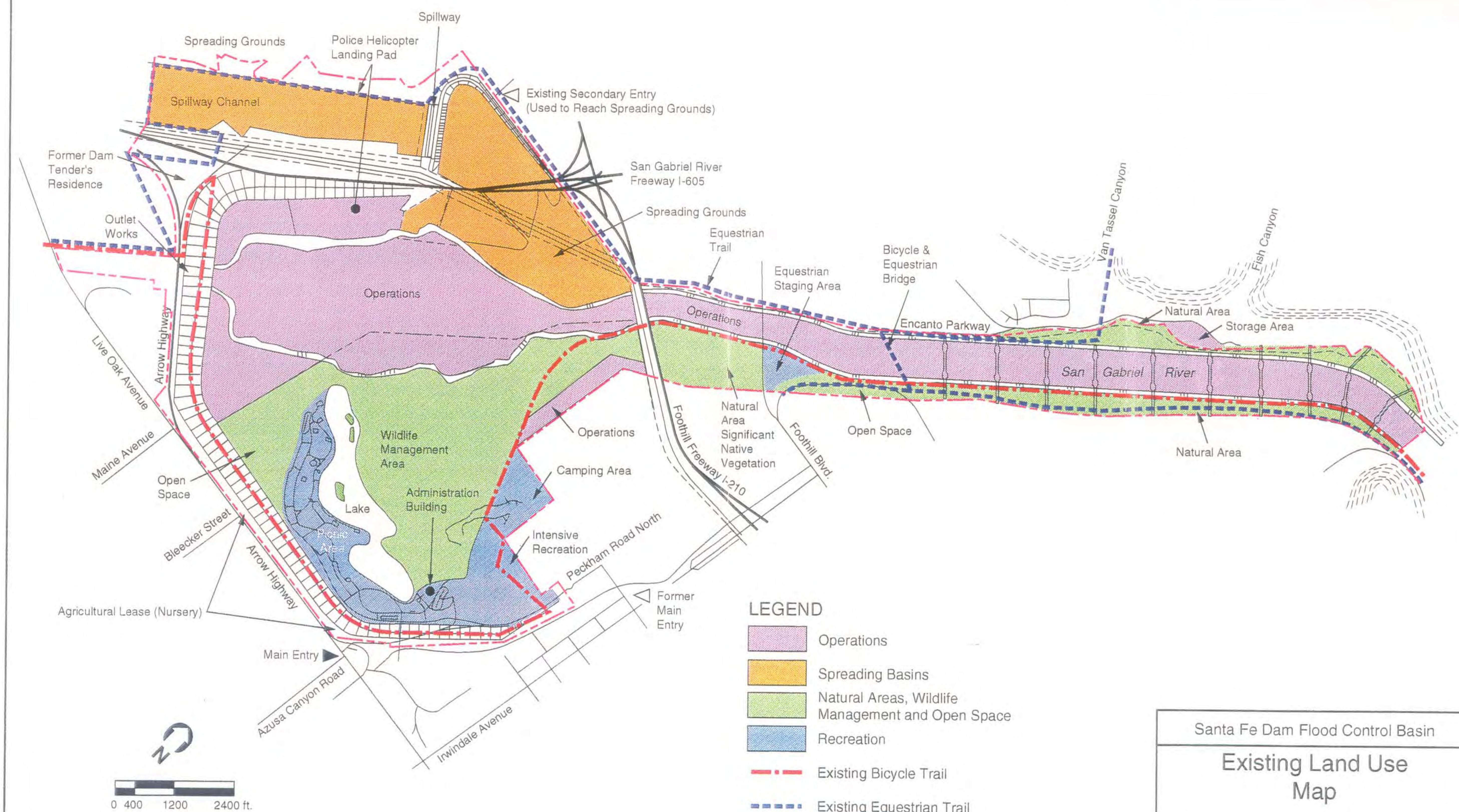


Exhibit 4. Existing Spreading Facilities

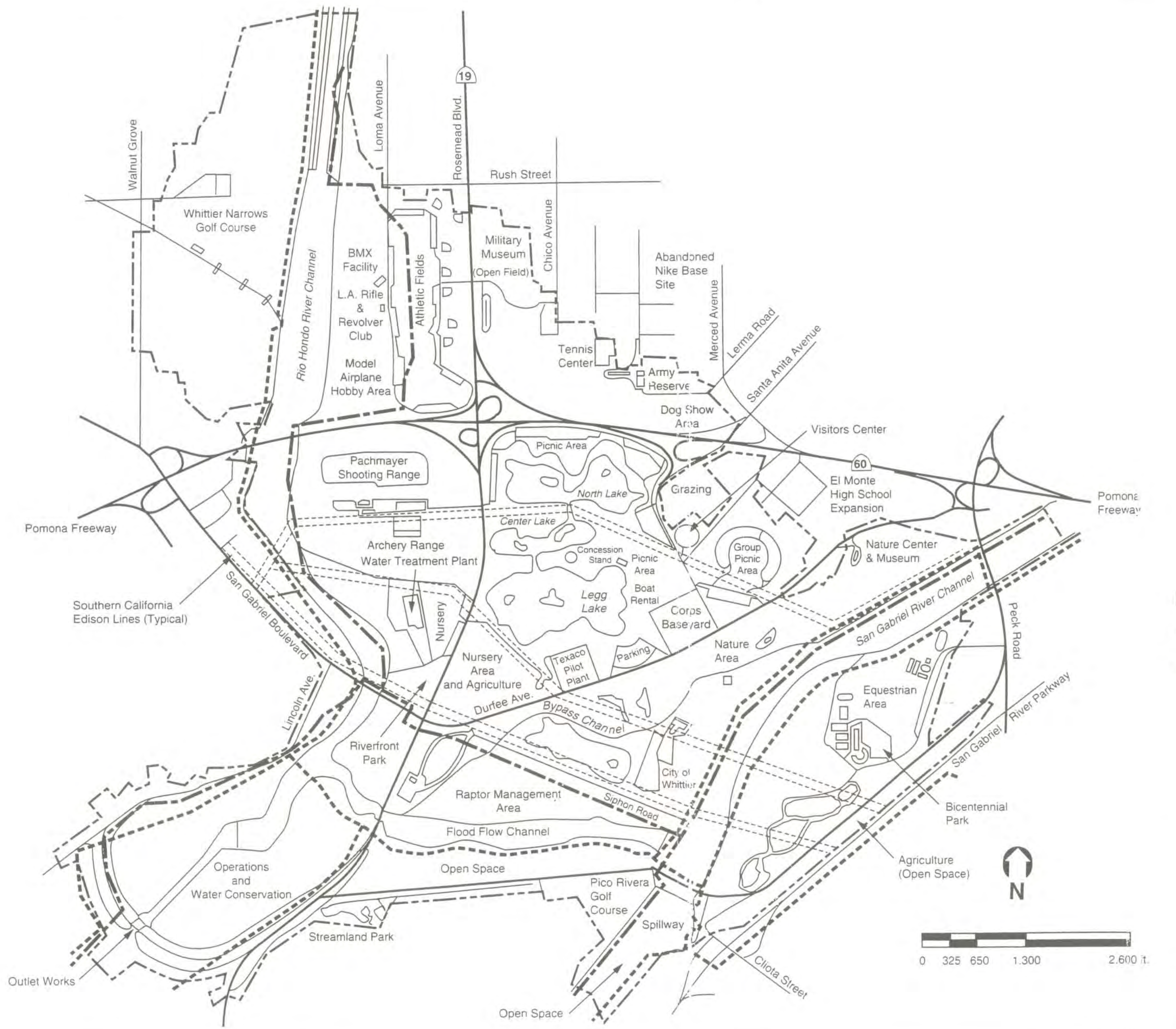


Santa Fe Dam Flood Control Basin

Existing Land Use Map

Exhibit 5

United States Army Engineer District
Los Angeles Corps of Engineers
SEPTEMBER 1997



Whittier Narrows Flood Control Basin

Existing Land Use Map

Exhibit 6

United States Army Engineer District
Los Angeles Corps of Engineers

SEPTEMBER 1997

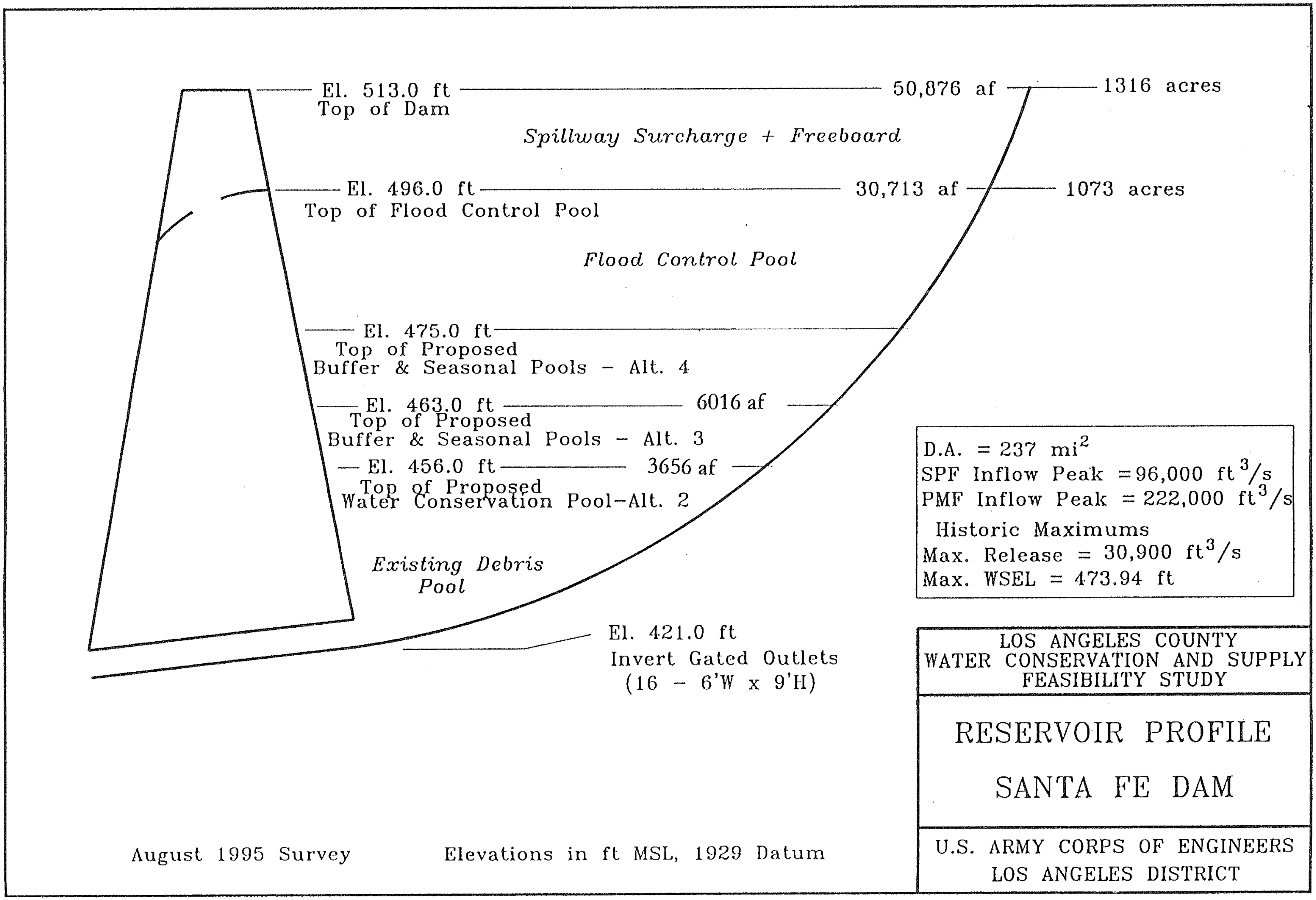

El. 513.0 ft
Top of Dam
50,876 af
1316 acres
Spillway Surcharge + Freeboard
El. 496.0 ft
Top of Flood Control Pool
30,713 af
1073 acres
Flood Control Pool
El. 475.0 ft
Top of Proposed
Buffer & Seasonal Pools – Alt. 4
El. 463.0 ft
Top of Proposed
Buffer & Seasonal Pools – Alt. 3
6016 af
El. 456.0 ft
Top of Proposed
Water Conservation Pool–Alt. 2
3656 af
Existing Debris
Pool
El. 421.0 ft
Invert Gated Outlets
(16 – 6'W x 9'H)
D.A. = 237 mi²
SPF Inflow Peak = 96,000 ft³/s
PMF Inflow Peak = 222,000 ft³/s
Historic Maximums
Max. Release = 30,900 ft³/s
Max. WSEL = 473.94 ft
LOS ANGELES COUNTY
WATER CONSERVATION AND SUPPLY
FEASIBILITY STUDY
RESERVOIR PROFILE
SANTA FE DAM
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT
August 1995 Survey
Elevations in ft MSL, 1929 Datum

Exhibit 7

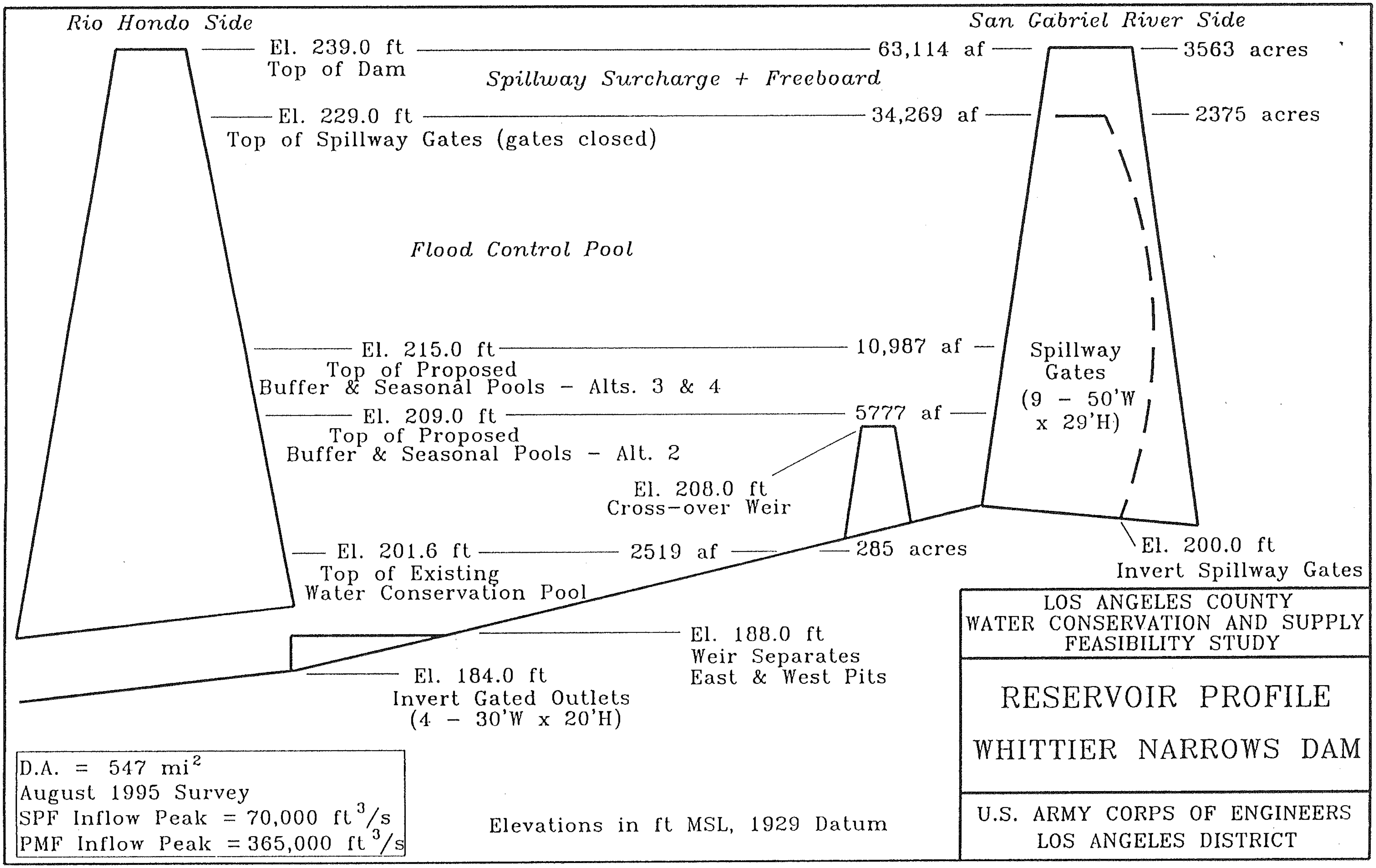

Rio Hondo Side
San Gabriel River Side
El. 239.0 ft
Top of Dam
63,114 af
3563 acres
Spillway Surcharge + Freeboard
El. 229.0 ft
Top of Spillway Gates (gates closed)
34,269 af
2375 acres
Flood Control Pool
El. 215.0 ft
Top of Proposed
Buffer & Seasonal Pools - Alts. 3 & 4
10,987 af
Spillway
Gates
(9 - 50'W
x 29'H)
El. 209.0 ft
Top of Proposed
Buffer & Seasonal Pools - Alt. 2
5777 af
El. 208.0 ft
Cross-over Weir
El. 201.6 ft
Top of Existing
Water Conservation Pool
2519 af
285 acres
El. 200.0 ft
Invert Spillway Gates
El. 188.0 ft
Weir Separates
East & West Pits
El. 184.0 ft
Invert Gated Outlets
(4 - 30'W x 20'H)
D.A. = 547 mi²
August 1995 Survey
SPF Inflow Peak = 70,000 ft³/s
PMF Inflow Peak = 365,000 ft³/s
Elevations in ft MSL, 1929 Datum
LOS ANGELES COUNTY
WATER CONSERVATION AND SUPPLY
FEASIBILITY STUDY
RESERVOIR PROFILE
WHITTIER NARROWS DAM
U.S. ARMY CORPS OF ENGINEERS
LOS ANGELES DISTRICT

Exhibit 8

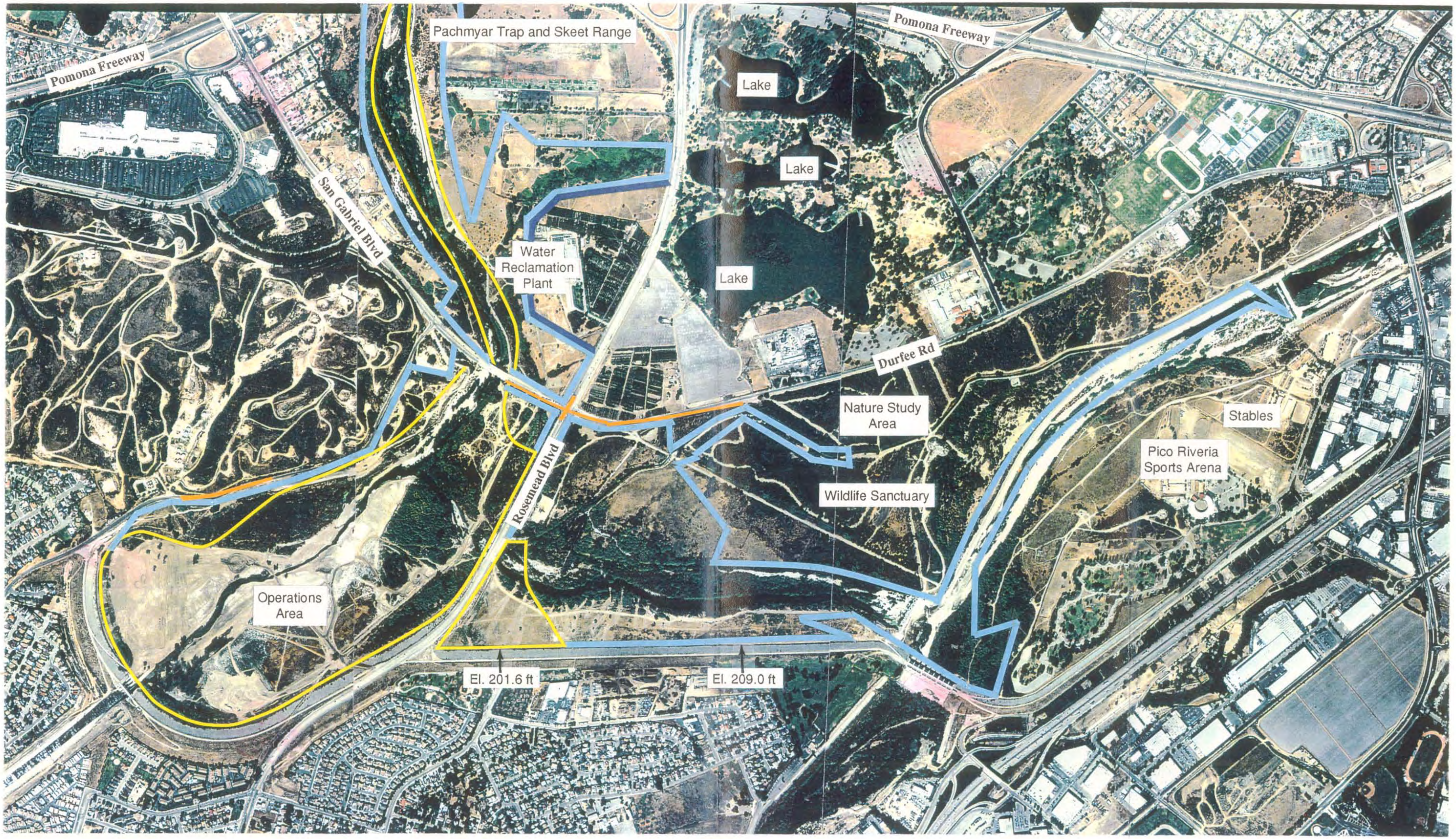
456 ft - Existing Debris Pool

463 ft - Buffer and Seasonal Pool

Date of Photo: Jan. 1994

LACDA WATER CONSERVATION STUDY

Impact Area - Santa Fe Dam



Existing Water Conservation Pool

Proposed Water Conservation Pool El. 209.0 ft

LEVEE AT WATER TREATMENT PLANT

Source: WAC Corp. Date of Photo: Jan. 1994

LACDA WATER CONSERVATION STUDY

Impact Area - Whittier Narrows Dam

EXHIBIT 10a

Date of Photo: Jan. 1994

Proposed Water Conservation Pool

LACDA WATER CONSERVATION STUDY

Impact Area - Whittier Narrows Dam

EXHIBIT 10b

California State Water Resources Control Board
California Department of Water Resources
California Department of Public Health

CERTIFICATION FOR COMPLIANCE WITH WATER METERING REQUIREMENTS FOR FUNDING APPLICATIONS

Funding Agency name: California Department of Water Resources

Funding Program name: Integrated Regional Water Management - Implementation

Applicant (Agency name): Water Replenishment District of Southern California

Project Title (as shown on application form):

Whittier Narrows Conservation Pool Project

Please check one of the boxes below and sign and date this form.

[X] As the authorized representative for the applicant agency, I certify under penalty of perjury under the laws of the State of California, that the agency is not an urban water supplier, as that term is understood pursuant to the provisions of section 529.5 of the Water Code.

[ ] As the authorized representative for the applicant agency, I certify under penalty of perjury under the laws of the State of California, that the applicant agency has fully complied with the provisions of Division 1, Chapter 8, Article 3.5 of the California Water Code (sections 525 through 529.7 inclusive) and that ordinances, rules, or regulations have been duly adopted and are in effect as of this date.

I understand that the Funding Agency will rely on this signed certification in order to approve funding and that false and/or inaccurate representations in this Certification Statement may result in loss of all funds awarded to the applicant for its project. Additionally, for the aforementioned reasons, the Funding Agency may withhold disbursement of project funds, and/or pursue any other applicable legal remedy.

Robb Whitaker

Name of Authorized Representative (Please print)

Signature

General Manager

Title

11/30/10

Date

Recycled Paper

California State Water Resources Control Board
California Department of Water Resources
California Department of Public Health

CERTIFICATION FOR COMPLIANCE WITH WATER METERING REQUIREMENTS FOR FUNDING APPLICATIONS

In 2004, Assembly Bill 2572 added section 529.5 to the Water Code, providing that, commencing January 1, 2010, urban water suppliers must meet certain volumetric pricing and water metering requirements in order to apply for permits for new or expanded water supply, or state financial assistance for the following types of projects:

1. wastewater treatment projects
2. water use efficiency projects (including water recycling projects)
3. drinking water treatment projects

For the purposes of compliance with Section 529.5, a "water use efficiency project" means an action or series of actions that ensure or enhance the efficient use of water or result in the conservation of water supplies.

Please consult with your legal counsel and review sections 525 through 529.7 of the Water Code before completing this certification.

<u>Applicants Affected</u>
This requirement applies to urban water suppliers.

"Urban water supplier" means a supplier, either publicly or privately owned, providing water for municipal purposes either directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre-feet of water annually. An urban water supplier includes a supplier or contractor for water, regardless of the basis of right, which distributes or sells for ultimate resale to customers.

<u>When Certification is Required</u>
State Water Resources Control Board (SWRCB): The application for financial assistance must include a completed and signed certification form demonstrating compliance with the water metering requirements.

Department of Water Resources (DWR) funding applications: This certification must be completed and submitted with the funding application. Check the specific proposal solicitation package for directions on applicability and submittal instructions.

Department of Public Health (DPH) Safe Drinking Water State Revolving Fund Program: This certification must be completed and submitted with the executed Notice of Acceptance of Application (NOAA).

INITIAL PROJECT MANAGEMENT PLAN
LOS ANGELES COUNTY DRAINAGE AREA
WATER CONSERVATION AND SUPPLY STUDY, CALIFORNIA
SANTA FE DAM - WHITTIER NARROWS DAM

PURPOSE AND SCOPE

The purpose of this Initial Project Management Plan (IPMP) is to identify the work items, funding schedules, and estimated cost of investigation required in the feasibility phase of the Los Angeles County Drainage Area Water Conservation and Supply Study, California. Because it was determined during the reconnaissance phase of the Los Angeles County Drainage Area Water Conservation and Supply Study that there may be a Federal interest in water conservation at Santa Fe and Whittier Narrows Dams and that a separate feasibility study is required for Hansen and Lopez Dams, the Feasibility Study will contain sufficient engineering and design to enable further refinement of project features, prepare the baseline cost estimate, develop a design and construction schedule, and allow preparation of plans and specifications on the selected plan to start immediately following receipt of PED funds. In order to clarify cost-sharing responsibilities, the study obligations of the Corps of Engineers (referred to as "The Corps" hereafter) and the non-Federal sponsor, the County of Los Angeles Public Works Department (referred to as the "Local Sponsor" hereafter), are identified in accordance with the Water Resources Development Act of 1986 (WRDA, 1986).

DESCRIPTION OF THE STUDY AREA

The Los Angeles County Drainage Area (LACDA) covers approximately 1,459 square miles and includes the Los Angeles, San Gabriel and Rio Hondo Rivers. The study area contains the second largest urban metropolitan region in the United States with a population of 8.4 million people. The population is projected to increase to about 10 million people by the year 2010. The current annual water use is over 2 million acre feet of water. The limited supply of imported water accounts for 2/3 of the total usage. The study area for this feasibility study is the Rio Hondo and San Gabriel River watersheds.

FEASIBILITY STUDY COORDINATION

Overall study management shall be the responsibility of an Executive Committee consisting of the Los Angeles District Commander; the Deputy District Engineer for Project Management; the Los Angeles District Chief of Planning Division; and the Director for the Los Angeles County Department of Public Works.

The Executive Committee will be assembled to coordinate the study, and will oversee the overall study by 1) maintaining a working knowledge of the Feasibility Study, 2) assisting in resolving emerging policy issues, 3) ensuring that evolving study results and policies are consistent and coordinated, 4) directing the Study Management Team, and 5) ratifying decisions made by the Study Management Team. The Executive Committee will also ensure that the approved IPMP is followed, the study schedule and budget are maintained, and that appropriate policies and guidelines are followed.

The Study Management Team will consist of a Corps Planning Manager, a Corps Project Manager, and a designated Study Manager from the Local Sponsor. The Study Management Team will oversee the studies to ensure the establishment of desired mutual roles, interests, and study objectives. The Study Management Team will implement overall direction of the study provided by the Executive Management Committee and work to ensure that Corps policy, local sponsor objectives, and the framework provided by the IPMP is followed. In addition, the Study Management Team will ensure that the study schedule and budget are maintained, that sound technical judgement is followed, and that multi-disciplinary studies and decisions are made in accordance with applicable guidelines and policies. The Study Management Team will ensure that adequate input to the study process is received from the appropriate Federal, State, and local agencies as well as interested organizations and individuals.

WORK TASKS AND RESPONSIBILITIES

The Los Angeles County Drainage Area Water Conservation and Supply Feasibility Study for Santa Fe and Whittier Narrows Dams will concentrate on the viable water conservation alternatives described in the Reconnaissance Study and will focus on formulating and optimizing the alternatives for implementation. The Feasibility Study will include the following study tasks: public involvement; environmental studies; hydrologic studies; geotechnical studies; study management; institutional studies; plan formulation; economic studies; design studies; cost estimation; fish and wildlife studies; cultural resource studies; real estate studies; report preparation; and review. Study progress and intermediate results will be reviewed and approved on a quarterly basis by the Executive Committee. Actual meeting dates will be negotiated and agreed upon at the first Executive Committee meeting. At the beginning of the study, Engineering Service Requests (ESR's) will be issued by the Study Management Team detailing specific study tasks, funding, milestones, and the form and detail of the expected product. The Study Management Team will finalize a critical path network detailing the start and finish times of each study element, in conjunction with the actual funding schedule.

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a. Budgeted Cost for Work Scheduled
b. Actual Cost of Work Performed

c. Budgeted Cost for Work Performed.

From this report the variances in schedule and cost to date may be analyzed. The total study cost and duration may also be extrapolated, based on the current month's information.

DESCRIPTION OF WORK

PUBLIC INVOLVEMENT

Responsibility for this task will be shared between the Corps and the Local Sponsor, with the Local Sponsor performing most of the work. This task primarily consists of obtaining input on the study scope and coordinating results with the public and public agencies; conducting public meetings and workshops; and responding to public inquiries. Also included is preparation of a public involvement plan upon initiation of the Feasibility Study. This plan will guide activities throughout the study.

The Corps will provide the Notice of Initiation of the Feasibility Study, assist the Local Sponsor with local coordination, conduct the final public meeting, and assist with necessary local, State and Federal coordination for the study.

The Local Sponsor will host public meetings, complete and distribute follow-up documentation, provide public information summaries near the study end, prepare the final public meeting, maintain mailing lists, and provide necessary local, State and Federal coordination for the study.

FEASIBILITY STUDY MANAGEMENT

This task will be accomplished primarily by the Corps, in coordination with the Local Sponsor. It includes coordination costs and study management tasks for the Local Sponsor as well as all Corps management activities, in accordance with current guidelines outlined in ER 1105-2-100, ER 1110-2-1150, ER 5-7-1, and EC 5-1-48. This task includes: study scheduling; providing detailed information for the work done for others; issuing Engineering Service Requests (ESR's); establishing study milestones; developing networks to include work activities, task schedules, critical path networks and funding schedules; directing, monitoring, and modifying assigned work items and funds as required and agreed upon by the local sponsor; reviewing results and reports provided by the technical support staff; budget preparation for current year and out years; maintaining

The following is a description of the major Feasibility Study tasks and the responsibilities for accomplishment of these tasks. At the beginning of each task, the non-initiating agency, either Corps or Local Sponsor, may review any planned work or contract of the other for adequacy. At the completion of each task, the non-initiating agency may review and approve the results of the work before it is considered complete. Review and assessment of the adequacy of the work will be accomplished by the Study Management Team and its technical staff. The term "in-kind" is defined as those tasks completed by the local sponsor in substitution of a cash contribution. The major study tasks for Los Angeles County Drainage Area Water Conservation and their expected costs are summarized in Table 1.

RESPONSIBILITY ASSIGNMENT MATRIX (RAM)

The Responsibility Assignment Matrix (RAM) is the union of the Work Breakdown Structure (WBS) and the Organizational Breakdown structure (OBS). This IPMP is based upon the logic network. Its attendant activity relationships were developed using the Open Plan (registered Trademark) project management software. Each activity in the critical path network is assigned to a responsible organization. In addition, each activity is also assigned a code to indicate which major study task it is a part of.

Although the RAM is implicit in the critical path network, it may also be presented as a separate report with most project management software, including Open Plan. Table 3 is the Open Plan computer generated RAM for this study. Please note that in this table the milestones are listed first, in chronological order, and then each organization, in hierarchial order, is listed with its respective activities. Code 1 refers to the WBS (see Chart 1) and Code 2 to the OBS (see Chart 2). Also shown in this table (for each task within an organization) is the early and late start dates, the early and late finish dates, and the total float in days.

MEASURE OF PERFORMANCE

Performance during the feasibility study will be measured utilizing the earned value method. Each month the project manager will ascertain the remaining durations, in working days, for the tasks currently scheduled to be performed. The project manager will also determine the approximate amount of effort, in either dollars or human hours, expended on those tasks, and this information will be entered into the computer operated critical path network for each task. The computer software will then compute and display the following information in an earned value report:

correspondence; report preparation and review; inter-organization coordination; conference preparation and presentation; point-of-contact responsibilities; and the development and negotiation of the PCA, MOA's and other customer agreements. Periodic meetings will be held between the Corps and the Local Sponsor to report on the status of the study and possible in-kind services. Monthly status reports covering selected financial and performance measurements will be provided by the Corps. Study Management Team meetings will be held on a quarterly basis, or more frequently if necessary.

Study management will ensure that all required tasks and coordination are performed such that the end result is production of a quality Feasibility Report document. Study management will maintain coordination with the multi-disciplinary study teams to ensure effective and timely decision making. Study management will monitor the scope and progress of activities to ensure that the study remains on track, within budget and on schedule, and that any potential impacts on scope, schedule and cost are fully coordinated and resolved with the Executive Committee.

If the Feasibility Study results in a plan recommended for Federal participation, the plans and procedures required for project implementation will be defined by a Project Management Plan (PMP). The PMP will include preparation of pre/post construction hydraulic data collection plans; preparation of a water quality control plan (if found necessary); and the coordination of O&M studies that need to be completed. Management activities will also include coordination and documentation of all MCACES estimates and revisions to these estimates. The Project Management Plan (PMP) will cover tasks, schedules, costs and management framework and direction for the project through construction.

Budgetary management responsibilities include tracking and documenting the funds and budget (accounting) of the study; document appropriations, interpretation of current and future budgetary guidance; submittal of project data sheets and justification sheets and other testimonial fact sheets as required; monitor and reprogram study funds; execute current year and future funds; processing schedules of monthly obligations and expenditures; monitor project financial performance; assess District manpower allocations versus available funds; set up and document all cost key accounts, and review of pre- and post-labor reports.

INSTITUTIONAL STUDIES

This task will be accomplished by the Corps with information provided by the Local Sponsor. It consists of determining the financial and legal arrangements required to implement the recommended plan, including methods of financing the projects. A financial capability analysis will examine whether or not the Local Sponsor has the organizational, legal, and financial capability to undertake the required financial obligations for implementation of the project after it is authorized for construction by Congress. Studies include determining the political and institutional arrangements of the study area and identifying attitudes and customs regarding the management and use of the resources. The results of the study will be provided in a financial and cost recovery analysis section of the Feasibility Report.

This task will also include estimating alternative repayment options for any incidental project purposes. This task will be performed by the Corps and Local Sponsor.

PLAN FORMULATION

This task will be primarily a Federal responsibility, with input from the Local Sponsor. Plan formulation will be in accordance with ER 1105-2-100, P&G, NEPA, and other pertinent engineering, environmental, and economic guidance and regulations. Plan formulation will identify the National Economic Development (NED) Plan. The report will identify and evaluate the locally preferred plan, if different from the NED plan. Plan formulation also includes reviewing and refining the plans selected for study during the feasibility phase and other plans developed during the course of study, and developing required plans such as the "no action" plan. This task includes identifying the NED plan, considering any environmental impacts and the views of the public, and formulating mitigation measures. The costs and benefits associated with each plan will be determined, and trade-offs required to select the recommended plan for implementation will be identified. Plan formulation includes application of engineering, economic, environmental, and other criteria to the specific problems, needs, and constraints of the study area to develop and analyze various methods, measures, and plans and their contributions to, and effectiveness in, addressing the specific problems. It is an iterative and constant review process that requires team participation and constant review, reformulation, and public support. Critical to the process of plan formulation will be the development of the without-project condition as a basis for comparison and evaluation of alternatives, and the recommendation of any key project features and/or related mitigation requirements. Plan formulation will also include an evaluation of advance engineering and construction plans for applicability to Section 104 credit.

The annual and periodic activities and responsibilities for operating and maintaining (O&M) the completed project will be described and closely coordinated with other requirements (e.g., cost estimates and environmental monitoring). The general magnitude of these activities will be described for all alternatives in detail; however, more detail will be provided for the alternative(s) recommended for implementation. All requirements of 33 CFR 208 and other Federal regulations specifying operation and maintenance requirements will be clearly described so that the Local Sponsor's future responsibilities will be known.

ECONOMIC STUDIES

This work will primarily be performed by the Corps in coordination with the Local Sponsor, with the Local Sponsor performing specific work items as noted below.

a) Service Area Determination - This task includes a review of the water distribution system in the Santa Fe - Whittier Narrows area, discussions with local water agency officials and review of needs and requirements of water agencies in the area. This work will be performed by the Corps and Local Sponsor 50/50. Estimated man-hours to completed this task are 120.

b) Estimate Future Water Supplies - All sources of supply will be analyzed for availability in the service area. Data will be obtained from various sources including water utilities, state and local planning agencies and State water resource agencies. The analysis will be accomplished by time period and include existing water supplies, institutional arrangements, additional water supplies, probability of water supply, and water quality. Particular attention will be directed to recent laws allowing transfer of water between agricultural users and municipalities. Consideration will also be given the effects of water conservation measures on future supplies. This work will be performed by the Corps and Local Sponsor 50/50. Estimated man-hours 320.

c) Project Future Water Use - Future water use will be projected by sector in consideration of seasonal variation. Projections will be based on an analysis of those factors that may determine variations in levels of water use. Future water use by sector will be projected for each of the following sectors: residential, commercial, industrial, and additional uses such as public service and unaccounted-for losses. The IWR or MWD-MAIN program will be used to complete this task. The determinants of demand for each sector, such as price of water and sewer service, income, number and type of housing units and population per unit, industrial mix, and level of economic activity will be identified. A relationship between future levels of water use and relevant determinants of water demand will be identified. Finally the water use will be forecast, and presented by time period. As much as possible existing projections such as MWD projections will be used or modified for use in this study. Estimated man-hours 160.

d) Identify the Deficit Between Future Water Supplies and Use - Comparison of projected water use with future water supplies will be made to determine deficit. An analysis of intensity, frequency and duration of expected deficits will be accomplished. Estimated man-hours required 40.

e) Identify alternatives without Federal Plan - Alternative plans that are likely to be implemented by communities in the absence of any Federal alternative will be identified. Various alternatives to the Federal plans will be tested for acceptability, effectiveness, efficiency, and completeness. The plans will be identified through analysis of the total water resources of the region, allowing for present and expecting competing uses. Any institutional barriers to the alternative plans will be identified. Alternative plans will be ranked and displayed on a least cost analysis. The most likely alternative will be selected as the basis for Federal plan benefits (known as the least cost alternative). This work will be performed by the Corps and Local Sponsor 50/50. Estimated man-hours required 320.

f) Compute M&I Water Supply Annualized Benefits - Benefits will be computed based on annualized cost of the most reasonable, least cost alternative. Any differences in treatment, distribution and other costs compared to the most likely alternative will be explained. Input Required - Water yield for all alternatives. Estimated man-hours required 160.

g) Evaluate Recreational Disbenefit - Compute recreation disbenefits accruing to the alternatives considered. The user-day value method will be used and no regional recreation model will be formulated. Estimated man-hours 80.

h) Develop NED Costs - Assist/develop NED costs associated with recreational, environmental and increased maintenance effects. Estimated man-hours 40.

i) Report Writing - Write F3 without project economic report, draft and final economic appendix. Input Required - Final costs and length of construction for all alternatives. Estimated man-hours 160.

j) Coordination - Attend all division conferences, study team meeting, assist study manager in plan formulation; etc. Estimated man-hours 160.

k) Response to comments - Provide verbal and/or written responses to comments from review chain and make any corrections to the analysis or report that are required by same. Estimated man-hours 120.

1) Risk and Uncertainty - Economic risk and uncertainty will be limited to an evaluation of the uncertainty associated with the least cost alternative water supply. The @triang function of the risk @risk package will be used with the expected cost of MWD non-interruptable supply as the mean. The nodes will be determined based on alternate sources of supply. The @risk package will be used to integrate the economic uncertainty for determination of expected annual results.

DESIGN

The proposed design work (feasibility level) will be performed in-house with Corps staff, in coordination with the Local Sponsor. The design will consist of civil, structural, mechanical, and electrical engineering features. The design will include preliminary design and cost estimates of the alternative plans, for the purpose of selecting the recommended plan.

The work effort will include field reconnaissance and review of existing data pertinent to analyzing each alternative plan. Results of Geotechnical and Hydraulic design will be incorporated into each alternative. Specific items to be evaluated are alternative levee alignments, flow diversion structures, spillway(s) over proposed levees, drainage structure through levee, and modifications or replacement required for all mechanical and electrical systems of each alternative plan. Additional costs attributable to operations, maintenance, and replacement will be quantified.

Quantities and cost estimates will be prepared for each alternative including present worth computations for maintenance and replacement costs. The selected plan will be developed to the required level of detail for the Feasibility Report. The work effort also includes providing technical coordination and information for each alternative, design section text for the report, coordination and responses to design comments, and support to the Study Manager. The Corps work effort also includes preparation of work and cost estimates for the Project Management Plan (PMP).

SURVEYS AND MAPPING

This work will be performed primarily by the Local Sponsor, in coordination with the Corps. This work will include review of existing surveys and maps of the study area; development of a topographic map at a scale of 1"=100 ft. with 2 foot contour intervals for all water conservation pool alternatives, including review of aerial photographs of past and present watershed conditions; creation of 2 sets of aerial photographs of the area defined above at a scale of approximately 1:2000, and plates, for inclusion in the appendix. Mapping is required to be compiled in 1929 Datum and must meet U.S. Bureau of the Budget's "United States National Map Accuracy Standards", and comply with Federal Geodetic Control Committee 1984 "Standards and Specifications for Geodetic Control Networks", and Corps Engineering Memorandums 1110-1-1002, Survey Markers and Monumentation; 1110-1-1003, 14 June 1991, "NAVSTAR Global Positioning System Surveying"; and 1110-1-1807, Parts 1 to 4, dated 30 July 1990, "Standards Manual for U.S. Army Corps of Engineers Computer-Aided Design and Drafting (CADD) Systems". The Corps work effort also includes preparation of work and cost estimates for the Project Management Plan (PMP).

COST ENGINEERING

This element will be accomplished by the Corps, in coordination with the Local Sponsor. Detailed baseline costs for the recommended plan will be developed in the MCACES format. The estimates will be prepared in accordance with ER 1110-1-1300, "Cost Engineering Policy and General Requirements" EREC 1110-2-1302, "Civil Works Cost Engineering", Civil Works "Work Breakdown Structure (WBS)", the latest code of accounts, and EC 11-2-163, dated 31 March 1994 "Annual Program and Budget Request for Civil Works Activities, Corps of Engineers, Fiscal Year 1996". A detailed construction cost estimate will be developed in the MCACES format. All costs will be displayed as both first costs and fully funded to mid point of construction. The Corps work effort also includes preparation of work and cost estimates for the Project Management Plan (PMP).

ENVIRONMENTAL STUDIES

This work will be performed under contract to the Corps by a consultant. The Corps will be responsible for managing the contract and monitoring the progress of the study. The Local Sponsor will provide review and input, particularly with respect to State environmental requirements. Study tasks will include collecting existing environmental data and performing necessary studies to define existing and future with- and without-project conditions. More specifically, such tasks will entail records and literature searches, review and evaluation of existing reports and data, field studies and surveys, compilation of data, preparation of report materials, including text and plates, and appendices. The alternatives will be evaluated in detail to determine known and potential environmental impacts. Mitigation requirements will be identified and suitable mitigation plans developed. Corps environmental staff will be available to review and comment on all submittals by the Contractor. The Corps work effort also includes preparation of work and cost estimates for the Project Management Plan (PMP).

The Environmental Evaluation (EE) prepared in the reconnaissance phase will be expanded into a Draft and Final Environmental Impact Statement/Environmental Impact Report (EIS/EIR) in conformance with the requirements of the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA). The EIS/EIR will evaluate the environmental effects of the proposed alternatives. This report will be fully coordinated with the appropriate Federal, State, and local governments and agencies as well as interested groups and individuals.

Potential impacts to fish and wildlife and other significant resources will be identified and, where warranted, appropriate mitigation plans developed and implemented. Individual biological/ecological resource studies may be required to determine potential impacts. Monitoring programs will be included as part of the overall mitigation plan to help ensure the effectiveness of the strategy selected. Any land required for mitigation, together with it's estimated acquisition cost, will be identified.

After a preferred plan is developed and before the EIS/EIR is completed, any sites which may be eligible for the National Register of Historic Places will be identified, together with a determination by the Corps as to whether they are likely to be effected by the project or not. This determination will be submitted to the State Historic Preservation Officer (SHPO) for their concurrence. If effect is likely or unavoidable, a mitigation plan will need to be developed in consultation with the SHPO and, if necessary, the Advisory Council on Historic Preservation (ACHP). These cultural resource studies will be conducted in accordance with the requirements of Section 106 of the National Historic Preservation Act (36 CFR 800).

If the placement of dredged or fill material into the waters of the United States is a component of any of the final plans selected for construction, a Clean Water Act Section 404(b)(1) Water Quality Evaluation will be prepared. The 404(b)(1) evaluation must then be submitted to the California Regional Water Quality Control Board, requesting either State Certification or a waiver thereof, pursuant to Section 401 of the Clean Water Act. Additionally, a public notice must be prepared and circulated affording public comment on the evaluation.

In compliance with the requirements of the Fish and Wildlife Coordination Act, the U.S. Fish and Wildlife Service (FWS) will be funded to prepare a Coordination Act Report (CAR). The CAR will assist the Corps in determining a viable preferred plan.

Statutory requirements of Section 7 of the Endangered Species Act will be complied with and completed during the feasibility study phase. These requirements will likely include both informal and formal consultation with the FWS. The formal consultation process entails the preparation and submission to the FWS of a Biological Assessment (BA), together with their response in the form of a Biological Opinion (BO). If necessary, a mitigation plan and monitoring program will be developed in consultation with the FWS.

Adherence to and compliance with the requirements of Executive Order 11988 regarding Flood Plain Management and other pertinent Executive Orders and regulations are to be noted in the EIS/EIR. Pertinent regional and local planning policy documents will be examined during the feasibility phase. Compliance with their requirements, where appropriate, will be noted in the EIS/EIR.

The Corps environmental staff will be available during the preparation of the EIS/EIR to support the various studies being conducted by the Contractor. The Corps will provide field reconnaissance support where needed. Coordination with and funding for the FWS, pursuant to requirements of the Fish and Wildlife Coordination Act and Endangered Species Act, will be conducted by Corps staff. Coordination with the State Historic Preservation Officer and the Advisory Council on Historic Preservation will be conducted by Corps staff.

FISH AND WILDLIFE STUDIES

The work associated with this task includes studies conducted by FWS pursuant to the requirements of the Fish and Wildlife Coordination Act. Corps environmental staff will be responsible for preparing the Scope of Work (SOW) for the FWS, funding the FWS, and management of the resultant FWS work agreement. The FWS will utilize a Habitat Evaluation Procedure (HEP) or other appropriate study methodology (e.g., instream flow incremental methodology) to define impacts and determine the amount of mitigation likely to be required. In these studies, baseline conditions and project-induced environmental effects will be evaluated, and types and amounts of mitigation for habitat losses will be determined. A Coordination Act Report will be prepared by the FWS. The CAR will define the project alternatives and discuss the potential environmental effects associated with the selected alternatives, summarize the HEP or other study findings, and incrementally analyze alternative mitigation strategies acceptable to the FWS and Corps for all alternatives studies in detail. Corps environmental staff will be afforded and opportunity to review and comment on the draft CAR prior to its finilization.

Corps environmental staff will provide the FWS with all pertinent maps and data regarding the proposed alternatives. Corps staff will be available to consult with and provide information to FWS staff as needed and as requested during the study, in addition to providing support to the Study Manager and others during the study phase.

CULTURAL RESOURCES STUDIES

This task will be conducted under contract to the Corps by a consultant. The cultural resource studies will determine the impacts of the alternative plans on all historical, architectural, and archaeological resources within the Area of Potential Effect (APE). All studies will be conducted in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, 36 CFR 800 "Protection of Historic Properties", and Corps Engineering Regulation 1105-2-100. The Corps work effort also includes preparation of work and cost estimates for the Project Management Plan (PMP).

In consultation with the State Historic Preservation Officer, the Contractor will conduct sufficient archival and field surveys to identify cultural sites within the study's Area of Potential Effect and Corps staff will evaluate the eligibility of all cultural sites for the National Register of Historic Places. The EIS/EIR will contain a detailed description of the cultural resources within the APE and assess the impacts of each project alternative on these resources. The report will also describe the range of additional future preservation or mitigation efforts and the associated costs of these studies. This section of the EIS/EIR will be prepared by the Contractor in consultation and with the assistance of the Corps cultural resource staff.

If project alternatives are found that will have an effect on sites eligible for the National Register, the Corps will proceed with further consultation with the SHPO and will afford the ACHP and other interested parties an opportunity to comment. If necessary, the Corps may enter into a Memorandum of Agreement with the SHPO, ACHP and non-federal sponsor to stipulate ways to avoid or reduce the effects of project alternatives on cultural resources. Preservation or mitigation of cultural resources will be considered in more detail for the plan recommended for construction in any advanced planning for the project.

HYDROLOGY

This task will be done by the Corps in coordination with the local sponsor. Hydrologic study tasks include period of record reservoir analysis to determine the average annual yield for the recommended plan and various alternatives at Santa Fe and Whittier Narrows Dams. The recommended plan for Santa Fe Dam consists of a water conservation pool up to elevation 456.0 ft NGVD during the flood season (Sep. 1 - Mar. 10) and a seasonal expanded water conservation pool to elevation 459.0 ft NGVD during the non-flood period (Mar. 11 - Aug. 31). The recommended plan for Whittier Narrows Dam entails increasing the current water conservation pool from elevation 201.6 ft NGVD to elevation

206.0 ft NGVD during the flood season (Sep. 1 - Mar. 10) and incorporating a seasonal expanded water conservation pool to elevation 209.0 ft NGVD during the non-flood period (Mar. 11 - Aug. 31).

Historical inflows for each reservoir will be analyzed, corrected, and updated to the current year. Computer runs will be made to simulate the operation schedules. Average annual quantities of water conserved will be determined. The historical record, along with routing of synthetic floods will be analyzed to ensure there is no adverse impact on flood control. The HEC-5 computer models developed during the reconnaissance phase will be modified and refined to account for more detail in the conservation and supply process. The effects on water quality and groundwater of utilizing water conservation pools for each reservoir will be addressed. The capturing of flood waters generally improves the water quality of surface and groundwater basins as long as the water is not held for long periods. The proposed water conservation and supply pools at each reservoir will hold water for relatively short durations, except on rare occasions, and therefore water quality and groundwater will not be adversely affected. No detailed modeling is anticipated. Hydrology Section will work in conjunction with Hydraulics Section to determine the potential increases in volumes of deposited sediment caused by the additional pools and quantify the impacts related to operation and maintenance. Elevation-duration-frequency curves will be developed for all alternatives. This information will be used by Planning and Environmental Sections to assess impacts on recreation and environmental resources. The uncertainty in the average-annual yield estimates will be qualitatively discussed. The increased risk of experiencing flood damage during the seasonal flood pool period (March 11-August 31) will be addressed. Additionally, the hydrologic impacts of including imported water for spreading during the non-flood period will be identified. Documentation will be provided at the completion of the study.

Report review, response to comments, and support to the Study Manager are included in the work effort. The Corps work effort also includes preparation of work and cost estimates for the Project Management Plan (PMP).

HYDRAULICS

This task will be done by the Corps in coordination with the Local Sponsor. In general, this work effort will consist of providing hydraulic design support for all alternative plans. The plans will be developed for modifications of existing facilities to accommodate the operations required for each of the water conservation pool levels selected for this study. The major Hydraulic tasks will include determining appropriate levee alignments and heights for protection of recreational and other features located within the flood control basins for each alternative. Required levee heights will be based on a combination of required storage volume, wind-induced wave run-up, and on the uncertainty of any topography used during design of the levees. Specific items to be addressed include flow diversion structures, spillways over proposed levees, and drainage structures through levees where required. The analysis will evaluate changes in reservoir storage, due to construction of levees, and will formulate mitigation alternatives in concert with Design.

Additionally, sedimentation analyses will be conducted to assess and quantify the impacts of the increased detention time on the volume of deposited sediment and the potential increase in the operation and maintenance costs.

Documentation of all analyses, review, response to comments, and support to the Study Manager are included in the work effort. The Corps work effort also includes preparation of work and cost estimates for the Project Management Plan (PMP).

RESERVOIR REGULATION

Reservoir Regulation involvement will be performed in house with Corps staff. The work effort will involve coordination with the Local Sponsor and other Corps elements. It includes review of draft and final reports in preparation for the development of a new Water Control Plan. The Water Control Plan will be developed after the feasibility phase. This task will review the water control plan to insure that they are feasible for implementation on a real time basis. If found to be impracticable, suggested modification will be provided to the study manager. The adapted water control plan will be documented in a revised water control manual. The Corps will prepare the revised water control manual in accordance with the standard Corps criteria, applicable publications and manuals. All sections of the water control manual shall be revised to contain the current information relevant to present-day conditions. The Corps work effort also includes preparation of work and cost estimates for the Project Management Plan (PMP).

GEOTECHNICAL STUDIES

This task will be done by the Corps in coordination with the Local Sponsor. The Soils Design Section will evaluate the seismic stability of the embankments under the proposed water conservation storage levels. The Corps work effort also includes preparation of work and cost estimates for the Project Management Plan (PMP).

SOILS DESIGN. Analyses to be performed will include the one-dimensional dynamic analysis SHAKE, and post-earthquake static slope stability. The purpose of these analyses is to assess the embankment response to input motions or "pseudo-static" forces caused by maximum credible earthquake events. Seepage analyses will also be performed as a supplement to the level of study performed during the Dam Safety Assurance Program. Geotechnical assumptions and parameters, developed during those studies and used in various dynamic analyses under various pool elevations, will be reviewed during the feasibility study and compared with the parameters established from recent local seismic events and changes to seismic criteria. Should there be a significant difference, additional analyses would be warranted and would be performed during subsequent phases. New analytical methods will also be considered.

GEOLOGY. Tasks will include a quarterly review of the published literature relating to faulting and seismic potential within the Los Angeles Basin, with special emphasis on lessons learned from the Northridge Earthquake. This information will be communicated to appropriate study team members during the study period and will be summarized in the geotechnical appendix to the Feasibility Report.

HTRW

A hazardous and toxic waste (HTRW) investigation will be a component of the studies required during the feasibility study phase. If HTRW resources are discovered during project construction, their removal and site remediation costs will be the responsibility of the local sponsor.

REAL ESTATE STUDIES

This work will be done by the Corps in coordination with the Local Sponsor. Studies will include preparation of preliminary real estate cost estimates for project right-of-way requirements, participation in preliminary Local Cooperation Agreement activities, preparation of a Real Estate Plan for inclusion in the Feasibility Report, preparation of a gross appraisal and Real Estate cost estimate in the code of accounts format, and preparation of work outlining the real estate effort for inclusion in the Project Management Plan.

Real estate coordination includes, but is not limited to, determining study requirements, participating in team meetings, negotiating work agreements, coordinating with other offices in acquiring necessary data, and monitoring of the progress and findings of the real estate study.

Preparation of the preliminary real estate cost estimates include: 1) a value estimate of the project's real property requirements (RPR), 2) an estimate of any PL 91-646 relocation payments required as a result of the project's RPR, 3) an estimate of the local sponsor's administration cost to accomplish the project's RPR, and 4) an estimate of the Corp's administration cost to assist and monitor the local sponsor's real property acquisition program.

A Real Estate Plan is an overall plan describing the minimum real estate requirements for the project. A Real Estate Plan will be prepared in this study.

The gross appraisal report provides a detailed estimate of all real estate costs associated with the acquisition of the proposed project's real property requirements. It must be in sufficient detail to provide an accurate cost estimate which will be sufficient for authorization considering the cost growth limits of Section 902 of Public Law 99-662. If the gross appraisal is to be provided by the local sponsor, the Chief of Real Estate shall participate in the selection and approval of the local sponsor's appraiser. The gross appraisal must be reviewed and approved according to current delegated authority.

Active involvement in reviewing the Feasibility Report and responding to South Pacific Division (SPD) comments is included in this study.

A baseline cost estimate, including accounts for the project's total estimated real estate costs, will be prepared using the code of accounts format, Feature Codes 01, Lands and Damages, as required by EC 111-2-538. This estimate of total real estate costs should include estimated costs for all Federal and local sponsor activities necessary for completion of the project.

A Real Estate Supplement will be provided to the project manager for inclusion in the PMP. Also, the Chief of Real Estate Division's endorsement of the PMP will certify that real estate requirements, including the schedule of acquisition, have been adequately and accurately included in the PMP.

REPORT PREPARATION

This work will be the responsibility of the Corps, in coordination with the Local Sponsor. The work will include collection and assembly of pertinent data, writing, editing, typing, drafting, reviewing, revising, reproducing, and distributing the draft and final Feasibility Reports, Environmental Assessments, and related technical documents and appendices. The Local Sponsor will reproduce copies of the camera-ready final document.

This task also includes work items necessary to support the review process from the signing of the Feasibility Report to the request by the Assistant Secretary of the Army for Civil Works

(ASA(CW)) to the Office of Management and the Budget (OMB) for the views of the administration. These items could also include answering comments, attending meetings, and revising the report.

REVIEW SUPPORT

This line item funds District and Local Sponsor activities in support of Washington (Corps Headquarters) review. It includes comment response and meeting attendance.

PROGRAMS AND PROJECT MANAGEMENT

This work includes all activities of the Project Manager and supporting programs management. Project Managements responsibilities include the following: Receive and set-up accounts; Coordinate/monitor resources (load leveling among functional elements); Develop budgetary documentation for testimony; Monitor pre-and post-updates, labor mod's and obligations and expenditure schedules; Prepare/issue PES reports, SACCR's, and programs and project management related correspondence and documents; and Prepare Draft and Final Project Management Plan (PMP).

STUDY CONTINGENCY

This work covers any requirements for additional rewriting, unforeseen technical modifications, reformulation, or documentation as a result of the Washington-level review process. Any costs that are incurred after the end of the feasibility phase (i.e., submittal of the report to the OMB by the ASA) but prior to Preconstruction Engineering and Design will be 100 percent Federal.

FEASIBILITY STUDY COST ESTIMATE

The feasibility study cost estimate for the Los Angeles County Drainage Area Water Conservation and Supply Study is $2,420,000 (see Tables 1 and 2). All feasibility phase study costs are required to be cost-shared between the Corps and the Local Sponsor on a 50-50 basis, with the Local Sponsor providing, at a minimum, half of its share as a cash contribution. Table 1 outlines the tasks to be performed, the estimated cost of each task, study obligations, and cost-sharing requirements for the Corps and Local Sponsor. Supervision and administration is covered under each task cost as overhead.

The Feasibility study cost estimate is based on October 1994 price levels, and is subject to revision for inflation for the out years. Inflation adjustments will be administered to the appropriate tasks at the current year approved rate. Changes in costs due to inflationary adjustments will not require a revision to the FCSA.

The cost estimate for the feasibility study is separated into fiscal years and quarters. Table 2 outlines the costs for each quarterly period during the feasibility study. The Corps will provide periodic reports to the Sponsor, which would include "Selective F&A Data Base Record, Form 666". The Local Sponsor will provide the Corps, on a quarterly basis, similar finance and accounting data that would record the work-in-kind efforts by the Local Sponsor. The value of in-kind services will be based on the equivalent government cost.

FEASIBILITY STUDY SCHEDULE

The final Feasibility Report, with Engineering Appendix, EA/EIS, PMP and Initial Financial Analysis are scheduled to be submitted to the South Pacific Division (SPD) approximately 36 months after initiation of the Feasibility Study. The signing of the FCSA is scheduled to take place 1 month prior to initiation of the study. A technical review conference (TRC) shall be held not later than 18 months into the feasibility study to verify the necessity of the field investigations and design studies. The Division Engineer's issuance of the Public Notice which completes the Feasibility Phase, is scheduled to occur 1 month after the final Feasibility Report is submitted.

COORDINATION BETWEEN THE CORPS AND THE SPONSOR

The Executive Committee is scheduled to meet, at a minimum, at the signing of the FCSA, at the Public Meeting, and at the concluding Feasibility Review Conference (FRC). The Committee will also meet periodically to discuss the project status and to handle changes in study scope that would result in an increase in total study cost or major changes in study direction, and at required Issue Resolution Conferences, if necessary. The Study Management Team will meet approximately every 6-8 weeks.

Financial coordination will include quarterly financial statements composed of expenditures and obligations. The Corps will also provide quarterly reports to the Local Sponsor, which would include "Selective F&A Data Base Record, Form 666". The Local Sponsor will provide to the Corps, on a quarterly basis, similar finance and accounting data that will record cash expenditures and work-in-kind efforts by the Local Sponsor. Cost-sharing cash payments will be made to the Corps on or about September 30, 1994, December 31, 1994, March 31, 1995, June 30, 1995, September 30, 1995, December 31, 1995, March 31, 1996, June 30, 1996, September 30, 1996, December 31, 1996, March 31, 1997, and June 30, 1997. The first payment will be made upon initiation of the study for the amount expected to be expended during the time until the next scheduled payment as outlined above. A final audit of the cost-sharing agreement and reconciliation of cash payments will be made at the conclusion of the study. The Corps will also furnish to the Local Sponsor a monthly progress report, detailing the status of each study task.

AGREEMENT
BETWEEN THE UNITED STATES OF AMERICA
AND
COUNTY OF LOS ANGELES DEPARTMENT OF PUBLIC WORKS, CALIFORNIA
FOR THE
LOS ANGELES COUNTY DRAINAGE AREA
WATER CONSERVATION AND SUPPLY STUDY, CALIFORNIA
SANTA FE AND WHITTIER NARROWS DAMS

THIS AGREEMENT, entered into this 8th day, of November 1994, by and between the United States of America (hereinafter called the "Government"), represented by the District Engineer executing this Agreement, and the County of Los Angeles Department of Public Works (hereinafter called the "Sponsor"),

WITNESSETH, that

WHEREAS, the authority to study the feasibility of Water Supply and Conservation Storage in the Los Angeles County Drainage Area (LACDA) at Santa Fe and Whittier Narrows Dams in Los Angeles County, California, is the Energy and Water Development Appropriations Act of 1993 (Public Law 102-377 dated October 2, 1992; and

WHEREAS, the Corps of Engineers has conducted a reconnaissance study of water conservation along the Los Angeles River at Hansen and Lopez Dams and along the San Gabriel and Rio Hondo Rivers at Whittier Narrows and Santa Fe Dams, pursuant to Public Law 102-377 dated October 2, 1992, and has determined that further study in the nature of a "Feasibility Phase Study" (hereinafter called the "Study") is required to fulfill the intent of the study authority and to complete the extent of the Federal interest in studying the feasibility of providing water conservation at Santa Fe and Whittier Narrows Dams, California, and has also determined during the reconnaissance phase that an additional "Feasibility Phase Study" is required to fulfill the intent of the study authority and to complete the extent of the Federal interest in studying the feasibility of providing water conservation at Hansen and Lopez Dams, California; and

WHEREAS, the Sponsor has the authority and capability to furnish the cooperation hereinafter set forth and is willing to participate in study cost sharing and financing in accordance with the terms of this agreement; and

WHEREAS, the Sponsor and the Government both understand that entering into this Agreement in no way obligates either party to implement a project and that whether a project is supported for authorization and budgeted for implementation depends on the outcome of this feasibility study and whether the proposed solution is consistent with the Principles and Guidelines and

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with the budget priorities of the Administration, and that at the present time, favorable budget priority is being assigned to projects providing primarily commercial navigation and flood or storm damage reduction outputs; and

WHEREAS, the Water Resources Development Act of 1986 (P.L. 99-662) specifies the cost sharing requirements applicable to the study;

NOW THEREFORE, the parties agree as follows:

ARTICLE I - DEFINITIONS

For the purposes of this Agreement:

a. The term "Study Cost" shall mean all disbursements by the Government pursuant to this Agreement, whether from Federal appropriations or from funds made available to the Government by the Sponsor, and all Negotiated Costs of work performed by the Sponsor pursuant to this Agreement. Such costs shall include, but not be limited to: labor charges; direct costs; overhead expenses; supervision and administration costs; and contracts with third parties, including termination or suspension charges; and any termination or suspension costs (ordinarily defined as those costs necessary to terminate ongoing contracts or obligations and to properly safeguard the work already accomplished) associated with this Agreement.

b. The term "Study Period" shall mean the time period for conducting the Study, commencing with the issuance of initial Federal feasibility funds following execution of this Agreement, and ending when the report is submitted to the Office of Management and Budget (OMB) by the Assistant Secretary of the Army for Civil Works ASA(CW) for review of consistency with the policies and programs of the President.

c. The term "Negotiated Cost" is the fixed fee for a work item to be accomplished by the Sponsor as in-kind services as specified in the Initial Project Management Plan (IPMP) incorporated herein and which is acceptable to both parties.

ARTICLE II - OBLIGATIONS OF PARTIES

a. The Sponsor and the Government, using funds contributed by the Sponsor and appropriated by the Congress, shall expeditiously prosecute and complete the Study, currently estimated to be complete in 36 months from the date of this Agreement, substantially in compliance with Article III herein and in conformity with applicable Federal laws and regulations, the <u>Economic and Environmental Principles and Guidelines for Water</u>

and Related Land Resources Implementation Studies, and mutually acceptable standards of engineering practice.

b. The Government and the Sponsor shall each contribute, in cash and in-kind services, fifty (50) percent of all Study Costs, which total cost is currently estimated to be $2,420,000 (October 1994 price levels), as specified in Article IV herein; provided, that the Sponsor may, consistent with applicable Federal statutes and regulations, contribute up to 25 percent of the Study Costs as in-kind services; provided further, the Government shall not obligate any cash contribution by the Sponsor toward Study Costs until such cash contribution has actually been made available to it by the Sponsor.

c. No Federal funds may be used to meet the local sponsor share of study costs under this Agreement unless the expenditure of such funds is expressly authorized by statute as verified by the granting agency.

d. The award of any contract with a third party for services in furtherance of this Agreement which obligates Federal appropriations shall be exclusively within control of the Government. The award of any contract by the Sponsor with a third party for services in furtherance of this Agreement which obligates funds of the Sponsor and does not obligate Federal appropriations shall be exclusively within control of the Sponsor, but shall be subject to applicable Federal statutes and regulations.

e. The Government and the Sponsor shall each endeavor to assign the necessary resources to provide for the prompt and proper execution of the Study, and shall, within the limits of law and regulation, conduct the Study with maximum flexibility as directed by the Executive Committee established by Article V, herein.

f. The Government will not continue with the Study if it determines that there is no solution in which there is a Federal interest or which is not in accord with current policies and budget priorities unless the Sponsor wishes to continue under the terms of this Agreement and the Department of the Army grants an exception. If a study is discontinued, it shall be concluded according to Article XII and all data and information shall be made available to both parties.

g. The Sponsor may wish to conclude the Study if it determines that there is no solution in which it has an interest or which is not in accord with its current policies and budget priorities. When such a case exists the study shall be concluded according to Article XII and all data and information shall be made available to both parties.

ARTICLE III - INITIAL PROJECT MANAGEMENT PLAN

Appendix A, the Initial Project Management Plan (IPMP), furnished with the Reconnaissance Report, is hereby incorporated into this Agreement. The parties to this Agreement shall substantially comply with the Initial Project Management Plan in prosecuting work on the Study. The following modifications, to be approved by the Executive Committee, shall require an amendment to this Agreement:

a. any modification which increases the total study costs by more than 15 percent;(Appendix-A pp. 20 & 21)

b. any modification in the estimated cost of a Study work item or any obligation for a Study work item, which changes the total cost of that work item by more than 15 percent;(Appendix-A, pp. 20 & 21)

c. any extension of the completed schedule for a Study work item of more than thirty (30) days;(Appendix-A, p. 19) or

d. any reassignment of work item between the Sponsor and the Government. (Appendix-A, p. 20)

ARTICLE IV - METHOD OF PAYMENT

a. The Government shall endeavor to obtain during each fiscal year the appropriation for that fiscal year at least in the amounts specified in the Initial Project Management Plan incorporated herein. Subject to the enactment of Federal appropriations and the allotment of funds to the District Engineer, the Government shall then fund the Study at least in the amounts specified in the Initial Project Management Plan herein.

b. The Sponsor shall endeavor to obtain during each Government fiscal year the cash contribution for that Government fiscal year at least in the amounts specified in the Initial Project Management Plan incorporated herein and, once it has obtained funds for a cash contribution, shall make such funds available to the Government. The Government shall withdraw and disburse funds made available by the Sponsor subject to the provisions of this Agreement.

c. Funds made available by the Sponsor to the Government and not disbursed by the Government within a Government fiscal year shall be carried over and applied to the cash contribution for the succeeding Government fiscal year; provided, that upon study termination any excess cash contribution shall be reimbursed to the Sponsor after a final accounting, subject to the availability of appropriations, as specified in Article XII herein.

d. Should either party fail to obtain funds sufficient to make obligations or cash contributions or to incur Study Costs in accordance with the schedule included in the Initial Project Management Plan incorporated herein, it shall at once notify the Executive Committee established under Article V herein. The Executive Committee shall determine if the Agreement should be amended, suspended, or terminated under Article XII herein.

ARTICLE V - MANAGEMENT AND COORDINATION

a. Overall study management shall be the responsibility of an Executive Committee consisting of the Los Angeles District Commander; the Deputy District Engineer for Project Management; the Los Angeles District Chief of Planning Division; and the Director for the Los Angeles County Department of Public Works.

b. To provide for consistent and effective communication and prosecution of the items in the Initial Project Management Plan, the Executive Committee shall appoint representatives to serve on a Study Management Team subject to the provisions of page 2, paragraph 2, Appendix A.

c. The Study Management Team will coordinate on all matters relating to the prosecution of the Study and compliance with this Agreement, including cost estimates, schedules, prosecution of work elements, financial transactions and recommendations to the Executive Committee for termination, suspension or amendment of this Agreement.

d. The Study Management Team will prepare periodic reports on the progress of all work items for the Executive Committee.

ARTICLE VI - DISPUTES

a. The Study Management Team shall endeavor in good faith to negotiate the resolution of conflicts. Any dispute arising under this Agreement which is not disposed of by mutual consent shall be referred to the Executive Committee. The Executive Committee shall resolve such conflicts or determine a mutually agreeable process for reaching resolution or for termination under Article XII herein.

b. Pending final decision of a dispute hereunder, or pending suspension or termination of this Agreement under Article XII herein, the parties hereto shall proceed diligently with the performance of this Agreement.

ARTICLE VII - MAINTENANCE OF RECORDS

The Government and the Sponsor shall each keep books, records, documents and other evidence pertaining to Study Costs and expenses incurred pursuant to this Agreement to the extent and in such detail as will properly reflect total Study Costs. The Government and the Sponsor shall maintain such books, records, documents and other evidence for inspection and audit by authorized representatives of the parties to this Agreement. Such material shall remain available for review for a period of three (3) years following the termination of this Agreement.

ARTICLE VIII - RELATIONSHIP OF PARTIES

a. The parties to this Agreement will act in an independent capacity in the performance of their respective functions under this Agreement, and neither party is to be considered the officer, agent, or employee of the other.

b. To the extent permitted by applicable law, any reports, documents, data, findings, conclusions, or recommendations pertaining to the Study shall not be released outside the Executive Committee or the Study Management Team; nor shall they be represented as presenting the views of either party unless both parties shall indicate agreement thereto in writing.

ARTICLE IX - OFFICIALS NOT TO BENEFIT

No member of or delegate to the Congress, or other elected official, shall be admitted to any share or part of this Agreement, or to any benefit that may arise therefrom.

ARTICLE X - FEDERAL AND STATE LAWS

In acting under its rights and obligations hereunder, the Sponsor agrees to comply with all applicable Federal and State laws and regulations, including Section 601 of Title VI of the Civil Rights Act of 1964 (Public Law 88-352) and Department of Defense Directive 5500.II issued pursuant thereto and published in Part 300 of Title 32, Code of Federal Regulations, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army."

ARTICLE XI - COVENANT AGAINST CONTINGENT FEES

The Sponsor warrants that no person or selling agency has been employed or retained to solicit or secure this Agreement upon agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by the local sponsor for the purpose of securing business. For breach or violation of this warranty, the Government shall have the right to annul this Agreement without liability, or, in its discretion, to add to the Agreement or consideration, or otherwise recover, the full amount of such commission, percentage, brokerage, or other contingent fee.

ARTICLE XII - TERMINATION OR SUSPENSION

a. This Agreement shall terminate at the completion of the Study Period; provided that prior to such time and upon thirty (30) days written notice, either party may terminate or suspend this agreement without penalty.

b. Within ninety (90) days upon termination of this Agreement the Study Management Team shall prepare a final written accounting of Study Costs, which shall display disbursements by the Government of Federal funds, cash contributions by the Local Sponsor, and credits for the Negotiated Costs of the Local Sponsor. Subject to the availability of funds, within thirty (30) days thereafter the Government shall reimburse the Local Sponsor for the excess, if any, of cash contributions and credits given over fifty (50) percent of total Study Costs. Within thirty (30) days thereafter, the Local Sponsor shall provide the Government any cash contributions required so that the total Local Sponsor share equals fifty (50) percent of the total Study Costs.

IN WITNESSETH WHEREOF, the parties hereto have executed this Agreement as of the day and year first above written.

THE UNITED STATES OF AMERICA

BY ______________________
Michal R. Robinson
Colonel, Corps of Engineers
District Engineer

LOS ANGELES COUNTY
BOARD OF SUPERVISORS

BY ______________________
Chairman, Board of Supervisors

APPROVED AS TO FORM
DE WITT W. CLINTON,
County Counsel
BY ______________________
Deputy

Appendix A - Initial Project Management Plan

COUNTY OF LOS ANGELES
CALIFORNIA

ATTEST: JOANNE STURGES
EXECUTIVE OFFICER -
CLERK OF THE BOARD OF SUPERVISORS
BY ______________________ Deputy

ADOPTED
BOARD OF SUPERVISORS
COUNTY OF LOS ANGELES

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Joanne Sturges
JOANNE STURGES
EXECUTIVE OFFICER

I hereby certify that pursuant to Section 25103 of the Government Code, delivery of this document has been made.

JOANNE STURGES
Executive Officer -
Clerk of the Board of Supervisors

By ______________________
DEPUTY

COUNTY OF LOS ANGELES
CALIFORNIA

WATER REPLENISHMENT DISTRICT
OF SOUTHERN CALIFORNIA

COOPERATIVE AGREEMENT
LOS ANGELES COUNTY FLOOD CONTROL DISTRICT

This Cooperative Agreement (the "Agreement") is made and entered into this __ day of November, 2009 ("Effective Date"), by and between the Water Replenishment District of Southern California ("WRD") and the Los Angeles County Flood Control District ("LACFCD") (collectively referred to as "Parties" or individually as "Party") for the purposes stated herein.

RECITALS

WHEREAS, the County of Los Angeles is home to approximately 10 million residents who depend on reliable sources of water; and

WHEREAS, two-thirds of the water supply is imported from sources outside of the region; and

WHEREAS, in addition to imported water, the water supply also depends on groundwater that is recharged from a variety of sources, including storm flows; and

WHEREAS, LACFCD engages in multiple projects which are designed to address water supply, conservation and water quality issues throughout Los Angeles County; and

WHEREAS, through its various projects, LACFCD conserves approximately 150,000 acre-feet of local stormwater runoff each year; and

WHEREAS, WRD is a special district created pursuant to California Water Code, Section 60000, *et seq*., adopted by the California legislature in 1955; and

WHEREAS, WRD has operated since 1959 to protect and preserve the quantity and quality of the groundwater supplies in the Central and West Coast Groundwater Basins, which serve as the source of nearly 40 percent of the water used by the four million people overlying the WRD's 420-square-mile service area; and

WHEREAS, WRD's mission includes managing and safeguarding the groundwater resources of the Central Basin by ensuring its water quality and by maximizing the amount of groundwater in the basins; and

WHEREAS, the Whittier Narrows Dam is owned and operated by the United States Army Corps of Engineers ("USACE") and provides flood control, recreation and water conservation for Los Angeles County; and

WHEREAS, the Whittier Narrows Dam has provided a reliable means of capturing local stormwater flows which are later released and conserved in the LACFCD-operated Rio Hondo and San Gabriel River Spreading Grounds for groundwater replenishment purposes; and

WHEREAS, in an effort to maximize the local water supply using existing infrastructure, and to provide additional space for the capture of stormwater, WRD and LACFCD wish to increase the elevation of the Whittier Narrows Conservation Pool from 201.6 feet to 205 feet; thereby increasing the ability to conserve approximately 1,100 acre-feet of additional water for recharge into the groundwater basin annually, and thereby reducing the need to rely on expensive water imported into the area from the Sacramento and Colorado Rivers; and

WHEREAS, the increased elevation of the Whittier Narrows Conservation Pool will work in conjunction with the recharge basin percolation enhancement and equalization projects currently being undertaken by WRD and LACFCD to provide drought relief and long-term water supply benefits to the Los Angeles region; and

WHEREAS, USACE desires to implement high priority water conservation projects to address the unprecedented water supply shortage condition; and

WHEREAS, in order to temporarily operate the Whittier Narrows Conservation Pool at the 205 foot elevation for the 2009-2010 storm season, WRD will prepare, at its expense, a Deviation Request Package (a deviation from the current 201.6 foot pool elevation) for USACE approval, and in order to permanently operate at the new elevation USACE will prepare, with local cost-share provided by WRD, an update to the Whittier Narrows Dam Feasibility Study ("Feasibility Study"); and

WHEREAS, LACFCD has agreed to pay the estimated cost of Seventy Five Thousand Dollars ($ 75,000.00) to USACE for its review and approval of the Deviation Request Package, and WRD has agreed to reimburse LACFCD for all such payments to USACE; and

WHEREAS, LACFCD has agreed to pay the estimated cost of Three Hundred Thousand Dollars ($300,000.00) to USACE for the preparation and processing of the Feasibility Study update, and WRD has agreed to reimburse LACFCD for all such payments to USACE; and

WHEREAS, any reimbursement by WRD exceeding Seventy Five Thousand Dollars ($75,000.00) for the Deviation Request Package, and/or exceeding Three Hundred Thousand Dollars ($300,000.00), for the Feasibility Study update are subject to the approval of the Board of Directors of WRD; and

WHEREAS, approval from USACE to operate at the increased pool elevation in time for the 2009-2010 storm season would implement an immediate and reliable conservation vehicle to provide drought relief for the Los Angeles region, and alleviate the long-term impact on the region's groundwater supply induced by ongoing drought.

NOW THEREFORE, in consideration of the mutual benefits derived by WRD and LACFCD, the Parties hereby agree as follows:

A. LACFCD AGREES:

1. To serve as a liaison to the USACE to facilitate the processing and review of the Deviation Request Package and the update of the Feasibility Study.

2. To draft and transmit a letter on behalf of the County of Los Angeles Flood Control District to the USACE requesting a temporary deviation from the approved Water Control Plan for the Whittier Narrows Dam for a period of three years. A deviation would allow temporary operation of the Conservation Pool at the proposed increased pool elevation while seeking approval for a permanent change to the operating plan.

3. To draft and transmit a letter, to the USACE, on behalf of the County of Los Angeles Flood Control District to request a permanent increase to the maximum conservation pool elevation at the Whittier Narrows Dam. Authorization by USACE will allow long term operation up to the increased pool elevation.

4. To work to amend its agreement with the USACE, to allow LACFCD to advance non-federal funding to USACE in the estimated amount of Three Hundred Thousand Dollars ($300,000.00) for USACE staff to begin work on the Feasibility Study update while federal funds are being secured.

5. To keep WRD apprised of project requirements and progress, and copy WRD on correspondence with USACE relevant to this cooperative effort.

B. WRD AGREES:

1. To take the necessary action to complete and submit the Deviation Request Package to USACE for its review and approval.

2. To contract with an environmental services consultant ("Consultant") who is experienced with United States Army Corps of Engineers projects and is familiar with the requirements for completion of the Deviation Request Package and to administer and fund the Consultant's contract.

3. To complete and submit the Deviation Request Package to the USACE in a reasonable amount of time to obtain approval to temporarily operate at the increased pool elevation by January 31, 2010, or upon receiving authorization by USACE.

4. To pay to LACFCD Two Hundred Twenty Five Thousand Dollars ($225,000.00) upon execution of this Agreement, of which Seventy Five Thousand Dollars ($75,000.00) shall be used as reimbursement of amounts advanced by LACFCD to USACE for its review and preparation of the Deviation Request Package, and One Hundred Fifty Thousand Dollars ($150,000.00) shall be used as reimbursement of amounts advanced by LACFCD to USACE for its preparation of the Feasibility Study update. WRD further agrees to pay LACFCD on July 1, 2010, the remaining One Hundred Fifty Thousand Dollars ($150,000.00) to be used as reimbursement of the amounts advanced by LACFCD to USACE for its preparation of the Feasibility Study update.

C. IT IS MUTUALLY UNDERSTOOD AND AGREED:

1. Term.

This Agreement is effective as of the Effective Date, and shall expire on December 31, 2012, or upon earlier termination by written notification from WRD or LACFCD. This Agreement shall be extended upon written notice by WRD that the Deviation Request Package or the Feasibility Study update has been delayed beyond the expected date of completion for reasons beyond the control of either Party.

2. Funding Mechanism.

This Agreement is intended as a funding mechanism to assist WRD in providing compensation to USACE for the preparation and review of the Deviation Request Package and the Feasibility Study update to increase the elevation of the Whittier Narrows Conservation Pool. Nothing in this Agreement is intended to transfer liability to WRD and/or the LACFCD for the manner of operation of the Whittier Narrows Conservation Pool. If the estimated USACE costs for its review of the Deviation Request Package and/or the preparation of the Feasibility Study are exceeded, WRD may elect to fund any additional costs to ensure the completion of these studies under the terms of this Agreement. Subject to the approval of the Secretary of the United States Army, the United States Government shall return any unexpended funds to LACFCD. LACFCD shall then remit said funds to WRD.

3. External Funding.

Parties agree to mutually support the other in seeking grant funding. Grant funding received by either of the Parties for the update of the Feasibility Study shall be applied toward reducing the local cost share as defined in the Agreement Between the United States of America and County of Los Angeles Department of Public Works, California for the Los Angeles County Drainage Area Water Conservation and Supply Study, California – Santa Fe Dam and Whittier Narrows Dams, adopted on November 8, 1994.

4. Operational Requirements.

In order to temporarily operate the Whittier Narrows Conservation Pool at the 205 foot elevation for the 2009-2010 storm season, a Deviation Request Package must be completed and approved by USACE, and permanent operation at the new elevation requires an update to the Whittier Narrows Dam Feasibility Study.

5. Feasibility Study.

After authorization by USACE of a deviation from the approved water control plan, the Parties shall work with USACE to expeditiously complete an update of the Feasibility Study as required to secure the USACE's approval for a change to the long-term water control plan for the Whittier Narrows Dam.

6. Applicability of Work Results with Respect to Long-term Goal.

To the maximum extent practicable, results of work performed and materials prepared for the completion of the Deviation Request Package (short-term goal) shall be applied toward satisfying the requirements of the Feasibility Study update. Wherever applicable, the results and cost value of in-kind deviation request components shall be credited toward the overall work requirements, and associated local cost share requirement, for completion of the Feasibility Study update, and toward achieving approval for a long-term operating plan. The conditions in this Section are contingent upon the USACE's decision to permit the work performed in completion of the Deviation Request Package to be credited toward satisfying the requirements of the Feasibility Study update.

7. Environmental Liability.

The Parties agree that this Agreement shall serve only as a funding agreement between the Parties, and shall not form the basis of any finding of environmental liability.

8. Compliance with Applicable Laws.

Parties shall comply with all laws and regulations applicable to the performance of the work hereunder, including but not limited to, the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA). WRD is the lead agency for purposes of CEQA and will comply with all requirements as such. USACE shall serve as the lead agency for purposes of NEPA. A Party's failure to comply with any law(s) or regulation(s) applicable to the performance of the work specified in Sections A, B and C(4) hereunder shall constitute a breach of this Agreement.

9. Choice of Law and Venue.

This Agreement shall be governed by and interpreted in accordance with the laws of the State of California. The Parties agree that the exclusive venue for any action or proceeding arising from or relating to this Agreement shall be in the County of Los Angeles, State of California.

10. Notices.

All notices provided by this Agreement shall be in writing and shall be sent by first-class mail and facsimile transmission as follows:

If to WRD:

Robert Siemak, Chief of Engineering and Planning
Water Replenishment District of Southern California
4040 Paramount Blvd.
Lakewood, CA 90712
Phone: (562) 921-5521
Fax: (562) 921-6101

If to LACFCD:

Christopher Stone, Assistant Deputy Director
County of Los Angeles, Department of Public Works
Water Resources Division
900 South Fremont Avenue
Alhambra, CA 91802-1460
Phone: (626) 458-6100
Fax: (626) 979-5436

11. Amendments.

This Agreement may be modified only by a writing signed by the Parties hereto.

12. Integration; Construction.

This Agreement sets forth the final, complete and exclusive expression of the Parties' agreement and supersedes any and all other agreements, representations, and promises, whether made orally or in writing with respect to the subject matter hereof,. The Parties represent and warrant that they are not entering into this Agreement based upon any representation or understanding that is not expressly set forth in this Agreement. This Agreement shall be construed as the product of a joint effort between the Parties and shall not be construed against either Party as its drafter.

13. Prior Agreements.

This Agreement shall not affect the rights or obligations of the Parties contained in any other agreements formally entered into by the Parties.

14. Authority.

Each person signing this Agreement represents that he or she has the authority to do so on behalf of the Party for whom he or she is signing.

IN WITNESS WHEREOF, the Parties have caused this AGREEMENT to be executed the day and year first above written.

WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA

______________________________	______________________________
Signature	*Signature*
Albert Robles	Lillian Kawasaki
Print Name	*Print Name*
President, Board of Directors	Secretary, Board of Directors
Title	*Title*

Approved As To Form:
MEYERS, NAVE, RIBACK, SILVER □ WILSON

____

James M. Casso
Attorneys for the Water Replenishment
District of Southern California

LOS ANGELES COUNTY DEPARTMENT OF PUBLIC WORKS

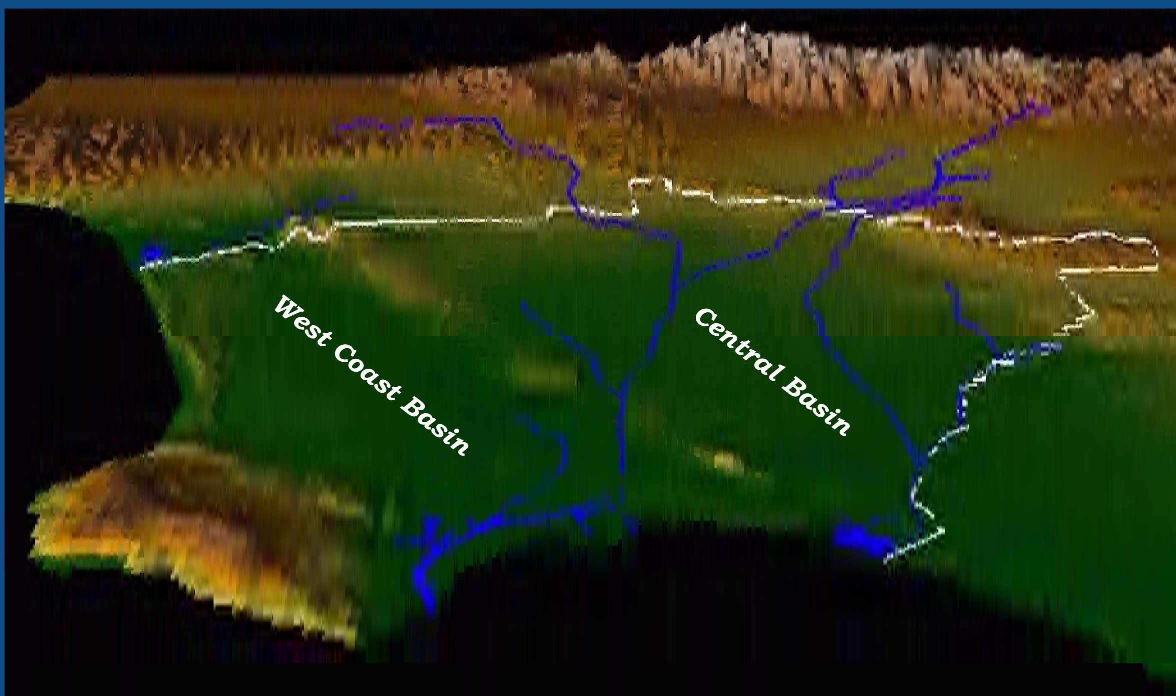
____
Signature
GAIL FARBER
Print Name
DIRECTOR OF PUBLIC WORKS
Title

Approved As To Form:
COUNTY OF LOS ANGELES

____

Robert E. Kalunian
County Counsel
1325638.1

Water Replenishment District of Southern California



Engineering Survey and Report

2010

WRD

March 19, 2010

Updated:
May 11, 2010

Water Replenishment District
Of Southern California

ENGINEERING SURVEY AND REPORT, 2010
Updated May 11, 2010

BOARD OF DIRECTORS	MANAGEMENT
Division 1	**General Manager**
Willard H. Murray, Jr., Secretary	Robb Whitaker
Division 2	**Chief Engineer**
Robert Katherman, Treasurer	Vacant
Division 3	**Chief Hydrogeologist**
Lillian Kawasaki, Vice President	Theodore Johnson
Division 4	**Chief Financial Officer**
Sergio Calderon, President	Scott Ota
Division 5	**Manager of External Affairs**
Albert Robles	Elsa Lopez
District Counsel	**Manager of Finance and Administration**
James Casso	Jenna Shaunessy

Professional Certification

This Engineering Survey and Report has been prepared under the direct supervision of the California Professional Geologist whose signature appears below. This individual certifies that the information contained in the report has been prepared in accordance with the generally accepted principles and practices of his profession.

Ted Johnson

Theodore A. Johnson, PG 6142, CHG 240

REGISTERED GEOLOGIST
THEODORE A. JOHNSON
No. 6142
STATE OF CALIFORNIA

WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA

MEMORANDUM

DATE: MAY 11, 2010

TO: INTERESTED PARTIES

FROM: ROBB WHITAKER, GENERAL MANAGER

SUBJECT: UPDATED 2010 ENGINEERING SURVEY AND REPORT

The Water Replenishment District of Southern California ("WRD" or "District") is the groundwater management agency responsible for safe and reliable groundwater in the Central and West Coast Basins in southern coastal Los Angeles County. Groundwater constitutes nearly 40% of the total water demand used by the 4 million residents and businesses in the 43 cities in the WRD service area.

On March 19, 2010, WRD completed an Engineering Survey and Report ("ESR") as required by the California Water Code (Section 60300) to present information on the past, current, and anticipated future conditions in the two groundwater basins. Information is presented on groundwater pumping, groundwater conditions (water levels, overdraft, changes in storage), projects related to groundwater supply and quality, and the amount, sources, and cost of replenishment water needed to replace the pumping overdraft.

According to Water Code Section 60305, the ESR must be completed by March of each year. But the annual Replenishment Assessment ("RA"), which is the fee placed on groundwater production to fund the cost of replenishment water, is not required to be set until May. Therefore, new and updated information is typically received in the two months between the initial ESR and the setting of the RA. To document these changes, the District publishes an updated ESR following adoption of the RA. This May 11, 2010 ESR updates and replaces the earlier March 19, 2010 report and contains the latest information on groundwater conditions and replenishment water sources and costs within the District.

On May 11, 2010, the WRD Board of Directors set the 2010/2011 RA at $205 per acre foot (AF) of groundwater pumped. This rate will go into effect July 1, 2010 and last through June 30, 2011. This is a 12.7% increase from the previous rate of $181.25/AF. As discussed in the numerous Committee meetings, Board meetings, and Public Workshops leading up to the adoption of the RA, the reasons for the increase are as follows:

- WRD purchases imported and recycled water from other agencies to replenish the groundwater basins. The cost of this replenishment water is a direct pass-through to our customers – the groundwater pumping community. In fiscal year 2010-11, the cost of replenishment water to WRD is expected to increase by $9.3 million, which is a direct impact to the RA. There are two main reasons for this large price increase:

    - The District since its inception in 1959 had available to it surplus imported water ("seasonal water") from the Metropolitan Water District of Southern California ("MWD") for groundwater replenishment activities. This water was provided by MWD at reduced rates since it was considered interruptible water, and was only offered at certain times of the year. But in May 2007, MWD stopped selling this water due to low water supplies in the State. As a result, the District has been unable to replenish the basins sufficiently and groundwater levels have dropped.

To ensure proper replenishment of the groundwater basins, the District budgeted for the next higher category of MWD water, known as Tier 1 untreated water. This water category, although not assured, is typically more available than seasonal water but also comes at a higher price. This decision was not taken lightly by WRD, but due to water levels hitting 30 year lows and the likelihood that seasonal water would remain unavailable, the District decided for the first time in its history to budget for Tier 1 water instead of seasonal water. This decision was supported by the pumpers Technical Advisory Committee and by numerous cities and water companies who realized that continued replenishment of the groundwater basins by WRD was critical to maintain a healthy groundwater reservoir.

- The second reason for the RA increase was due to the rise in cost for the other water types that WRD purchases from other agencies for replenishing, including imported and recycled water at the spreading grounds, seawater barrier injection wells, and the In-Lieu program. These price increases ranged from 6% to 67%, and averaged a unit price increase of 16% overall.

My staff and I welcome any comments or questions you may have regarding the updated report. Additional copies are available by calling the District at (562) 921-5521 or by downloading it from our web site at http://www.wrd.org. Thank you for your interest and input on groundwater conditions in the Central and West Coast Basins.

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GLOSSARY OF ACRONYMS

ABP	Alamitos Barrier Project
AF	Acre-Feet (equivalent to 325,851 gallons)
AFY	Acre-Feet per Year
APA	Allowed Pumping Allocation
CB	Central Basin
CBMWD	Central Basin Municipal Water District
CDPH	California Department of Public Health (formerly California Department of Health Services)
CHG	Certified Hydrogeologist
CIP	Capital Improvement Program
CPI	Consumer Price Index
CWCB	Central and West Coast Basins
DGBP	Dominguez Gap Barrier Project
DPH	California Department of Public Health
DTSC	California Department of Toxic Substances Control
DWR	State Department of Water Resources
EIR	Environmental Impact Report
EPA	U.S. Environmental Protection Agency
ESR	Engineering Survey and Report
FY	Fiscal Year (July 1 – June 30)
GAC	Granular Activated Carbon
GIS	Geographic Information System
IRWMP	Integrated Regional Water Management Plan
LACDHS	Los Angeles County Department of Health Services
LACDPW	Los Angeles County Department of Public Works (Flood Control)
LADWP	Los Angeles Department of Water and Power
LBWD	Long Beach Water Department
Met	Metropolitan Water District of Southern California
MCL	Maximum Contaminant Level
MF	Microfiltration
MFI	Modified Fouling Index
mgd	Million Gallons per Day
MOU	Memorandum of Understanding
msl	Mean Sea Level
MWD	Metropolitan Water District of Southern California

GLOSSARY OF ACRONYMS (continued)

NDMA	N-Nitrosodimethylamine
O&M	Operations and Maintenance
ppb	Parts Per Billion
PG	Professional Geologist
PRC	Program Review Committee
PWRP	Pomona Water Reclamation Plant
RA	Replenishment Assessment
RO	Reverse Osmosis
RTS	Readiness-to-Serve
RWQCB	Regional Water Quality Control Board (Los Angeles Region)
SAT	Soil Aquifer Treatment
SDLAC	Sanitation Districts of Los Angeles County
SDWP	Safe Drinking Water Program
SGVMWD	San Gabriel Valley Municipal Water District
SJCWRP	San Jose Creek Water Reclamation Plant
TAC	Technical Advisory Committee
TITP	Terminal Island Treatment Plant
USGS	United States Geological Survey
USGVMWD	Upper San Gabriel Valley Municipal Water District
UV	Ultraviolet Light Treatment
VOC	Volatile Organic Compound
WAS	Water Augmentation Study
WBMWD	West Basin Municipal Water District
WCB	West Coast Basin
WCBBP	West Coast Basin Barrier Project
WIN	Water Independence Network
WNWRP	Whittier Narrows Water Reclamation Plant
WRD	Water Replenishment District of Southern California
WRP	Water Reclamation Plant
WY	Water Year (October 1 – September 30)

BOARD SUMMARY

District Staff is pleased to present the 2010 Engineering Survey and Report ("ESR"). It was prepared pursuant to the California Water Code, Section 60300 et seq. and determines the past, current, and ensuing year groundwater conditions in the Central and West Coast Basins ("CWCB"). The report contains information on groundwater production, annual and accumulated overdraft, water levels, quantity, source, and cost of replenishment water, and a discussion of necessary projects and programs to protect and preserve the groundwater resources of the basins.

The ESR provides the Board of Directors with the necessary information to justify the setting of a replenishment assessment ("RA") for the ensuing fiscal year (July 1 – June 30) to purchase replenishment water and to fund projects and programs related to groundwater replenishment and groundwater quality over the water year (October 1 – September 30).

The following is a summary of information presented in the ESR:

1. **Groundwater Production**
   - Adjudicated Amount: 281,835 AF
   - Previous Water Year: 243,402 AF
   - Current Water Year: 241,000 AF (est)
   - Ensuing Water Year: 243,000 AF (est)

2. **Annual Overdraft**
   - Previous Water Year: 112,700 AF
   - Current Water Year: 95,800 AF (est)
   - Ensuing Water Year: 97,800 AF (est)

3. **Accumulated Overdraft**
   - Previous Water Year: 753,300 AF
   - Current Water Year: 749,700 AF (est)

4. **Groundwater Levels**

Groundwater levels are an indication of the amount of water in the basins. They indicate areas of recharge and discharge and reveal which way the groundwater is moving. Groundwater levels are used to determine when additional replenishment water is required and are used to calculate storage changes. The groundwater levels can also indicate possible source areas for saltwater intrusion and can show the effectiveness of the seawater barrier injection wells along the coast.

WRD staff tracks groundwater levels throughout the year by measuring the depth to water in production wells and monitoring wells. In the previous WY 2008/2009, water levels fell up to 15 feet in the Central Basin due to the lack of imported water for replenishment and increased pumping. In the West Coast Basin, water levels rose in some areas, fell in others, but remained generally flat over most of the basin. Overall, there was a loss of groundwater storage of 51,500 AF. In the current water year there has been a rise in water levels in the Montebello Forebay due to above normal precipitation and the purchase of untreated Tier 1 (firm delivery) replenishment water for spreading.

5. Quantity Required for Replenishment

Chapter IV details the quantity of water that WRD must purchase in the ensuing water year to help offset the annual overdraft. A summary is listed below:

- Spreading Water: 71,000 AF (50,000 recycled; 21,000 imported)
- Seawater Barrier Water: 28,400 AF (14,100 recycled; 14,300 imported)
- In-Lieu Program Water: 10,303 AF
- Total Water: 109,703 AF

6. Source of Replenishment Water

The sources of replenishment water to the District for the ensuing water year are detailed in Chapter IV. Seasonal spreading water from MWD which has not been available since May 2007, and is not anticipated to be available again. Therefore, for the first time in its history WRD is budgeting for untreated Tier 1 imported water for spreading as it may be more available than the seasonal water, although it is more expensive. The In-Lieu water is not currently available from MWD but is being budgeted for in case it becomes available. If it does not, the collected monies will be placed in a water purchase reserve for replenishment water purchases at a later time. A summary of the sources of replenishment water is as follows:

- Recycled Water: Spreading water from the County Sanitation Districts of Los Angeles County (CSDLAC). West Coast Basin Barrier Project (WCBBP) water from the West Basin Municipal Water District's Edward C. Little Water Treatment Facility. Dominguez Gap Barrier Project (DGBP) water from the City of Los Angeles Terminal Island Treatment Plant. Alamitos Barrier Project (ABP) water from WRD's Leo J. Vander Lans Facility.

- Imported Water: Spreading water from Central Basin Municipal Water District or other MWD member agencies. WCBBP water and DGBP water from West Basin Municipal Water District. ABP water from the City of Long Beach.

7. Cost of Replenishment Water

WRD has estimated it will need 109,703 AF of replenishment water in the ensuing year. The Metropolitan Water District of Southern California (MWD) and their member agencies set the price for the imported water WRD buys for the replenishment at the spreading grounds, barrier wells, and In-Lieu, and are a direct pass-through on WRD's replenishment assessment.

MWD and their member agencies have recently set their new prices for water, including replenishment water, for the ensuing year. In addition, the CSDLAC has recently notified WRD of an increase in their price for recycled water for spreading. These price increases ranged from 6% to 67% and averaged a unit price increase to WRD of 16% overall. These increases are due to the State's water crisis including drought, environmental concerns, energy concerns, and reductions in water purchases through conservation and the continued poor economy, as well as increases in costs for water quality treatment and treatment plant operations. In addition, WRD has had to budget for untreated Tier 1 imported water for spreading versus seasonal water, as the seasonal water remains unavailable.

With the known and estimated costs for replenishment water in mind, WRD has estimated that it will cost $38,106,991 to purchase the replenishment water in the ensuing year. **Tables 1 and 2** present the details of these anticipated costs.

The estimated cost for replenishment water has been detailed in this report. However, this is just the District's water costs and does not include the costs for projects and programs necessary to replenish the basins and to protect and preserve the groundwater quality. The entirety of the District costs were presented during the annual budgeting and rate setting process that culminated in the Board's adoption of the Replenishment Assessment for FY 2010/2011 on May 11, 2010, at a rate of $205 per acre foot of groundwater extracted.

8. Projects and Programs

A list of the WRD projects and programs related to groundwater replenishment and the protection and preservation of water quality is shown on **Table 3**. Funds are required to finance these projects and programs. Sections 60221 and 60230 of the Water Replenishment District Act authorize the WRD to undertake a wide range of capital projects and other programs aimed at enhancing groundwater replenishment. Section 60224 of the Water Replenishment District Act states that WRD may establish projects or programs that will directly or indirectly preserve and protect the groundwater supplies within its boundaries.

These projects and programs address any existing or potential problems related to the basin's groundwater, and may extend beyond the District's boundaries if the threat of contamination is outside those boundaries. The programs span all phases of planning, design, and construction and are financed by the collection of a replenishment assessment. A more detailed description of each project and program is presented in Chapter V of the report.

9. Conclusions

Based upon the information presented in the ESR, a replenishment assessment is necessary in the ensuing year to purchase replenishment water to help make up the overdraft and to finance projects and programs to perform replenishment and water quality activities. These actions will ensure sufficient supplies of high quality groundwater within the District for the benefit of the residents and businesses in the Central and West Coast Basins.

CHAPTER I
INTRODUCTION

Purpose of the Engineering Survey Report

To facilitate the Board of Directors' decisions and actions, the Water Replenishment District Act requires that an engineering survey and report ("ESR") be prepared each year. This *Engineering Survey and Report 2010* is in conformity with the requirements of Section 60300 et seq. Water Replenishment District Act and presents the necessary information on which the Board of Directors can declare whether funds shall be raised to purchase water for replenishment during the ensuing year, as well as to finance projects and programs aimed at accomplishing groundwater replenishment. With the information in this ESR, the Board can also declare whether funds shall be collected to remove contaminants from the groundwater supplies or to exercise any other power under Section 60224 of the California Water Code. The information presented in this report along with the District's strategic planning and budget preparation presents the necessary information on which the Board of Directors can base the establishment of a replenishment assessment for the ensuing year 2010/2011.

Scope of Engineering Survey Report

This report contains specific information outlined in Chapter I, Part 6 of Division 18 of the Water Code (the Water Replenishment District Act, § 60300 and § 60301). The following is a brief description of the contents of this report:

1) *a discussion of groundwater production within the District (Chapter II);*
2) *an evaluation of groundwater conditions within the District, including estimates of the annual overdraft, the accumulated overdraft, changes in water levels, and the effects of water level fluctuations on the groundwater resources (Chapter III);*
3) *an appraisal of the quantity, availability, and cost of replenishment water required for the ensuing water year (Chapter IV); and*
4) *a description of current and proposed programs and projects to accomplish replenishment goals and to protect and preserve high quality groundwater supplies within the District (Chapter V).*

Schedule for Setting the Replenishment Assessment

The following actions are required by the Water Code to set the Replenishment Assessment:

1) *The Board shall order the preparation of the ESR by the second Tuesday in February (see Section 60300).*
2) *The Board shall declare by resolution whether funds shall be collected to purchase replenishment water and to fund projects and programs related to replenishment and/or water quality activities by the second Tuesday in March and after the ESR has been completed (see Section 60305).*
3) *A Public Hearing will be held for the purpose of determining whether District costs will be paid for by a replenishment assessment. The Public Hearing will be opened on or before the second Tuesday in April and may be continued from time to time to subsequent Board meetings but will be completed by the first Tuesday in May (see Section 60306).*

4) *The Board by resolution shall levy a replenishment assessment for the ensuing fiscal year by the second Tuesday in May (see Sections 60315; 60317).*

Although dates specified in the code refer generally to 'on or before certain Tuesdays', the Water Code (Section 60043) also states that "*Whenever any act is required to be done or proceeding taken on or set for a particular day or day of the week in any month, the act may be done or proceeding set for and acted upon a day of the month otherwise specified for a regular meeting of the board*". Therefore, there is flexibility as to the actual dates when Board actions are taken regarding the ESR, adopting resolutions, conducting public hearings, and the setting the replenishment assessment.

The ESR is completed in March of each year to provide the Board with the necessary information to determine whether a replenishment assessment will be needed in the ensuing year to purchase replenishment water and to fund projects and programs related to water quality and replenishment activities. However, in the subsequent months leading up to the adoption of the replenishment assessment in April or May, new information is normally received that affects the findings presented in the March ESR. This new information is typically related to the price WRD has to pay for replenishment water since the rates set by the Metropolitan Water District of Southern California (MWD or Met) and the Met-member agencies are not typically finalized until after the March ESR is adopted. The final information used by the Board to adopt the replenishment assessment in April or May is reflected in an updated ESR published following the adoption of the replenishment assessment.

The 2010/2011 Replenishment Assessment was adopted by the Board on May 11, 2010 and was set at a rate of $205.00 per acre foot of groundwater pumped within the District. The new rate takes effect on July 1, 2010 through June 30, 2011. This represents a 12.7% increase from the previous year's rate of $181.85 per acre foot. The increase was due to a large increase in the cost of replenishment water that WRD's purchases from MWD and its member agencies and from the County Sanitation Districts of Los Angeles County. The increase was also due to the continued lack of seasonal imported spreading water, necessitating the budgeting for more expensive but more available untreated Tier 1 (firm delivery) water from MWD.

This updated ESR replaces the earlier March 19, 2010 report.

CHAPTER II
GROUNDWATER PRODUCTION

Adjudication and Demand

Prior to the adjudication of groundwater rights in the early 1960s, annual production (pumping) reached levels as high as 292,000 AF in the Central Basin ("CB") and 94,000 AF in the West Coast Basin ("WCB"). This was more than double the natural safe yield of the basins as determined by the California Department of Water Resources in 1962 (173,400 AF). Due to this serious overdraft, water levels declined, groundwater was lost from storage, and seawater intruded into the coastal aquifers. To remedy this problem, the courts adjudicated the two basins to put a limit on pumping. The West Coast Basin adjudication was set at 64,468.25 acre feet/year ("AFY"). The Central Basin adjudication was set at 271,650 AFY, although the Judgment set a lower "Allowed Pumping Allocation" ("APA") of 217,367 AFY to impose stricter control. Therefore, the current amount allowed to be pumped from both basins is 281,835 AFY (rounded).

The adjudicated pumping amounts are greater than the natural replenishment of the groundwater aquifers, creating an annual deficit or annual overdraft. WRD is enabled under the California Water Code to purchase and recharge additional water to make up the overdraft, which is known as artificial replenishment. WRD has the authority to levy a replenishment assessment on all pumping within the District to raise the monies necessary to purchase the artificial replenishment water and to fund projects and programs necessary for replenishment and groundwater quality activities.

Production

Under the terms of Section 60326.1 of the Water Replenishment District Act, each groundwater producer must submit a report to the District summarizing their monthly production activities (quarterly for smaller producers). The information from these reports is the basis by which each producer pays the replenishment assessment. WRD then provides these production data to the State Department of Water Resources ("DWR"), which acts as the court-appointed Watermaster in connection with the adjudication of the Central and West Coast Basins ("CWCB").

Previous Water Year:

Per the Water Code, WRD tracks and reports on groundwater production (pumping) on a Water Year ("WY") basis covering the time frame of October 1 - September 30 for each year. For the previous WY (2008/2009), groundwater production in both basins totaled 243,402.27 AF (198,156.32 AF in CB; 45,245.95 AF in WCB). This is about 1,329 AF less than the previous water year in total, with CB pumping 8,103 AF less than the previous year and WCB pumping 6,774 AF more than the previous year.

Plate 1 illustrates the groundwater production in the CWCB during the previous water year and **Table A-5** presents historical pumping amounts in the CWCB.

Current Water Year:

For the first three months of the current WY (October – December), production was 47,204 AF in the CB compared to 44,564 AF the previous year, a 6% decrease attributable to a City of Long Beach pumping outage in October. In the WCB, there was 11,183 AF of production versus 10,638

AF in the previous year (a 7% increase). For estimating year end production, there is escalating imported water rates which may drive groundwater production higher but also a continued weak economy and water conservation efforts that are making overall water demands less. Taking these into account, it is estimated that the current WY production will total 241,000 AF (195,000 AF in CB and 46,000 AF in WCB).

Ensuing Water Year:

To estimate production for the ensuing year, averages have generally been used. Five-year averages have been used as good indicators of longer term pumping patterns when conditions are generally stable. Three-year averages have been used when anomalous conditions affected the 5-year results. Actual pumping patterns can vary considerably throughout the year based on a pumper's individual operational needs, water demands, and hydrology, making forecasting difficult. For example, in October 2009 the City of Long Beach had an outage causing their pumping to be considerably lower than normal (over 2,000 AF), and should not be factored into forecasting.

Therefore, to estimate the ensuing year's production, WRD is forecasting 243,000 AF total for both basins, representing 198,000 AF in the CB and 45,000 AF in the WCB. The 198,000 AF in the CB represents current trends not including increased amounts due to storage extractions or major pumping outages. The 45,000 in WCB represents the increases seen over the past few years.

Table 1 shows the groundwater production amounts for the previous, current, and ensuing years.

Measurement of Production

With few exceptions, meters installed and maintained by the individual producers measure the groundwater production from their wells. Through periodic testing, DWR as Watermaster verifies the accuracy of individual meters and orders corrective measures when necessary. The production of the few wells that are not metered is estimated on the basis of electrical energy consumed by individual pump motors, duty of water, or other reasonable means.

Carryover and Drought Provisions

The "carryover" of unused rights influences the actual amount of production for any given year. The "carryover" for any single year is 20% of the allotted pumping right in both the Central and West Coast Basins. This provision extends the flexibility with which the pumpers can operate. Conversely, the use of rights beyond the annual allotted quantity affects the annual production amount in the opposite manner. The original court adjudication in both basins allows for each individual pumper to extract up to 10% beyond their allowable pumping rights within a given year.

During emergency or drought conditions, WRD can allow under certain conditions an additional 27,000 AF of extractions for a four-month period (17,000 for Central Basin and 10,000 for West Coast Basin). This provision has yet to be exercised but offers the potential use of an additional 7.8% for Central Basin and 15% for West Coast Basin pumpers.

CHAPTER III
GROUNDWATER CONDITIONS

Introduction

The California Water Code Section 60300 requires WRD to determine annually in the Engineering Survey and Report ("ESR") the following items related to groundwater conditions in the Central and West Coast Basins ("CWCB"):

1) Total groundwater production for the previous water year and estimates for the current and ensuing water years;

2) The Annual Overdraft for the previous water year and estimates for the current and ensuing water years;

3) The Accumulated Overdraft for previous water year and an estimate for the current water year;

4) Changes in groundwater levels (pressure levels or piezometric heights) within the District and the effects these changes have on groundwater supplies within the District; and

5) An estimate of the quantity, source, and cost of water available for replenishment during the ensuing water year;

To meet these requirements, WRD's hydrogeologists and engineers closely monitor and collect data to manage the groundwater resources of the District throughout the year. They track groundwater levels from WRD's network of specialized monitoring wells and from groundwater producers' production wells. They update and run computer models developed by the United States Geological Survey ("USGS") and others to simulate groundwater conditions and to predict future conditions. They use their geographic information system ("GIS") and database management system to store, analyze, map, and report on the information required for the ESR. They work closely with the Los Angeles County Department of Public Works on spreading grounds and seawater barrier wells to determine current and future operational impacts to groundwater supplies. They work closely with the Metropolitan Water District of Southern California ("MWD" or "Met"), the local MWD member agencies, and the Sanitation Districts of Los Angeles County ("SDLAC") on the current and future availability of supplemental replenishment water. They also work with regulators on replenishment criteria for water quality and recycled water use, and with the groundwater pumpers, the pumpers' Technical Advisory Committee ("TAC"), and other stakeholders to discuss the current and future groundwater conditions within the District and in neighboring basins.

The information on Annual Overdraft, Accumulated Overdraft, water levels, and change in storage are discussed in the remainder of this chapter. Groundwater production was previously discussed in Chapter II. The estimated quantity, source, and cost of replenishment water will be discussed in Chapter IV.

Annual Overdraft

Section 60022 of the Water Replenishment District Act defines Annual Overdraft as "*...the amount...by which the quantity of groundwater removed by any natural or artificial means from the* *groundwater supplies within such replenishment district during the water year exceeds the quantity of non-saline water replaced therein by the replenishment of such groundwater supplies in such water year by any natural or artificial means other than replenishment under the provisions of Part 6 of this act or by any other governmental agency or entity*." (Part 6 of the Act pertains to water that WRD purchases for replenishment). Therefore, the Annual Overdraft equals the natural inflows to basins (not including WRD purchased water) minus all of the outflows (mostly pumping). There is an Annual Overdraft almost every year for the simple fact that the groundwater extractions typically exceed the natural groundwater replenishment. It has been one of the District's main responsibilities since 1959 to help make up this Annual Overdraft by purchasing artificial replenishment water to recharge the aquifers and supplement the natural recharge.

To determine the Annual Overdraft for the previous water year, WRD determines the inflows and outflows of the CWCB. In Water Year 2008/09, natural inflows (storm water capture, areal recharge, and underflow) totaled 130,705 AF and WRD or others purchased 61,197 AF of recharge water (at barrier wells and spreading grounds). The total net outflows from the basins were 243,402 AF from pumping. The difference between the inflows and outflows was -51,500 AF, which is a loss from storage. The Annual Overdraft is the outflows minus natural inflows, or 112,700 AF.

For the current and ensuing WY estimates for Annual Overdraft, the concept of “Average Annual Groundwater Deficiency” is utilized. The Average Annual Groundwater Deficiency is the long-term average of natural inflows minus total outflows and represents the long term average deficit (Annual Overdraft) in the basins. The development of the USGS/WRD computer model derived these long term average inflow and outflow terms. **Table 4** presents this information, which concluded that the Average Annual Groundwater Deficiency is 105,385 AFY. Values of the average deficiency are based on the long term (30 year average) inflows and outflows as calculated by the computer model. Long-term average inflows are influenced by the amount of precipitation falling on the District as well as for storm water capture at the spreading grounds. **Table 5** shows the historical precipitation at LACDPW Station #107D, located in Downey near the Montebello Forebay.

The calculation of the Average Annual Groundwater Deficiency represents in general that WRD needs to replenish about 105,385 AFY assuming long-term average conditions for the water balance to reach equilibrium, the overall change in storage to equal zero, and groundwater levels to remain relatively constant. As shown in **Table 6**, adjustments have been made to the long term average inflows and outflows for the current and ensuing WY to reflect determine estimates of the Annual Overdraft for those years. Based on these adjustments, the current year Annual Overdraft is estimated at 95,800 AF and 97,800 AF for the ensuing year. The determination of an anticipated Annual Overdraft in the ensuing WY gives the District justification under the Water Code to levy a replenishment assessment on groundwater production in the ensuing year to purchase artificial replenishment water to help make up the annual overdraft.

Accumulated Overdraft

Section 60023 of the Water Replenishment District Act defines *"Accumulated Overdraft"* as "*...the aggregate amount…by which the quantity of ground water removed by any natural or artificial means from the groundwater supplies…during all preceding water years shall have exceeded the quantity of nonsaline water replaced therein by the replenishment of such ground water supplies in such water years by any natural or artificial means…”*

In connection with the preparation of Bulletin No. 104-Appendix A (1961), the DWR estimated that the historically utilized storage (Accumulated Overdraft) between the high water year of 1904 and 1957[1] was 1,080,000 AF (780,000 in CB, 300,000 in WCB). Much of this storage removal was from the forebay areas (Montebello Forebay and Los Angeles Forebay), where aquifers are merged, unconfined and serve as the "headwaters" to the confined pressure aquifers. Storage loss from the confined and completely full, deeper aquifers was minimal in comparison or was replaced by seawater intrusion, which can not be accounted for under the language of the Water Code since it is considered saline water.

The goal of groundwater basin management by WRD is to ensure a sufficient supply of high quality groundwater in the basins for annual use by the pumpers, to keep a sufficient supply in storage for times of drought when imported water supplies may be curtailed for several consecutive years as well as to keep suitable room available in the basins to receive natural water replenishment in very wet years, such as an El Niño type year. Groundwater storage discussions currently underway in the region may also lead to projects that bank water in some of the available storage space in the basins.

To compute the Accumulated Overdraft since this initial amount, WRD takes each consecutive year's Annual Overdraft and replenishment activities and determines the change in storage. It adds to or subtracts the corresponding value from the Accumulated Overdraft. Since the base level, the aggregate excess of extractions over recharge from the basins has been reduced due to the replenishment by WRD, the reduction of pumping from the adjudications, and the replenishment from seawater barrier injection. Because of the loss from storage last year of 51,500 AF, the Accumulated Overdraft at the end of the previous WY was determined to be 753,300 AF. For the current year, the Accumulated Overdraft is estimated at 749,700 AF. This could change if hydrology or pumping patterns or planned artificial replenishment supplies vary considerably.

Table 7 presents information for the previous and current Accumulated Overdraft estimate. The annual changes in storage since 1961 are presented on **Table 8**.

Groundwater Levels

A groundwater elevation contour map representing water levels within the District in fall 2009 (end of the water year) was prepared for this report and is presented as **Plate 2**. The data for the map were collected from wells that are screened in the deeper basin aquifers where the majority of groundwater pumping occurs. These deeper aquifers include the Upper San Pedro Formation aquifers, including the Lynwood, Silverado, and Sunnyside. Water level data was obtained from WRD's network of monitoring wells and from groundwater production wells that are screened in the deeper aquifers.

As can be seen on **Plate 2**, groundwater elevations range from a high of about 170 feet above mean sea level (msl) in the northeast portion of the basin above the spreading grounds in the Whittier Narrows to a low of about 120 feet below msl in the Long Beach area and about 130 feet below msl in the Gardena area. With the exception of the Montebello Forebay and along the West Coast Basin Barrier Project, the majority of groundwater levels in the District are below sea level, which is why continued injection at the seawater barriers is needed to prevent saltwater intrusion.

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[1] DWR Bulletin 104-A did not refer to the ending year for the storage determination. WRD has assumed it to be the year 1957, as this is the end year for their detailed storage analysis presented in Bulletin 104-B – Safe Yield Determination.

Plate 2 also shows the location of the key wells used for long-term water level data. These long-term hydrographs have been presented in the ESR for years, and provide a consistent basis from which to compare changing water levels. A discussion of water levels observed in the key wells is presented below.

<u>Los Angeles Forebay</u>

The Los Angeles Forebay occupies the westerly portion of the Central Basin Non-Pressure Area. Historically a recharge area for the Los Angeles River, this forebay's recharge capability has been substantially reduced since the river channel was lined. Recharge is now limited to deep percolation of precipitation, in-lieu when available, subsurface inflow from the Montebello Forebay, the northern portion of the Central Basin outside of WRD's boundary, and relatively small amounts from the San Fernando Valley through the Los Angeles Narrows.

Key well **2S/13W-10A01** represents the overall water level conditions of the Los Angeles Forebay (see **Figure B**). The water level high was observed in 1938 and by 1962 water levels had fallen nearly 180 feet due to basin over-pumping and lack of sufficient natural recharge. Since then, basin adjudication and artificial replenishment by WRD have improved water levels in this area by over 80 feet. Over the past 7 years, groundwater levels in this well have remained relatively constant with only minor fluctuations. This past year saw a rise of about 2 feet.

For the current water year, rainfall is 8% above normal. This plus a pumping decrease and the spreading of untreated Tier 1 (firm delivery) imported water in the Montebello Forebay are expected to cause water levels in the Los Angeles Forebay to rise.

<u>Montebello Forebay</u>

The Montebello Forebay lies in the northeastern portion of the Central Basin and connects with the San Gabriel Basin to the north to the Central Basin via the Whittier Narrows. The Rio Hondo and San Gabriel River Spreading Grounds in the forebay provide the vast majority of surface recharge to the Central Basin aquifers. Three key wells help describe the water level conditions in the Montebello Forebay, a northern well, middle well, and southeastern well (**Plate 2**):

- **Well 2S/11W-18C07** (WRD Monitoring Well Pico#1, Zone 4) is in the northern part of the Montebello Forebay. It replaces the earlier production well 2S/11W-18K02 that had been used for over 50 years but has been destroyed. The upper chart on **Figure C** shows the water levels for this well. At the end of water year 2008/2009, groundwater levels in this well were 15 feet lower than the previous year due to lack of imported water for replenishment and a dry year.
- **Well 2S/12W-24M08** (LACDPW Well No. 1601T) is centrally located between the two spreading grounds. This well is monitored weekly by WRD to assess water levels in the forebay and as an indicator for the need to purchase replenishment water. The middle chart on **Figure C** shows the water levels for this well. The historic water level high was observed in 1942, but by 1957 had fallen 117 feet to an all-time low due to basin over-pumping and insufficient natural recharge. As described above for the Los Angeles Forebay, adjudication of pumping rights and artificial replenishment water by WRD helped restore water levels in the Montebello Forebay. At the end of WY 2008/2009, groundwater levels in this well were 11 feet lower than the previous year and reached a 32-year low due to the below normal recharge from lack of imported spreading water and a dry year.

- **Well 3S/12W-01A06** (LACDPW Well No. 1615P) is located downgradient and southeast of the spreading grounds near the southern end of the Montebello Forebay and the water level responses in this well are less pronounced than the other two wells because it is further from the spreading grounds and the recharge that occurs there. The lower chart on **Figure C** shows the water levels for this well. At the end of water year 2008/09, groundwater levels in this well were 8 feet lower than the previous year due to below normal recharge from lack of imported spreading water and a dry year.
- For the current water year, rainfall is 8% above normal. This plus a pumping decrease and the spreading of untreated Tier 1 (firm delivery) imported water in the Montebello Forebay are expected to cause water levels to rise.

<u>Central Basin Pressure Area</u>

The District monitors key wells **4S/13W-12K01** (LACDPW No. 906D) and **4S/12W-28H09** (LACDPW No. 460K) which represent the conditions of the pressurized groundwater levels in the Central Basin Pressure Area. The hydrographs for these two wells are shown on **Figure D**.

Groundwater highs were observed in these wells in 1935 when they began to continually drop over 110 feet until their lows in 1961 due to the over-pumping and insufficient natural recharge. Groundwater levels recovered substantially during the early 1960s as a result of replenishment operations and reduced pumping. Between 1995 and 2007 there have been 100-foot swings in water levels each year from winter to summer. These swings were due to pumping pattern changes by some of the Central Basin producers who operate with more groundwater in the summer months and less groundwater in the winter months, and took advantage of the MWD and WRD In-Lieu program. However, since May 2007 the In-Lieu water has not been available, so pumping has remained more constant throughout the year and water levels remain depressed as shown in the two hydrographs.

At the end of WY 2008/09, water levels in well 4S/13W-12K01 were 12 feet lower than the previous year, and well 4S/12W-28H09 was 10 feet lower than the previous year. Water levels in the CB Pressure area are expected to rise somewhat as continued conservation efforts reduce overall water demand.

<u>West Coast Basin</u>

The West Coast Basin is separated from the Central Basin by the Newport-Inglewood Uplift which is a series of discontinuous, subparallel hills and faults that act as a partial barrier to groundwater flow. Groundwater moves across the uplift from one basin to the other based on water levels on either side of the uplift.

Figure E shows the hydrographs of key wells **3S/14W-22L01** (LACDPW No. 760C) and **4S/13W-21H05** (LACDWP No. 869). These two wells represent the general conditions of the water levels in the West Coast Basin. In 1955, the control of groundwater extractions in the West Coast Basin resulted in stabilizing and reversal of the declining water levels in the center of the basin (well 3S/14W-22L01), whereas at the eastern end near the Dominguez Gap Barrier water levels continued to decline until about 1971, when a recovery began due mostly to the startup of the Dominguez Gap Barrier Project. For the previous year 2008/2009, water levels in both wells were a generally lower by a couple feet, possibly due to the increased pumping in the West Coast Basin. Water levels in the West Coast Basin are expected to decline a couple more feet as pumping is higher in the current year than in the previous year.

Groundwater Conditions

Plate 3 shows the water level changes over the entire CWCB over the previous water year. Because of the dry year and lack of imported replenishment water, the Central Basin experienced water level declines over 15 feet. The West Coast Basin was less impacted because the inflows generally matched the outflows in the western half of the basin, but in the eastern have drawdowns over 10 feet were observed.

Based on the groundwater levels observed over various areas of the Central and West Coast Basins and the projections for the current and ensuing year, the District anticipates no problems in having adequate groundwater supplies to meet the demands of the groundwater pumpers in the immediate future.

Change in Storage

The District determines the change in storage by comparing water levels from one year to the next. Rising water levels means an increase in groundwater storage and a drop in water levels means a decrease in storage. Using water level elevation data collected from WRD's monitoring well network and selected production wells, the District constructs a water level change map from one year to the next (**Plate 3**). The data from this map are multiplied by the storage coefficient values for the aquifers as obtained from the USGS calibrated model of the District to produce the change in storage.

As reported in the Annual Overdraft discussion, the change in storage in WY 2008/2009 was approximately 51,500 AF. Over the past 10 years, there have been two years of gaining storage and 8 years of losing storage, with the average loss from storage at 17,100 AFY, or 171,000 AF loss over 10 years. This is a considerable amount of storage loss and is attributable to dry years and lack of replenishment water. But, the groundwater basins can act as a reservoir, draining in times of drought and rising in times of surplus. The District monitors these changes and compares it to its defined Optimum Groundwater Quantity, as described below.

For the current water year, rainfall is 8% above normal. This plus a pumping decrease and the spreading of untreated Tier 1 (firm delivery) imported water in the Montebello Forebay are expected to cause water levels in much of the basins to rise resulting in a gain in the amount of groundwater in storage. **Table 8** provides the historical tracking of storage changes in the CWCB.

Optimum Groundwater Quantity

In response to a 2002 State audit of the District’s activities, the Board of Directors adopted an Optimum Quantity for groundwater amounts in the Central and West Coast Basins. The Optimum Quantity is based on the Accumulated Overdraft (AOD) concept described in the Water Code and in this ESR. The historic maximum groundwater drawdown due to over pumping reported in the CWCB between 1904 and 1957 was 1,080,000 AF. This is defined as the historic maximum AOD. As pumping eased and artificial replenishment occurred, more water was put back into the basins and the AOD was reduced resulting in rising water levels.

After considerable analysis and discussion, on June 18, 2003 the Board of Directors adopted the Optimum Quantity for the CWCB at an AOD of 400,000 AF, or 680,000 AF on top of the historic maximum AOD. The adopted value was based on the amount of groundwater necessary to meet the pumpers' demands in a worst case scenario of a major 3-year major drought where pumping would be maximized due to a lack of MWD water and replenishment at the spreading grounds and other means is at a minimum.

In 2003 through 2006, however, new discussions were being held by the local water community on groundwater storage opportunities within the District. The original derivation of the Optimum Quantity of AOD = 400,000 AF did not take into full account storage projects. If this Optimum Quantity were fully realized, there would not be enough storage space in the aquifers for large storage projects. Therefore, to utilize the groundwater basins for both endeavors, the Board of Directors on April 19, 2006 established a new Optimum Quantity at an AOD of 612,000 AF. This value was based on an extensive review of over 70 years of water level fluctuations in the District and recognizing that in the year 2000, groundwater amounts were at a healthy quantity to sustain the adjudicated pumping rights in the basins. The AOD in the year 2000 was 612,000, and therefore was set by the Board of Directors as the new Optimum Quantity.

The Board of Directors at that April 19, 2006 meeting also adopted a policy to make up the Optimum Quantity should it fall too low. The policy is as follows:

An Accumulated Overdraft greater than the Optimum Quantity is a deficit. WRD will make up the deficit within a 20 year period as decided by the Board on an annual basis. If the deficit is within 5 percent of the Optimum Quantity, then no action needs to be taken to allow for natural replenishment to makeup the deficit.

Since the end of WY 1999/2000, a total of approximately 141,300 AF have been lost from storage, brining the AOD down to 753,300. Based on the adopted policy, the Board will be considering options to make up the AOD and return the basin to the Optimum Quantity over a period of time.

CHAPTER IV
GROUNDWATER REPLENISHMENT: QUANTITIES, AVAILABILITY, AND COSTS

As discussed in the previous chapter, the Central and West Coast Basins have an annual overdraft because more groundwater is pumped out than is replaced naturally. The District purchases supplemental water (artificial replenishment water) each year to help offset this overdraft. The purchased water enters the groundwater basins at the Montebello Forebay spreading grounds, at the seawater barrier injection wells, and through the District's In-Lieu Program. The purpose of this Chapter is to determine the quantities of water needed for purchase in the ensuing year and to determine the availability and cost of that water.

The District currently has available to it recycled and imported water sources for use as artificial replenishment water. These two sources are described below:

- ***Recycled Water**: Recycled water is wastewater from the sewer systems that is reclaimed through extensive treatment at water reclamation plants ("WRP"s). The water is treated to high quality standards so that it can be reused safely. Some agencies and businesses use recycled water for non-potable purposes, such as for irrigation of parks, golf courses, and street medians, or for industrial purposes. WRD uses recycled water for groundwater recharge since 1962. In semi-arid areas such as Southern California where groundwater and imported water are in short supply, recycled water has proven to be a safe and reliable additional resource to supplement the water supply. Recycled water is used at the spreading grounds and the seawater barrier wells. Although recycled water is high quality, relatively low cost, and a reliable supply all year long, the District is limited by regulatory agencies in the amount it can use for replenishment. Therefore, imported water is also used for recharge.*
- ***Imported Water**: This source originates from northern California (State Water Project) and the Colorado River and is brought to the District by the Metropolitan Water District of Southern California ("MWD" or "Met"). Raw (untreated), surplus imported water is used at the spreading grounds whereas potable imported water is used at the seawater intrusion barriers and for the in-lieu program. Because of treatment and transportation costs, it is the most expensive source for recharge water. The supply is under full upstream control, and its availability at the spreading grounds is limited and variable, especially during drought years. In fact, since May 2007 MWD has stopped delivery of this water for replenishment and In-Lieu and the availability for 2010/2011 is questionable due to continued drought and Bay Delta issues.*

Recommended Quantities of Replenishment Water

With information presented in the preceding chapters regarding the basins' pumping demands and the overall condition of the groundwater basins, WRD can estimate its projected need for replenishment water in the ensuing year.

<u>Spreading</u>

Groundwater recharge through surface spreading occurs in the Montebello Forebay Spreading Grounds adjacent to the Rio Hondo and the San Gabriel River, within the unlined portion of the San Gabriel River, and behind the Whittier Narrows Dam in the Whittier Narrows Reservoir. Owned and operated by the Los Angeles County Department of Public Works ("LACDPW"), they were originally constructed in 1938 for flood control and conservation of local storm water, but have been used since the 1950s to replenish the basins with imported water and since 1962 with recycled water.

Since recycled water is a high quality, less expensive, and available year-round source of replenishment water, the District maximizes its use within established regulatory limits. These limits are discussed below under "Expected Availability of Replenishment Water". In general, the District plans on purchasing 50,000 AF in the ensuing year to maximize the amount under regulatory limits, unless lack of dilution water (storm water and imported water) causes a reduction in the recycled water amounts.

Additional replenishment water is needed beyond the 50,000 AFY of recycled water and will have to come from the purchase of imported water from MWD. In 2003, the WRD Board adopted the long term average of 27,600 AFY of imported water to purchase for spreading. This value was based on long-term (30 year) averages of the overall water budget of the basins using the USGS computer model. The 2003 ESR discusses the derivation of this value in more detail.

Since that time, the District has invested in cooperative projects with the LACDPW to capture more storm water and to lessen the need for imported water as part of WRD's Water Independence Now program, or WIN. Improvements to the Whittier Narrows Conservation Pool are expected to conserve an additional 3,000 AFY of storm water on average. Two new rubber dams were built in the San Gabriel River near Valley Boulevard and are expected to conserve an additional 3,600 AFY on average. Therefore, the new Long Term Average for imported spreading demands is 21,000 AFY. This amount plus the recycled demand cited earlier brings the total WRD basic spreading needs for the ensuing year to 71,000 AF.

In addition, supplemental water may be needed to make up the deficit in the Optimum Quantity discussed at the end of Chapter 3. WRD's Water Resources Committee has been discussing this topic. Per the Board's policy in 2006, the District would attempt to make up the Optimum Quantity deficit over a 20-year period. Much of this deficit, however, could be made up by rainfall if a few extremely wet years would occur. Over the past 3 years, there has been a shortage of about 41,000 AF of imported water that the District has been unable to purchase due to the MWD cutoff. Making this up over a 20-year period would require approximately 2,000 AFY of additional imported water. For 10-years it would take 4,000 AFY. The Water Resources Committee continued to discuss possible makeup options for the Optimum Quantity deficit.

Table 9 presents the currently anticipated imported water replenishment needs.

<u>Injection</u>

Another way of replenishing the groundwater supply is to inject water at the three seawater intrusion barriers owned and operated by the LACDPW, including the West Coast Basin Barrier, Dominguez Gap Barrier, and Alamitos Barrier. Although the primary purpose of the barriers is for seawater intrusion control, groundwater replenishment also occurs as the freshwater is injected into the CWCB aquifers and then moves inland towards pumping wells.

To determine the amount of barrier water estimated for the ensuing year, WRD under an Agreement with LACDPW gets annual estimates from the expected demand at the barriers. WRD reviews these estimates and makes adjustments as necessary. For 2010/2011, no adjustments were made to estimates provided by the LACDPW.

For the West Coast Basin Barrier Project 16,000 AF are estimated of which half will be recycled water and half will be imported water. For the Dominguez Gap Barrier Project 8,000 AF are estimated, with half recycled and half imported. For the Alamitos Barrier 4,400 AF are estimated with 2,100 AF recycled and 2,300 AF imported.

The total barrier demand forecast for the ensuing year is 28,400 AF (**Table 9**), or 14,100 AF recycled and 14,300 AF imported.

<u>In-Lieu Replenishment Water</u>

The basic premise of WRD's In-Lieu Program is to offset the pumping in the basin to lower the annual overdraft and reduce the artificial replenishment needs. It helps provide an alternate means of replenishing the groundwater supply by encouraging basin pumpers to purchase surplus imported water when available instead of pumping groundwater. This can help raise water levels in areas that are otherwise more difficult to address. Since May 2007, the In-Lieu water has not been made available by MWD due to water shortages. However, WRD has planned for it in case the water became available. If monies raised go unspent, they are placed in a water purchase reserve for subsequent year water purchases.

For the ensuing year, the pumper's Technical Advisory Committee ("TAC") recommended budgeting for the In-Lieu Program and the Board of Directors agreed when they adopted the 2010/2011 budget and established the Replenishment Assessment on May 11, 2010. Therefore, for the ensuing year 2010/2011, WRD has budgeted 10,303 AF for the In-Lieu program (6,000 AF in the Central Basin and 4,303 AF in the West Coast Basin).

Expected Availability of Replenishment Water

The availability of water supplies for the ensuing water year has been taken into account when determining how funds should be raised. If a particular resource is expected to be unavailable during a given year, money can still be raised to fund the purchase of that quantity of water in a succeeding year.

The Water Resources Committee has been discussing potential water purchase scenarios for the ensuing year, recognizing the unique circumstances of water availability, 30-year water level lows, significant deficit in the Optimum Quantity, lack of traditional spreading and In-Lieu water, and recycled water permitting requirements and availability. They developed the following scenarios:

Option	Water Variable for Ensuing Year
A)	Baseline (normal): seasonal spreading, 75% recycled at WCBBP, In-Lieu, no Optimum Quantity
B)	Untreated Tier 1 for spreading, 50% recycled at WBBP, No-In Lieu, no Optimum Quantity
C)	Same as B) with addition of 2,000 AF Tier 1 for Optimum Quantity Makeup
D)	Same as B) with addition of 4,000 AF Tier 1 for Optimum Quantity Makeup
E)	Same as B) with addition of In Lieu Program
F)	Same as B) with addition of In Lieu and 2,000 AF Tier 1 Optimum Quantity
G)	Seasonal spreading, 50% recycled at WB, no In Lieu, no Optimum Quantity

Groundwater Replenishment

The pumpers Technical Advisory Committee met on March 18, 2010 and recommended Option E. The WRD Board agreed when they adopted the 2010/2011 budget and established the Replenishment Assessment on May 11, 2010. Therefore, the values used on **Tables 1 and 2** of the ESR use Option E since these were the final adopted values.

<u>Recycled Water</u>

Recycled water is reliable all year round but its use is capped by regulatory limits. The current limits for recycled water spreading in the Montebello Forebay are established by the California Regional Water Quality Control Board (RWQCB) and are detailed in Order No. 91-100 adopted on September 9, 1991, and amendments made on April 2, 2009 under Order No. R4-2009-0048. The District is limited to spreading 35% recycled water over a 5-year period based on the total inflow of all waters into the Montebello Forebay, meaning that at least 65% of the waters entering the forebay must be dilution waters such as storm water, underflow, rainfall, and imported water. As these dilution sources become scarce due to dry years or continued lack of imported replenishment water, the amount of recycled water will have to be reduced to maintain the 35% regulatory cap.

The Sanitation Districts of Los Angeles County (SDLAC) provides the recycled water to WRD for spreading by LACDPW. This water comes from the Whittier Narrows Water Reclamation Plant ("WNWRP"), San Jose Creek Water Reclamation Plant ("SJCWRP"), and Pomona Water Reclamation Plant ("PWRP"). WRD purchases water from the WNWRP and SJCWRP, whereas the water from the PWRP is considered incidental recharge and is not purchased. For planning purposes, the District assumes a total of 50,000 AFY for spreading of recycled water each year to meet the regulatory cap. **Table 2** shows the breakdown amounts for these purchases.

Recycled water for injection into the seawater barrier wells comes from different agencies depending on the specific barrier. At the WCBBP, the water is provided by WBMWD's Edward C. Little Water Recycling Facility. Per regulatory limits, this resource can provide up to 75% of the water injected into the West Coast Basin Barrier with an increase up to 100% being planned. Because of recent influent water quality issues at the plant, only about 50% recycled water has been provided with 50% imported water making up the difference. Since 16,000 AF is anticipated for the ensuing year, 8,000 AF will be recycled and 8,000 AF imported.

Recycled water for the DGBP is available from the City of Los Angeles' Terminal Island Treatment Plant (Harbor Recycled Water Project). The plant is permitted to provide the barrier with up to 5 million gallons per day (mgd) or 5,600 AFY, or 50% of the total barrier supply, whichever is less. Since 8,000 AF is anticipated for the ensuing year, 4,000 AF will be recycled water and 4,000 AF will be imported water.

Recycled water for the ABP is available from WRD's Leo J. Vander Lans Water Treatment Facility. This treatment plant is permitted to provide up to 50% of barrier water with recycled water with the remainder being imported. Since 4,400 AF is anticipated for the ensuing year, 2,100 AF will be recycled and 4,300 AF imported. This is not quite a 50/50 blend based on past operational conditions and occasional plant outages for maintenance.

<u>Imported Water</u>

All indications from MWD are that seasonal spreading water and In-Lieu water will once again not be available in the ensuing year due to drought, environmental issues, and judicial decisions on the

Bay Delta. As imported deliveries are cut back during dry years or with climate change or extended periods of drought, WRD may need to look at other sources for replenishment water, such as increased used of recycled water and storm water, or purchasing more expensive but more available imported water such as untreated Tier 1 (firm delivery) water. This has occurred in the current year, where WRD purchased 5,991 AF from the City of Long Beach and 20,295 AF from CBMWD for spreading. The TAC recommended and the WRD Board approved budgeting for untreated Tier 1 water in the ensuing year since the seasonal water will likely be unavailable.

For the imported water used for injection at the seawater barrier wells, the District pays the premium price for "non-interruptible" water meaning that it will be available all year long with the possible exception that MWD could invoke a Water Allocation Plan to ration available supplies to all users if there is a severe drought. Because of the increasing water costs at the barriers, the District is looking at ways to minimize costs such as reduction of pumping near the barriers, increased recycled water to offset imported water, or banking water at lower seasonal rates. At the ABP, the City of Long Beach and WRD have entered into an agreement to bank seasonal treated water through inland injection wells and then extract the water for injection at the barriers, thus saving considerable costs on barrier water. However, because MWD has halted the availability of seasonal water, the amount remaining in the bank (about 2,000 AF) has been put on hold and treated Tier 1 water is being purchased. When seasonal water becomes available again, the storage bank will be refilled.

Projected Cost of Replenishment Water

WRD has estimated it will need 109,703 AF of replenishment water in the ensuing year. The MWD and their member agencies, and the SDLAC set the price for the replenishment water WRD buys for the replenishment at the spreading grounds, barrier wells, and In-Lieu, and are a direct pass-through on WRD's replenishment assessment.

MWD and their member agencies have recently set their new prices for water for the ensuing year and had considerable increases that will impact WRD and the pumpers. These increases are due to the State's water crisis including drought, environmental concerns, energy concerns, and reductions in water purchases through conservation and the continued poor economy, as well as increases in costs for water quality treatment. WRD's Water Resources Committee evaluated numerous options for the budgeting of water for the ensuing year as follows:

Option	Water Cost Variable for Ensuing Year	Water Cost (estimated)
n/a	Cost for Water in Current Year for use as Comparison	$ 28,815,746
A)	Baseline: seasonal spreading, 75% recycled at WBBP, In-Lieu, no Optimum Quantity	$ 33,296,025
B)	Untreated Tier 1 spreading, 50% recycled at WBBP, No-In Lieu, no Optimum Quantity	$ 34,051,110
C)	Same as B with addition of 2,000 AF Tier 1 for Optimum Quantity	$ 35,352,110
D)	Same as B with addition of 4,000 AF Tier 1 for Optimum Quantity	$ 36,653,110
E)	Same as B with addition of In Lieu	$ 38,106,991
F)	Same as B with addition of In Lieu and 2,000 AF Tier 1 Optimum Quantity	$ 39,054,025
G)	Seasonal spreading, 50% recycled at WB, no In Lieu, no Optimum Quantity	$ 31,132,110

Groundwater Replenishment

The pumpers Technical Advisory Committee met on March 18, 2010 and recommended Option E. The WRD Board agreed when they adopted the 2010/2011 budget and established the Replenishment Assessment on May 11, 2010. Therefore, the values used on **Tables 1 and 2** of the ESR use Option E since these were the final adopted values.

<u>Recycled Water Rates</u>

Under an interim contract, the current price for recycled water from the WNWRP is $7.00/AF. The unit cost of recycled water from the SJCWRP is adjusted every three-years based on an agreement between WRD and the SDLAC. In January 2007, the new three year period commenced with the price going down from $21.31/AF to $20.66/AF. However, WRD was recently notified by the SDLAC that this was an incorrect calculation and that is should have been $27.65/AF and will be assessing a makeup fee for the difference ($228,898 per year for 3 years). In addition, the new 3-year rate starting January 2010 is $34.40/AF.

At the WCBBP, the cost of recycled water from WBMWD is expected to increase from $458/AF to $540/AF based on a new agreement between WBMWD and WRD for long term reliability of the water.

At the DGBP, the rate for recycled water from the Terminal Island Treatment Plant will cost $431/AF from the City of Los Angeles. This is a guaranteed rate for the first 5 years of the project, and is good until 2011.

For recycled water at the ABP from the Leo J. Vander Lans Water Treatment Facility, WRD has determined that the cost of water to the District will be $406/AF, which represents the operations and maintenance costs of the treatment plant less the MWD rebate. However, this cost is incorporated into the District's budgeting for the operations and maintenance costs for the facility (WRD Project #001), and therefore is deducted from the cost of water shown on **Table 2**.

<u>Imported Water Rates</u>

WRD cannot buy directly from MWD because it is not a member agency. The District, therefore, purchases water from MWD member agencies such as the CBMWD, WBMWD, and the City of Long Beach for the spreading grounds, barrier wells, and In-Lieu. The cost of replenishment water to WRD is the MWD rate plus any surcharges added by the MWD member agencies.

MWD has made increases in their water rates due to the State's water crisis including drought, environmental concerns, energy concerns, water quality treatment, and reductions in water purchases through conservation and the continued poor economy. The base commodity rate (without member surcharges) for untreated Tier 1 (firm delivery) water that WRD will use for spreading in the ensuing year will increase from $484/AF to $527/AF (9% increase). For seawater barrier injection water (treated Tier 1 firm delivery water) the rate will increase from $701/AF to $744/AF (6% increase). The switching from seasonal water to untreated Tier 1 water also has a large cost impact, with the prices rising from $366/AF to $527/AF (44% increase).

Met-member agencies also add surcharges on top of the MWD rates. WBMWD and CBMWD have administrative surcharges and water service charges. These costs and all water costs are shown on **Tables 1 and 2**.

In-Lieu Rates

The WRD Board of Directors sets the In-Lieu program and rates. For 2010/2011, the Board adopted the rates on May 11, 2010, as shown on **Tables 1 and 2**. Any unused portion will go into the water purchase reserve for subsequent water purchases.

Summary

Based on the pricing structures discussed earlier in this Chapter and on the quantities of water forecast for purchase in the ensuing year, WRD estimates that the cost to purchase 109,703 AF of replenishment water will be $38,106,991. **Tables 1 and 2** presents the detailed breakdown of these costs for Option E, which was supported by the TAC and adopted by the WRD Board.

These estimated costs are for water purchases only. They do not include the additional costs for the projects and programs needed to replenish the basins and to protect groundwater quality. Those projects and programs are discussed in the next chapter and their costs were presented in the District's separate annual budgeting process that culminated in the Board’s adoption of the Replenishment Assessment for FY 2010/2011 on May 11, 2010 at a rate of $205/AF pumped.

CHAPTER V
PROJECTS AND PROGRAMS

California Water Code Sections 60220 through 60226 describe the broad purposes and powers of the District to perform any acts necessary to replenish, protect, and preserve the groundwater supplies of the District. In order to meet its statutory responsibilities, WRD has instituted numerous projects and programs in a continuing effort to effectively manage groundwater replenishment and groundwater quality in the Central and West Coast Basins ("CWCB"). These projects and programs include activities that enhance the replenishment program, increase the reliability of the groundwater resources, improve and protect groundwater quality, and ensure that the groundwater supplies are suitable for beneficial uses.

These projects and programs have had a positive influence on the basins, and WRD anticipates continuing these activities into the ensuing year. The following is a discussion of the projects and programs that WRD intends to continue or initiate during the ensuing year.

001 Leo J. Vander Lans Water Treatment Facility Project

The Leo J. Vander Lans Water Treatment Facility provides advanced treated recycled water to the Alamitos Seawater Intrusion Barrier. The facility receives tertiary-treated water from the Sanitation Districts and provides the advanced treatment through a process train that includes microfiltration, reverse-osmosis, and ultraviolet light. The facility's operations permit was approved by the Los Angeles Regional Water Quality Control Board on September 1, 2005, and the replenishment operations of this facility started in October 2005. The product water has since been discharging to the barrier to replace up to 50% of the potable imported water currently used, thereby improving the reliability and quality of the water supply to the barrier. The plant is designed to produce approximately 3,000 AFY for delivery to the barrier. Studies are underway to potentially expand the capacity of the facility so that it can provide up to 100% of the barrier water demands thereby eliminating the need for the imported water. The Long Beach Water Department (LBWD) is responsible for operation and maintenance of the treatment plant under contract with WRD. Expected costs for the coming year will primarily involve operating and maintaining the plant through the LBWD contract as well as meeting groundwater monitoring requirements from the permit to inject recycled water at the barrier. Because the primary purpose of this project is to provide a more reliable means of replenishing the basin through injection, 100% of the costs are considered to be drawn from the Replenishment Fund.

002 Robert W. Goldsworthy Desalter Project

The Robert W. Goldsworthy Desalter has been operating since 2002 to remove brackish groundwater from a saline plume in the Torrance area that was stranded inland of the West Coast Basin Barrier after the barrier was put into operation in the 1950s and 1960s. The production well and desalting facility are located within the City of Torrance, and the product water is delivered for potable use to the City's distribution system. The treatment plan capacity is about 2,200 AFY.

As with the Vander Lans facility, future costs for this project will involve O&M activities and replacement costs. The purpose of the desalter is directly related to remediating degraded groundwater quality, and costs are thus attributed 100% to the Clean Water Fund.

Additional measures may be necessary in the future to fully contain and remediate the saline plume, which extends outside of the Torrance area. WRD is actively pursuing long-term solutions to this problem and continues to work with the City of Torrance Municipal Water Department, the pumpers' Technical Advisory Committee, and other stakeholders on the future of the saline plume removal in the West Coast Basin.

004 Recycled Water Program

Recycled water (reclaimed municipal wastewater) has been used for groundwater recharge by WRD since 1962. Using recycled water to replenish the groundwater basins provides a reliable source of high quality water for surface spreading in the Montebello Forebay and injection at the seawater intrusion barriers. In view of the drought conditions that periodically occur in California and uncertainty in the future availability of imported supplies, this resource has become increasingly vital and essential as a replenishment source.

WRD participates in various activities to ensure that the use of recycled water continues to be safe and reliable for groundwater recharge. WRD, along with other stakeholders, is working closely with the California Department of Public Health ("CDPH") to revise regulations on groundwater recharge using recycled water. Through this dialogue, WRD and CDPH exchange information and develop a mutual understanding of each agency's perspectives.

From an operational standpoint, the District continues to coordinate with the Sanitation Districts of Los Angeles County with permit compliance activities, including groundwater monitoring and reporting, to ensure that the current practice and operation of replenishing with recycled water continues to be safe. Many monitoring wells and production wells are sampled frequently by WRD staff, and the results are reported as required to the regulatory agencies.

In addition to regular monitoring and sampling around the spreading grounds, WRD is partnering with others to more fully investigate the effectiveness of soil aquifer treatment ("SAT") during percolation. Research is being conducted by specialists and experts and includes specific tests to characterize the percolation process and quantify the filtering and purifying properties of the underlying soil on constituents of concern such as nitrogen, total organic carbon, and emerging contaminants. More recently, the District is participating in a study through the WateReuse Foundation to compare the relative risks of water supplies that contain a portion of recycled water after SAT with water supplies that do not and found that there are no significant differences. In addition, the Colorado School of Mines completed an investigation that studied the effectiveness of SAT in removing organic carbon after recycled water percolates through the soil, which serves as a surrogate for potentially harmful contaminants, and compared it with percolation of drinking water and characterized similarities and differences. The District continues to be vigilant in monitoring research on the detection, significance, and treatment of emerging contaminants, such as pharmaceuticals and personal care products.

Tracer studies to verify travel time estimates from the spreading facilities to neighboring production wells were completed in mid-2006. It was shown that the depth to the screens of these wells was a more significant factor than horizontal distances between the spreading facilities and the wells. Also, travel time increased in one well after its well screen was sealed at shallow depths, thereby restricting flow into the well only from deeper aquifers. Based on modifications to a production well in 2009 in an attempt to increase travel time, the tracer test is being repeated in 2010. These efforts, in addition to periodic studies assessing health effects and toxicological issues, are necessary to provide continued assurances that recycled water for groundwater recharge remains safe and compliant with regulatory standards in the local basins.

Recycled water is also injected into the three seawater intrusion barriers in Los Angeles County (Alamitos, West Coast Basin, and Dominguez Gap). Work associated with the use of recycled water at those facilities is maintained under the specific project (e.g., Leo J. Vander Lans Water Treatment Facility) that delivers that resource to the barriers or under the program related to recycled water use at the specified barrier.

Projects under this program help to improve the reliability and utilization of an available local resource. This resource is used to improve replenishment capabilities and is thus funded 100% from the Replenishment Fund.

005 Groundwater Resources Planning Program

The Groundwater Resources Planning Program was instituted to evaluate basin management issues and to provide a means of assessing project impacts over the Central and West Coast Groundwater Basins. Prior to moving forward with a new project, an extensive evaluation is undertaken. Within the Groundwater Resources Planning Program, new projects and programs are analyzed based on benefits to overall basin management. This analysis includes performing an extensive economic evaluation to compare estimated costs with anticipated benefits. As part of this evaluation process, all new capital projects are brought to the District's Technical Advisory Committee for review and recommendation

The past several years have focused on the potential groundwater storage capabilities of the two basins. This year, the District will continue to work closely with basin stakeholders to finalize the framework for the implementation of storage projects.

Under this program, District staff will continue to monitor State and Federal funding programs to determine applicability to the District's list of potential projects. In the coming year, the District will continue participation in Integrated Regional Water Management Planning ("IRWMP") for Greater Los Angeles County. The development of this plan is a requirement for entities to secure grant funding under Proposition 84 and Proposition 1E which were passed in November 2006. It is expected that this plan will play a significant role in future grant funding opportunities at the Local, State and Federal levels, including those proposed for the November 2010 state ballot. District staff will also monitor the ongoing AB303 grant funding program.

Projects under the Groundwater Resources Planning Program serve to improve replenishment operations and general basin management. Accordingly, this program is also wholly funded through the Replenishment Fund.

006 Groundwater Quality Program

This comprehensive program constitutes an ongoing effort to address water quality issues that affect WRD projects and the pumpers' facilities. The District monitors and evaluates the impacts of proposed, pending and recently promulgated drinking water regulations and proposed legislation. The District assesses the justification and reasoning used to draft these proposals and, if warranted, joins in coordinated efforts with other interested agencies to resolve concerns during the early phases of the regulatory and/or legislative process.

The District continually evaluates current and proposed water quality compliance in production wells, monitoring wells, and spreading/injection waters of the basins. If noncompliance is identified, WRD staff quickly investigates to determine the causes of noncompliance, develops recommended courses of action and estimates their associated costs to address the problem, and implements the best alternative to achieve compliance.

Effective January 1, 2007, the District assumed responsibility for the Central Basin Title 22 Groundwater Monitoring Program that had been administered previously by the Central Basin Municipal Water District. This program provides services for monitoring of drinking water wells as required by state statutes to ensure that they continue to be safe for domestic use. Twenty pumpers with 79 wells have elected to continue participation in this program. In addition, a new contract for sample collection and laboratory analysis was issued for this work. This program is paid for by the participants, and therefore, does not impact the District's replenishment assessment.

In recent years, new emerging contaminants have been identified as impacting local groundwater not only in the Central and West Coast Basins, but also in neighboring regions such as the Main San Gabriel Basin, Orange County Basin, Chino Basin, etc. Constituents such as perchlorate, n-nitroso dimethylamine (NDMA), hexavalent chromium, and 1,4-dioxane have emerged as contaminants of concern and pose a potential threat to the local resources. In addition, due to advancements in and greater sensitivity of new laboratory analytical methods, trace amounts of pharmaceutical drugs have also been found. Existing drinking water regulations are being revisited and may be revised in the near future, which would impact the use of some existing wells. New regulations may be established as well. Monitoring for potential contaminants began on January 1, 2008 to comply with the federal Unregulated Contaminated Monitoring Rule 2.

WRD's service area contains a large and diverse industrial and commercial base. Consequently, many potential groundwater contamination sources exist within District boundaries. Examples of potential contamination sources include leaking underground storage tanks, petroleum pipeline leaks at refineries and petrochemical plants, and discharges from dry cleaning facilities, auto repair shops, metal works facilities, and others. Such contamination sources may pose a threat to the drinking water aquifers. Accordingly, WRD established its Groundwater Contamination Prevention Program as a key component of the Groundwater Quality Program, in an effort to minimize or eliminate threats to groundwater supplies.

The Groundwater Contamination Prevention Program includes several ongoing efforts:

- Central and West Coast Basin ("CWCB") Groundwater Contamination Forum: Several years ago, WRD established this data-sharing and discussion forum with key stakeholders including the U.S. Environmental Protection Agency ("USEPA"), the California Department of Toxic Substances Control ("DTSC"), the California Regional Water Quality Control Board – Los Angeles ("RWQCB-LA"), the CDPH, the U.S. Geological Survey ("USGS"), and various cities and pumpers. Stakeholders drafted and signed a Memorandum of Understanding ("MOU") agreeing to meet regularly (meetings are held 3 to 4 times per year at WRD) and share data on contaminated groundwater sites within the District. WRD has acted as the meeting coordinator and data repository/distributor, helping stakeholders to characterize the extent of contamination to identify pathways for shallow contaminants to reach deeper drinking water aquifers, and develop optimal methods for remediating contaminated groundwater.

- With the cooperation and support of all stakeholders in this Forum, WRD developed a list of high-priority contaminated groundwater sites within the District. This list is a living document, subject to cleanup and "closure" of sites as well as discovery of new sites warranting further attention. Currently, the list includes over 40 sites across the CWCB. WRD works with the lead regulatory agencies for each of these sites to keep abreast of their status, offer data collection, review and recommendations as needed, and facilitate progress in site characterization and cleanup.

- In 2003, WRD developed a scope of work with the Los Angeles County Department of Health Services ("LACDHS") to clarify the status of 217 potentially abandoned (a.k.a., "unknown status") wells located within District boundaries, as identified through researching WRD's groundwater production database. WRD completed numerous tasks to determine the status of these wells, including: distributing, collecting and tallying a survey questionnaire to all well owners associated with the potentially abandoned wells; searching through thousands of hard-copy well construction and destruction permits at the DWR, LACDHS, and City of Long Beach; conducting field reconnaissance trips to locate and photograph wells. These efforts were successful: WRD was able to reduce the number of "unknown status" wells from 217 to 20, and most of the remaining 20 are suspected to have been paved over during development of industrial and residential neighborhoods. At this time, it is WRD's intention to revisit its groundwater production database periodically, to identify any new "unknown status" wells, and to repeat the tasks listed above to clarify their status.

WRD is also participating in the Water Augmentation Study ("WAS") of the Los Angeles and San Gabriel River Watershed Council. This is a multi-year investigation to evaluate the feasibility of capturing more storm runoff at localized sites in lieu of discharge into the storm drains, channels, and ultimately to the ocean. It is a potential source of new replenishment water, and would be in addition to stormwater currently captured and retained for percolation at in the existing spreading grounds within the District. The underlying concept for the WAS is to retain more stormwater rather than allow it to be lost to the ocean; however, precautions must be taken to ensure that this new water does not degrade groundwater quality if allowed to percolate at local sites. More stormwater could be saved by utilizing Best Management Practices ("BMPs"), e.g., bioswales, infiltration basins, and porous pavements. Much of the WAS is focused on evaluating the technical feasibility of this project and the potential impacts on groundwater quality. Other aspects of the WAS include modeling to estimate the amount of water that can be percolated in the local watershed and the economic value of this additional source of water. In 2009, a neighborhood demonstration project was constructed with BMP's to evaluate the effectiveness and potential of a large-scale project.

Much of the work for the coming year will involve additional investigations at well sites known to have contaminated water, continued monitoring of water quality regulations and proposals affecting production and replenishment operations, further characterization of contaminant migration into the deeper aquifers, and monitoring and expediting cleanup activities at contaminated sites. All work under this program is related to water quality and cleanup efforts; therefore, 100% of it is funded from the Clean Water Fund.

010 Geographic Information System (GIS)

The District maintains an extensive database and Geographic Information System (GIS) in-house. The database includes water level and water quality data throughout the entire WRD service area with information drawn not only from the District's Regional Groundwater Monitoring Program and permit compliance monitoring, but also from water quality data obtained from the CDPH. The system requires continuous update and maintenance but serves as a powerful tool for understanding basin characteristics and overall basin health.

The GIS is used to provide better planning and basin management. The system is used to organize and store an extensive database of spatial information, including well locations, water level data, water quality information, well construction data, production data, aquifer locations, and computer model files. Staff uses the system daily for project support and database management. Specific information is available to any District pumper or stakeholder upon request and can be delivered through the preparation of maps, tables, reports, or other compatible format. Additionally, the District has made its web-based Interactive Well Search tool available to selected users. This web site provides these users with limited access to WRD's water quality and production database.

District staff will continue to streamline and refine the existing data management system and website as well as satisfy both internal and external data requests. As part of the streamlining of the data, staff will fully automate the transfer of water quality data from the laboratory directly into the District's water quality database. Additionally, District staff will continue the development of applications to more efficiently manage and report groundwater production information. Continued use, upkeep, and maintenance of the GIS are planned for the coming year. The use of the system supports both replenishment activities and groundwater quality efforts. Accordingly, the cost for this program is equally split between the Replenishment and Clean Water Funds.

011 Regional Groundwater Monitoring Program

The Regional Groundwater Monitoring Program provides for the collection of basic information used for groundwater basin management including groundwater level data and water quality data. It currently consists of a network of about 250 WRD and USGS-installed monitoring wells at over 50 locations throughout the District, supplemented by the existing groundwater production wells. The information generated by this program is stored in the District's GIS and provides the basis to better understand the dynamic changes in the Central and West Coast Basins. WRD staff, comprised of hydrogeologists and engineers, provides the in-house capability to collect, analyze and report groundwater data.

Water quality samples from the monitoring wells are collected twice a year. Water levels are measured in most monitoring wells with automatic data loggers daily, while water levels in all monitoring wells are measured by WRD field staff a minimum of four times per year. On an annual basis, staff prepares a report that documents groundwater level and groundwater quality conditions throughout the District.

Most of the work during the coming year will involve continuous field activities including quarterly and semi-annual data collection, continuous well and equipment maintenance, and annual reporting activities. In addition, new nested monitoring wells will be constructed. Work associated with the Regional Groundwater Monitoring Program also supports activities relating to both replenishment and water quality projects. The program, therefore, is funded 50% each from the Replenishment and Clean Water Funds.

012 □ Safe Drinking Water Program

WRD's Safe Drinking Water Program ("SDWP") has operated since 1991 and is intended to promote the cleanup of groundwater resources at specific well locations. Through the installation of wellhead treatment facilities at existing production wells, the District hopes to remove contaminants from the underground supply and deliver the extracted water for potable purposes. Projects implemented through this program are accomplished through direct input and coordination with well owners. In May 2007, the latest treatment plant went online which was a removal system for iron, manganese, and arsenic. The removal mechanism is a pressurized filtration system.

The current program focuses on the removal of VOCs and offers financial assistance for the design and equipment of the selected treatment facility. Another component of the program offers no-interest loans for other constituents of concern that affect a specific production well. The capital costs of wellhead treatment facilities range from $800,000 to over $2,000,000. Due to financial constraints, this initial cost is generally prohibitive to most pumpers. Financial assistance through the District's SDWP makes project implementation much more feasible.

There are several current projects in various stages of completion and new candidates for participation are on the rise. A total of fifteen (15) facilities are already completed and online and one facility has successfully completed removal of the contamination and no longer needs treatment. While continued funding of this program is anticipated for next year, the District has revised the guidelines of the SDWP to place a greater priority on projects involving VOC contamination or other anthropogenic (man-made) constituents, now classified as Priority A Projects. Further, any treatment projects for naturally-occurring constituents would be classified as Priority B Projects and funded on a secondary priority, on a case-by-case basis, and only if program monies are still available during the fiscal year. While such projects are of interest to WRD, availability of funding for them will not be determined until after the budget process.

Projects under the SDWP involve the treatment of contaminated groundwater for subsequent beneficial use. This water quality improvement assists in meeting the District's groundwater cleanup objectives. Thus, funding for the costs of the program is drawn wholly from the Clean Water Fund.

018 □ Dominguez Gap Barrier Recycled Water Injection

This Project involves the delivery of recycled water from the City of Los Angeles Department of Water and Power's ("LADWP") Terminal Island Treatment Plant ("TITP") Advanced Water Treatment Facility ("AWTF") to the Dominguez Gap Barrier ("DGB"). Deliveries of recycled water to the barrier commenced in late February 2006 and have continued into 2010.

This water is being treated with microfiltration, reverse osmosis, and chlorination before being injected into the DGB. The project is permitted to maintain an overall ratio of 50% recycled water and 50% potable water to the entire barrier to satisfy regulatory requirements. Additional water quality requirements, including turbidity and modified fouling index ("MFI"), must also be met to minimize potential fouling of injection wells in the DGB, which is owned and operated by the County of Los Angeles Department of Public Works.

While LADWP is responsible for the treatment and delivery of the recycled water and all the water quality sampling associated with those activities, WRD has responsibility over groundwater monitoring compliance. As part of the permit, groundwater monitoring is required to observe water quality conditions and to anticipate potential problems before recycled water travels to down gradient drinking water wells. In addition, a tracer study continues to be investigated to determine the extent of travel and movement of the recycled water blend. This is necessary to determine if adequate mixing and further blending in the ground is occurring and to ascertain if groundwater samples being collected are representative of the recycled water blend.

Recycled water use at the barriers improves the reliability of a supply that is needed on a continuous basis. Traditionally, water purchases for the barriers have been viewed as a replenishment function. Therefore, this program is funded 100% through the Replenishment Fund.

023 Replenishment Operations

WRD actively monitors the operation and maintenance practices at the LACDPW-owned and operated spreading grounds and seawater barriers within the District. Optimizing replenishment opportunities is fundamentally important to WRD, in part because imported and recycled water deliveries directly affect the District's annual budget. Consequently, the District seeks to ensure that the conservation of stormwater is maximized, and that imported and recycled water replenishment are optimized.

Due to the reduction and unreliability of imported water for replenishment, WRD is working on its Water Independence Now ("WIN") program to eventually become independent from imported water for groundwater recharge. Currently, the District needs about 31,000 AF of imported water for recharge; 21,000 AF for spreading and 10,000 AF for injection at the seawater barriers. By maximizing the use of recycled water and stormwater, the amount of imported water can eventually be reduced or eliminated, thereby providing the groundwater basins with full replenishment needs through locally-derived water.

WRD coordinates regular meetings with LACDPW, MWD, SDLAC, and other water interests to discuss replenishment water availability, spreading grounds operations, scheduling of replenishment deliveries, seawater barrier improvements, upcoming maintenance activities, and facility outages or shutdowns. The District tracks groundwater levels in the Montebello Forebay weekly to assess general basin conditions and determine the level of artificial replenishment needed. WRD also monitors the amount of recycled water used at the spreading grounds and seawater barriers to maximize use while complying with pertinent regulatory limits.

A major District goal for the coming year is to continue working with LACDPW to complete construction of the Interconnection Pipeline. This jointly-funded project is a new, dedicated pipeline and pumping station that will be constructed between the Rio Hondo and San Gabriel River Spreading Grounds to transfer replenishment water in either direction via gravity flow from the Rio Hondo to San Gabriel or pumping in the reverse direction. When completed, this project is expected to conserve approximately 1,300 AF/year of additional stormwater on average, help maximize the amount of recycled water conserved by approximately 5,700 AF/year, and provide operational flexibility to mitigate obstacles to performing replenishment at these spreading grounds. The Interconnection Pipeline project is a key component of the District's WIN.

As its name implies, this program deals primarily with replenishment issues and its costs are borne completely by the Replenishment Fund.

025 – Hydrogeology Program

This program accounts for the projects that occur regularly each year, related to the hydrogeology of the Central and West Coast Basins and surrounding groundwater basins. Staff work performed under this program includes the preparation of the annual Engineering Survey and Report, which incorporates the calculation and determination of annual overdraft, accumulated overdraft, change in storage, pumping amounts, and replenishment needs and costs. Extensive amounts of data are compiled and analyzed by Staff to determine these values. Maps are created showing water levels in the basins and production patterns and amounts. The updates, maintenance, and use of the Regional Groundwater Flow Model developed by the USGS and WRD are part of this program. This model is a significant analytical tool utilized by WRD to determine basin benefits and impacts of changes proposed in the management of the Central and West Coast Basins. It will be utilized for conjunctive use and water banking programs discussed earlier under Project 005.

An ongoing effort at the District to better characterize the hydrogeologic conditions across the Central and West Coast Basins is called the "Hydrogeologic Conceptual Model". This long-term project involves compiling and interpreting the extensive amounts of data generated during drilling and logging of the WRD/USGS monitoring wells, and collected from historical information for production wells and oil wells within the District. The ultimate goal of this project is to incorporate these data in WRD's database/GIS and apply the system to generate aquifer surfaces and cross-sections for comparison with historical interpretations of basin hydrogeology. The final conceptual model will significantly improve the understanding of the aquifer depths, extents, and thicknesses throughout the District, and will assist Staff, pumpers and stakeholders with planning for groundwater resource projects such as new well drilling, storage opportunities, or modeling. The data will also be made available on WRD's website to be used as a reference source for hydrogeologic interpretations and fulfilling project-related data requests.

Hydrogeologic analysis is also needed for projects associated with groundwater quality concerns and specific cleanup projects. Staff work may include investigative surveys, data research, and oversight of specific project studies. Such efforts are used to relate water quality concerns with potential impact to basin resources. An example of this type of Staff work is the District’s Well Profiling Program. The District assists pumpers in evaluating drinking water supply well contamination. Services may include existing data collection and review, and field tasks such as spinner logging and depth-discrete sampling. WRD’s evaluation helps pumpers to determine the best course of action; e.g., sealing off a particular screened interval of a well, wellhead treatment, or well destruction.

For the ensuing year, it is expected that additional investigative research projects into the saline plume, well testing, and recycled water travel time using tracers will be performed. In 2010/2011, a major update to the regional groundwater flow model will continue to be performed by the USGS to incorporate 8 years of new information since the model was last updated.

The Hydrogeology Program addresses both groundwater replenishment objectives and groundwater quality matters. This dual service warrants that the cost of the program be split evenly between the Replenishment and Clean Water Funds.

033 – Groundwater Reliability Improvement Program ("GRIP")

The WRD continues to pursue projects through its WIN program that develop local, sustainable sources of water for use in groundwater replenishment. This has become increasingly important in light of the environmental and political issues limiting delivery of imported water to Los Angeles area together with the potential for a drought to hit California.

To address these issues WRD is seeking alternative sources of water to offset the imported water used for replenishment in the Montebello Forebay. This program is referred to as the Groundwater Reliability Improvement Program (GRIP). The effort of this program is to evaluate all feasible alternatives for replacing or offsetting the current quantity of imported water used for replenishment. One alternative being considered is the use of advanced treated recycled municipal wastewater (microfiltration, reverse osmosis, ultra-violet light with hydrogen peroxide.) from the SDLAC's San Jose Creek Water Reclamation Plant.

To determine the viability of this project, in 2009 WRD entered into a partnership with the Upper San Gabriel Valley Municipal Water District ("USGVMWD") and the SDLAC to share in the cost for a consultant to perform a conceptual design of the facility on the proposed site for the purpose of developing preliminary cost estimates. The project will deliver advanced treated water to the San Gabriel River spreading basins to meet a portion of WRD's replenishment requirements along with delivery to proposed spreading basins near the Santa Fe Dam to help satisfy the needs of the USGVMWD.

More recently, the project partners have jointly funded a consultant to perform an Alternatives Analysis to evaluate various project options to bring replenishment water to the spreading grounds. The project partners are also intending to hire an outreach consultant to educate and solicit input from the pumping community, elected officials, non-governmental organizations, as well as the general public. Projects associated with the GRIP help to improve the reliability and utilization of an available local resource. This resource is used to improve replenishment capabilities and is thus funded 100% from the Replenishment Fund.

TABLES

Table 1

GROUNDWATER CONDITIONS AND REPLENISHMENT SUMMARY

ITEM	WATER YEAR Oct 1 - Sep 30		
	2008-2009	***2009-2010*** [(a)]	***2010-2011*** [(a)]
Total Groundwater Production	243,402 AF	241,000 AF	243,000 AF
Annual Overdraft	(112,700) AF	(95,800) AF	(97,800) AF
Accumulated Overdraft	(753,300) AF	(749,700) AF	

Quantity Required for Artificial Replenishment for the Ensuing Year

Spreading		
Imported for Spreading in Montebello Forebay	21,000	AF
Recycled for Spreading in Montebello Forebay	50,000	
Subtotal Spreading	71,000	
Injection		
Alamitos Seawater Barrier Imported Water (WRD side only)	2,300	
Alamitos Seawater Barrier Recycled Water (WRD side only)	2,100	
Dominguez Gap Seawater Barrier Imported Water	4,000	
Dominguez Barrier Seawater Barrer Recycled Water	4,000	
West Coast Seawater Barrier Imported Water	8,000	
West Coast Seawater Barrier Recycled Water	8,000	
Subtotal Injection	28,400	
In-lieu[(b)]		
Subtotal In-lieu	10,303	
Total	**109,703**	AF

Source and Unit Cost of Replenishment Water for the Ensuing Year

Spreading	**Oct-Dec**		**Jan-Sep**	
MWD Commodity Rate for Tier 1 Untreated Imported	*$ 484*	*/AF*	*$ 527*	*/AF*
CBMWD Administrative Surcharge	*$ 96*	*/AF*	*$ 96*	*/AF*
*CBMWD Readiness to Serve (RTS) charge **	*$ 18*	*/AF*	*$ 30*	*/AF*
Cost to WRD (sum of above)	□ **598**	**/AF**	□ **653**	**/AF**
plus CBMWD Water Service Charge	$ 69	/cfs/mo	$ 69	/cfs/mo
SDLAC recycled water from San Jose Creek	$ 34.40	/AF	$ 34.40	/AF
SDLAC recylced water from Whittier Narrows WRP	$ 7	/AF	$ 7	/AF
SDLAC makeup for undercharges in 2007-2009	$ 19,074.86	/mo	$ 19,074.86	/mo
Injection				
Alamitos Barrier				
MWD Commodity Rate for Tier 1 Treated Imported	*$ 701*	*/AF*	*$ 744*	*/AF*
Long Beach Administrative Surcharge	*$ 5*	*/AF*	*$ 5*	*/AF*
Cost to WRD (sum of above)	□ **706**	**/AF**	□ **749**	**/AF**
plus Long Beach Capacity Charge *	$ 600	/cfs/mo	$ 600	/cfs/mo
Recycled water from WRD Vander Lans plant	$ 406	/AF	$ 406	/AF
Dominguez Gap and West Coast Barriers				
MWD Commodity Rate for Tier 1 Treated Imported	*$ 701*	*/AF*	*$ 744*	*/AF*
WBMWD Administrative Surcharge	*$ 65*	*/AF*	*$ 65*	*/AF*
*WBMWD RTS **	*$ 94*	*/AF*	*$ 125*	*/AF*
Cost to WRD (sum of above)	□ **860**	**/AF**	□ **934**	**/AF**
plus WBMWD Water Service Charge	$ 34	/cfs/mo	$ 34	/cfs/mo
plus WBMWD Capacity Charge *	$ 530	/cfs/mo	$ 530	/cfs/mo
Recycled water from LADWP (Dominguez Gap)	$ 431	/AF	$ 431	/AF
Recycled water from WBMWD (West Coast)	$ 540	/AF	$ 540	/AF
In-lieu[(b)]				
MWD Member Agency			$ 333	/AF
WBMWD Customer			$ 398	/AF

(a) Estimated values

(b) Amounts and rates for In-lieu are estimated. Not yet been established by the Board for ensuing year

* *Amount is a direct pass through to MWD*

Table 2

QUANTITY AND COST OF REPLENISHMENT WATER FOR WY 2010-2011

	Item	Quantity (AF)	Total Cost	
Summary - All Water	Spreading - Tier 1 Untreated Imported	21,000	$	13,796,850
	Spreading - Recycled	50,000	$	1,674,898
	Alamitos Barrier - Imported	2,300	$	1,728,215
	Alamitos Barrier - Recycled*	2,100	$	-
	Dominguez Barrier - Imported	4,000	$	3,754,480
	Dominguez Barrier - Recycled	4,000	$	1,724,000
	West Coast Barrier - Imported	8,000	$	7,500,800
	West Coast Barrier - Recycled	8,000	$	4,320,000
	In-Lieu MWD Member	7,503	$	2,494,748
	In-Lieu WBMWD Customer	2,800	$	1,113,000
	TOTAL	**109,703**	□	**38,106,991**

Detailed Breakout of Water Costs and Surcharges to WRD

	Item	Quantity	Oct-Dec	Jan-Sep	Melded	Total
Imported Water	**MWD**					
	MWD Treated Tier 1 - Barrier ($/af)	14,300	$ 701	$ 744	$ 733	$ 10,485,475
	MWD Untreated Tier 1 - Spreading ($/af)	21,000	$ 484	$ 527	$ 516	$ 10,841,250
	WBMWD RTS ($/af)	12,000	$ 94	$ 125	$ 117	$ 1,407,000
	CBMWD RTS ($/af)	21,000	$ 18	$ 30	$ 27	$ 567,000
	WBMWD Capacity Charge ($/cfs/month)	34	-	-	$ 530	$ 216,240
	LBWD Capacity Charge ($/cfs/month)	4.20	-	-	$ 600	$ 30,240
	Total to MWD					□ **23,547,205**
	CBMWD					
	CBMWD Administrative Surcharge ($/af)	21,000	$ 96	$ 96	$ 96	$ 2,016,000
	CBMWD Water Service Charge ($/cfs/month)	450	-	-	$ 69	$ 372,600
	Total to CBMWD					□ **2,388,600**
	LBWD					
	LBWD Administrative Surcharge ($/af)	2,300	$ 5	$ 5	$ 5	$ 11,500
	Total to LBWD					□ **11,500**
	WBMWD					
	WBMWD Administrative Surcharge ($/af)	12,000	$ 65	$ 65	$ 65	$ 780,000
	WBMWD Water Service Charge ($/cfs/month)	130	-	-	$ 34	$ 53,040
	Total to West Basin MWD					□ **833,040**
	IN-LIEU				IL-PMT	
	MWD Member Agency ($/af)	7,503	-	-	$ 333	$ 2,494,748
	WBMWD Member Agency ($/af)	2,800	-	-	$ 398	$ 1,113,000
	Total for In-Lieu Payments					□ **3,607,748**
Recycled Water	**LADWP**					
	LADWP Recycled Water ($/af)	4,000	$ 431	$ 431	$ 431	$ 1,724,000
	Total to LADWP					□ **1,724,000**
	SDLAC					
	SDLAC - San Jose Creek WRP ($/af)	40,000	$ 34	$ 34	$ 34	$ 1,376,000
	SDLAC - Whittier Narrows WRP ($/af)	10,000	$ 7	$ 7	$ 7	$ 70,000
	SDLAC - Makeup Payment ($)					$ 228,898
	Total to SDLAC					□ **1,674,898**
	WBMWD					
	WBMWD Recycled Water ($/af)	8,000	$ 540	$ 540	$ 540	$ 4,320,000
	Total to WBMWD					□ **4,320,000**
	WRD					
	WRD Recycled Water Vander Lans ($/af)	2,100	$ 406	$ 406	$ 406	□ **852,600**
	WRD Recycled Water Vander Lans ($/af)*	2,100	$ 406	$ 406	$ 406	□ **(852,600)**
	Total to WRD					□ **-**
	TOTAL					□ **38,106,991**

* Cost is based on O&M less MWD rebate. Shown as a water cost but deducted out since it's part of the Vander Lans project

Table 3

WRD PROJECTS AND PROGRAMS

PROJECT / PROGRAM		DISTRICT FUNCTION	
		Replenishment	Clean Water
001	Leo J. Vander Lans Water Treatment Facility Project	100%	
002	Robert W. Goldsworthy Desalter Project		100%
004	Recycled Water Program	100%	
005	Groundwater Resources Planning Program	100%	
006	Groundwater Quality Program		100%
010	Geographic Information System	50%	50%
011	Regional Groundwater Monitoring Program	50%	50%
012	Safe Drinking Water Program		100%
018	Dominguez Gap Barrier Recycled Water Injection	100%	
023	Replenishment Operations (Spreading & Barriers)	100%	
025	Hydrogeology Program	50%	50%
033	Groundwater Resources Improvement Program (GRIP)	100%	0%

Table 4

30-YEAR AVERAGE GROUNDWATER BALANCE
FROM USGS □ WRD REGIONAL MODEL

INFLOWS	Average AFY	OUTFLOWS	Average AFY
Natural Inflows:		**Artificial Outflows:**	
Local water conserved at spreading grounds [1]	48,825	Pumping	250,590
Interior and mountain front recharge	47,900		
Net underflow from adjacent basins [2]	48,480		
Subtotal Natural Inflows:	145,205		
Artificial Inflows:			
Imported and recycled spreading [3]	74,075		
Barrier injection water [4]	34,600		
Subtotal Artificial Inflows:	108,675		
Total Inflows:	**253,880**	**Total Outflows:**	**250,590**

Average Annual Groundwater Deficiency (afy) □ Natural Inflows - Total Outflows □ (105,385)

[1] includes stormwater and base flow water captured and recharged at the spreading grounds

[2] does not include average of 7,100 afy of seawater intrusion, which can not be considered as replenishment per the water code

[3] includes all imported purchased, all recycled purchased, and Pomona Plant (free) recycled water.

[4] includes all injected water at the three barrier systems, including all of Alamitos Barrier. Model value may differ slightly from actual purchases.

Description of the model can be found in USGS, 2003, Geohydrology, Geochemistry, and Ground-Water Simulation - Optimization of the Central and West Coast Basins, Los Angeles County, California; Water Resources Investigation Report 03-4065 by Reichard, E.G., Land, M., Crawford, S.M., Johnson, T., Everett, R.R., Kulshan, T.V., Ponti, D.J., Halford, K.J., Johnson, T.A., Paybins, K.S., and Nishikawa, T.

Table 5

HISTORICAL RAINFALL

Station 107D, Downey Fire Department

Water Year	Inches	Water Year	Inches	Water Year	Inches	Water Year	Inches
1925-26	12.63	1950-51	8.27	1975-76	9.55	2000-01	14.98
1926-27	16.92	1951-52	24.68	1976-77	11.23	2001-02	2.52
1927-28	11.97	1952-53	10.53	1977-78	33.85	2002-03*	19.89
1928-29	11.52	1953-54	12.33	1978-79	18.68	2003-04	7.73
1929-30	10.84	1954-55	11.84	1979-80	28.29	2004-05	23.43
1930-31	10.45	1955-56	13.97	1980-81	8.74	2005-06	11.36
1931-32	14.52	1956-57	9.89	1981-82	13.41	2006-07	1.95
1932-33	10.02	1957-58	24.65	1982-83	30.3	2007-08	17.11
1933-34	11.1	1958-59	6.68	1983-84	11.96	2008-09	9.49
1934-35	21.94	1959-60	9.84	1984-85	12.44		
1935-36	9.65	1960-61	4.3	1985-86	19.47		
1936-37	22.11	1961-62	18.46	1986-87	6.49		
1937-38	21.75	1962-63	10.9	1987-88	11.47		
1938-39	18.69	1963-64	6.86	1988-89	7.82		
1939-40	12.81	1964-65	13.27	1989-90	7.87		
1940-41	34.21	1965-66	17.02	1990-91	12.22		
1941-42	14.66	1966-67	17.78	1991-92	16.07		
1942-43	17.91	1967-68	11.46	1992-93	26.55		
1943-44	17.89	1968-69	22.33	1993-94	9.26		
1944-45	11.25	1969-70	7.52	1994-95	26.82		
1945-46	10.31	1970-71	11.45	1995-96	10.68		
1946-47	15.24	1971-72	6.4	1996-97	13.95		
1947-48	8.62	1972-73	18.57	1997-98	32.47		
1948-49	9.04	1973-74	14.51	1998-99	7.29		
1949-50	10.14	1974-75	15.01	1999-00	9.21		
			Period of Record	**84 years**			
			Running 84 Year Average	**14.3 inches**			
			Minimum	**2.0 inches**			
			Maximum	**34.2 inches**			

* 2002/03 from station 388D (City of Paramount Fire Station), since 107D data are incomplete

Table 6

ANNUAL OVERDRAFT CALCULATION

for Current and Ensuing Water Years (in acre-feet)

Item	WATER YEAR	
	2009-2010	2010-11
Average Annual Groundwater Deficiency (from Table 4)	(105,385)	(105,385)
Adjustments/Variances to AAGD		
(1) Local Water at Spreading Grounds[a]	0 [d]	0 [d]
(2) Precipitation, mountain front recharge, applied water[a]	0 [d]	0 [d]
(3) Subsurface inflow[b]	0 [d]	0 [d]
(4) Groundwater Extractions[c]	(9,600) [d]	(7,600) [d]
ANNUAL OVERDRAFT [AAGD□(1)□(2)□(3)-(4)]	(95,800)	(97,800)

Note: Numbers in parentheses represent negative values.

(a) Difference between actual and model average. Positive value indicates increased recharge.

(b) Difference between annual model value and average model value. Positive value indicates increased inflow. Does not include seawater intrusion inflow

(c) Difference between actual and model average. Positive value indicates increased pumpage.

(d) Estimated Values. A value of zero indicates average year was assumed.

Table 7

ACCUMULATED OVERDRAFT CALCULATION (in acre-feet)

ITEM	AMOUNT
Accumulated Overdraft at end of Previous Water Year	(753,300)
Estimated Annual Overdraft for Current Year	(95,800)
Subtotal without artificial replenishment	(849,100)
Planned Artificial Replenishment for Current Year	
Imported Water Purchased for Spreading	21,000
Recycled Water Purchased for Spreading	50,000
Imported and Recycled Water Purchased for Barrier Wells	28,400
Replenishment Subtotal	99,400
PROJECTED ACCUMULATED OVERDRAFT FOR CURRENT YEAR	**(749,700)**

Note: Numbers in parentheses represent negative values.

Table 8

CHANGES IN GROUNDWATER STORAGE

WATER YEAR	CHANGE IN AMT OF WATER IN STORAGE (AF)	CUMULATIVE CHANGE IN STORAGE (AF)	WATER YEAR	CHANGE IN AMT OF WATER IN STORAGE (AF)	CUMULATIVE CHANGE IN STORAGE (AF)
1961-62	88,500	88,500	1985-86	10,600	238,200
1962-63	(11,100)	77,400	1986-87	4,000	242,200
1963-64	10,300	87,700	1987-88	(11,700)	230,500
1964-65	35,200	122,900	1988-89	10,400	240,900
1965-66	21,100	144,000	1989-90	13,600	254,500
1966-67	21,400	165,400	1990-91	28,400	282,900
1967-68	11,400	176,800	1991-92	1,600	284,500
1968-69	(7,500)	169,300	1992-93	45,800	330,300
1969-70	(800)	168,500	1993-94	(28,500)	301,800
1970-71	(3,400)	165,100	1994-95	19,400	321,200
1971-72	(50,600)	114,500	1995-96	12,500	333,700
1972-73	34,800	149,300	1996-97	15,700	349,400
1973-74	(2,400)	146,900	1997-98	16,700	366,100
1974-75	(14,100)	132,800	1998-99	(80,200)	285,900
1975-76	(40,200)	92,600	1999-00	(30,000)	255,900
1976-77	(32,900)	59,700	2000-01	(400)	255,500
1977-78	88,600	148,300	2001-02	(36,500)	219,000
1978-79	30,100	178,400	2002-03	(10,500)	208,500
1979-80	(1,100)	177,300	2003-04	(43,000)	165,500
1980-81	17,100	194,400	2004-05	89,100	254,600
1981-82	18,400	212,800	2005-06	12,000	266,600
1982-83	46,800	259,600	2006-07	(59,000)	207,600
1983-84	(22,400)	237,200	2007-08	(41,600)	166,000
1984-85	(9,600)	227,600	2008-09	(51,500)	114,500

Note: Numbers in parentheses represent negative values.

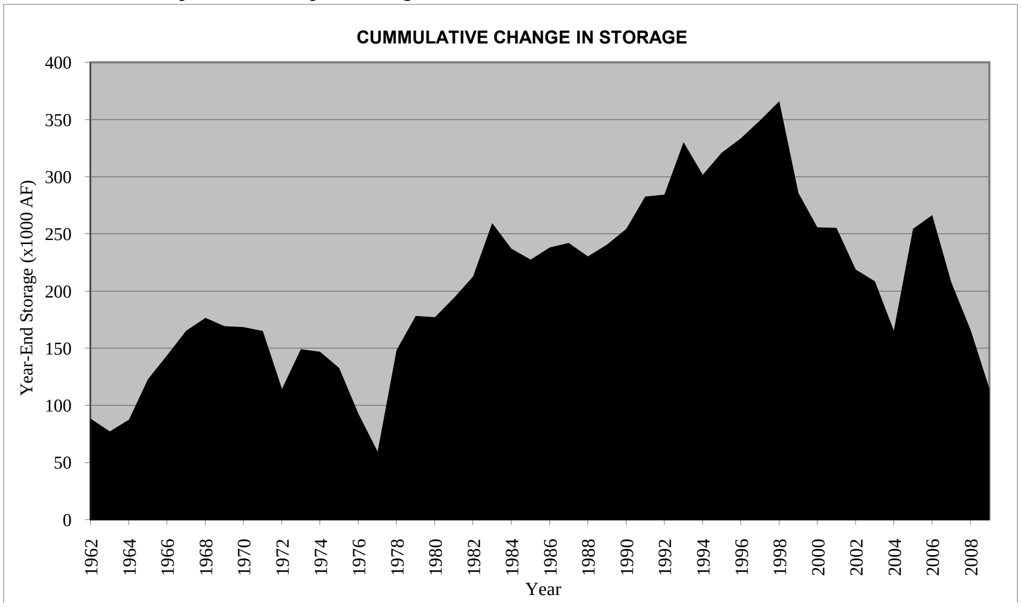


Table 9
QUANTITY OF WATER REQUIRED FOR ARTIFICIAL REPLENISHMENT

WATER TYPE	AMOUNT (AF)
Long Term Average for Imported Spreading (updated, see below)*	21,000
Recycled Water for Spreading (WRD Purchases)	50,000
Total Spreading	**71,000**
West Coast Barrier - Imported	8,000
West Coast Barrier - Recycled	8,000
Dominguez Gap - Imported	4,000
Dominguez Gap - Recycled	4,000
Alamitos Barrier - Imported - WRD portion only	2,300
Alamitos Barrier - Recycled - WRD portion only	2,100
Total Barriers	**28,400**
In-Lieu Central Basin	6,000
In-Lieu West Coast Basin	4,303
Total In-Lieu	**10,303**
Total Water Purchase Estimate for Ensuing Year	**109,703**

* - Derivation of new Long Term Imported Spreading Requirement is possible due to new projects that will capture more stormwater for conservation, and thus less imported needs:

1. Long Term Average of 27,600 af defined in 2003 ESR
2. Minus 3,000 afy for increasing Whittier Narrows Conservation Pool
3. Minus 3,600 afy for two new rubber dams on San Gabriel River
4. Equals new Long Term Average of **21,000** afy imported spreading

HISTORICAL AMOUNTS OF WATER REPLENISHED IN THE MONTEBELLO FOREBAY SPREADING GROUNDS

(In Acre-feet)

WATER YEAR	Imported Water		Recycled Water	Local Water [a]	Make-up Water		TOTAL
	LACFCD	WRD	San Jose Creek, Whittier & Pomona WRP	Stormwater & River Baseflow	USGVMWD & SGVMWD	CBMWD	
1953-54	30,000						30,000
1954-55	24,800						24,800
1955-56	54,500						54,500
1956-57	50,000						50,000
1957-58	105,100			87,558			192,658
1958-59	54,400			31,787			86,187
1959-60	80,900			20,064			100,964
1960-61	80,800	66,400		9,118			156,318
1961-62	39,500	168,600		39,548			247,648
1962-63	4,800	75,800	8,898	14,565			104,063
1963-64		104,900	8,903	9,992			123,795
1964-65	75,500	84,600	7,368	13,097			180,565
1965-66	67,800	53,900	13,113	45,754	6,500		187,067
1966-67	74,100	10,200	16,223	59,820	-		160,343
1967-68	66,600	28,800	18,275	39,760	-		153,435
1968-69	12,500	5,300	13,877	119,395	-		151,072
1969-70	25,800	43,100	17,157	52,917	-		138,974
1970-71	46,700	25,400	38,990	89,514	-		200,604
1971-72		34,400	17,543	17,688	-	-	69,631
1972-73		71,900	22,005	45,077	-	20,000	158,982
1973-74		68,200	21,392	29,171	-	23,900	142,663
1974-75		71,900	21,883	29,665	-	-	123,448
1975-76		50,800	21,455	22,073	-	-	94,328
1976-77		9,300	22,864	19,252	14,500	6,900	72,816
1977-78		39,900	19,380	147,317	-	-	206,597
1978-79		65,300	22,499	68,859	-	-	156,658
1979-80		10,200	24,382	106,820	10,900	-	152,302
1980-81	3,300	28,700	26,108	50,590	31,500	-	140,198
1981-82		4,600	29,434	47,930	30,900 [c]	-	112,864
1982-83		2,000	17,037	126,076	8,900 [c]	-	154,013
1983-84		1,500	27,731	60,710	20,800 [c]	-	110,741
1984-85		40,600	27,055	39,099	-	-	106,754
1985-86		21,500	25,312	66,966	-	-	113,778
1986-87		49,200	34,619	27,613	-	6,500	117,932
1987-88		23,300	40,191	50,068	5,800 [c]	-	119,359
1988-89		50,300	38,331	17,096	6,500 [c]	-	112,227
1989-90		52,700	50,109	9,388	13,600 [c]	-	125,797
1990-91		56,287	53,864	35,717	100 [c]	-	145,968
1991-92		43,103	46,903	136,357	-	-	226,363
1992-93		16,561	48,864	147,699	-	-	213,124
1993-94		20,411	53,981	55,896	-	-	130,288
1994-95		21,837	33,300	100,578	-	-	155,715
1995-96		18,012	53,862	62,920	-	-	134,794
1996-97		22,738	49,959	58,262	-	-	130,959
1997-98		952	37,017	96,706	-	-	134,675
1998-99		-	47,201	32,013	-	-	79,214
1999-00		45,037	43,271	20,607	-	-	108,915
2000-01		23,451	46,343	39,724	-	-	109,518
2001-02		42,875 [d]	60,598	18,605	-	-	122,078
2002-03		22,366 [e]	42,727	63,340	-	-	128,433
2003-04		27,520 [f]	44,925	30,464	-	-	102,909
2004-05		25,296 [f]	29,504	148,673	-	-	203,473
2005-06		33,229	42,022	60,376	-	-	135,627
2006-07		40,214	45,028	11,508	-	-	96,749
2007-08	1,510	- [b]	39,767	55,047	-	-	96,323
2008-09	0	-	39,611	35,348	-	-	74,959
TOTAL	898,610	1,823,188			150,000	57,300	7,264,163
	Import: 2,721,798		Recycled: 1,510,880	Local: 2,824,186	Make-up: 207,300		

(a) Local water is stormwater or river baseflow captured at the Montebello Forebay Spreading Grounds.
(b) CBMWD purchased 1,510 af of imported water for spreading for Downey, Lakewood, and Cerritos.
(c) Includes State Project water imported by the San Gabriel Valley Municipal Water District.
(d) Includes 1,607 af of EPA extracted groundwater from Whittier Narrows considered imported water to WRD. Paid for in 2003.
(e) Includes 5,069 af of EPA extracted groundwater from W.N. considered imported water to WRD. Paid for in June 2005.
(f) includes 13,000 af of water banked by Long Beach under a storage agreement with WRD (792 af of 02/03, 12,210 af of 3/04).

HISTORICAL AMOUNTS OF WATER PURCHASED FOR INJECTION

(In Acre-feet)

Water Year	West Coast Barrier (a)			Dominguez Gap Barrier (b)			Alamitos Barrier							TOTAL
							WRD			OCWD			Total	
	Imported	Recycled	Total	Imported	Recycled	Total	Imported	Recycled	Total	Imported	Recycled	Total		
1952-53	1,140		1,140											1,140
1953-54	3,290		3,290											3,290
1954-55	2,740		2,740											2,740
1955-56	2,840		2,840											2,840
1956-57	3,590		3,590											3,590
1957-58	4,330		4,330											4,330
1958-59	3,700		3,700											3,700
1959-60	3,800		3,800											3,800
1960-61	4,480		4,480											4,480
1961-62	4,510		4,510											4,510
1962-63	4,200		4,200											4,200
1963-64	10,450		10,450											10,450
1964-65	33,020		33,020				2,760		2,760	200		200	2,960	35,980
1965-66	44,390		44,390				3,370		3,370	350		350	3,720	48,110
1966-67	43,060		43,060				3,390		3,390	490		490	3,880	46,940
1967-68	39,580		39,580				4,210		4,210	740		740	4,950	44,530
1968-69	36,420		36,420				4,310		4,310	950		950	5,260	41,680
1969-70	29,460		29,460				3,760		3,760	720		720	4,480	33,940
1970-71	29,870		29,870	2,200		2,200	3,310		3,310	822		822	4,132	36,202
1971-72	26,490		26,490	9,550		9,550	4,060		4,060	936		936	4,996	41,036
1972-73	28,150		28,150	8,470		8,470	4,300		4,300	883		883	5,183	41,803
1973-74	27,540		27,540	7,830		7,830	6,140		6,140	1,148		1,148	7,288	42,658
1974-75	26,430		26,430	5,160		5,160	4,440		4,440	658		658	5,098	36,688
1975-76	35,220		35,220	4,940		4,940	4,090		4,090	565		565	4,655	44,815
1976-77	34,260		34,260	9,280		9,280	4,890		4,890	885		885	5,775	49,315
1977-78	29,640		29,640	5,740		5,740	4,020		4,020	833		833	4,853	40,233
1978-79	23,720		23,720	5,660		5,660	4,220		4,220	898		898	5,118	34,498
1979-80	28,630		28,630	4,470		4,470	3,560		3,560	459		459	4,019	37,119
1980-81	26,350		26,350	3,550		3,550	3,940		3,940	524		524	4,464	34,364
1981-82	24,640		24,640	4,720		4,720	4,540		4,540	392		392	4,932	34,292
1982-83	33,950		33,950	6,020		6,020	3,270		3,270	1,946		1,946	5,216	45,186
1983-84	28,000		28,000	7,640		7,640	2,440		2,440	1,402		1,402	3,842	39,482
1984-85	25,210		25,210	7,470		7,470	3,400		3,400	1,444		1,444	4,844	37,524
1985-86	20,260		20,260	6,160		6,160	3,410		3,410	1,863		1,863	5,273	31,693
1986-87	26,030		26,030	6,230		6,230	4,170		4,170	2,887		2,887	7,057	39,317
1987-88	24,270		24,270	7,050		7,050	3,990		3,990	2,173		2,173	6,163	37,483
1988-89	22,740		22,740	5,220		5,220	3,900		3,900	1,674		1,674	5,574	33,534
1989-90	20,279		20,279	5,736		5,736	4,110		4,110	1,929		1,929	6,039	32,054
1990-91	16,039		16,039	7,756		7,756	4,096		4,096	1,818		1,818	5,914	29,709
1991-92	22,180		22,180	6,894		6,894	4,172		4,172	1,552		1,552	5,724	34,798
1992-93	21,516		21,516	4,910		4,910	3,350		3,350	1,565		1,565	4,915	31,341
1993-94	15,482		15,482	5,524		5,524	2,794		2,794	1,309		1,309	4,103	25,109
1994-95	14,237	1,480	15,717	4,989		4,989	2,883		2,883	890		890	3,773	24,479
1995-96	12,426	4,170	16,596	5,107		5,107	3,760		3,760	2,010		2,010	5,770	27,473
1996-97	11,388	6,241	17,629	5,886		5,886	4,015		4,015	1,750		1,750	5,765	29,280
1997-98	8,173	8,308	16,481	3,771		3,771	3,677		3,677	1,504		1,504	5,181	25,433
1998-99	10,125	6,973	17,097	4,483		4,483	4,012		4,012	1,689		1,689	5,700	27,280
1999-00	11,172	7,460	18,632	6,010		6,010	4,028		4,028	1,707		1,707	5,735	30,377
2000-01	13,988	6,838	20,826	3,923		3,923	3,710		3,710	1,964		1,964	5,674	30,423
2001-02	12,724	7,276	20,000	5,459		5,459	3,961		3,961	2,232		2,232	6,193	31,652
2002-03	10,419	6,192	16,611	8,056		8,056	3,445		3,445	1,197		1,197	4,642	29,309
2003-04	9,304	3,669	12,973	6,089		6,089	3,876		3,876	2,092		2,092	5,968	25,030
2004-05	4,548	3,920	8,468	8,557		8,557	2,870		2,870	1,685		1,685	4,555	21,580
2005-06	5,997	4,249	10,246	7,259	1,450	8,709	1,042	921	1,963	330	254	584	2,547	21,502
2006-07	4,373	10,960	15,333	5,510	1,733	7,243	1,568	219	1,787	543	165	708	2,495	25,071
2007-08	3,662	10,954	14,616	4,468	2,452	6,920	3,467	1,284	4,751	1,283	475	1,758	6,509	28,045
2008-09	7,178	6,434	13,612	4,550	2,414	6,964	4,145	1,275	5,420	1,518	535	2,053	7,473	28,049
TOTAL	1,031,610	95,123	1,126,733	232,297	8,049	240,346	166,871	3,699	170,570	56,410	1,429	57,838	228,408	1,595,486

(a) Prior to 10/1/71, water was purchased by the State, West Basin Water Association, local water interests, Zone II of the LA County Flood Control District and WRD. After 10/1/71, all purchases have been by WRD

(b) In 1970-71, purchases were shared by WRD and Zone II. After 10/1/71, all purchases have been by WRD

HISTORICAL AMOUNTS OF THE IN-LIEU PROGRAM

(In Acre-Feet)

WATER YEAR	CENTRAL BASIN	WEST COAST BASIN	TOTAL
1965-66	-	745	745
1966-67	-	851	851
1967-68	-	850	850
1968-69	-	850	850
1969-70	-	900	900
1970-71	-	881	881
1971-72	-	756	756
1972-73	-	901	901
1973-74	-	901	901
1974-75	-	400	400
1975-76	-	400	400
1976-77	-	400	400
1977-78	11,316	4,815	16,131
1978-79	9,723	8,655	18,378
1979-80	10,628	4,333	14,961
FISCAL YEAR			
1980-81	17,617	6,206	23,823
1981-82	14,050	4,833	18,883
1982-83	13,813	5,939	19,752
1983-84	29,216	12,524	41,740
1984-85	23,246	13,594	36,840
1985-86	15,505	10,627	26,132
1986-87	16,205	12,997	29,202
1987-88	15,518	12,893	28,411
1988-89	11,356	14,069	25,425
1989-90	16,858	12,293	29,151
1990-91	11,886	10,153	22,039
1991-92	13,000	6,104	19,104
1992-93	37,652	15,654	53,306
1993-94	83,488	26,093	109,581
1994-95	32,904	17,994	50,898
1995-96	37,517	13,816	51,333
1996-97	34,547	4,847	39,394
1997-98	22,995	7,335	30,330
1998-99	13,213	10,303	23,516
1999-00	18,799	3,479	22,278
2000-01	18,364	2,817	21,181
2001-02	11,931	8,789	20,720
2002-03	6,866	4,339	11,205
2003-04	-	-	-
2004-05	6,000	1,804	7,804
2005-06	7,475	2,414	9,889
2006-07	5,779	3,480	9,259
2007-08	-	-	-
2008-09	-	-	-
TOTAL	567,468	272,035	839,503

HISTORICAL AMOUNTS OF
WATER FOR REPLENISHMENT
(In Acre-feet)

WATER YEAR	SPREADING					INJECTION	IN-LIEU	TOTAL
	IMPORTED WATER	RECLAIMED WATER	LOCAL WATER	MAKEUP WATER	TOTAL			
1952-53						1,140		1,140
1953-54	30,000			-	30,000	3,290		33,290
1954-55	24,800			-	24,800	2,740		27,540
1955-56	54,500			-	54,500	2,840		57,340
1956-57	50,000			-	50,000	3,590		53,590
1957-58	105,100		87,558	-	192,658	4,330		196,988
1958-59	54,400		31,787	-	86,187	3,700		89,887
1959-60	80,900		20,064	-	100,964	3,800		104,764
1960-61	147,200		9,118	-	156,318	4,480		160,798
1961-62	208,100		39,548	-	247,648	4,510		252,158
1962-63	80,600	8,898	14,565	-	104,063	4,200		108,263
1963-64	104,900	8,903	9,992	-	123,795	10,450		134,245
1964-65	160,100	7,368	13,097	-	180,565	35,980		216,545
1965-66	121,700	13,113	45,754	6,500	187,067	48,110	745	235,922
1966-67	84,300	16,223	59,820	-	160,343	46,940	851	208,134
1967-68	95,400	18,275	39,760	-	153,435	44,530	850	198,815
1968-69	17,800	13,877	119,395	-	151,072	41,680	850	193,602
1969-70	68,900	17,157	52,917	-	138,974	33,940	900	173,814
1970-71	72,100	38,990	89,514	-	200,604	36,202	881	237,687
1971-72	34,400	17,543	17,688	-	69,631	41,036	756	111,423
1972-73	71,900	22,005	45,077	20,000	158,982	41,803	901	201,686
1973-74	68,200	21,392	29,171	23,900	142,663	42,658	901	186,222
1974-75	71,900	21,883	29,665	-	123,448	36,688	400	160,536
1975-76	50,800	21,455	22,073	-	94,328	44,815	400	139,543
1976-77	9,300	22,864	19,252	21,400	72,816	49,315	400	122,531
1977-78	39,900	19,380	147,317	-	206,597	40,233	16,131	262,961
1978-79	65,300	22,499	68,859	-	156,658	34,498	18,378	209,534
1979-80	10,200	24,382	106,820	10,900	152,302	37,119	14,961	204,382
1980-81	32,000	26,108	50,590	31,500	140,198	34,364	23,823	198,385
1981-82	4,600	29,434	47,930	30,900	112,864	34,292	18,883	166,039
1982-83	2,000	17,037	126,076	8,900	154,013	45,186	19,752	218,951
1983-84	1,500	27,731	60,710	20,800	110,741	39,482	41,740	191,963
1984-85	40,600	27,055	39,099	-	106,754	37,524	36,840	181,118
1985-86	21,500	25,312	66,966	-	113,778	31,693	26,132	171,603
1986-87	49,200	34,619	27,613	6,500	117,932	39,317	29,202	186,451
1987-88	23,300	40,191	50,068	5,800	119,359	37,483	28,411	185,253
1988-89	50,300	38,331	17,096	6,500	112,227	33,534	25,425	171,186
1989-90	52,700	50,109	9,388	13,600	125,797	32,054	29,151	187,002
1990-91	56,287	53,864	35,717	100	145,968	29,709	22,039	197,716
1991-92	43,103	46,903	136,357	-	226,363	34,798	19,104	280,265
1992-93	16,561	48,864	147,699	-	213,124	31,341	53,306	297,771
1993-94	20,411	53,981	55,896	-	130,288	25,109	109,581	264,978
1994-95	21,837	33,300	100,578	-	155,715	24,479	50,898	231,092
1995-96	18,012	53,862	62,920	-	134,794	27,473	51,333	213,601
1996-97	22,738	49,959	58,262	-	130,959	29,280	39,394	199,633
1997-98	952	37,017	96,706	-	134,675	25,433	30,330	190,438
1998-99	-	47,201	32,013	-	79,214	27,280	23,516	130,010
1999-00	45,037	43,271	20,607	-	108,915	30,377	22,278	161,570
2000-01	23,451	46,343	39,724	-	109,518	30,423	21,181	161,122
2001-02	42,875	60,598	18,605	-	122,078	31,652	20,720	174,450
2002-03	22,366	42,727	63,340	-	128,433	29,309	11,205	168,947
2003-04	27,520	44,925	30,464	-	102,909	25,030	-	127,939
2004-05	25,296	29,504	148,673	-	203,473	21,580	7,804	232,857
2005-06	33,229	42,022	60,376	-	135,627	21,502	9,889	167,018
2006-07	40,214	45,028	11,508	-	96,750	25,071	9,259	131,079
2007-08	1,510	39,767	55,047	-	96,323	28,045	-	124,368
2008-09	-	39,611	35,348	-	74,959	28,049	-	103,008
TOTAL	2,721,799	1,510,880	2,824,186	207,300	7,264,164	1,595,486	839,503	9,699,153

HISTORICAL AMOUNTS OF GROUNDWATER PRODUCTION

(In Acre-feet)

YEAR	CENTRAL BASIN	WEST COAST BASIN	TOTAL
WATER YEAR			
1960-61	292,500	61,900	354,400
1961-62	275,800	59,100	334,900
1962-63	225,400	59,100	284,500
1963-64	219,100	61,300	280,400
1964-65	211,600	59,800	271,400
1965-66	222,800	60,800	283,600
1966-67	206,700	62,300	269,000
1967-68	220,100	61,600	281,700
1968-69	213,800	61,600	275,400
1969-70	222,200	62,600	284,800
1970-71	211,600	60,900	272,500
1971-72	216,100	64,800	280,900
1972-73	205,600	60,300	265,900
1973-74	211,300	55,000	266,300
1974-75	213,100	56,700	269,800
1975-76	215,300	59,400	274,700
1976-77	211,500	59,800	271,300
1977-78	196,600	58,300	254,900
1978-79	207,000	58,000	265,000
1979-80	209,500	57,100	266,600
1980-81	211,915	57,711	269,626
1981-82	202,587	61,874	264,461
1982-83	194,548	57,542	252,090
1983-84	196,660	51,930	248,590
1984-85	193,085	52,746	245,831
1985-86	195,972	53,362	249,334
1986-87	196,660	48,026	244,686
1987-88	194,704	43,837	238,541
1988-89	200,207	44,323	244,530
1989-90	197,621	48,047	245,668
1990-91	187,040	53,660	240,700
1991-92	196,400	56,318	252,718
1992-93	150,495	40,241	190,736
1993-94	156,565	41,826	198,391
1994-95	180,269	41,729	221,998
1995-96	182,414	52,222	234,636
1996-97	187,561	52,576	240,137
1997-98	188,305	51,859	240,164
1998-99	204,418	51,926	256,344
1999-00	198,483	53,599	252,082
2000-01	195,361	53,870	249,231
2001-02	200,168	50,063	250,231
2002-03	190,268	51,946	242,214
2003-04	200,365	48,013	248,378
2004-05	188,707	41,297	230,004
2005-06	191,030	36,809	227,839
2006-07	198,115	37,655	235,770
2007-08	206,260	38,472	244,732
2008-09	198,156	45,246	243,402
2009-10 est	195,000	46,000	241,000
TOTAL	10,186,939	2,665,125	12,852,064

HISTORICAL AMOUNTS OF TOTAL WATER USE
IN THE WATER REPLENISHMENT DISTRICT*

(In Acre-feet)

YEAR	GROUNDWATER PRODUCTION	IMPORTED WATER FOR DIRECT USE*	RECLAIMED WATER FOR DIRECT USE*	TOTAL
WATER YEAR				
1960-61	354,400	196,800		551,200
1961-62	334,900	178,784		513,684
1962-63	284,500	222,131		506,631
1963-64	280,400	257,725		538,125
1964-65	271,400	313,766		585,166
1965-66	283,600	308,043		591,643
1966-67	269,000	352,787		621,787
1967-68	281,700	374,526		656,226
1968-69	275,400	365,528		640,928
1969-70	284,800	398,149		682,949
1970-71	272,500	397,122		669,622
1971-72	280,900	428,713		709,613
1972-73	265,900	400,785		666,685
1973-74	266,300	410,546		676,846
1974-75	269,800	380,228		650,028
1975-76	274,700	404,958		679,658
1976-77	271,300	355,896		627,196
1977-78	254,900	373,116		628,016
1978-79	265,000	380,101	100 [(a)]	645,201
1979-80	266,600	397,213	200	664,013
1980-81	269,626	294,730	300	564,656
1981-82	264,461	391,734	300	656,495
1982-83	252,090	408,543	400	661,033
1983-84	248,590	441,151	1,800	691,541
1984-85	245,831	451,549	2,000	699,380
1985-86	249,334	427,860	2,400	679,594
1986-87	244,686	478,744	2,300	725,730
1987-88	238,541	479,318	3,500	721,359
1988-89	244,530	466,166	5,300	715,996
1989-90	245,668	448,285	5,900	699,853
1990-91	240,700	485,109	5,000	730,809
1991-92	252,718	395,191	4,900	652,809
1992-93	190,736	388,949	824	580,509
1993-94	198,391	483,287	3,413	685,091
1994-95	221,998	437,191	6,143	665,332
1995-96	234,636	426,699	19,804	681,139
1996-97	240,137	436,569	25,046	701,752
1997-98	240,164	375,738	27,075	642,977
1998-99	256,344	396,655	30,510	683,509
1999-00	252,082	395,681	33,589	681,352
2000-01	249,231	395,024	32,589	676,844
2001-02	250,231	395,799	38,694	684,724
2002-03	242,214	381,148	38,839	662,201
2003-04	248,378	389,233	36,626	674,237
2004-05	230,004	402,660	33,988	666,652
2005-06	227,839	366,815	35,301	629,955
2006-07	235,770	376,492	41,899	654,161
2007-08	244,732	346,035	45,120	635,887
2008-09	243,402	320,711	43,153	607,266
TOTAL	12,611,064	18,779,983	527,013	31,918,060

(a) Los Coyotes on-line in 1979; Long Beach on-line in 1980

** - Includes imported & recycled at seawater barriers, but not spreading grounds.*

WRD GROUNDWATER BANKING PROGRAM

(In Acre-feet)

WATER YEAR	CITY OF LONG BEACH			LONG BEACH/ALAMITOS BARRIER Seasonal Water			LONG BEACH/ALAMITOS BARRIER Tier 1 Water			TOTAL		
	Banked	Called	Balance	Banked	Called	Balance	Banked	Called	Balance	Banked	Called	Balance
2002-03	4,864	-	4,864	-	-	-	-	-	-	4,864	-	4,864
2003-04	8,136	-	13,000	-	-	-	-	-	-	8,136	-	13,000
2004-05	-	-	13,000	3,652	-	3,652	-	-	-	3,652	-	16,652
2005-06	-	-	13,000	1,324	56	4,919	-	-	-	1,324	56	17,919
2006-07	-	-	13,000	300	1,561	3,658	-	-	-	300	1,561	16,658
2007-08	-	3,231	9,769	-	1,498	2,160	-	-	-	-	4,729	11,929
2008-09	-	6,519	3,250	-	-	2,160	2,000	-	2,000	2,000	6,519	7,410
TOTAL	13,000	9,750		5,275	3,115		2,000	-		20,275	12,865	

FIGURES

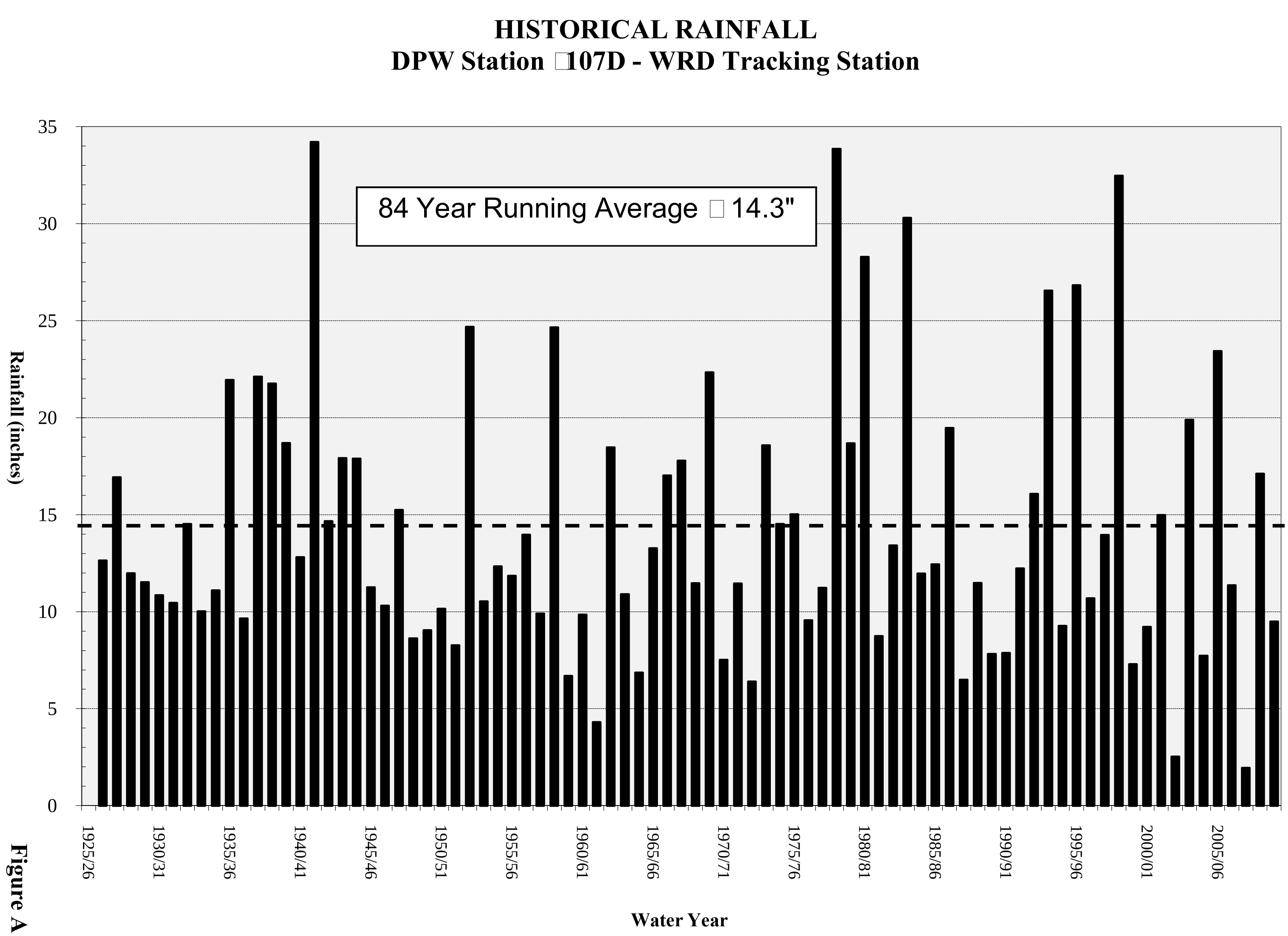
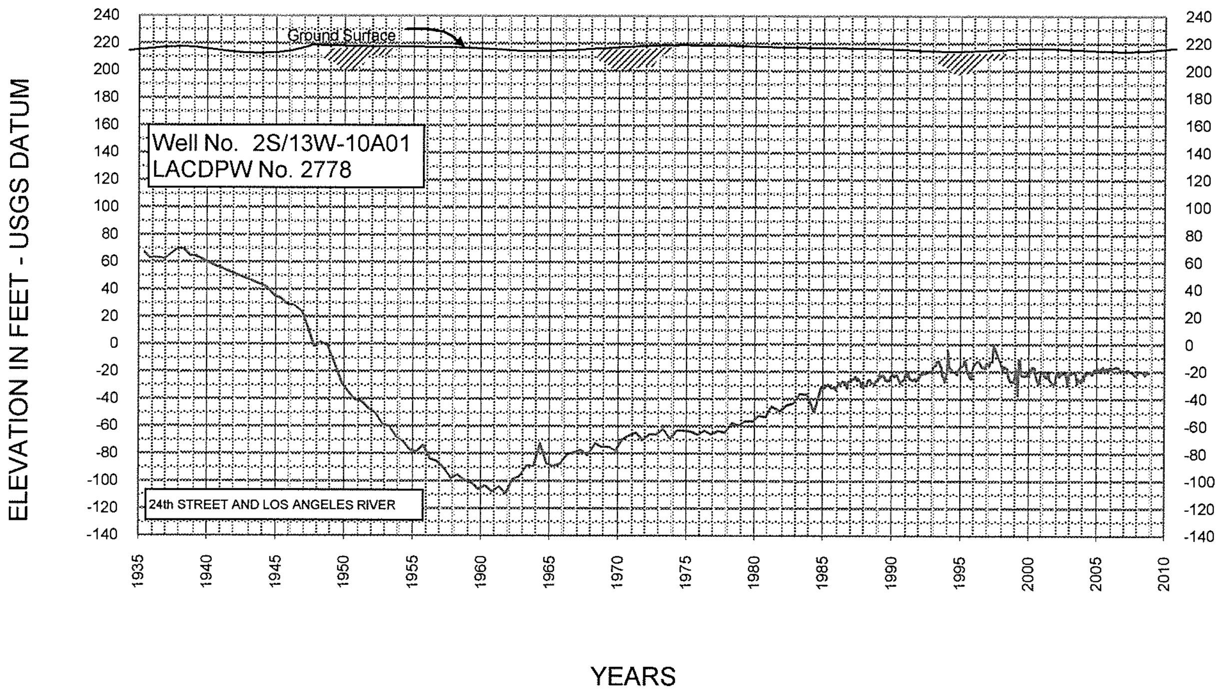
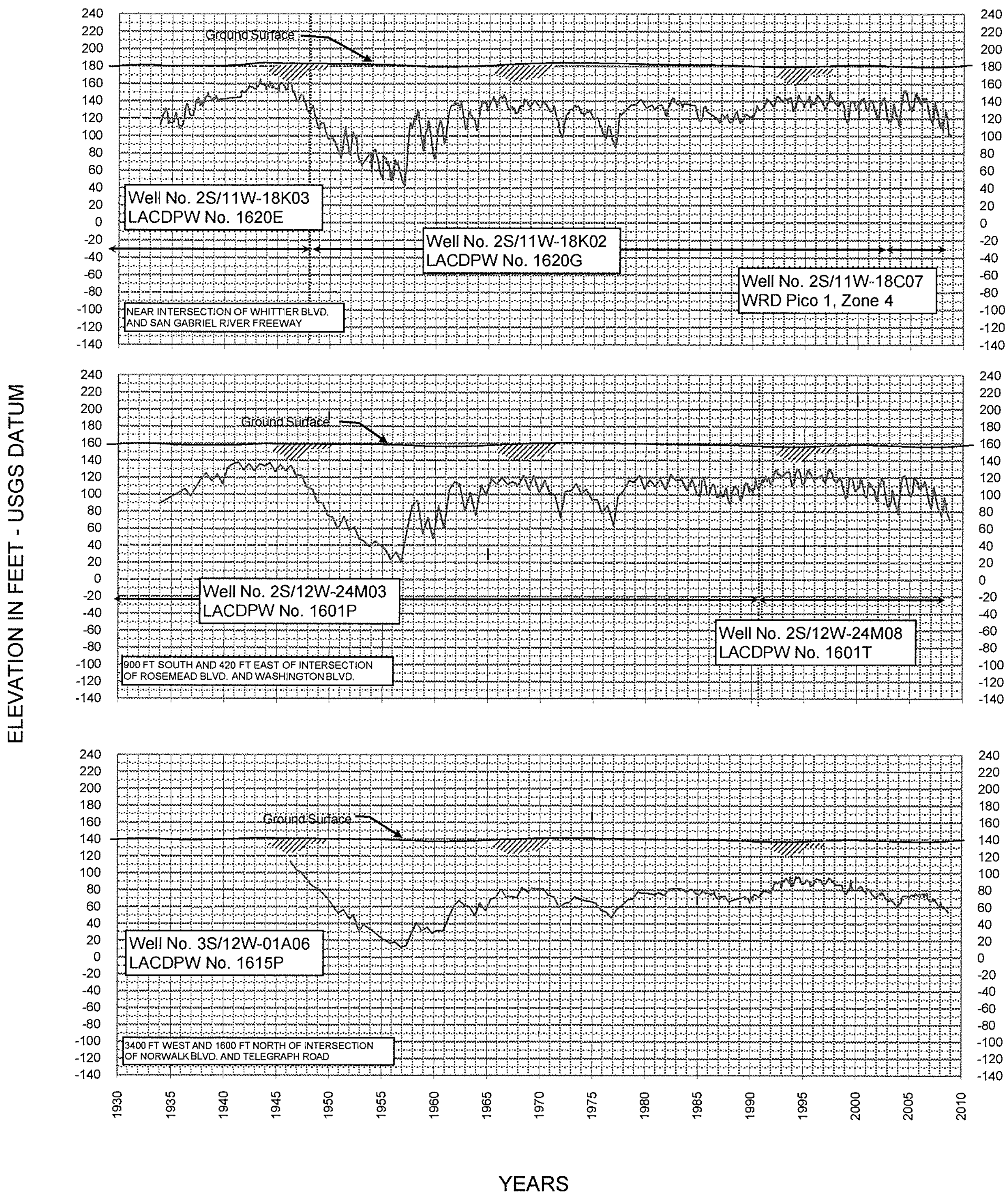

HISTORICAL RAINFALL
DPW Station □107D - WRD Tracking Station
84 Year Running Average □ 14.3"
Rainfall (inches)
0
5
10
15
20
25
30
35
1925/26
1930/31
1935/36
1940/41
1945/46
1950/51
1955/56
1960/61
1965/66
1970/71
1975/76
1980/81
1985/86
1990/91
1995/96
2000/01
2005/06
Water Year

Figure A



FLUCTUATIONS OF WATER LEVEL AT WELLS
LOS ANGELES FOREBAY

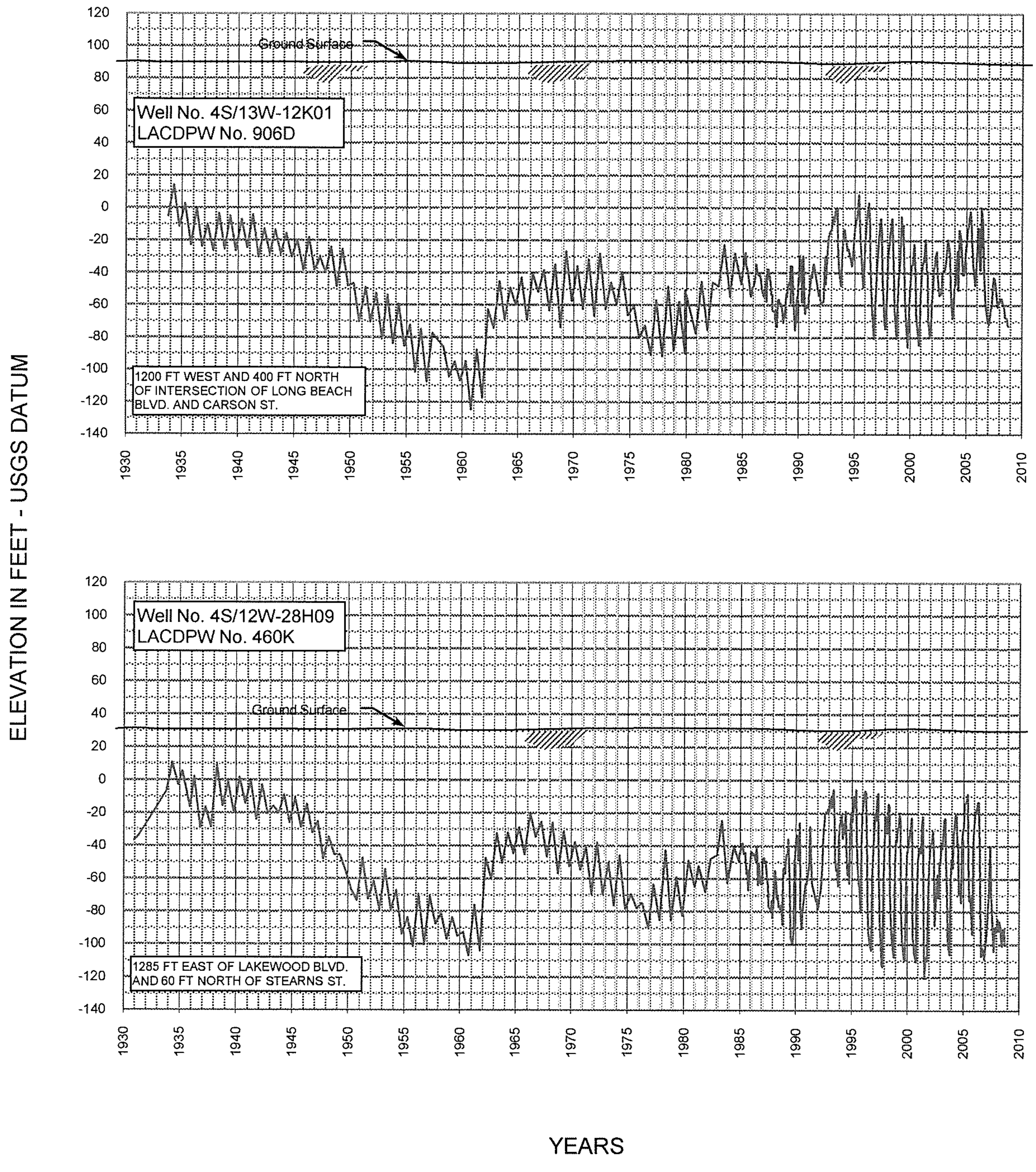
Figure B



FLUCTUATIONS OF WATER LEVEL AT WELLS

MONTEBELLO FOREBAY

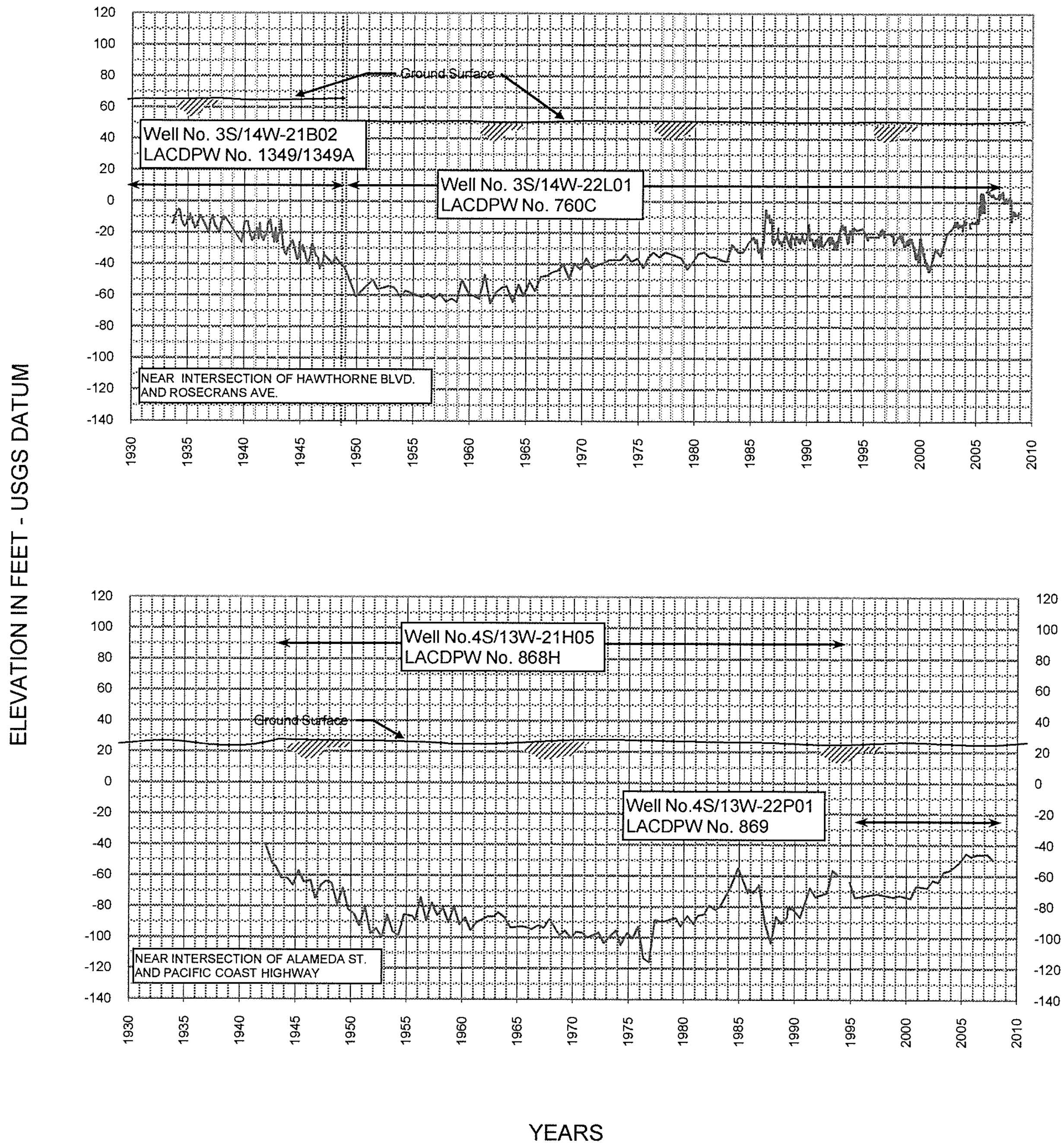
Figure C



FLUCTUATIONS OF WATER LEVEL AT WELLS

CENTRAL BASIN PRESSURE AREA

Figure D



FLUCTUATIONS OF WATER LEVEL AT WELLS
WEST BASIN

Figure E

PLATES

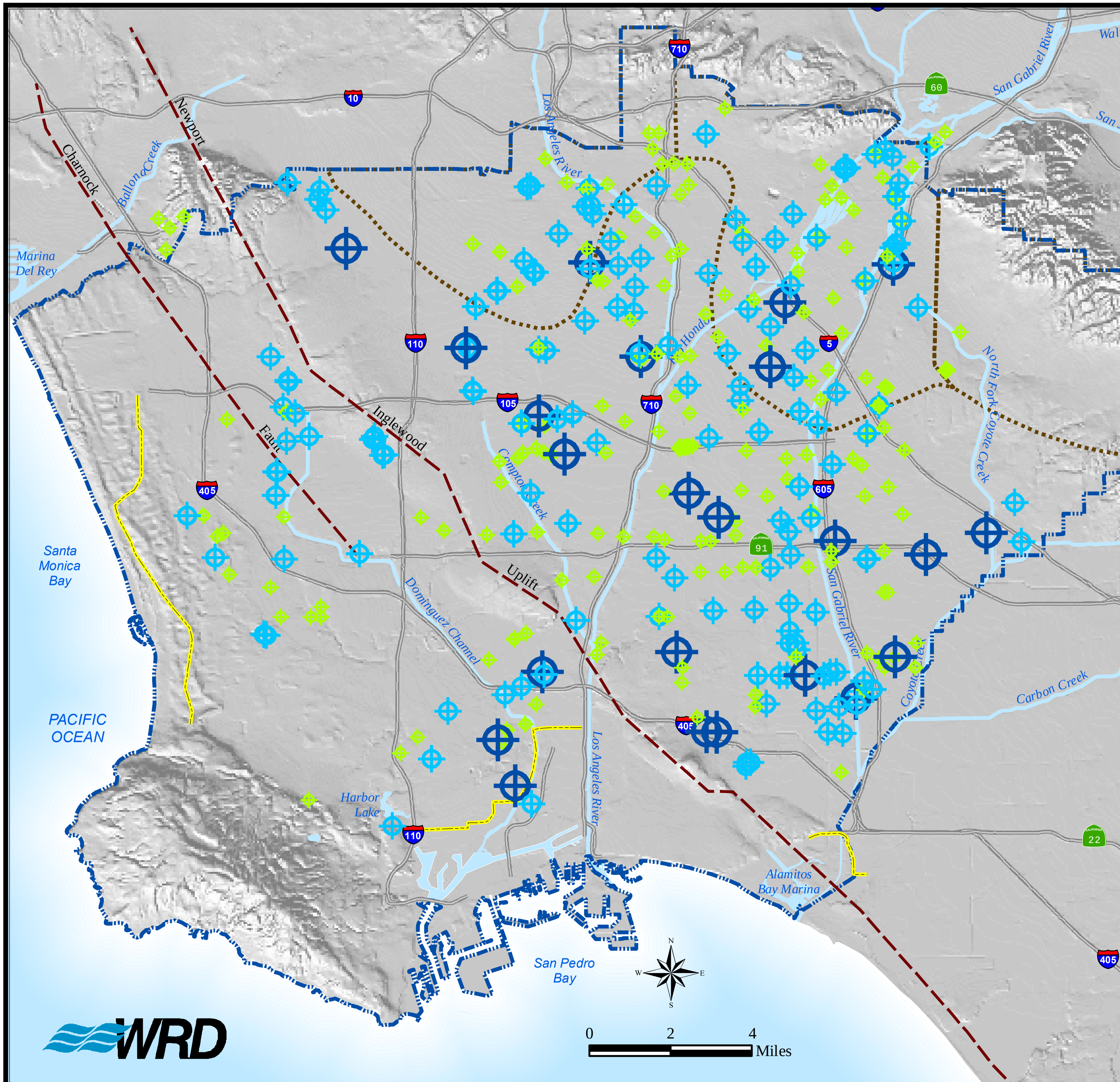


PLATE 1

GROUNDWATER PRODUCTION
WATER YEAR
2008 - 2009

LEGEND

Groundwater Production (AF/Y)

- < 500 Acre Ft/Yr
- 501 - 2000 Acre Ft/Yr
- > 2000 Acre Ft/Yr

Data Source: WRD Production Database

- Barrier Injection Wells
- WRD Boundary
- Forebay

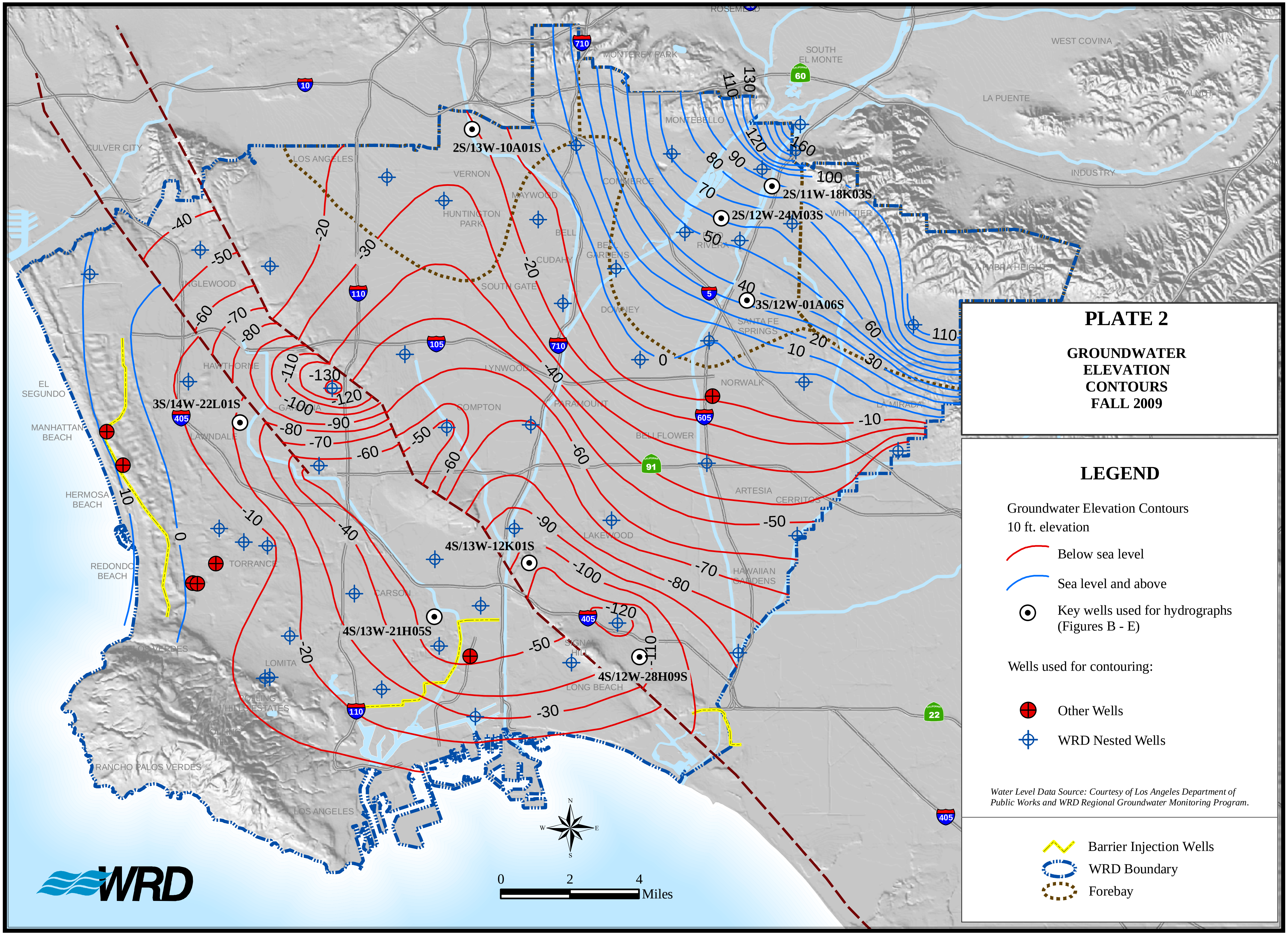


PLATE 2
GROUNDWATER ELEVATION CONTOURS FALL 2009
LEGEND
Groundwater Elevation Contours 10 ft. elevation
Below sea level
Sea level and above
Key wells used for hydrographs (Figures B - E)
Wells used for contouring:
Other Wells
WRD Nested Wells
Water Level Data Source: Courtesy of Los Angeles Department of Public Works and WRD Regional Groundwater Monitoring Program.
Barrier Injection Wells
WRD Boundary
Forebay
2S/13W-10A01S
2S/11W-18K03S
2S/12W-24M03S
3S/12W-01A06S
3S/14W-22L01S
4S/13W-12K01S
4S/13W-21H05S
4S/12W-28H09S
0
2
4
Miles
WRD
WEST COVINA
SOUTH EL MONTE
LA PUENTE
MONTEREY PARK
MONTEBELLO
INDUSTRY
WHITTIER
LA HABRA HEIGHTS
CULVER CITY
LOS ANGELES
VERNON
COMMERCE
MAYWOOD
HUNTINGTON PARK
BELL
BELL GARDENS
CUDAHY
RIVERA
SOUTH GATE
DOWNEY
SANTA FE SPRINGS
NORWALK
LA MIRADA
INGLEWOOD
HAWTHORNE
LYNWOOD
PARAMOUNT
COMPTON
BELLFLOWER
ARTESIA
CERRITOS
EL SEGUNDO
MANHATTAN BEACH
LAWNDALE
GARDENA
HERMOSA BEACH
LAKEWOOD
HAWAIIAN GARDENS
REDONDO BEACH
TORRANCE
CARSON
SIGNAL HILL
LOMITA
LONG BEACH
ROLLING HILLS ESTATES
RANCHO PALOS VERDES

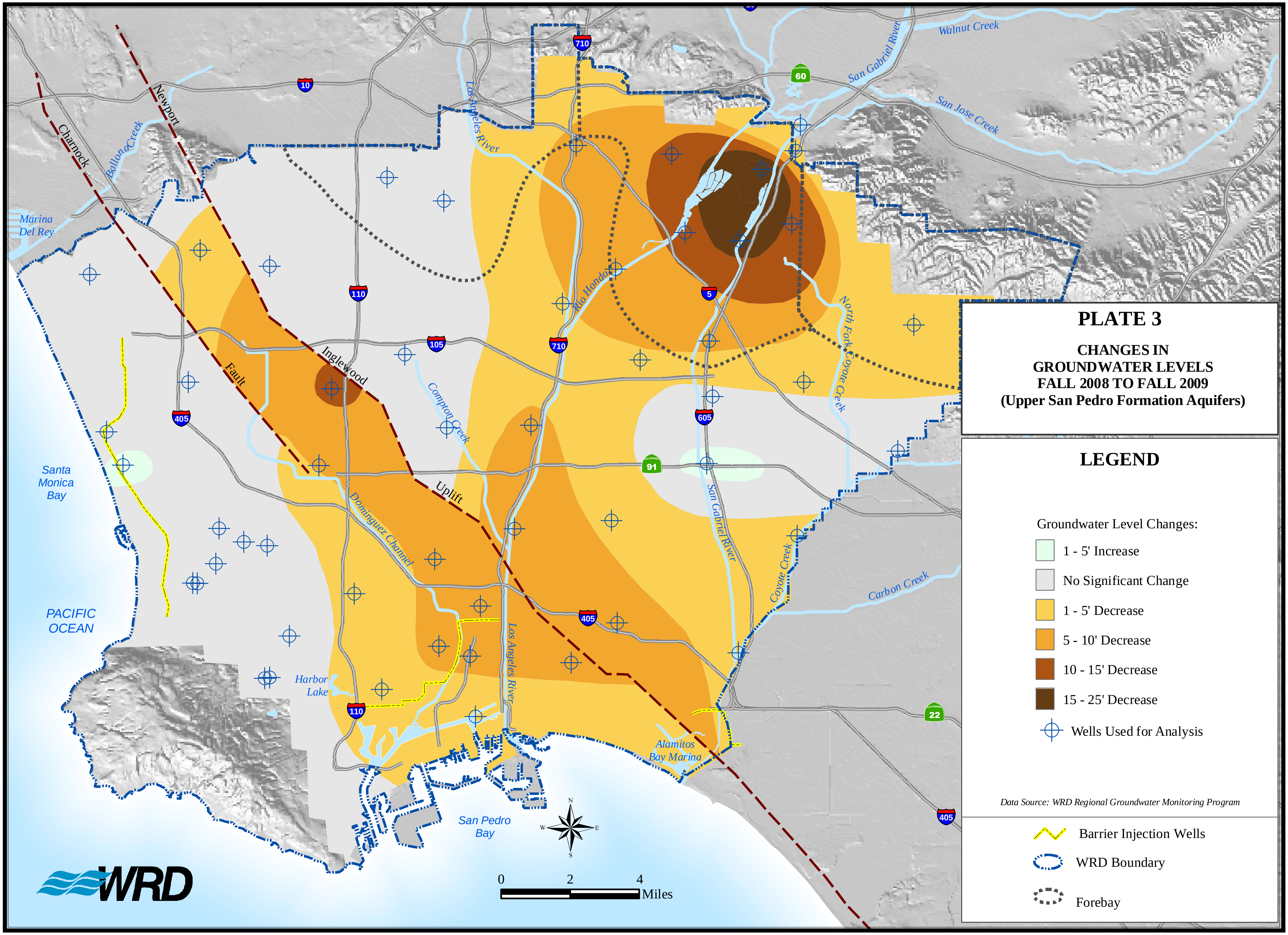


PLATE 3
CHANGES IN
GROUNDWATER LEVELS
FALL 2008 TO FALL 2009
(Upper San Pedro Formation Aquifers)
LEGEND
Groundwater Level Changes:
1 - 5' Increase
No Significant Change
1 - 5' Decrease
5 - 10' Decrease
10 - 15' Decrease
15 - 25' Decrease
Wells Used for Analysis
Data Source: WRD Regional Groundwater Monitoring Program
Barrier Injection Wells
WRD Boundary
Forebay
Walnut Creek
San Gabriel River
San Jose Creek
Los Angeles River
Ballona Creek
Marina Del Rey
Santa Monica Bay
PACIFIC OCEAN
Harbor Lake
San Pedro Bay
Alamitos Bay Marina
Rio Hondo
North Fork Coyote Creek
Coyote Creek
Carbon Creek
Compton Creek
Dominguez Channel
Newport
Inglewood
Fault
Uplift
Charnock
0
2
4
Miles
WRD

Water Replenishment District
of Southern California
4040 Paramount Boulevard
Lakewood, CA 90712
(562) 921-5521 phone
(562) 921-6101 fax
www.wrd.org

WRD


RIO HONDO
60
San Gabriel Blvd
19
Conservation Pool (205')
Durfee Ave.
SAN GABRIEL RIVER
Peck Road
60
Whittier Narrows Dam
RIO HONDO
19
SAN GABRIEL RIVER
INTERSTATE
605
N
W
E
S
0
1/4
1/2
3/4
1
MILES

Project Management Plan - Time and Cost Estimate for the Feasibility Phase **Prepared:** **September 29, 2010**

Sec/Br **By:** **Jeannine Hogg**

Whittier Narrow Water Conservation Feasibility Study

Feasibility Phase (PMP)-Economics

Task/	Task Description	Predecessor/Successor To Task	Work Days	PDT Labor	Section Mgmt/Supt	Branch Mgmt/Supt	Total Labor	Non-Labor Contract/ Travel, etc	Totals (Rounded)
	Daily PDT Member and Section/Branch Support Labor Estimates (Sec/Br □reflect □ of daily □applicable to this Project not total daily rate)			$1,000	10%	$0			
A	**Initiate Study/Prepare Baseline Conditions Report**								
1	Conduct a literature search and a review of all the pertinent data		5	$5,000	$500	$0	$5,500		
2	Without Project Demographic, Lanad Use, Socioeconomic Analysis		10	$10,000	$1,000	$0	$11,000		
3	Develop Economic GIS Database		5	$5,000	$500	$0	$5,500		
4	Conduct analysis of of future water use/demands within the service areas		8	$8,000	$800	$0	$8,800		
5	Conduct analysis of existing amd future sources of water supply		8	$8,000	$800	$0	$8,800		
6	Determine the costs of water sources		5	$5,000	$500	$0	$5,500		
7	Develop Model to Project M&I Water Costs under Without Project Conditions		10	$10,000	$1,000	$0	$11,000		
8	Incorporate R&U into RBA economic model		5	$5,000	$500	$0	$5,500		
9	Preliminary RED/OSE Analysis		3	$3,000	$300	$0	$3,300		
10	Meetings & Coordination		5	$5,000	$500	$0	$5,500		
11	Report Documentation		5	$5,000	$500	$0	$5,500		
12	Response to DQC, ATR, and Policy Review Comments		3	$3,000	$300	$0	$3,300		
13	Prepare for & Attend FSM Conference		1	$1,000	$100	$0	$1,100		
	Subtotal		**73**	**□73,000**	**□7,300**	**□0**	**□80,300**	**□0**	**□80,000**
B	**Alternatives Analysis/Recommended Plan Selection Report (F4)**								
1	Coordinate and consult with other PDT members for array of alternatives		3	$3,000	$300	$0	$3,300		
2	Updates to Without Project water supply, demand and water costs analysis		8	$8,000	$800	$0	$8,800		
3	Coordinate yield data for proposed alternatives		3	$3,000	$300	$0	$3,300		
4	Evaluate impacts of alternatives, including recreation, traffic, existing structures within the basin, potential for downstream flooding, etc.		15	$15,000	$1,500	$0	$16,500		
5	Updated Economic Model to evaluate With Project Future M&I Water Costs		10	$10,000	$1,000	$0	$11,000		
6	Coordinate with PDT to determine costs for proposed alternatives		3	$3,000	$300	$0	$3,300		
7	Analyze annual benefits and costs and benefit/cost analysis		5	$5,000	$500	$0	$5,500		
8	Conduct the RED for proposed alternatives		10	$10,000	$1,000	$0	$11,000		
9	Conduct the OSE for proposed alternatives		5	$5,000	$500	$0	$5,500		
10	Prepare model & documentation for model review & certification		5	$5,000	$500	$0	$5,500		
11	Meetings and coordination		4	$4,000	$400	$0	$4,400		
12	Report documentation		5	$5,000	$500	$0	$5,500		
13	Response to DQC, model review, ATR & policy review comments		4	$4,000	$400	$0	$4,400		
14	Prepare for & Participate in F4 Conference		1	$1,000	$100	$0	$1,100		
			81	**□81,000**	**□8,100**	**□0**	**□89,100**	**□0**	**□89,000**
C	**Additional Analysis of Tentatively Recommended Plan (AFB)**								

Project Management Plan - Time and Cost Estimate for the Feasibility Phase

Prepared: **September 29, 2010**

Sec/Br

By: **Jeannine Hogg**

Whittier Narrow Water Conservation Feasibility Study

Feasibility Phase (PMP)-Economics

Task/	**Task Description**	**Predecessor/Successor To Task**	**Work Days**	**PDT Labor**	**Section Mgmt/Supt**	**Branch Mgmt/Supt**	**Total Labor**	**Non-Labor Contract/ Travel, etc**	**Totals (Rounded)**
	Daily PDT Member and Section/Branch Support Labor Estimates (Sec/Br □reflect □ of daily □applicable to this Project not total daily rate)			$1,000	10%	$0			
1	Update analysis & report per ATR, policy review, and model review comments		10	$10,000	$1,000	$0	$11,000		
2	Revisions & updates to the water supply, demand and cost analysis		7	$7,000	$700	$0	$7,700		
3	Detailed benefit/cost analysis for recommended plan & LPP		7	$7,000	$700	$0	$7,700		
4	Meetings and coordination		4	$4,000	$400	$0	$4,400		
5	Report documentation		4	$4,000	$400	$0	$4,400		
6	Respond to AFB ATR, IEPR and PGM comments		5	$5,000	$500	$0	$5,500		
7	Participate in AFB conference		1	$1,000	$100	$0	$1,100		

Project Management Plan - Time and Cost Estimate for the Feasibility Phase **Prepared: September 29, 2010**

Sec/Br **By: Jeanninne Hogg**

Whittier Narrow Water Constervation Feasibility Study

Feasibility Phase (PMP)-Economics

Task/	Task Description	Predecessor/Successor To Task	Work Days	PDT Labor	Section Mgmt/Supt	Branch Mgmt/Supt	Total Labor	Non-Labor Contract/ Travel, etc	Totals (Rounded)
	Daily PDT Member and Section/Branch Support Labor Estimates (Sec/Br □reflect □ of daily □applicable to this Project not total daily rate)			$1,000	10%	$0			
	Subtotal		**38**	**□38,000**	**□3,800**	**□0**	**□41,800**	**□0**	**□42,000**
D	**Draft Feasibility Report (F5)**								
1	Update analysis & report per ATR, PGM & IEPR Comments		10	$10,000	$1,000	$0	$11,000		
2	Revisions & updates to the water supply, demand and cost analysis		6	$6,000	$600	$0	$6,600		
3	Meetings and coordination		3	$3,000	$300	$0	$3,300		
4	Prepare input for draft report and update economic appendix		3	$3,000	$300	$0	$3,300		
5	Respond to comments on draft report		2	$2,000	$200	$0	$2,200		
	Subtotal		**24**	**□24,000**	**□2,400**	**□0**	**□26,400**	**□0**	**□26,000**
F	**Final Report (F8)**								
1	Update analysis and report per review comments		5	$5,000	$500	$0	$5,500		
2	Revisions and updates to the water supply, demand and cost analysis		4	$4,000	$400	$0	$4,400		
3	Meetings and coordination		2	$2,000	$200	$0	$2,200		
4	Prepare input for final report and update economic appendix		3	$3,000	$300	$0	$3,300		
5	Provide Economics input for Chief's Report		2	$2,000	$200	$0	$2,200		
				$0	$0	$0	$0		
	Subtotal			**□16,000**	**□1,600**	**□0**	**□17,600**	**□0**	**□18,000**
	Section Total		**216**	**232,000**	**23,200**	**0**	**255,200**	**0**	**□255,000**

Project Management Plan - Time and Cost Estimate for the Feasibility Phase								Prepared:	October 15, 2010	
Design Branch/Cost & Specs Engineering Section								By:	Phillip Eng	

Whittier Narrows Dam Water Conservation Study - PMP, FY 2011

Feasibility Phase (PMP)

Task/	Task Description	Predecessor/Successor To Task	Work Days	PDT Labor	Section Mgmt/Supt	Branch Mgmt/Supt	Total Labor	Non-Labor Contract/ Travel, etc	Totals (Rounded)
	Daily PDT Member and Section/Branch Support Labor Estimates (Sec/Br □reflect □ of daily □applicable to this Project not total daily rate)			$1,100	$220	$50			
A	**Initiate Study/Updated Baseline Conditions Report**								
1	Meetings, conferences, coordination	Predecessor	4	$4,400	$880	$200	$5,480		
	Subtotal		*4*	*$4,400*	*$880*	*$200*	*$5,480*	*$0*	*$5,000*
B	**Alternatives Analysis/Recommended Plan Selection Report (F4)**								
1	Meetings, conferences, coordination, filing	Predecessor	2	$2,200	$440	$100	$2,740		
2	Research/gathering information	Successor	3	$3,300	$660	$150	$4,110		
3	Site Visit	Successor	1	$1,100	$220	$50	$1,370		
4	Quantities evaluation	Successor	5	$5,500	$1,100	$250	$6,850		
5	MCACES (Mii) Estimates for 3 alternatives	Successor	15	$16,500	$3,300	$750	$20,550		
6	Independent tech. Review (ITR), address comments	Successor	3	$3,300	$660	$150	$4,110		
7	Air Quality Impact Evaluation -- Env Support	Successor	3	$3,300	$660	$150	$4,110		
	Subtotal		*32*	*$35,200*	*$7,040*	*$1,600*	*$43,840*	*$0*	*$44,000*
C	**Additional Analysis of Tentatively Recommended Plan (AFB)**								
1	Meetings, conferences, coordination	Predecessor	2	$2,200	$3,300	$750	$6,250		
2	Research/gathering information	Successor	3	$3,300	$1,100	$250	$4,650		
3	Quantities evaluation	Successor	5	$5,500	$1,100	$250	$6,850		
4	Refine MCACES (Mii) estimate for Alternative	Successor	15	$16,500	$3,300	$750	$20,550		
5	Draft Cost Engineering Appendix	Successor	5	$5,500	$1,100	$250	$6,850		
7	Develop Total Project Cost Summary (TPCS)	Successor	5	$5,500	$1,100	$250	$6,850		
10	Independent Technical Review (ITR), address comments	Successor	3	$3,300	$660	$150	$4,110		
	Subtotal		*38*	*$41,800*	*$11,660*	*$2,650*	*$56,110*	*$0*	*$56,000*
D	**Draft Feasibility Report (F5)**								
1	Final Draft Cost Engineering Appendix / Documentation	Predecessor	5	$5,500	$1,100	$250	$6,850		
2	Agency Technical Review (ATR), address comments	Successor	3	$3,300	$660	$150	$4,110		
3	Update/Change Mii (MCACES) Cost Estimate for NED (LRR if applicable)	Successor	10	$11,000	$2,200	$500	$13,700		
4	Update/Change Cost Engineering Appendix narrative	Successor	3	$3,300	$660	$150	$4,110		
5	Update / Change TPCS	Successor	3	$3,300	$660	$150	$4,110		
6	Cost and Schedule Risk Analysis (if necessary)	Successor							
	Subtotal		*24*	*$26,400*	*$5,280*	*$1,200*	*$32,880*	*$0*	*$33,000*
F	**Final Report (F8)**								
1	Meetings, conferences, coordination	Predecessor	1	$1,100	$220	$50	$1,370		
2	Final Cost Engineering Efforts	Successor	5	$5,500	$1,100	$250	$6,850		
	Subtotal			*$6,600*	*$1,320*	*$300*	*$8,220*	*$0*	*$8,000*
	Section Total		**98**	**114,400**	**26,180**	**5,950**	**146,530**	**0**	**□146,000**

Time and Cost Estimate
Whittier Narrows Dam
Water Conservation Feasibility Study

Prepared: 10/6/2010
Last Updated: 11/4/2010
By: KC

Task Number	Task	Work Days	Task Total	Need by Milestone
1	Elevation-Frequency-Duration Analyses	37	$44,400	F4
2	Draft Documentation for F4	4	$4,800	F4
3	Final Adjustments Elevation-Frequency-	5	$6,000	F5
4	Conceptual Operation Plan	5	$6,000	F5
5	Final Draft Documentation for F5	3	$3,600	F5
6	Final Documentation for F8	6	$7,200	F8
	Totals =>	60	□72,000	

Project Management Plan - Time and Cost Estimate for the Feasibility Phase | Prepared: **October 21,2010**

Section - Asset Management Division | By: **Pete Garcia**

Whittier Narrows Water Conservation Study

Feasibility Phase (PMP)

Task/ DDR □	Task Description	Predecessor/Successor To Task	Work Days	PDT Labor	Section Mgmt/Supt	Branch Mgmt/Supt	Total Labor	Non-Labor e.g. Travel	Totals (Rounded)
	Daily PDT Member and Section/Branch Support Labor Estimates (Sec/Br □reflect □ of daily □applicable to this Project not total daily rate)			$1,000	$100	$150			
A	**Initiate Study/ Update Baseline Conditions Report (F1-F3)**								
1	Coordination and Participation in team meetings		3	$3,000	$0	$450	$3,450		
2	Preliminary Market Study/Identify and Determine land ownerships,		2	$2,000	$0	$300	$2,300		
	requirements and estates.			$0	$0	$0	$0		
				$0	$0	$0	$0		
	Subtotal		*5*	*$5,000*	*$0*	*$750*	*$5,750*	*$500*	*$6,000*
B	**Alternatives Analysis/ Recommended Plan Selection Report (F4)**								
1	Coordination and Participation in team meetings		3	$3,000	$200	$450	$3,650		
2	Detailed Estimate of all Real Estate Cost		5	$5,000	$0	$0	$5,000		
3	Prepare Preliminary Take drawings		5	$5,000	$0	$0	$5,000		
4	Coordinate Rights of Entry request (if applicable)		2	$2,000	$300	$300	$2,600		
5	Prepare Preliminary draft of Real Estate Plan		15	$15,000	$0	$400	$15,400		
6	Internal Technical Review		2	$2,000	$500	$800	$3,300		
			0	$0	$0	$0	$0		
				$0	$0	$0	$0		
				$0	$0	$0	$0		
	Subtotal		*32*	*$32,000*	*$1,000*	*$1,950*	*$34,950*	*$500*	*$35,000*
C	**Additional Analysis of Tentatively Recommend (AFB)**								
1	Coordination and Participation in team meetings		1	$1,000	$200	$300	$1,500		
				$0	$0	$0	$0		
				$0	$0	$0	$0		
	Subtotal		*1*	*$1,000*	*$200*	*$300*	*$1,500*	*$0*	*$3,000*
D	**Draft Feasibility Report (F5)**								
1	Real Estate's Final Draft Report		3	$3,000	$300	$450	$3,750		
2	Real Estate Input to Project Management Plan for Plans and Specs.		2	$2,000	$200	$300	$2,500		
				$0	$0	$0	$0		
				$0	$0	$0	$0		
				$0	$0	$0	$0		
	Subtotal		*5*	*$5,000*	*$500*	*$750*	*$6,250*	*$0*	*$12,500*
E	**Final Report (F8)**								
1	Issue Resolution		2	$2,000	$200	$300	$2,500		
				$0	$0	$0	$0		
	Subtotal		*2*	*$2,000*	*$200*	*$300*	*$2,500*	*$0*	*$3,000*

Project Management Plan - Time and Cost Estimate for the Feasibility Phase **Prepared:** **October 21,2010**

Section - Asset Management Division **By:** **Pete Garcia**

Whittier Narrows Water Conservation Study

Feasibility Phase (PMP)

Task/ DDR □	Task Description	Predecessor/Successor To Task	Work Days	PDT Labor	Section Mgmt/Supt	Branch Mgmt/Supt	Total Labor	Non-Labor e.g. Travel	Totals (Rounded)
	Daily PDT Member and Section/Branch Support Labor Estimates (Sec/Br □reflect □ of daily □applicable to this Project not total daily rate)			$1,000	$100	$150			
	Section Total		**45**	**45,000**	**1,900**	**4,050**	**□50,950**	**□1,000**	**□52,000**

Project Management Plan - Time and Cost Estimate for the Feasibility Phase — **Prepared:** **September 30, 2010**

Environmental Coordinator — **By:** **Debbie Lamb**

Whittier Narrows Dam Basin Water Supply and Conservation Integrated Feasibility Study

Feasibility Phase (PMP)

Task/	Task Description	Work Day	Env Coordinator 9 hour day	Biologist 8 hour day	Cultural Resources 8 hour day	EC Section Support Mgmt/Supt	Biologist Sectin Support	Cultural Resources Section Support	Branch Mgmt/Supt	Planning Division Man/Support	Total Labor	Non-Labor Contract/ Travel, etc	Total Section Support Labor	Totals
	Daily PDT Member and Section/Branch Support Labor Estimates (Sec/Br reflect of daily applicable to this Project not total daily rate)		$1,260		$1,000	$126		$100	$126	$63				
A	**Initiate Study/Updated Baseline Conditions Report**													
1	Record Search and Field Survey	10			$8,000			$200	$200	$100	$8,500			
2	Meetings, draft measures, site visits	4			$4,000			$400	$400	$200	$5,000			
3	Prepare document	6			$6,000			$600	$600	$300	$7,500			
4	Resond to DQC comments/revise	1			$1,000			$100	$100	$50	$1,250			
5	Respond to ATR comments and revise	1			$1,000			$100	$100	$50	$1,250			
6	F3 Review Conference	1			$1,000			$100	$100	$50	$1,250			
7														
8														
	Subtotal	*23*	*$0*		*$21,000*			*$1,500*	*$1,500*	*$750*	*$24,750*			*$19,000*
B	**Alternatives Analysis/Recommended Plan Selection Report (F4)**													
1	Review, update surveys/	2			$2,000			$200	$200	$100	$2,500			
2	Coordinate with SHPO	4			$4,000			$200	$200	$100	$4,500			
3	Participate in PDT meetings	2			$2,000			$200	$200	$100	$2,500			
4	Prepare documentation	3			$3,000			$300	$300	$150	$3,750			
5	Respond to DQC comments and Revise	1			$1,000			$100	$100	$50	$1,250			
6	Respond to ATR comments and revise	1			$1,000			$100	$100	$50	$1,250			
7	Participate in milestone conferrence	1			$1,000			$100	$100	$50	$1,250			

Project Management Plan - Time and Cost Estimate for the Feasibility Phase | **Prepared:** | **September 30, 2010**

Environmental Coordinator | **By:** | **Debbie Lamb**

Whittier Narrows Dam Basin Water Supply and Conservation Integrated Feasibility Study

Feasibility Phase (PMP)

Task/	Task Description	Work Day	Env Coordinator 9 hour day	Biologist 8 hour day	Cultural Resources 8 hour day	EC Section Support Mgmt/Supt	Biologist Sectin Support	Cultural Resources Section Support	Branch Mgmt/Supt	Planning Division Man/Support	Total Labor	Non-Labor Contract/ Travel, etc	Total Section Support Labor	Totals
	Daily PDT Member and Section/Branch Support Labor Estimates (Sec/Br □reflect □ of daily □applicable to this Project not total daily rate)		$1,260		$1,000	$126		$100	$126	$63				
	Subtotal	***14***	***0***		***$14,000***	***0***		***$1,200***	***1200***	***$600***	***$17,000***			***$17,000***
C	**Additional Analysis of Tentatively Recommended Plan (AFB)**													
1	Revise and Update	2			$2,000			$200	$200	$100	$2,500			
2	Attend and participate in team meetings	2			$2,000			$200	$200	$100	$2,500			
3	Resond to DQC comments and revise	1			$1,000			$100	$100	$50	$1,250			
4	Respond to ATR comments and revise	1			$1,000			$100	$100	$50	$1,250			
5	Participate in milestone conference	1			$1,000			$100	$100	$50	$1,250			
13														
	Subtotal	***7***	***$0***		***$7,000***			***$700***	***$700***	***$350***	***$8,750***			***$9,000***

Project Management Plan - Time and Cost Estimate for the Feasibility Phase | Prepared: **September 30, 2010**

Environmental Coordinator | By: **Debbie Lamb**

Whittier Narrows Dam Basin Water Supply and Conservation Integrated Feasibility Study

Feasibility Phase (PMP)

Task/	Task Description	Work Day	Env Coordinator 9 hour day	Biologist 8 hour day	Cultural Resources 8 hour day	EC Section Support Mgmt/Supt	Biologist Sectin Support	Cultural Resources Section Support	Branch Mgmt/Supt	Planning Division Man/Support	Total Labor	Non-Labor Contract/ Travel, etc	Total Section Support Labor	Totals
	Daily PDT Member and Section/Branch Support Labor Estimates (Sec/Br □reflect □ of daily □applicable to this Project not total daily rate)		$1,260		$1,000	$126		$100	$126	$63				
D	**Draft Feasibility Report (F5)**													
1	Revise and Update	2			$2,000			$200	$200	$100	$2,500			
2	Participate in milestone conference	1			$1,000			$100	$100	$50	$1,250			
	Subtotal	***3***	***$0***		***$3,000***			***$300***	***$300***	***$150***	***$3,750***			***$4,000***
	Final Report (F8)													
1	Address Agency and public comments and revise as required	2			$2,000			$200	$200	$100	$2,500			
6	Meetings and coordination	1			$1,000			$100	$100	$50	$1,250			
7	Addition Meetings	1			$1,000			$100	$100	$50	$1,250			
	Subtotal	***4***	***$0***		***$4,000***	***$0***		***$400***	***$400***	***$200***	***$5,000***			***$5,000***
	Section Total	**51**	**0**			**0**			**4,100**		**59,250**	**0**		**□54,000**

From:	Sulzer, Daniel E SPL
To:	Anderson, Kathleen S SPL; Theresa Wu;
cc:	Axt, Josephine R SPL; Demesa, Eduardo T SPL; Van Dorpe, David M SPL; Green, Michael P SPL;
Subject:	RE: Whittier Narrows -Statement regarding funding (UNCLASSIFIED)
Date:	Friday, December 03, 2010 2:51:21 PM

Classification: UNCLASSIFIED
Caveats: FOUO

Ms. Wu,

After conversations with Kathleen Anderson, Mike Green, and other Planning Staff, please see the message below. I hope this is sufficient. Please let me know if it is not.

The US Army Corps of Engineers Los Angeles District (SPL) is working closely with Los Angeles County Department of Public Works (LADPW) and the Water Replenishment District of Southern California (WRD) to update the Whittier Narrows Water Conservation Feasibility Study (Study)and are in final stages of completing a Project Management Plan (PMP) and Cost Sharing Agreement (FCSA) for District and South Pacific Division approval. The approved FCSA and PMP will be provided to LADPW for signature. Immediately afterwards, Commander Col Toy will sign off to execute the agreement.

Los Angeles District is committed to pursuing funds for the project and has received $134,000 in 2010 in GI funds for the Study, has requested funds for 2011 to continue work, and will be requesting funds for 2012. The project team will use available funds to initiate the FCSA and will move forward on the feasibility study as quickly as possible once the agreement is signed and matching non-federal funds are received. The project cannot progress without receipt of matching funds. Once the cost share agreement is completed, we are confident funding will be made available with your matching funds.

Thank you very much, and if you have any questions, please don't hesitate to call me.

Daniel E. Sulzer
Assistant Chief, Planning Division
Los Angeles District
U.S. Army Corps of Engineers
(213) 452-3784

APPENDIX M

Water and Energy Efficiency in the School and Hotel/Motel Sectors – West Basin Municipal Water District

REACHING BEYOND THE VISION:
Achieving a Drought-Proof Region

CONSERVATION MASTER PLAN
Highlights

WEST BASIN
MUNICIPAL WATER DISTRICT

"Once again, West Basin demonstrates its leadership in developing innovative local programs and partnering with businesses and government agencies to safeguard our precious water supply and retain the quality of life we so cherish in Southern California."

Jacki Bacharach, Executive Director
South Bay Cities Council of Governments

"West Basin is a leader in promoting water supply sustainability in southern California. Their Conservation Master Plan is a leap forward in the pursuit of regional targets for water use efficiency, and an excellent complement to their aggressive water recycling program."

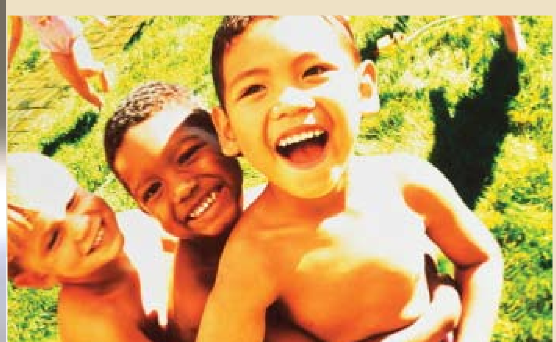
Tim Brick, Chairman
Metropolitan Water District
of Southern California

"The California Urban Water Conservation Council is pleased to indicate its overall support for the excellent conservation master planning efforts that have been initiated by West Basin MWD. This effort is a thorough, well-thought out process that is rarely seen in conservation planning."

Mary Ann Dickinson, Executive Director
California Urban Water Conservation Council

"The unique partnership between the Surfrider Foundation and West Basin Municipal Water District speaks to the ability of the District in reaching out to the environmental community. I see this partnership as a model on how we can work together on an integrated approach to improving water quality at our local beaches while simultaneously meeting ever increasing demands for fresh water."

Joe Geever, Environmental Coordinator
Southern California Regional Manager
Surfrider Foundation



INTRODUCTION

Fifteen years ago, drought conditions throughout Southern California reminded us that we live in a desert-like environment. At that time, our region relied too much upon distant water sources.

Since that time, the West Basin Municipal Water District has joined with leaders in government, industry, the water community, environmental organizations and concerned citizens to pursue a comprehensive water resource strategy. The goal in past years has been to achieve a safe and reliable water supply for Southern California – a supply that was not dependent predominantly on "imported" water.

This ambitious goal has resulted in numerous successes. Major water conservation, recycling and education programs have been launched with positive results. The region's water supply portfolio has diversified dramatically, becoming less dependent on imported water.

In recognition of these accomplishments, West Basin has received several prestigious awards for its conservation programs and water sustainability initiatives. However, the District is not resting on these laurels. Going forward, the goal is to move "Beyond the Vision" in pursuing as many initiatives as possible to achieve a drought-proof region for generations to come.

As we have learned, successful water conservation requires more than the application of water saving devices, retrofits and irrigation programs. Integrated partnerships between West Basin and numerous government agencies, political leaders, non-profit organizations, water and energy utilities, education, commercial and community groups have helped Southern California achieve a more reliable water supply. These outstanding partners include:

U.S. Bureau of Reclamation
California Dept. of Water Resources
Metropolitan Water District of S. California
City of El Segundo
City of Inglewood
City of Lomita
City of Malibu
City of Manhattan Beach
City of Torrance

California-American Water Company
California Water Service Company
Golden State Water Company
Los Angeles County Waterworks District #29
Water Replenishment District of S. California
South Bay Cities Council of Governments
South Bay Energy Savings Center
California State University, Dominguez Hills
Los Angeles Unified School District

Surfrider Foundation
Heal the Bay
Mono Lake Committee
PV/South Bay Audubon Society
Ballona Creek Watershed
Santa Monica Baykeeper
Malibu Creek Watershed
Resource Conservation District
of the Santa Monica Mountains

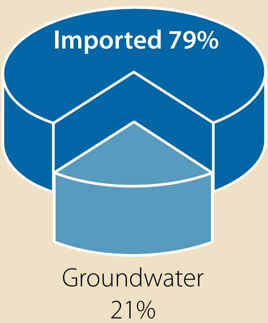
Going forward, progress on water-related supply and sustainability issues will continue to help insure an integrated and diverse system of managing one of our region's most precious resources — water.

West Basin developed this Conservation Master Plan to guide regional investments and translate conservation goals into tangible initiatives for residents, businesses and governments.

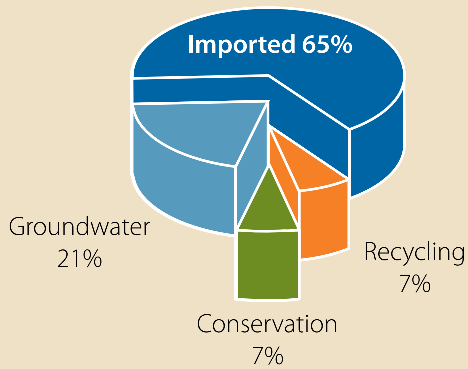
REACHING BEYOND THE VISION: ACHIEVING A DROUGHT-PROOF REGION

Conservation is an integral part of West Basin's goals of reducing imported water use and diversifying the mix of supplies for the region. Two decades ago most of our area's need for water was met by imported sources. By 2015, a significant portion of local water will come from the conservation programs and policies now being implemented.

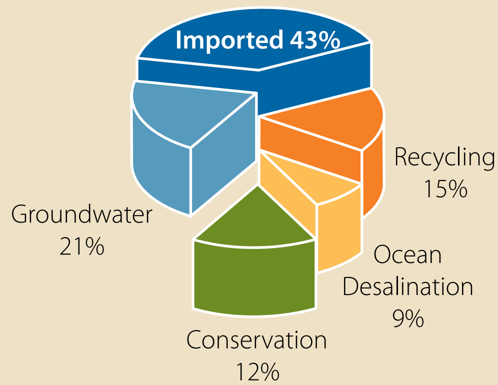
1990
Heavy Dependence on Imported Supply



2006
Today's Water Supply Mix



2015
More Balance and Diversity



To reach these goals, West Basin developed this Conservation Master Plan to guide regional investments and translate conservation goals into tangible initiatives for residents, businesses and governments. This Plan has been created to adapt to changing technologies and environmental conditions, while at the same time offering substantive recommendations within home environments and business communities. Key highlights of the Plan are outlined on the following pages.

The Master Plan is designed to be flexible and adaptable to changing technologies and environmental conditions. Similarly, the Plan is based on programs that deliver water and energy savings, environmental and other benefits that exceed the cost to local residents and businesses.

DEVELOPMENT OF THE CONSERVATION MASTER PLAN

This Master Plan results from a collaborative and methodical process involving numerous stakeholders, water experts and government entities, and incorporates the following goals:

Achieve long-term water savings targets
Implement cost-effective programs that have high stakeholder acceptance
Create a plan that is flexible and expandable

The steps necessary to develop the Master Plan are as follows:

Step 1: Create End-Use Database
Retail water agencies in the area provided water usage history from over 16,000 commercial and industrial accounts. Data included type of water user, total water use and location. Storing this information in a database will help West Basin design targeted, cost-effective conservation programs well into the future.

Step 2: Develop Preliminary Program Concepts
Using the information provided in Step 1, and industry knowledge of conservation devices that are cost-effective and readily available, West Basin developed preliminary concepts for conservation programs.

Step 3: Add Stakeholder Input
Through public workshops, individuals from local agencies, environmental groups, and conservation industry professionals offered insight into the pitfalls and possibilities of various conservation programs as well as ideas for new programs.

Step 4: Complete, Evaluate and Rank Programs
Each program concept was expanded to include specific details regarding market potential, expected water savings, costs per unit and overall budget. West Basin narrowed the program list using evaluation criteria weighted by importance.

Step 5: Recommend Programs and Implementation Plan
The final recommended list of programs is a diverse mix of both new and on-going programs covering commercial, industrial, residential, and landscape opportunities. New programs will be phased-in to allow West Basin to adequately plan for budget and staffing needs. The Recommended Program Mix was approved by the West Basin Board of Directors.

Step 6: Monitoring and Updating the Master Plan
The 5-Year Recommended Program Mix contained within the Master Plan is West Basin's best projection of future water savings required to meet long-term targets. Actual results, however, may vary for many different reasons. West Basin will monitor program performance and periodically update the Master Plan, drawing from the end-use database created in Step 1, and the latest conservation practices and devices.

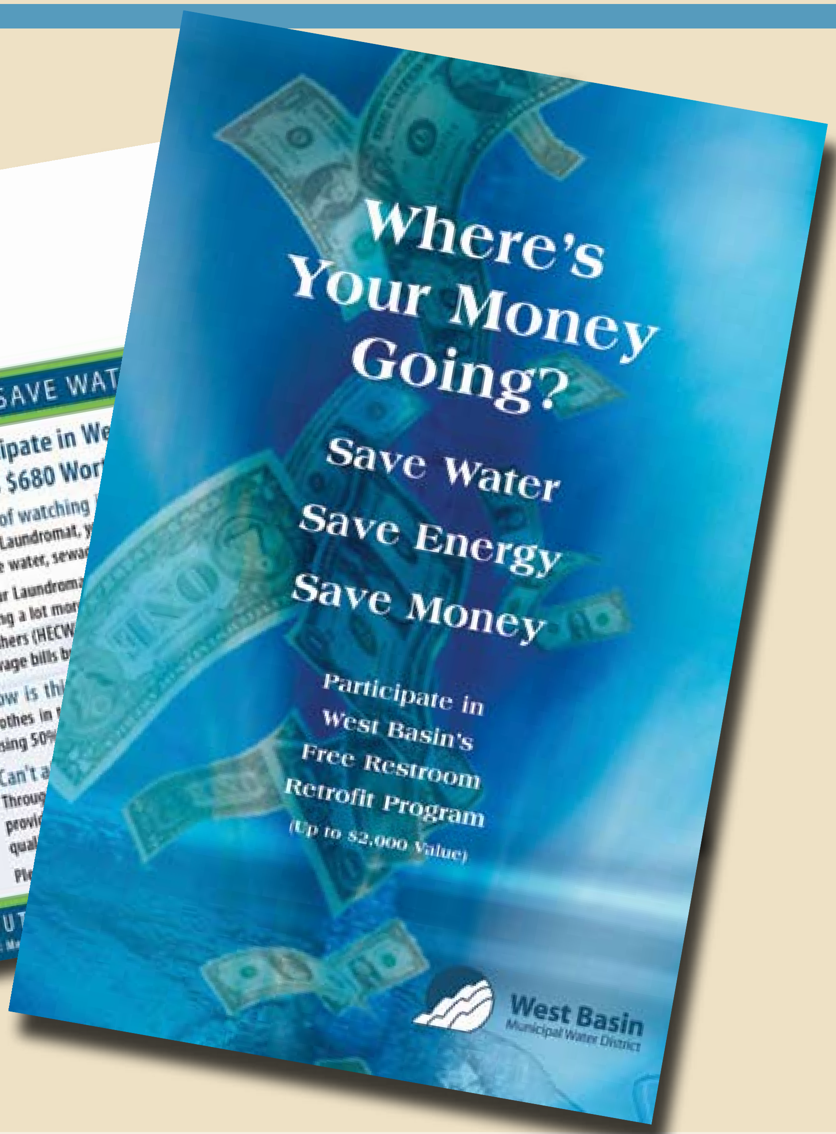
CONSERVATION MASTER PLAN RECOMMENDED PROGRAM MIX

PROGRAMS	FY 06-07	FY 07-08	FY 08-09	FY 09-10	FY 10-11
RESIDENTIAL					
HET[1] Distributions & Multi-family Installations	■	■	■	■	■
Residential HECW[2] Rebates	■				
HET Rebates	■	■	■	■	■
COMMERCIAL					
Save-A-Buck CII Incentives	■	■	■	■	■
Complete Restroom Retrofit	■	■			
Pre-Rinse Spray Valve Installs	■				
Comprehensive Laundromat Program	■	■	■		
Conductivity Controllers Incentive		■	■	■	■
Industrial Process Improvement		■	■	■	■
Comprehensive Supermarket Program				■	■
OUTDOOR					
Smart Controller Distributions	■	■	■	■	■
Residential and Professional Landscape Workshops	■	■	■	■	■
Ocean-Friendly Landscape	■	■	■	■	■

Length of programs subject to availability of funding.

[1] HET = High-Efficiency Toilet
[2] HECW = High-Efficiency Clothes Washer

West Basin hosts stakeholder workshop during Master Plan development.



There is still a large opportunity for water-efficient retrofits within our businesses, schools, restaurants, and other high-traffic facilities.

COMMERCIAL AND INDUSTRIAL PROGRAMS

The approximately 12,000 commercial customers in our region use 12% of all water in the region. There is still a large opportunity for water-efficient retrofits within our businesses, schools, restaurants, and other high-traffic facilities. These customers can save water and save money by participating in one or more of the following West Basin incentive programs:

Complete Restroom Retrofit Program

Through the aid of a State grant and various incentives, the Complete Restroom Retrofit Program provides qualifying businesses, schools, restaurants and other facilities with free water-efficient fixtures and installations that can save up to 90,000 gallons of water annually. Every customer can receive up to two High-Efficiency Toilets (HET), two automatic sensor sink faucets and one Water-free urinal per restroom, at no cost.

Comprehensive Laundromat Program

Coin-operated laundromats are high water consumers. However, replacing laundromat machines can be a costly endeavor. Now, through partnership incentives from West Basin and several other water and energy utilities, participating laundromats can recover up to $680 for every washer that is upgraded to a high-efficiency model. These new High-Efficiency Clothes Washers can reduce energy costs by up to 50% and lower water and sewer costs by 30-50% while conserving over 100 gallons per day.

"Save Water Save A Buck" Program

The "Save Water Save A Buck" Program currently offers rebates and incentives on various devices including toilets, waterless urinals and high-efficiency urinals, water brooms, connectionless food steamers and restaurant spray nozzles. Businesses, schools, restaurants and other facilities can save up to several hundred dollars per product. A complete list of all available "Save A Buck" incentives can be found by visiting www.westbasin.org.

Cooling Tower Retrofit Program

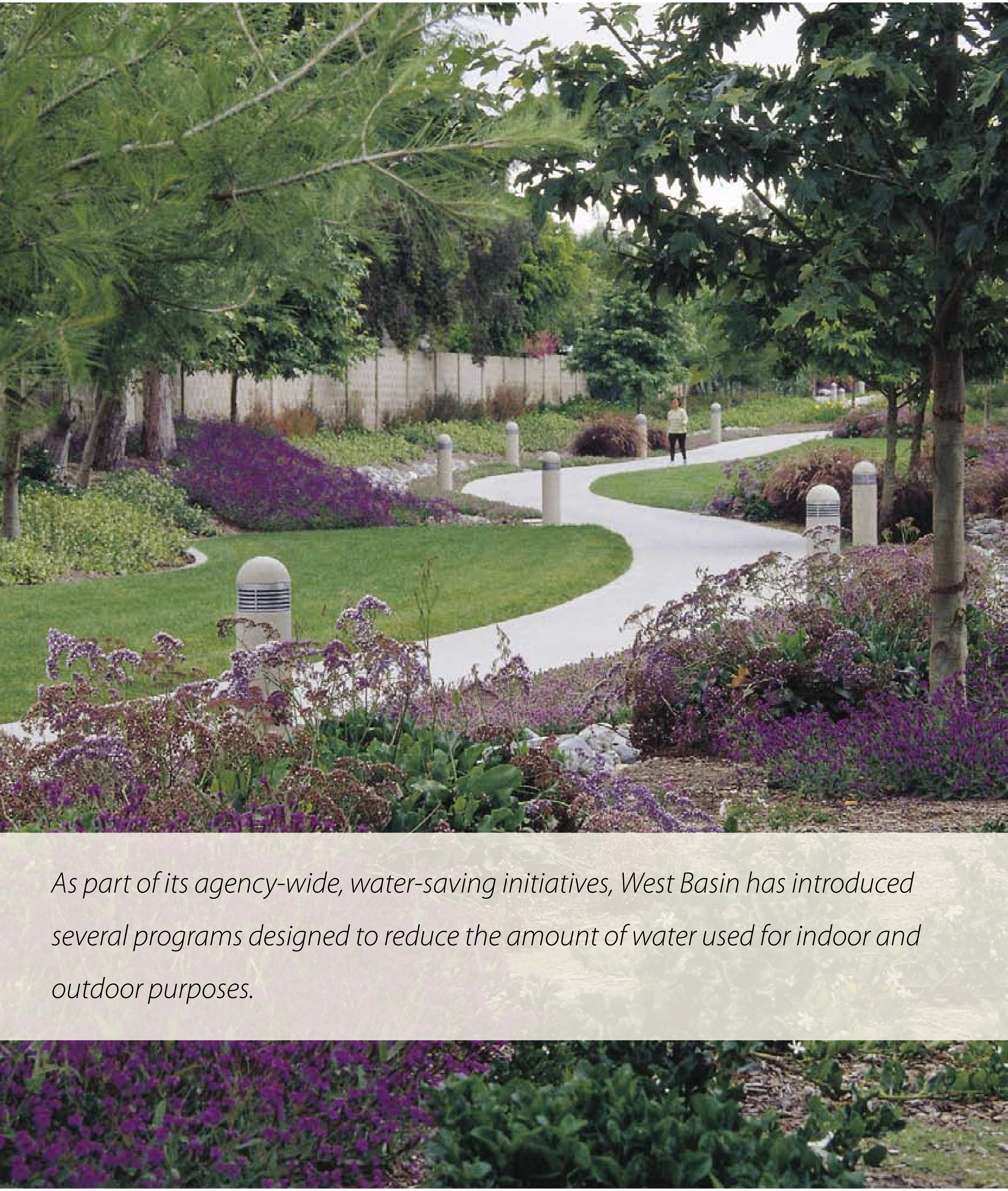
Cooling towers often are the largest users of water in industrial plants, office buildings, hospitals and other facilities with large air conditioning requirements. Automated monitoring and control systems can improve cooling system efficiency. In fact, towers retrofitted with conductivity or pH controllers can save as much as 3,000 gallons of water per day.

The Cooling Tower Retrofit Program targets buildings over three stories tall. Businesses will receive financial and technical assistance to retrofit their cooling towers with conductivity controllers or pH / alkalinity controllers. This program will launch in 2008.

Industrial Process Improvement Program

Industrial process water use provides another promising opportunity for water efficiency improvements. Few water conservation programs have been directed solely at process water use in the industrial sector.

Beginning in 2008, this new program will provide process-improvement surveys, customized incentives, and follow-up support to the approximately 1,300 small- to mid-sized West Basin industrial customers including those in food processing, textiles, electronics, industrial laundries, fabricated metals and dye houses.



As part of its agency-wide, water-saving initiatives, West Basin has introduced several programs designed to reduce the amount of water used for indoor and outdoor purposes.

INDOOR AND OUTDOOR RESIDENTIAL PROGRAMS

Since 1991, West Basin and its city and water agency partners have saved billions of gallons of water through indoor conservation programs. An estimated 50,000 water-efficient toilets and rebates have been distributed, as well as low-flow shower heads, sink aerators and washer rebates.

Since outdoor landscape irrigation accounts for over half of all water use, West Basin has also introduced several programs designed to reduce the amount of water used for commercial and residential irrigation purposes. West Basin is partnering with cities, water agencies, botanical gardens and nurseries to provide residents with native plant selection classes and new irrigation technologies.

In a unique partnership, West Basin and The Surfrider Foundation will launch an "Ocean-Friendly" Landscape Program in 2007 that will not only conserve water but also aid local communities in reducing dry weather runoff.

New Innovations

- "Smart" irrigation controllers save water by automatically adjusting watering schedules based on weather patterns.
- High-Efficiency Toilets use about 20% less water than conventional ultra-low-flush toilets that use 1.6 gallons per flush. Price decreases and customer incentives make it possible to distribute free toilets to the public. West Basin is also pursuing direct-installation opportunities within the multi-family sector, which includes apartment buildings, homeowners associations, condominium complexes, and mobile home parks.
- High-Efficiency Clothes Washer Rebates will continue as long as funding is available. These washers save 50% of water and energy use. In addition, clothes come out cleaner with less wear and tear.
- Free Landscape Surveys and Irrigation Equipment Incentives. Landscape professionals evaluate landscape areas, including soil and plant materials, and provide recommendations for enhanced water efficiency. Several incentives are also offered by West Basin to encourage commercial landscapers, homeowners, schools and parks to upgrade irrigation equipment.

Participants in landscape class learn about programming irrigation controllers for water use efficiency.

Educating the next generation of Southern Californians about the importance of water and water-use is a critical goal of West Basin's conservation program.

ADDITIONAL PROGRAM INITIATIVES

Just as visionary thinking secured our region's water supply goals decades ago, this same momentum continues to direct West Basin into the future. Our accomplishments in ocean-water desalination, water recycling and community outreach are just a few of the ways in which we reach "Beyond the Vision" to achieve a drought-proof water supply for our residents and businesses.

To further the District's efforts, several additional programs support our efforts in water conservation. These include the following:

Education and Training
Educating the next generation of Southern Californians about the importance of water and water-use is a critical goal of West Basin's conservation program. To this end, the District's educational outreach programs have consistently grown in popularity and scope.

Legislative Advocacy
West Basin actively supports local, state and federal legislation that promotes water-efficient practices and technologies.

Community Outreach
Public awareness is essential in promoting water conservation. West Basin provides cities and retail agencies with opportunities for support for conservation programs in their respective areas.

Partnerships
West Basin and the South Bay Energy Savings Center have joined forces to promote the interrelationship between water and energy use – and conservation. Now, South Bay residents, businesses and institutions have convenient access to energy and water savings products, rebates and information.

Grantsmanship
Through successful pursuit of grants and the generous contributions of various agency partners, West Basin is able to deliver approximately $3.50 worth of conservation programs for every dollar it spends.

South Bay Energy Savings Center hosts event promoting water and energy conservation partnership.

Today, with 185 square miles of territory and an ever-growing population, the District fully recognizes the importance of meticulous planning of future resource needs.

WEST BASIN MUNICIPAL WATER DISTRICT

The West Basin Municipal Water District was formed in 1947 by the public to preserve underground water supplies by providing supplemental water. Today, with 185 square miles of territory and an ever-growing population, the District fully recognizes the importance of meticulous planning of future resource needs. Conservation is a critical resource component of the Integrated Resource Planning process; the goal being a master plan portfolio of conservation programs that deliver a high volume of water savings at a cost-effective price.

West Basin Municipal Water District is governed by a 5 member Board of Directors elected by the public. The District serves the Cities and communities of Carson, Palos Verdes Estates, Rancho Palos Verdes, Rolling Hills, Rolling Hills Estates, Inglewood, South Ladera Heights, a portion of Lennox and unincorporated areas of Athens, Howard and Ross-Sexton, Hermosa Beach, Lomita, Manhattan Beach, Redondo Beach and unincorporated areas of Torrance, Culver City, El Segundo, Malibu, West Hollywood and unincorporated areas of Lennox, North Ladera Heights, Del Aire, Topanga, View Park and Windsor Hills, Gardena, Hawthorne, Lawndale and unincorporated portions of El Camino Village.

WEST BASIN
MUNICIPAL WATER DISTRICT

17140 South Avalon Blvd, Suite. 210
Carson, California 90746-1296
Phone: 310-217-2411

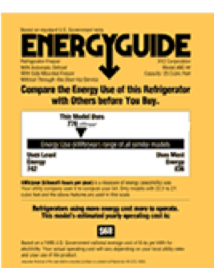
www.westbasin.org

Save Energy at Home

- Overview
- Summer Savings Tips
- Changing Habits
- Efficient Appliances
- Upgrade Your Home
- Natural Gas Efficiency
- Home Energy Audit
- Flex Your Power TV Ads
- Rebates, Incentives □ Services
- Product Guides
- Energy Tips
- Find a Store

ENERGY STAR

What are the ENERGY STAR and EnergyGuide Labels?



How do I read the EnergyGuide label?

Residential Overview > Product Guides >

Showerheads

Get Rebates, Incentives □ Services

California Zipcode:

Sector:

Residential

Search

Introduction

Reducing hot water use saves energy because your hot water heater has less work to do. Approximately 73% of the water used in a typical shower is hot water. Inexpensive and simple-to-install, low-flow showerheads and faucet aerators can reduce home water consumption and water heating costs by as much as 50%. Faucet aerators replace the faucet head screen, lowering the flow by adding air to the spray. Low-flow showerheads either draw in air, or have it forced into the water stream by using compressed air. The air-water mixture under pressure creates a high velocity spray, which makes it seem like more water is coming out than there actually is.

Technology Options

The Federal Energy Policy Act of 1992 requires that all faucet fixtures manufactured in the United States restrict maximum water flow at or below 2.5 gallons per minute (gpm) at 80 pounds per square inch (psi) of water pressure or 2.2 gpm at 60 psi. This ensures that most faucet products available will offer at least minimal water efficiency benefits.

There are two main types of low-flow faucets and showerheads: aerating (the most popular) and non-aerating. Aerating mixes air into the water stream. This maintains steady pressure so the flow has an even, full shower spray. Because air is mixed in with the water, the water temperature can cool down a bit towards the floor of the shower. Non-aerating adds a pulse to the water stream; maintaining temperature and delivering a strong spray.

Efficiency Benefits

Standard kitchen and bathroom water faucets use 4 to 7 gallons of water per minute (gpm). This means that a single incidence of washing dishes may consume up to 120 gallons of water. Non-conserving showerheads use 5 to 8 gpm, consuming up to 40 gallons of water for a single five-minute shower.

Simply installing a high-efficiency showerhead and faucet aerator will save about 7,800 gallons of water per year in an average household. An easy-to-install faucet aerator will reduce both the flow rate (from 4 to 7 gpm to 1 to 2.75 gpm) and splashing while increasing areas of coverage. This conserves water and improves faucet performance at the same time. Low-flow heads save more than 12 gallons per shower (a savings of 44% over non-conserving showerheads). Ultra-low-flow heads conserve even more, using only .8 to 1.5 gpm, reducing the average five-minute shower's water usage from 40 to 7.5 gallons.

Cost-Effectiveness Example			
Performance	Base Model[a]	Recommended Level	Best Available
Water Use Only			
Gallons per minute/cycle	2.5 gpm	2.2 gpm	1.5 gpm
Annual Water Use	18.250 gallons	16,060 gallons	10,950 gallons

Annual Water Cost	$73	$64	$44
Lifetime Water Cost	$590	$520	$350
Electric Water Heating			
Annual Energy Use	2,370 kWh	2,120 kWh	1,540 kWh
Annual Energy Cost	$142	$127	$92
Lifetime Energy Cost[b]	$1,070	$960	$690
Lifetime Energy and Water Cost Savings	-	**□200**	**□600**
Gas Water Heating			
Annual Energy Use	131 therms	120 therms	94 therms
Annual Energy Cost	$53	$48	$38
Lifetime Energy and Water Cost Savings	-	**□100**	**□350**

[a]The flow rate of the base model just meets the current Federal standards for showerheads.

[b]Lifetime energy cost is the sum of the discounted value of annual energy or water costs, based on average usage and an assumed showerhead life of 10 years. Future energy price trends and a discount rate of 4.1% are based on Federal guidelines (effective from April, 1998 to March, 1999). Future water and wastewater treatment costs are conservatively assumed to increase only at the rate of inflation.

Note: Metric Conversions: 1 gallon = 3.8 liters

By reducing the demand for hot water, a household reduces the amount of energy needed to heat the water. In this way, a low-flow showerhead helps to cut the emission of 376 pounds of climate-changing carbon dioxide each year and a faucet aerator helps to prevent the release of 83 pounds of carbon dioxide per year.

Purchasing Tips

Typically new kitchen faucets will be equipped with a 2.2 gallons per minute (gpm) aerator, while bathroom faucets usually have aerators that restrict flow to 1.5, 1.2, or even 1.0 gpm. If an aerator is already installed on the faucet, it will have its rated flow imprinted on the side. This should read 2.75 gpm or lower. If the flow rate is higher, then it should be replaced. If no aerator is installed, check to see if there are threads just inside the tip of the faucet. Most modern faucets are threaded to accept aerators. For highest efficiency, insist on 1.0 gpm flow restrictors. It is the aerator (the screw-on tip of the faucet nozzle) that ultimately determines the maximum flow rate for water. It's a good idea to bring your old aerator (and any associated washers) to the store when you purchase a new one to ensure that the new aerator will fit on the faucet fixture.

Before 1992, some showerheads had flow rates of 5.5 gpm. Therefore, if you have fixtures that pre-date 1992, you might want to replace them if you're not sure of their flow rates. Here's a quick test to determine whether you should replace a showerhead:

1. Place a bucket—marked in gallon increments—under your shower head.
2. Turn on the shower at the normal water pressure you use.
3. Time how many seconds it takes to fill the bucket to the 1-gallon (3.8 liter) mark.

If it takes less than 20 seconds to reach the 1-gallon mark, you could benefit from a low-flow shower head. Low-flow showerheads and faucet aerators are available at most hardware or plumbing supply stores. Low-flow faucet aerators usually cost $5 to $10. Low-flow showerheads range from $8 to $50. A wide variety of water conserving showerheads is available for purchase with prices starting at $2. A typical handheld massaging showerhead will cost around $25. Designer models cost from $50 to $300 depending on the model and materials used. Hand-held models are more expensive than fixed models.

Use this cost calculator from the U.S. Department of Energy's Federal Energy Management Program (FEMP) to compare the energy costs for your selection with FEMP-recommended and "Best Available" faucets. You can model different scenarios by varying water cost, flow rates, electricity or gas costs and expected usage.

There is a substantial difference in the quality of spray for different showerheads and faucets, even among models with the same flow rate. For spray pattern ratings and other features, refer to Consumer Reports (subscription required).

Emerging Technology

A fairly recent trend in bathroom design could dramatically increase shower water usage. An oversized shower stall with two (or more) showerheads is becoming a popular item in upscale bathrooms across the country — potentially leading to two, three or even four times as much water for showering. Some of these showers have separate controls for each showerhead so that if only one person is showering, only one showerhead is used.

With faucets, there are two designs making their way into homes. A foot pedal faucet controller is simply an on/off switch for your faucet located on the floor. A hands free "leaning" faucet controller has considerably more potential in the residential market. A bar is installed underneath the sink counter as an on/off control for the faucet. The temperature and flow rate of the faucet are still adjusted with the handle, but depressing the bar by leaning against it starts the flow of water. When you move away, a spring pushes the bar out and stops the water flow. The bar also has a locking feature that enables the user to keep the faucet flowing.

ZURN ECOVANTAGE 2009 NET PRICE SHEET

MODEL	DESCRIPTION	NET	Kohler	AmSt	USA
Z5615	WALL MOUNT 1.28 GPF TOILET	$60.00			MAY
Z5655	FLOOR MOUNT 1.28 GPF TOP SPUD, STD HEIGHT	$60.00			
Z5665	FLOOR MOUNT 1.28 GPF TOP SPUD, ADA HEIGHT	$72.22			

Z5708	NANO PINT URINAL W/ BATTERY FV	$416.29			
Z5738	SMALL PINT URINAL W/ BATTERY FV	$395.00			
Z5758	ENLARGED PINT URINAL W/ BATTERY FV	$450.00			
Z5798	LARGE PINT URINAL W/ BATTERY FV	$415.00			
Z5795	LARGE WATERLESS URINAL	$225.00			
Z5796	SMALL WATERLESS URINAL	$205.00			

DO NOT WANT THESE, BATTERY FLUSH VALVES.

THIS COULD ALSO BE AN OPTION...

Z5535	STD 1.28 GRAVITY ELON TANK TYPE	$140.00			no
Z5555	ADA 1.28 GRAVITY ELON TANK TYPE	$142.00			no
Z5562	ADA DUAL FLUSH ELON PRESSURE ASSIST TANK TYPE	$194.44			no
Z5572	STD DUAL FLUSH ELON PRESSURE ASSIST TANK TYPE	$194.44			no

			SLOAN		
Z6200PEV	1.28 MANUAL PISTON CLOSET FV	$75.00	CROWN 111-1.28		
ZTS6200EV	1.28 TOP BATTERY POWERED PISTON CLOSET FV	$235.00	8111-1.28		yes
ZGEN6000EV	1.28 GENERATOR CLOSET FLUSH VALVE	$265.00			
Z6203PEV-EWS	0.5 MANUAL PISTON URINAL FV	$75.00	CROWN 186-0.5		
ZTS6203EV	0.5 TOP BATTERY PISTON URINAL FV	$235.00	8186-0.5		
ZGEN6003EV	0.5 GENERATOR PISTON URINAL FV	$265.00			

ZEMS6200PEV-IS	1.28 HARD-WIRED PISTON CLOSET FV*	$245.00	111-1.28ES-S		
ZEMS6203PEV-IS	0.5 HARD-WIRED PISTON URINAL FV*	$245.00	186-0.5ES-S		
* P6000-HW6	TRANSFORMER FOR HARD-WIRED FV, WILL HANDE UP TO 8	$25.00			
ZER6200PEV-CPN	1.28 SIDE BATTERY POWERED PISTON CLOSET FV	$225.00	111-1.28-SMO		
ZER6203PEV-EWS-CPM	0.5 SIDE BATTERY POWERED PISTON URINAL FV	$225.00	186-0.5-SMO		

P6900-GEN	RETROFIT HYDRO GENERATOR FOR BATTERY FCTS	$84.80			
Z7000-S8	1.75 GPM SHOWER HEAD	$11.00			
Z7000-S9	1.5 GPM SHOWER HEAD	$11.00			
Z6704	HAND DRYER	$392.00			

*** ITEMS WITH "MAY" ON THEM WILL MEET "AMERICA" IF THEY ARE SPECIFIED WHEN ORDERED TO COMPLY**

FOR OTHER PARTS NOT LISTED ON THIS SHEET PLEASE CALL THE CHARLOTTE OFFICE

PLEASE CONTACT YOUR SALESMAN WITH ANY FURTHER QUESTIONS

QUALITY MARKETING - 3500-C WOODPARK BLVD, CHARLOTTE, NC 28206 - 704-599-9407

Assumptions for CFLs

Category	Value	Data Source
Power		
ENERGY STAR Qualified Unit		
Initial Cost per Unit	$3.40	average of available products found in EPA research, 200
Wattage	10 watts	calculated
	15 watts	calculated
	18 watts	calculated
	25 watts	calculated
	37 watts	calculated
Bulb Life	6,000 hours	LBNL 2007
	8,000 hours	LBNL 2007
	10,000 hours	LBNL 2007
	12,000 hours	LBNL 2007
Lifetime		
For 6,000 hour CFL	5 years	calculated
For 8,000 hour CFL	7 years	calculated
For 10,000 hour CFL	9 years	calculated
For 12,000 hour CFL	11 years	calculated
Conventional Unit		
Initial Cost per Unit	$0.60	average of available products found in EPA research, 200
Wattage	40 watts	LBNL 2007
	60 watts	LBNL 2007
	75 watts	LBNL 2007
	100 watts	LBNL 2007
	150 watts	LBNL 2007
Bulb Life	750 hours	LBNL 2007
	1,000 hours	LBNL 2007
Lifetime		
For 750 hour incandescent bulb	0.7 years	calculated
For 1,000 hour incandescent bulb	0.9 years	calculated
Maintenance		
Labor cost (per hour)	$20	EPA 2004
Installation labor hours	0.15 hours	Assumption
Usage		
Hours used per day	3 hours/day	LBNL 2007
Number of days per year	365 days/year	Assumption
CFL annual bulb replacements		
6,000 hours	0.18 bulbs/year	Calculated
8,000 hours	0.14 bulbs/year	Calculated
10,000 hours	0.11 bulbs/year	Calculated
12,000 hours	0.09 bulbs/year	Calculated
Incandescent annual bulb replacements		
750 hours	1.46 bulbs/year	Calculated
1,000 hours	1.10 bulbs/year	Calculated
Discount Rate		
Commercial and Residential Discount Rate (real)	4%	A real discount rate of 4 percent is assumed, which is roughly equivalent to the nominal discount rate of 7 percent (4 percent real discount rate + 3 percent inflation rate).
Energy Prices		
Commercial Electricity Price	$0.1030 $/kWh	Energy Information Administration, Annual Energy Outlook 2009 (Early Release) edition. (converted from
Residential Electricity Price	$0.1127 $/kWh	Energy Information Administration, Annual Energy Outlook 2009 (Early Release) edition. (converted from 2007 to 2008 dollars).
Carbon Dioxide Emissions Factors		
Electricity Carbon Emission Factors	1.54 lbs CO_2/kWh	EPA's Climate Change Action Plan (CCAP) number for 2009.
CO_2 Equivalents		
Annual CO_2 sequestration per forested acre	9,700 lbs CO_2/acre-yr	EPA's Greenhouse Gas Equivalencies Calculator. http://www.epa.gov/cleanenergy/energy-resources/calculator.html
Annual CO_2 emissions for "average" passenger car	12,037 lbs CO_2/acre-yr	EPA's Greenhouse Gas Equivalencies Calculator. http://www.epa.gov/cleanenergy/energy-resources/calculator.html

Products that earn the ENERGY STAR prevent greenhouse gas emissions by meeting strict energy efficiency guidelines set by the U.S. Environmental Protection Agency and the U.S. Department of Energy.
www.energystar.gov

CHANGE FOR THE BETTER WITH ENERGY STAR

Life Cycle Cost Estimate for 1 ENERGY STAR Qualified Compact Fluorescent Lamp(s)

This energy savings calculator was developed by the U.S. EPA and U.S. DOE and is provided for estimating purposes only. Actual energy savings may vary based on use and other factors. CFLs are available in a variety of shapes and sizes, but pricing in this calculator is based on the most common spiral or globe with standard screw-in base.

Enter your own values in the gray boxes or use our default values.

	ENERGY STAR Qualified Unit	Conventional Unit
Number of units	1	
Electricity Rate ($/kWh)	$ 0.113	
Hours used per day	3	
Initial cost per unit (estimated retail price)	$3.40	$0.60
Wattage (watts)	15 *	60
Lifetime (hours)	10,000	1,000

**ENERGY STAR wattage is calculated based on the wattage selected for the incandescent unit, user can enter an alternative value if desired.*

Annual and Life Cycle Costs and Savings for 1 CFLs

	1 ENERGY STAR Qualified Units	1 Conventional Units	Savings with ENERGY STAR
Annual Operating Costs*			
Energy cost	$2	$7	$6
Maintenance cost	$0	$4	$4
Total	**$2**	**$11**	**$9**
Life Cycle Costs*			
Operating cost (energy and maintenance)	$14	$85	$71
Energy costs (lifetime)	$14	$56	$42
Maintenance costs (lifetime)	$0	$30	$30
Purchase price for 1 unit(s)	$3.40	$0.60	-$2.80
Total	**$17**	**$86**	**$69**
Simple payback of initial additional cost (years)†			**0.3**

** Annual costs exclude the initial purchase price. All costs, except initial cost, are discounted over the products' lifetime using a real discount rate of 4%. See "Assumptions" to change factors including the discount rate.*

† A simple payback period of zero years means that the payback is immediate.

Summary of Benefits for 1 CFLs

Initial cost difference	**$3**
Life cycle savings	**$71**
Net life cycle savings (life cycle savings - additional cost)	**$69**
Simple payback of additional cost (years)	**0.3**
Life cycle energy saved (kWh)	**450**
Life cycle air pollution reduction (lbs of CO_2)	**693**
Air pollution reduction equivalence (number of cars removed from the road for a year)	**0.06**
Air pollution reduction equivalence (acres of forest)	**0.07**
Savings as a percent of retail price	**2020%**

Estimated Savings and Costs for New Fixtures

Existing Fixture	New Fixture	Annual Savings	Range of Cost per Unit	Estimate Used for Application
Pre-1992 model toilet, flushing at 3.5 gpf or higher	High-Efficiency Toilet [1.28 gallons per flush (gpf)]	13,850 gallons	$64 - $255	$215
1.5 gpf or higher model urinal	Low Consumption Urinal [0.125 gpf]	39,988 gallons	$361 - $489	$400
100 Watt Incandescent Light Bulb	Compact Fluorescent Light Bulb (27 Watt Compact Fluorescent Light Bulb)	450 kilowatt-hours per year	$2 - $3	$3
Standard Showerhead [2.5 to 2.2 gpm]	Low-Flow Showerhead (1.5 gpm)	11,994 gallons	$8 - $11	$3
Standard aerator [2.5 to 2.2 gpm]	Low-Flow Aerators [0.5 gallons per minute(gpm)]	3,999 gallons	$2 - $3	$3
Non-weather based irrigation timer	Weather Based Irrigation Controller(s)	4,204 gallons	$900 - $1,400	$1,250

- 325,900 gallons = 1 acre-foot
- gpf = gallons per flush
- gpm = gallons per minute

High-Efficiency Toilet Examples

FLUSHOMETER-TYPE TOILET EXAMPLE

Toto TMT1LN

- 1.28 GPF Manual Toilet Flushometer Valve Only

Our Price: **$141.60**

Toto CT705EN

- 1.28GPF Commercial Elongated Flushometer HET (Less Seat and Flush Valve)

Our Price: **$114.60 - $132.00**

TANK-TYPE TOILET EXAMPLE

PROFLO PF9412WHC White PF9400 1.28gpf High-Efficiency Toilet Tank PF9412WHC

Type: Toilets, Thermostats/Valves and Trim

1.28gpf High-Efficiency Toilet TankFeatures:Tank only Vitreous china HET (High Efficiency Toilet) Gravity fed, double jetted box rim EPA WaterSense Certified 81/2" x 7" water surface Uses 20% less water than standard low more ...

Part #:

PF9412WHC

Lowest Price: $63.65

Assumptions Used for Application
• **It is expected that there will be more tank type toilets installed through the program, therefore evening out the cost difference. This will even out the cost that was quoted in the proposal ($215**

per toilet)
• **Flushometer-type toilets would replace existing commercial flushometer toilets**
• **Tank-type toilet to be used for the other application (hotel guest rooms).**
Please note that these are <u>retail</u> prices and most likely the contractor selected to implement this program will obtain wholesale prices

High-Efficiency Urinal Examples

Water Saving, Eco-Friendly Urinal #Z5738

Shown: #Z5738.207

Manual "The Small Pint" Urinal
$361.42

Water Saving, Eco-Friendly Retrofit Urinal #Z5758

Shown: #Z5758.207

Manual "The Retrofit Pint" Urinal
$489.87

Water Saving, Eco-Friendly Retrofit Urinal #Z5759

click for larger image

Very Low Water Consumption "Retrofit Pint" Concealed Urinal = $371.23

Source: Plumbing Supply.com

One of the above model urinals is priced higher than the estimated price; however we anticipate there will be enough of a variety of

installation that we will remain under the amount budgeted for the purchase of urinals overall.

COUNTY OF LOS ANGELES

DEPARTMENT OF PUBLIC WORKS

"To Enrich Lives Through Effective and Caring Service"

900 SOUTH FREMONT AVENUE
ALHAMBRA, CALIFORNIA 91803-1331
Telephone: (626) 458-5100
http://dpw.lacounty.gov

GAIL FARBER, Director

ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1460
ALHAMBRA, CALIFORNIA 91802-1460

IN REPLY PLEASE
REFER TO FILE: WW-1

December 16, 2010

Mr. Zaffar Eusuff, Program Manager
Department of Water Resources
Division of Financial Assistance
P.O. Box 942836
Sacramento, CA 94236

Dear Mr. Eusuff:

LOS ANGELES COUNTY WATERWORKS DISTRICT NO. 29, MALIBU
LETTER OF FINANCIAL SUPPORT

We are pleased to provide this Letter of Financial Support for the West Basin Municipal Water District's (West Basin) Water and Energy Efficiency in the Schools and Hotel/Motel Sectors Program being submitted for Proposition 84 funding.

The Los Angeles County Waterworks District No. 29, Malibu (District), is a retail agency of the West Basin. West Basin's proposed project directly affects the District's service area in the City of Malibu and the unincorporated area of Topanga in the North Santa Monica Bay subregion of the Greater Los Angeles County Integrated Regional Water Management Planning area. The benefits from this project are so substantial that the District is committing a financial contribution of up to $108,000 towards this project.

The City of Malibu and the unincorporated area of Topanga are 100 percent dependent on imported water supplies and, therefore, water conservation programs are vital for ensuring the reliability of water in this area. We believe that the anticipated annual savings of 82 acre-feet of water and 347,945 kilowatt-hours of electricity will have a significant impact to this area. These savings will also assist in meeting the State's 20 percent energy and water conservation target by 2020. The schools and hotels/motels will benefit from the actual device retrofits while providing an opportunity to educate the students of the schools and guests of the hotels/motels on conserving water and energy.

We look forward to this project being implemented within our service area and helping to meet the State's targets for energy and water conservation.

If you have any questions, please contact Ms. Virginia Maloles-Fowler at (626) 300-3362 or vmfowler@dpw.lacounty.gov.

Very truly yours,

GAIL FARBER
Director of Public Works

FOR ADAM ARIKI
Assistant Deputy Director
Waterworks Division

DR:lr
LTS209

Enc.

AB 1420 Self- Certification Statement Table 1

Note: Table 1 documents Status of Past and Current BMP implementation.

Self-Certification Statement: The Urban Water Supplier and its authorized representative certifies, under penalty of perjury, that all information and claims, stated in this table, regarding compliance and implementation of the BMPs, including alternative conservation approaches, are true and accurate. This signed AB 1420 Self-Certification Statement Table 1, and Table 2 are the basis for granting funds by the Funding Agency. Falsification and/or inaccuracies in AB 1420 Self Certification Statement Table 1, and Table 2 and in any supporting documents substantiating such claims may, at the discretion of the funding agency, result in loss of all State funds to the applicant. Additionally, the Funding Agency, in its sole discretion, may halt disbursement of grant or loan funds, not pay pending invoices, and/or pursue any other applicable legal remedy and refer the matter to the Attorney General's Office.

Name of Signatory ________ Dan Lafferty ______ Title of Signatory Assistant Division Head ________ Signature of signatory Daniel Lafferty Date 12/16/10

Application Date:

Proposal Identification Number: [ ] **CUWCC Member? Yes/No** Yes

Has Urban Water Supplier submitted a 2005 Urban Water Management Plan? Yes/No Yes **Is the UWM Plan Deemed Complete by DWR? Yes/No** Yes

Applicant Name: Los Angeles County Waterworks District No. 29

Project Title:

Applicant's Contact Information: **Name:** Virginia S. Maloles-Fowler **Phone:** (626) 300-3362 **E-mail:** vmfowler@dpw.lacounty.gov

Participants:

Retailer (List Below)	*Wholesaler (List Below)*
LA County Water Works #29	

C1

C2	C3	C4	C5	*C6	C7	**C8	**C9	**C10	C11	C12	C13	C14	C15	C16	C17	C18
			BMP Implemented by Retailers and/or Wholesalers / BMP			Compliance Options/Alternative Conservation Approaches (1)			BMP Is Exempt (2)			BMP Implementation Requirements Met				
BMPs required for Wholesale Supplier	BMPs required for Retail Supplier	BMPs	Retailer *Yes/No*	Wholesaler *Yes/No*	Regional *Yes/No*	BMP Checklist	Flex Track	Gallons Per Capita Per Day GPCD	Not Cost Effective	Lack of Funding	Lack of Legal Authority	CUWCC MOU Requirement Met: Retailer *Yes/No*	CUWCC MOU Requirement Met: Wholesaler *Yes/No*	Date of BMP Report Submitted to CUWCC for (2007-2008) (MOU Signatories)	Date BMP Implementation Data Submitted to DWR in CUWCC Format (Non MOU Signatories) (3)	All Supporting Documents have been Submitted Yes/No
	✓	BMP 1 Water Survey for Single/Multi-Family Residential Customers	Yes									No		May-09		
	✓	BMP 2 Residential Plumbing Retrofit	Yes									No		May-09		
✓	✓	BMP 3 System Water Audits, Leak Detection	Yes									Yes		May-09		
✓	✓	BMP 3 Leak Repairs	Yes									Yes		May-09		
	✓	BMP 4 Metering with Commodity Rates for All New connections	Yes									Yes		May-09		

C1

C2	C3	C4	C5	*C6	C7	**C8	**C9	**C10	C11	C12	C13	C14	C15	C16	C17	C18
			BMP Implemented by Retailers and/or Wholesalers / *BMP*			Compliance Options/Alternative Conservation Approaches (1)			BMP Is Exempt (2)			BMP Implementation Requirements Met				
BMPs required for Wholesale Supplier	BMPs required for Retail Supplier	BMPs	Retailer *Yes/No*	Wholesaler *Yes/No*	Regional *Yes/No*	BMP Checklist	Flex Track	Gallons Per Capita Per Day GPCD	Not Cost Effective	Lack of Funding	Lack of Legal Authority	CUWCC MOU Requirement Met: Retailer *Yes/No*	CUWCC MOU Requirement Met: Wholesaler *Yes/No*	Date of BMP Report Submitted to CUWCC for (2007-2008) (MOU Signatories)	Date BMP Implementation Data Submitted to DWR in CUWCC Format (Non MOU Signatories) (3)	All Supporting Documents have been Submitted Yes/No
	✓	BMP 4 Retrofit of Existing Connections	Yes									No		May-09		
	✓	BMP 5 Large Landscape Conservation Programs and Incentives	Yes									Yes		May-09		
	✓	BMP 6 High-Efficiency Washing Machine Rebate Programs	Yes									No		May-09		
✓	✓	BMP 7 Public Information	Yes									No		May-09		
✓	✓	BMP 8 School Education	Yes									Yes		May-09		
	✓	BMP 9 Conservation programs for Commercial, Industrial, and Institutional (CII) Accounts	Yes									Yes		May-09		
✓		BMP 10 Wholesale Agency Assistance Programs														
	✓	BMP 11 Conservation Pricing	Yes									Yes		May-09		
✓	✓	BMP 12 Conservation Coordinator	Yes									Yes		May-09		
	✓	BMP 13 Water Waste Prohibitions	Yes									No		May-09		
	✓	BMP 14 Residential ULFT Replacement Programs	Yes									No		May-09		

***C6:** Wholesaler may also be a retailer (supplying water to end water users)
****C8, **C9, **, and C10:** Agencies choosing an alternative conservation approach are responsible for achieving water savings equal or greater than that which they would have achieved using only BMP list.

(1) For details, please see: http://www.cuwcc.org/mou/exhibit-1-bmp-definitions-schedules-requirements.aspx.
(2) BMP is exempt based on cost-effectiveness, lack of funding, and lack of legal authority criteria as detailed in the CUWCC MOU
(3) Non MOU signatories must submit to DWR reports and supporting documents in the same format as CUWCC.

AB 1420 Self- Certification Statement Table 2

Provide Schedule, Budget, and Finance Plan to Demonstrate Commitment to Implement All BMP's to Become in Compliance with BMP Implementation - Commencing Within 1st Year of Agreement for Which Applicant Receives Funds.

Self-Certification Statement: The Urban Water Supplier and its authorized representative certifies, under penalty of perjury, that all information and claims, stated in this table, regarding compliance and implementation of the BMPs, including alternative conservation approaches, are true and accurate. This signed AB 1420 Self-Certification Statement Table 1 and Table 2 are the basis for granting funds by the Funding Agency. Falsification and/or inaccuracies in AB 1420 Self Certification Statement Table 1 and Table 2, and in any supporting documents substantiating such claims may, at the discretion of the funding agency, result in loss of all State funds to the applicant. Additionally, the Funding Agency, in its sole discretion, may halt disbursement of grant or loan funds, not pay pending invoices, and/or pursue any other applicable legal remedy and refer the matter to the Attorney General's Office.

Name of Signatory Dan Lafferty Title of Signatory Assistant Division Head Signature of signatory Date 12/16/10

Application Date:

Proposal Identification Number: 5026 CUWCC Member? Yes/No Yes

Applicant Name: Los Angeles County Waterworks District No. 29 Is the UWM Plan Deemed Complete by DWR? Yes/No Yes

Project Title:

Applicant's Contact Information: Name Virginia S. Maloles-Fowler

	Retailer (List Below)		
Participants:	LA County Water Works #29		

C1	C2	C3	C4	C5	*C6	C7	C8	**C9	**C10	**C11	C12			C13	C14	C15	C16	C17	C18	C19
				BMP Implemented by Retailers and/or Wholesalers				Compliance Options / Alternative Conservation Approaches (1)			BMP is Exempt (2)			Implementation Scheduled to Commence within 1st Year of Agreement						
CUWCC 2010 Flex Track BMPs	BMPs required for Wholesale Supplier	BMPs required for Retail Supplier	BMPs	Retailer Yes/No	Wholesaler Yes/No	Regional Yes/No	Alternative Conservation Approaches Yes/No	BMP Checklist	Flex Track	Gallons Per Capita Per Day GPCD	Not Cost Effective	Lack of Funding	Lack of Legal Authority	Start Date (MM/YR)	Completion Level (%)	BMP Completion Date (MM/YR)	Budget (Dollars)	Funding Source & Finance Plan to Implement BMPs	Meets CUWCC Coverage Yes/No	Funds Requested if Available? (See AB 1420 Compliance Table 3) Yes/No
1. Utility Operations Programs																				
1.11	✓	✓	BMP 12 Conservation Coordinator																	
1.12		✓	BMP 13 Water Waste Prohibitions	Yes			No						√	Mar-11	50%	Mar-12	0	WWD No. 29 General Fund'	Yes	No
1.13	✓	✓	BMP 10 Wholesale Agency Assistance Programs																	
1.20	✓	✓	BMP 3 System Water Audits, Leak Detection/Repair																	
1.30		✓	BMP 4 Metering with Commodity Rates for All New/Retrofit of Existing connections	Yes			Yes	√						Jun-95			0	WWD No. 29 General Fund'	Yes	No
1.40		✓	BMP 11 Conservation Pricing																	
2. Educational Programs																				
2.10	✓	✓	BMP 7 Public Information	Yes			Yes		√					Dec-11	20%	Dec-16	0	WWD No. 29 General Fund'	Yes	No
2.20	✓	✓	BMP 8 School Education																	
3. Residential																				
3.11		✓	BMP 1 Indoor Water Survey for Single/Multi-Family Residential Customers	Yes			Yes		√					Dec-11	20%	Dec-16	$ 50,250	WWD No. 29 General Fund' & Prop 50 Grant	Yes	No
3.12			BMP 1 Outdoor Water Survey for Single/Multi-Family Residential Customers	Yes			Yes		√					Dec-11	20%	Dec-16	$ 50,250	WWD No. 29 General Fund' & Prop 50 Grant	Yes	No

CUWCC 2010 Flex Track BMPs	BMPs required for Wholesale Supplier	BMPs required for Retail Supplier	BMPs	BMP Implemented by Retailers and/or Wholesalers: Retailer Yes/No	Wholesaler Yes/No	Regional Yes/No	Alternative Conservation Approaches Yes/No	Compliance Options / Alternative Conservation Approaches (1): BMP Checklist	Flex Track	Gallons Per Capita Per Day GPCD	BMP is Exempt (2): Not Cost Effective	Lack of Funding	Lack of Legal Authority	Implementation Scheduled to Commence within 1st Year of Agreement: Start Date (MM/YR)	Completion Level (%)	BMP Completion Date (MM/YR)	Budget (Dollars)	Funding Source & Finance Plan to Implement BMPs	Meets CUWCC Coverage Yes/No	Funds Requested, if Available. (See AB 1420 Compliance Table 3) Yes/No
3.20		✓	BMP 2 Residential Plumbing Retrofit	Yes			Yes		√					Dec-11	20%	Dec-16	$ 50,250	WWD No. 29 General Fund' & Prop 50 Grant	Yes	
3.30		✓	BMP 6 High-Efficiency Washing Machine Rebate Programs	Yes			Yes		√					Dec-11	20%	Dec-16	$ 22,500	WWD No. 29 General Fund' & Prop 50 Grant	Yes	No
3.40		✓	BMP 14 Residential ULFT Replacement Programs	Yes			Yes		√					Dec-11	20%	Dec-16	$ 22,500	General Fund' & Prop 50 Grant	Yes	No
4. Commercial, Industrial, Institutional																				
4.00		✓	BMP 9 Conservation programs for Commercial, Industrial, and Institutional (CII) Accounts																	
5. Landscape																				
5.00		✓	BMP 5 Large Landscape Conservation Programs and Incentives																	

*C6: Wholesaler may also be a retailer (supplying water to end water users)
**C9, ** C10, and **C11: Agencies choosing an alternative conservation approach are responsible for achieving water savings equal or greater than that which they would have achieved using only BMP list.
(1) For details, please see http://www.cuwcc.org/mou/exhibit-1-bmp-definitions-schedules-requirements.aspx.
(2) BMP is exempt based on cost-effectiveness, lack of funding, or lack of legal authority, as detailed in the CUWCC MOU.

<u>**Showerhead Examples**</u>

Ultra Saver Showerhead, 1.5 GPM

Price: □7.49

1.5 GPM SHOWERHEAD W/PUSH BTN. - 1 EA

Image for illustration purposes only

Click here to view alternate photo

Information	
Product Code:	9707704 (BD SKU 882584)
Manufacturer:	WHEDON PRODUCTS (1)
Manufacturer's P□N:	USB4C
UPC:	043433312432

Pricing Details	
Retail Price:	~~**□10.45**~~
Your Price:	**□8.96** □1 EA (you must purchase at least 2)
Stock:	Only **23** left in stock

	(most orders ship within 24 business hours)
Weight:	3.68 pounds
Quantity to Order:	2 **(System may automatically enter minimum order quantity)**

<u>Aerator Examples</u>

0.5 GPM Low Flow Dual-Thread Faucet Aerator - Kitchen □ Bathroom

2 new from □2.00

0.5 GPM Low Flow Dual-Thread Faucet Aerator - Kitchen □ Bathroom

Our Price: **□2.00**

□Shipping: □4.99