COPY

WaterSMART: 2014 Title XVI Water Reclamation and Reuse Program

Alamitos Barrier Recycled Water Project Grant Application Proposal

Contact:

Paul Fu, Senior Engineer
Water Replenishment District of Southern California
4040 Paramount Boulevard
Lakewood, CA, 90712
Email: pfu@wrd.org
Phone/Fax: (562) 275-4251

Prepared for:
U.S. Department of the Interior, Bureau of Reclamation
Policy and Administration
Funding Opportunity Number: R14AS00002

Previous Financial Assistance Agreements
00-FC-30-0008, ARRA R10AC35R19, R11AC35299, R12AC35346, R12AC35346 (FOA13)

Prepared by:
Water Replenishment District of Southern California
DUNS Number: 076235431

January 3, 2014

Table of Contents

Technical Proposal

1. Executive Summary

The Water Replenishment District of Southern California (WRD) located in Lakewood, Los Angeles County, California was established in 1959 under the California Water Code (CWC) to manage the groundwater resources of the Central Basin and West Coast Basin (CBWCB). The WRD is responsible for maintaining adequate groundwater supplies, preventing seawater intrusion into the underground aquifers, and protecting groundwater quality against contamination. In a joint effort with the Los Angeles County Department of Public Works (LACDPW), WRD operates a program to artificially replenish the CBWCB by spreading and injecting replenishment water.

WRD utilizes spreading facilities and three seawater intrusion barriers, including the Alamitos Seawater Intrusion Barrier (Alamitos Barrier Project or ABP). WRD purchases potable water as well as produces advanced treated recycled water for injection into the Alamitos Barrier. The potable water is purchased through the Long Beach Water Department (LBWD). The potable water is supplied via LB7A station that connects to a regional supply pipeline owned by the Metropolitan Water District of Southern California (MWD). Since October 2005, the Leo J. Vander Lans Water Treatment Facility (LVLWTF) located in Long Beach, Los Angeles County California, also known as the Alamitos Barrier Recycled Water Project (Project), has provided advanced treated recycled water to the Alamitos Barrier. The recycled water and the potable water are mixed through a blend station prior to conveyance to the Alamitos Barrier for injection.

To replace the use of imported water, WRD is committed to expand the production capacity of the LVLWTF from 3.0 million gallons per day (mgd) to 8.0 mgd (Project). WRD currently receives tertiary treated (Title 22) recycled water from the adjacent Los Angeles County Sanitation District's (LACSD's) Long Beach Water Reclamation Plant (LBWRP). The Long Beach Water Department (LBWD) owns rights to the Title 22 recycled water produced at LACSD's LBWRP, which serves as the source water for the LVLWTF. Under a contract with the WRD, the LBWD operates and maintains the LVLWTF and furnishes the advanced treated recycled water to the ABP. After the LVLWTF expansion, the LBWD will continue to operate the facility and provide source water to the LVLWTF. In order to ensure a sufficient supply of source water to meet the expansion requirements of the LVLWTF, WRD has executed an agreement with LBWD to purchase additional Title 22 recycled water for treatment by LVLWTF. The current LVLWTF has a production capacity of approximately 3,000 acre-feet per year (AFY). Upon completion of the expansion, the future production capacity is estimated at 8,000 AFY.

2. Technical Project Description

2.1 Role of WRD

The WRD manages groundwater for approximately four million residents (about 10 percent of the entire population of the State of California) in 43 cities in southern Los Angeles County within the Central and West Coast Groundwater Basins. The 420 square mile service area uses approximately 250,000 acre-feet (AF) of groundwater per year, which equates to nearly 40 percent of the total water demand for this area.

Historically the WRD has purchased imported water delivered by the Metropolitan Water District of Southern California (MWD) for groundwater replenishment and barrier injection. The WRD typically purchases over 30,000 acre-feet per year (afy) of imported water. In addition, the WRD purchases nearly 70,000 afy of recycled water from the County Sanitation Districts of Los Angeles County (CSDLAC), West Basin Municipal Water District (WBMWD) and the Los Angeles Department of Water and Power (LADWP).

In recent years, the availability of imported water for replenishment has become less reliable due to a combination of drought and water export restrictions from the Sacramento-San Joaquin Bay Delta. As a result, more reliable replenishment supplies are needed in order to sustain the current pumping demands of the groundwater users. WRD is moving to create a locally sustainable groundwater replenishment supplies that reduce and ultimately eliminate dependence on imported water.

Through its comprehensive water conservation/reuse program, Water Independence Now (WIN), the WRD pursues projects that develop local, sustainable sources of water for replenishment of the Central and West Coast Groundwater Basins. A reliable supply of water for basin recharge is increasingly important as drought conditions continue, and the availability of imported water to the Los Angeles area is reduced.

2.2 Alamitos Barrier Project Description

The LVLWTF is a state-of-the-art water treatment facility located in the City of Long Beach, California. The LVLWTF presently can satisfy up to 3,000 AFY of the total water demand for the Alamitos Barrier, which is an engineered fresh water pressure ridge designed to protect the Central Groundwater Basin of Los Angeles County and the southwest portion of the Coastal Plain area in Orange County from seawater intrusion. WRD supplies the water injected into the Los Angeles County side of the barrier and the Orange County Water District (OCWD) purchases the water injected into the Orange County side of the barrier. The pressure ridge is created by the injection of a blend of recycled water and potable water into the groundwater aquifer, thereby preventing further seawater intrusion. Potable water for injection to the Alamitos Barrier consists of water imported from the State Water Project and/or Colorado River water while the recycled water is supplied from the LVLWTF.

The LVLWTF's main role is to produce recycled water through advanced treatment of wastewater. The LVLWTF processes Title 22 recycled water from the LACSD's LBWRP using microfiltration

(MF), reverse osmosis (RO), and ultraviolet (UV) light. Approximately three million gallons (mgd) of near-distilled quality water are produced daily, blended with imported water, and then pumped into the Alamitos Barrier. Presently, the LVLWTF's existing plant effluent capacity is 3.0 mgd. The treatment plant was designed to accommodate future expansion to 8.0 mgd. By implementing this expansion, WRD will reduce the need for potable water to be blended prior to injection. The expansion of the LVLWTF could enable WRD to increase its recycled water contribution (RWC) to the Alamitos Barrier from 50 percent to 100 percent, thereby, reducing and ultimately eliminating the need for potable blending water.

2.3 Collaboration with Bureau of Reclamation

Under the Title XVI Water Reclamation and Reuse Program, WRD has received support for the LVLWTF Expansion project from the U.S. Bureau of Reclamation (USBR) through the following cooporative assistance agreements:

Agreement No.	Description
Agreement 00-FC-30-0008	Original LVLWTF Design and Construction
ARRA Agreement R10AC35R19	Predesign for expansion of LVLWTF
Agreement R11AC35299	Final Design for expansion of LVLWTF
Agreement R12AC35346	Construction for expansion of LVLWTF
Agreement R12AC35346 (FOA13)	Construction for expansion of LVLWTF

As of January 2014, WRD hereby requests supplemental funding assistance through the FY 2014 WaterSMART Title XVI Program to partially fund the cost of constructing the LVLWTF facility expansion. The Project's feasibility and design activities are complete and its construction phase is currently approximately 60 percent complete.

2.4 Participating Agencies and Contractual Commitments

The LVLWTF expansion will be achieved through the cooperative efforts of the agencies listed in Table 1. The roles and duties of the project participants are described in the table. Specific contractual commitments among the project participants are also indicated.

2.5 Alamitos Barrier Project Location

The project site is located at 7380 East Willow Street in Long Beach, California, near the southeast corner of Los Angeles County, approximately two miles inland from the Pacific Ocean. The location is depicted on Figure 1. As shown on Figure 1, the LVLWTF is constructed on a rectangular site that is located within a triangular parcel of land south of East Willow Street with Coyote Creek to the east/southeast and the San Gabriel River to the west. The proposed expansion

Table 1: Project Participants and Their Roles

Project Participant	Roles
Water Replenishment District of Southern California (WRD)	Manages the Central and West Coast Groundwater Basins in Los Angeles County. WRD purchases water injected into the ABP for the benefit of Los Angeles County. WRD owns the site for the LVLWTF and is purveyor of recycled water produced at the LVLWTF. WRD serves as the lead agency under the CEQA and certified the Negative Declaration for the ABP expansion.
City of Long Beach Water Department (LBWD)	Owns rights to the Title 22 filtered/disinfected tertiary recycled water produced at LACSD's LBWRP, which serves as the source water for the LVLWTF. Under a contract with the WRD, the LBWD operates and maintains the LVLWTF and furnishes the advanced treated recycled water to the ABP. After the LVLWTF expansion, the LBWD will continue to operate the facility and provide source water (tertiary water) to the LVLWTF.
Los Angeles County Department of Public Works (LACDPW)	Owns and operates the ABP and maintains the existing water transmission pipeline, distribution header, injection wells, extraction wells and monitoring wells along the ABP. WRD and LACDPW has a long-term agreement for replenishment at the ABP where WRD is responsible to provide either imported water of recycled for injection and LACDPW is responsible for the physical injection of the water into the barrier.
Los Angeles County Sanitation District (LACSD)	Serves as the regional wastewater management agency and owns and operates the LBWRP. LACSD receives the residual solids and brine generated by LVLWTF for conveyance and treatment at its Joint Water Pollution Control Plant. LACSD administers the source control program for industrial and commercial dischargers into the LBWRP and has entered into a Memorandum of Understanding with WRD for operation of the source control program to meet CDPH requirements.
California Department of Public Health (CDPH)	Regulates groundwater projects that use recycled water under the State Water Recycling Criteria (Title 22 of the Code of Regulations). CDPH has not yet promulgated specific regulations for groundwater recharge projects and uses draft regulations as guidance for providing recommendations to the RWQCB for permit conditions.
Los Angeles Regional Water Quality Control Board (LARWQCB)	Regulates discharges to groundwater and surface water in the Los Angeles Region. The ABP site is on the border between two RWQCB regions: the LARWQCB and the Santa Ana RWQCB. For the ABP, the Santa Ana RWQCB has deferred to the LARWQCB, in whose region the injection facilities are located, to issue the WDR and WRR for the ABP. The existing project operates under Order No. R4-2005-0061 and SWRCB Order WQ 2006-0001.
Metropolitan Water District (MWD)	Provides potable imported water to LBWD for injection into the ABP. Administer Local Resources Program (LRP) for the ABP.
State Water Resources Control Board (SWRCB)	Protects surface water and groundwater quality by setting statewide policy, coordinating and supporting the RWQCB efforts, and reviewing petitions that contest RWQCB actions. The SWRCB is also solely responsible for allocating surface water rights.
US Bureau of Reclamation (USBR)	Provide partial funding to the Project activities via Title XVI Water Reclamation and Reuse Program. Monitor and provide federal oversight of activities performed under the funding agreement.
California Department of Water Resources	Provide partial funding to the Project activities via California Proposition 84 Integrated Regional Water Management Implementation funding. Monitor and provide state oversight of activities performed under the funding agreement.

would occur within the existing LVLWTF property. The Coyote Creek flows into the San Gabriel River south of the site. Both the San Gabriel River and Coyote Creek are concrete-lined channels. The LBWRP is within the parcel of land immediately to the south of the project site. The remainder of the adjacent land consists of disturbed vacant land crossed by drainage channels and dirt paths/roads to the north and a Southern California Edison (SCE) high voltage powerline easement to

the west. Other uses near the project site include the Coyote Creek Bikeway and San Gabriel River Bike Trail to the east/southeast and west respectively, and Interstate-605 (I-605) to the east. The El Dorado Park Golf Course is located to the west, opposite the San Gabriel River, and the El Dorado Nature Center, a part of El Dorado Regional Park, is located to the north, opposite East Willow Street.

Figure 1 – Regional Map

2.6 Existing Facilities

The LVLWTF occupies approximately four acres. The building pad was constructed on fill material at an elevation of 30 feet above mean sea level (MSL), approximately 18.5 feet above the adjacent ground elevation level. The facility is accessed from a service road off of eastbound East Willow Street. It has a gated entry and is surrounded by chain link security fencing.

WRD owns the LVLWTF, which provides advanced treatment of tertiary effluent from the LBWRP and is designed to achieve the water quality required for groundwater recharge. Since October 2005, the LVLWTF has produced recycled water with water quality equivalent or superior to the quality of the historical imported potable water used for the barrier injection. The Los Angeles Regional Water Quality Control Board (LARWQCB) has established water quality standards (i.e., Basin Standards) for the Central Basin. The advanced treated recycled water from LVLWTF has significantly reduced concentrations of water quality parameters in the Basin Standards, and therefore, has improved the water quality in the Central Basin near the Alamitos Barrier.

Operated by LACSD, LBWRP provides tertiary treatment to influent water received from the City of Long Beach and the surrounding areas, and supplies reclaimed water (disinfected filtered tertiary recycled water) to the LVLWTF. The effluent exits the southern end of the LBWRP and is either delivered to the Long Beach reclaimed water system pumping station and pumped north along the San Gabriel River to the Long Beach Water Department (LBWD) reclaimed water system and to the LVLWTF; or is dechlorinated and discharged into Coyote Creek to the east. The LBWRP includes full secondary and tertiary (filtration and disinfection) treatment capacity to meet the California Department of Public Health (CDPH) Title 22 requirements for various end 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. The City of Long Beach operates the reclaimed water system, which provides reclaimed water for parks, golf courses and greenbelt irrigation, as well as feed water for the LVLWTF.

The existing LVLWTF facility consists of the following treatment process equipment:

- Automatic strainers,
- MF system with eight 25-module MF units, excess flow recirculation, compressed air system, and membrane cleaning system,
- Equalization tank,
- RO transfer pumps,
- Cartridge filter,
- High pressure RO feed pump,
- Two-stage RO train,
- UV disinfection system,
- Decarbonator,
- Product water pumps, and
- Chemical storage.

Electric and control equipment are located within a 2,000 square-foot maintenance building.

Site drainage/runoff from the plant flows to the base of the slope (i.e., berm). The site has electrical power and other utilities. The locations of the existing facilities are shown in Figure 2. Photos of the existing treatment processes are provided in Figure 3.

Figure 2 – Existing Facilities Plan

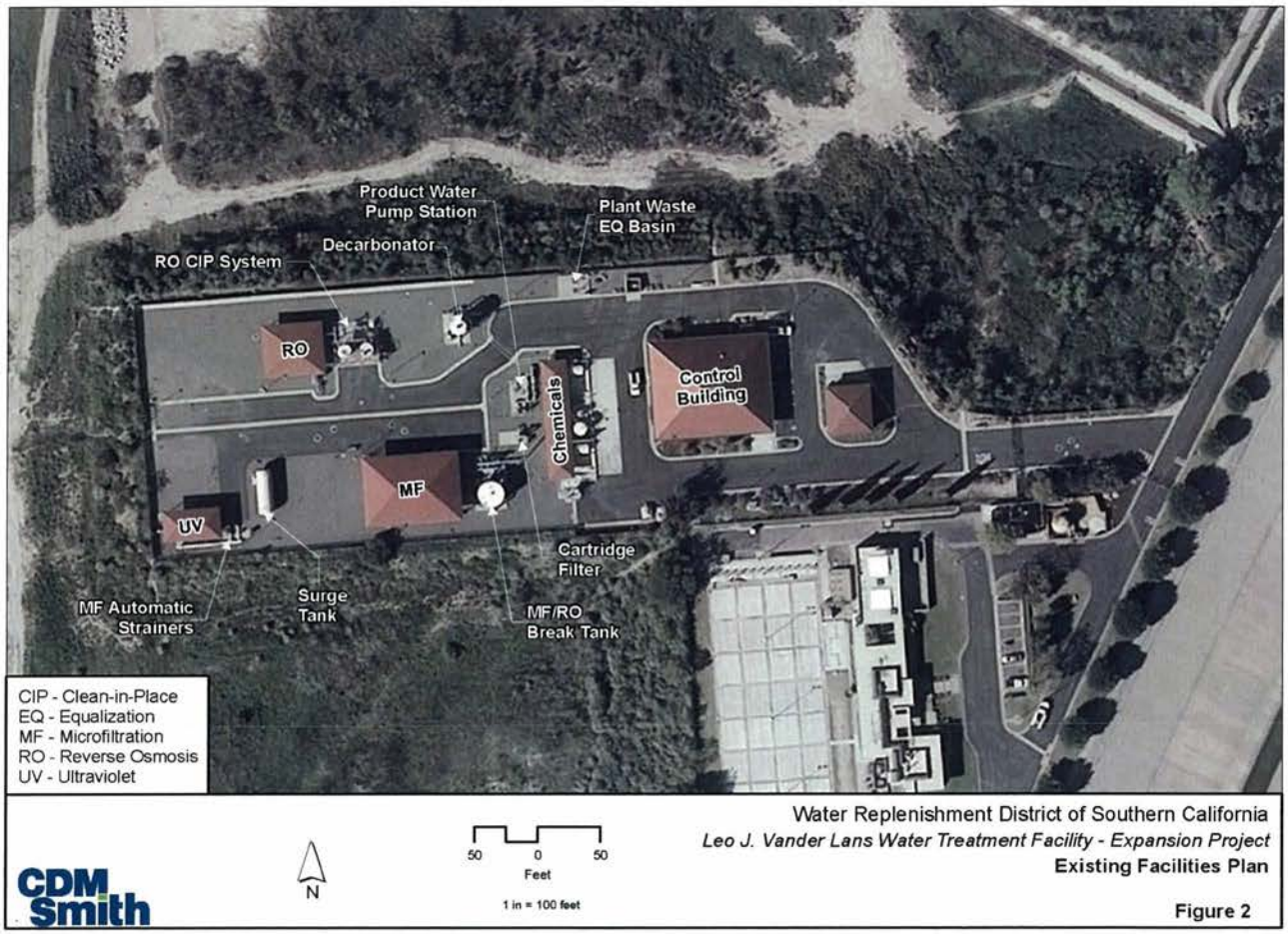


Figure 3 – Existing Treatment Facilities Photo

Existing MF

Existing RO

Existing UV System

Figure 3: Existing Treatment Facilities Photos

2.7 New Facilities

WRD is expanding the LVLWTF to increase recycled water production capacity from 3.0 mgd up to 8.0 mgd. The additional increment of recycled water will be used for the Alamitos Barrier to provide up to 100 percent of the Recycled Water Contribution (RWC) for the barrier.

The proposed project would be constructed within the existing four-acre LVLWTF site owned by the WRD. Consistent with the existing facilities, the proposed expansion would use tertiary effluent from the LBWRP, which is treated to meet Title 22 non-potable reuse standards. Influent flows into the LVLWTF site would continue via the current location at the southwest portion of the site. The LVLWTF would improve the quality of the reclaimed water to meet the more rigorous standards required for injection into the Alamitos Barrier.

The LVLWTF expansion would increase the capacities of the MF, RO, and UV treatment systems and add hydrogen peroxide (capacity for advanced oxidation) to the process, add MF backwash waste recovery treatment using dissolved air flotation (DAF) and backwash treatment (BWT) MF, and add post treatment systems for stabilization.

The amount of waste discharged to the sewer system would continue to be subject to the current LACSD limitation of 760,000 gallons per day (gpd). To not exceed this limit, the proposed project needs to provide the additional five mgd of treatment capacity without increasing the waste flow to the sewer. The water from the MF system would be treated and reused while a third stage would be added to the RO to increase the RO recovery rate. The expanded plant would have an overall 92 percent recovery rate.

The treatment process and water quality are summarized in Section 2.7.1 and 2.7.2 below.

2.7.1 Site and Treatment Processes

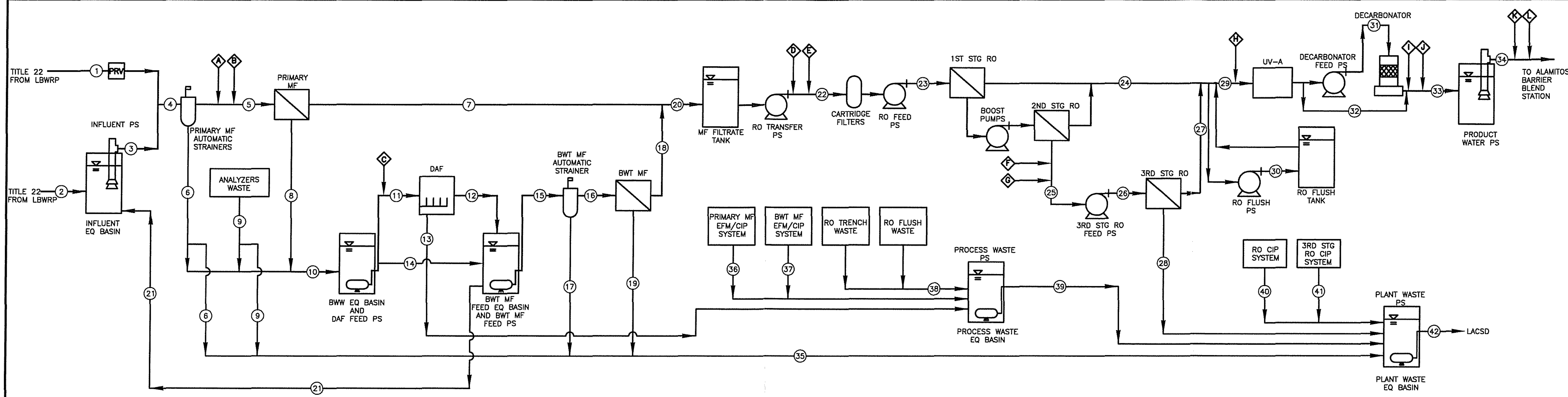
The LVLWTF expansion will increase the capacity of the processes in the current treatment train, comprised of microfiltration (MF), reverse osmosis (RO) and ultraviolet light (UV) disinfection. Figure 4 shows a process flow diagram. The new facilities will be located on the same site as shown in the site layout on Figure 5.

Influent Equalization Tank

A new influent equalization tank will be added for regulating the source water flow from LBWRP. The influent may be discharged directly to the automatic strainers under pressure or be discharged first into the equalization tank prior to low-head pumping to the automatic strainers.

Microfiltration System and MF Backwash Treatment System

The Pall MF system will be expanded to provide approximately 8.35 mgd of MF filtrate. Six new Pall MF Quad racks with 100 modules per rack (600 modules total) will be installed west of the current system. Each of the quad racks acts as a separate train. The MF system is sized for a flux



	TITLE 22 FROM LBWRP	TITLE 22 FROM LBWRP	TITLE 22 FROM LBWRP	STRAINER FEED	PRIMARY MF FEED	STRAINER BWW (NOTE 4)	PRIMARY MF FILTRATE	PRIMARY MF BWW (NOTE 4)	ANALYZERS WASTE	TOTAL BWW EQ	DAF FEED	DAF EFFLUENT	DAF WASTE (NOTE 4)	DAF BYPASS	BWT MF STRAINER FEED	BWT MF FEED	BWT MF STRAINER BWW (NOTE 4)	BWT MF FILTRATE	BWT MF BWW (NOTE 4)	TOTAL MF FILTRATE	DAF EFFLUENT RETURN (BWT MF BYPASS) (FUTURE)
PROCESS STREAM ID	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
RECOVERY (%)					99.5%		94%					98%				99.5%		89%			
DESIGN FLOW (MGD)	8.70	8.70	8.70	8.70	8.65	0.04	8.14	0.52	0.022	0.58	0.58	0.57	0.012	0.58	0.57	0.57	0.003	0.51	0.063	8.62	0.57
MAXIMUM FLOW (GPM)	6,070	6,070	6,470	6,470	6,470	302	6,010	800	15	1,120	406	406	390	406	398	398	20	396	200	6,390	400
AVERAGE PRESSURE (PSI)	60	5	25	25	20	NOTE 3	10	NOTE 3	NOTE 3	NOTE 3	5	NOTE 3	NOTE 3	5	40	40	NOTE 3	10	NOTE 3	10	NOTE 3
MAXIMUM PRESSURE (PSI)	100	10	35	35	30	NOTE 3	30	NOTE 3	NOTE 3	NOTE 3	10	NOTE 3	NOTE 3	10	50	50	NOTE 3	30	NOTE 3	30	NOTE 3
AVERAGE DOSE (MG/L)																					
MAXIMUM DOSE (MG/L)																					

	RO LOW PRESSURE FEED	RO HIGH PRESSURE FEED	1ST & 2ND STAGE RO PERMEATE	1ST & 2ND STAGE RO CONCENTRATE	3RD STAGE RO FEED	3RD STAGE RO PERMEATE	3RD STAGE RO CONCENTRATE	UV FEED	RO FLUSH WATER	DECARBONATOR FEED	DECARBONATOR BYPASS	STABILIZED WATER	FINAL PRODUCT WATER	MF WASTE EQ FLOW	PRIMARY MF EFM/CIP WASTE (NOTE 5)	BWT MF EFM/CIP WASTE (NOTE 5)	RO TRENCH WASTE AND RO FLUSH WASTE (NOTE 6)	PROCESS WASTE EQ	RO CIP WASTE (NOTE 7)	3RD STAGE RO CIP WASTE (NOTE 7)	TOTAL PLANT WASTE DISCHARGE
PROCESS STREAM ID	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42
RECOVERY (%)			85%			52%															
DESIGN FLOW (MGD)	8.62	8.62	7.33	1.29	1.29	0.67	0.62	8.00	0.14	3.00	5.00	8.00	8.00	0.07	0.020	0.0059	0.0166	0.054	0.012	0.0015	0.740
MAXIMUM FLOW (GPM)	5,990	5,990	5,090	898	898	467	430	5,560	100	2,080	5,560	5,560	5,560	220	800	200	440	650	1,440	350	570
AVERAGE PRESSURE (PSI)	40	150	5	90	160	5	NOTE 3	5	10	10	NOTE 3	NOTE 3	70	NOTE 3	NOTE 3	NOTE 3	NOTE 3	5	NOTE 3	NOTE 3	5
MAXIMUM PRESSURE (PSI)	40	220	10	120	200	10	NOTE 3	10	10	10	NOTE 3	NOTE 3	70	NOTE 3	NOTE 3	NOTE 3	NOTE 3	10	NOTE 3	NOTE 3	10
AVERAGE DOSE (MG/L)																					
MAXIMUM DOSE (MG/L)																					

	AQUEOUS AMMONIA	SODIUM HYPOCHLORITE	FERRIC CHLORIDE	SULFURIC ACID	THRESHOLD INHIBITOR	SULFURIC ACID	THRESHOLD INHIBITOR	HYDROGEN PEROXIDE	SODIUM HYDROXIDE	CALCIUM CHLORIDE	SODIUM HYPOCHLORITE	AQUEOUS AMMONIA
PROCESS STREAM ID	A	B	C	D	E	F	G	H	I	J	K	L
RECOVERY (%)												
DESIGN FLOW (MGD)												
MAXIMUM FLOW (GPM)												
AVERAGE PRESSURE (PSI)												
MAXIMUM PRESSURE (PSI)												
AVERAGE DOSE (MG/L)	1.0	4.0	30	37	2.0	140	0.0	3.5	20	20	4.0	1.0
MAXIMUM DOSE (MG/L)	1.5	6.0	100	40	3.0	180	4.0	5.0	50	35	6.0	1.5

NOTES:

1. AVERAGE FLOWS REPRESENT SYSTEM DESIGN CAPACITY ON A 24-HR BASIS.
2. MAXIMUM FLOWS REPRESENT PEAK INSTANTANEOUS FLOW CONDITIONS PRIMARILY RESULTING FROM MF SYSTEM BACKWASH SEQUENCES.
3. GRAVITY FLOW OR MINIMAL HEAD.
4. INTERMITTENT FLOW.
5. PERIODIC FLOW. FLOWS ASSUME EFM CLEANING OF 3 PRIMARY MF SKIDS AND 2 BWT MF SKIDS PER DAY. FLOWS DO NOT INCLUDE CIP WASTE.
6. PERIODIC FLOW. INCLUDED IN DAILY WASTE FLOW ESTIMATE.
7. PERIODIC FLOW. NOT INCLUDED IN DAILY WASTE FLOW ESTIMATE. PLANT PRODUCTION WILL BE REDUCED DURING RO CIP.
8. UNDER NORMAL OPERATIONS, FLOW STREAM 14 AND 19 WILL BE ZERO.
9. FOR DAF SYSTEM BYPASS, FLOWS FOR STREAMS 11, 12, AND 13 WILL BE ZERO, AND FLOW STREAM 14 WILL BE 400 GPM.
10. FOR BWT MF SYSTEM BYPASS, FLOWS FOR STREAMS 15, 16, AND 17 WILL BE ZERO, AND FLOW STREAM 19 WILL BE 400 GPM.

REGISTERED PROFESSIONAL ENGINEER EUN CHU YOU No. C 70014 Exp. 09/30/2012 CIVIL STATE OF CALIFORNIA 05/18/12

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: E. YOU
DRAWN BY: G.KABIL
SHEET CHK'D BY: G. WETTERAU
CROSS CHK'D BY: D. CUTLER
APPROVED BY: R. CHALMERS
DATE: MAY 2012

CDM Smith
111 Academy Way, Suite 150
Irvine, California 92617
Tel: (949) 752-5452

WRD
WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA

WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA

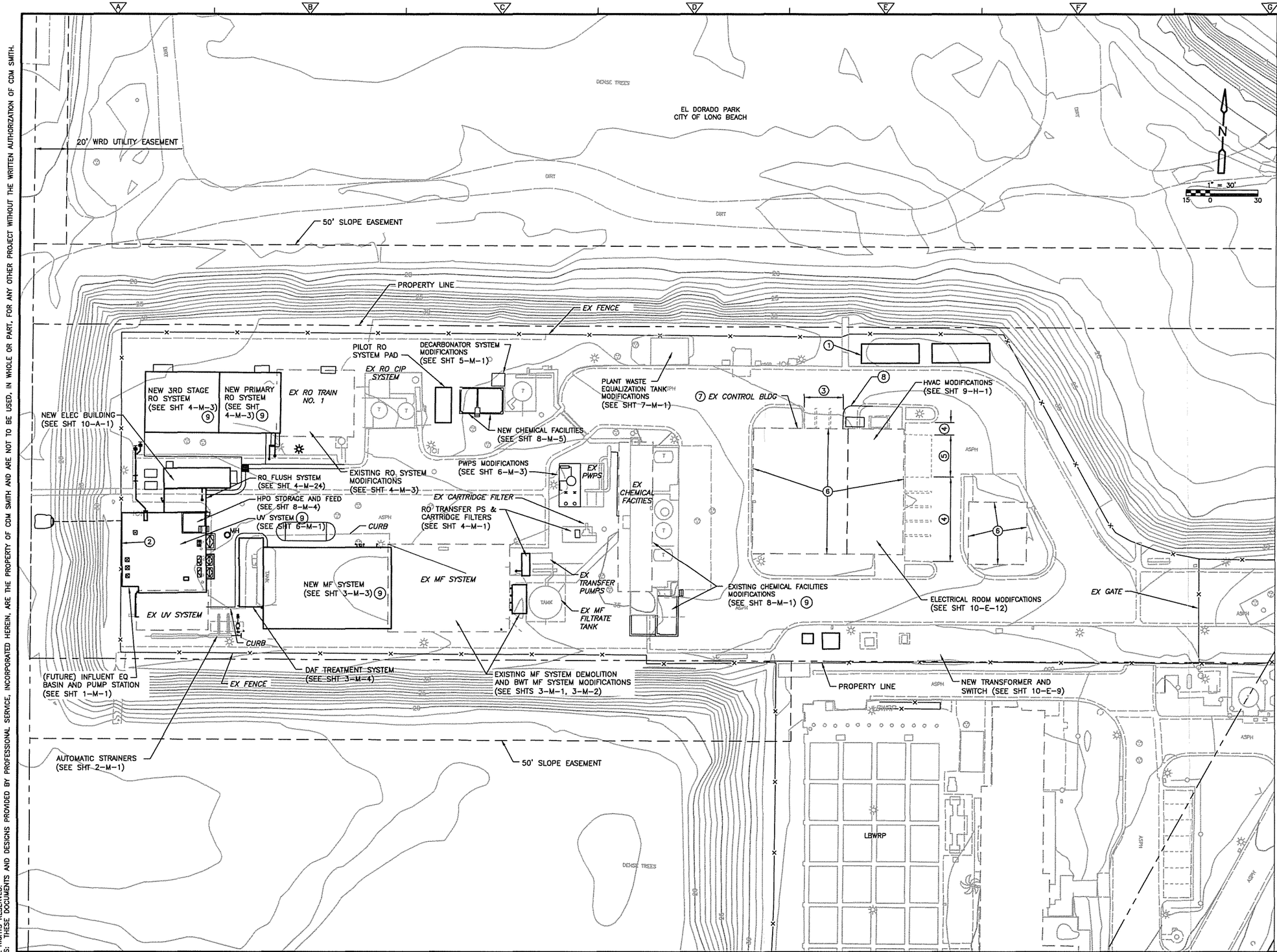
LEO J. VANDER LANS WATER TREATMENT FACILITY EXPANSION PROJECT

PROCESS FLOW DIAGRAM

PROJECT NO. 2784-85304
FILE NAME: G00G04FD
SHEET NO.

Figure 4

100% SUBMITTAL



CONSTRUCTION NOTES:

1. TEMPORARY CONSTRUCTION TRAILER PER SPEC SECTION 01500. REPLACE SPRINKLERS AND LANDSCAPING IN KIND.
2. RELOCATE FENCE AS SHOWN ON SHT 1-M-1.
3. PARKING SPACES RESERVED FOR WRD & LBWD STAFF AND CONSTRUCTION MANAGER.
4. AVAILABLE FOR CONTRACTOR PARKING AND LAYDOWN. SEE SHT 0-C-1.
5. LIMITED ACCESS: CONTRACTOR CAN USE THIS AREA FOR TEMPORARY PARKING, HOWEVER, OWNER SHALL BE PROVIDED WITH ACCESS. SEE SHT 0-C-2.
6. ACCESS TO THE CONTROL BUILDING AND WAREHOUSE IS RESTRICTED, EXCEPT TO PERFORM WORK UNDER THIS CONTRACT. SEE SHT 0-C-2.
7. WORK STATION MODIFICATION TO EXISTING CONTROL SYSTEMS. SEE SPECIFICATIONS.
8. MODIFY EXISTING CURB TO ACCOMMODATE NEW CU-3. SEE DETAIL 3, SHT 1-C-3.
9. PROCESS AREAS ARE SHOWN WITHOUT CANOPY FOR CLARITY. SEE STRUCTURAL DRAWINGS FOR DETAILS OF CANOPIES.

REGISTERED PROFESSIONAL ENGINEER
DONALD W. CUTLER
No. C55452
Exp. 12/31/12
CIVIL
STATE OF CALIFORNIA
05/18/12

REV. NO.	DATE	DRWN	CHKD	REMARKS

DESIGNED BY: D. CUTLER
DRAWN BY: E. DOAK
SHEET CHK'D BY: B. O'DONNELL
CROSS CHK'D BY: B. CHALMERS
APPROVED BY: D.CUTLER
DATE: MAY 2012

CDM Smith
111 Academy Way, Suite 150
Irvine, California 92617
Tel: (949) 752-5452

WRD
WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA

WATER REPLENISHMENT DISTRICT OF SOUTHERN CALIFORNIA

LEO J. VANDER LANS WATER TREATMENT FACILITY EXPANSION PROJECT

OVERALL SITE PLAN

PROJECT NO. 2784-85304
FILE NAME: C01C01PL

Figure 5

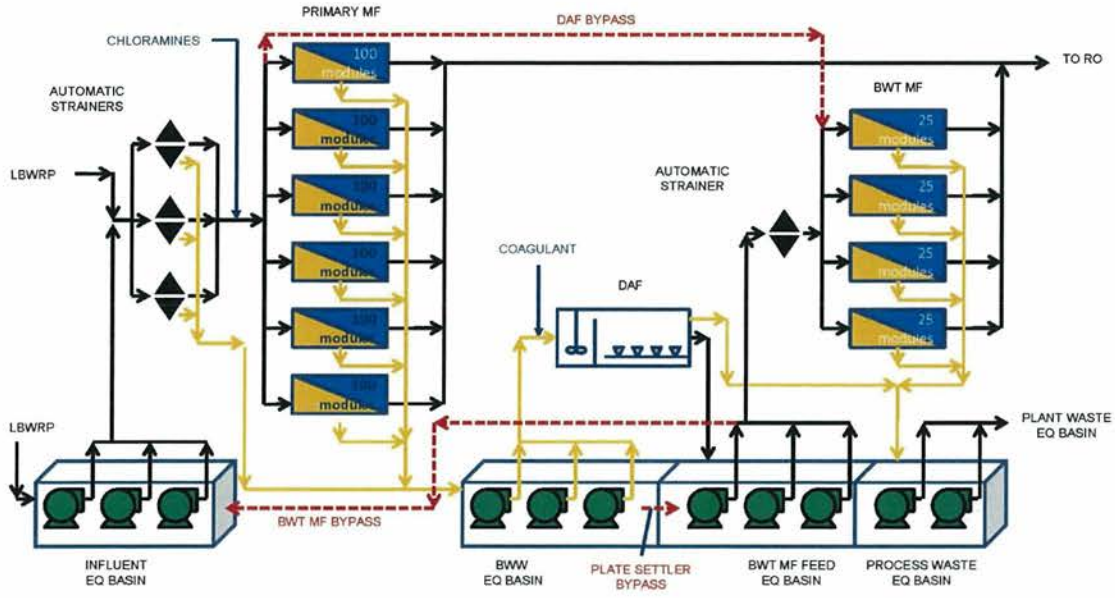
100% SUBMITTAL

C:\Documents and Settings\Doaks\Desktop\X-EXPORT MANAGED COPY\C01C01PL.dwg 04/03/2012 2:15pm doaks

rate of 35 gallons per square foot per day (gfd). Enhanced flux maintenance (EFM) cleanings will be performed periodically (every other day) while clean-in-place (CIP) washings will be performed on a monthly basis. Half of the current MF system (four out of eight 25-module units, 100 modules) will be modified to treat MF backwash from the new Pall MF equipment; while the modules from the other half of the existing MF system (100 modules) will be moved to the new primary MF racks. These modules are installed in 2011. The Pall System operates at a recovery of approximately 94%. The MF filtrate is discharged into a MF filtrate tank to equalize the flows between the MF and RO systems.

Figure 6 shows the configurations of the proposed new primary MF system and the treatment system for the backwash from the primary MF system. The backwash water will be treated using dissolved air flotation (DAF) followed by polishing by dedicated MF membranes. Due to this level of treatment and the fact that no virus removal credit is being taken for the MF system, this water will be reused as influent to the RO system. The MF Backwash Treatment System will provide 0.35 mgd of MF filtrate. Bench-scale testing and single membrane fiber testing has been performed to confirm the viability of the MF backwash processes.

Figure 6 – MF System Configuration



BWT – Backwash Treatment
DAF – Dissolved Air Flotation
EQ - Equalization
MF – Microfiltration
RO – Reverse Osmosis
LBWRP – Long Beach Water Reclamation Plant

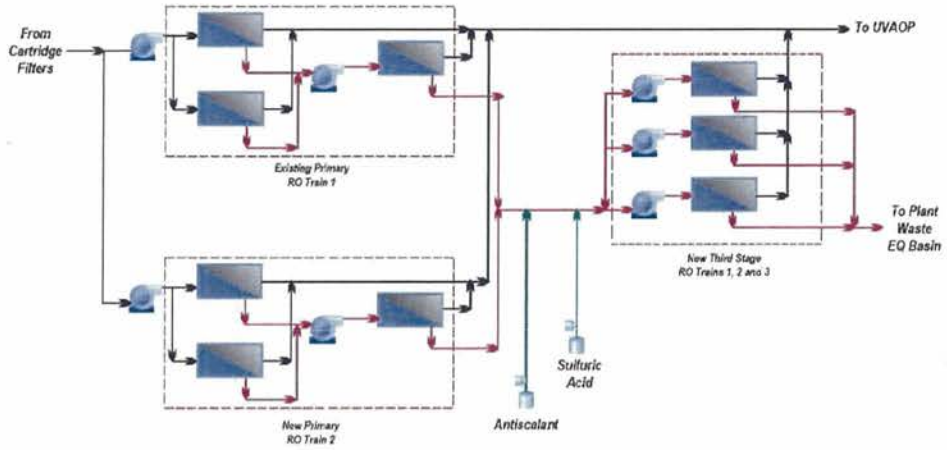
Figure 6 MF System Configuration

Reverse Osmosis System

Figure 7 presents the configuration of the expanded RO system. The current two-stage RO system will be expanded to a three-stage RO system produce 8 mgd of RO permeate. The existing 3 mgd equipment will be modified to produce 3.7 mgd by increasing the flux rate to 12.2 gfd. A second primary two stage 3.7 mgd RO system, also operated at 12.2 gfd flux, will be constructed to the west of the existing RO equipment. The primary two-stage RO system will have an approximate recovery of 85%. A third-stage RO system, as shown in Figure 7, will increase the 85% recovery of the first

two stages of RO to a total 92.5% recovery of the 3-stage RO system. The third-stage RO will have 3 parallel trains to allow production using 2 of the trains while the third train is being cleaned.

Figure 7 – RO System Configuration



RO - Reverse Osmosis
EQ - Equalization
UVAOP - Ultraviolet/Advanced Oxidation Process

Figure 7: RO System Configuration

UV/AOP System

Figure 8 presents the existing UV system and the expansion of the UV system with advanced oxidation (AOP) using hydrogen peroxide. Currently, the LVLWTF has nine (seven duty and two standby) 30AL50 Trojan UVPhox™ reactors that employ low-pressure, high-output (LPHO) technology, rated for 3 mgd capacity.

Figure 8 – UV/AOP System Configuration

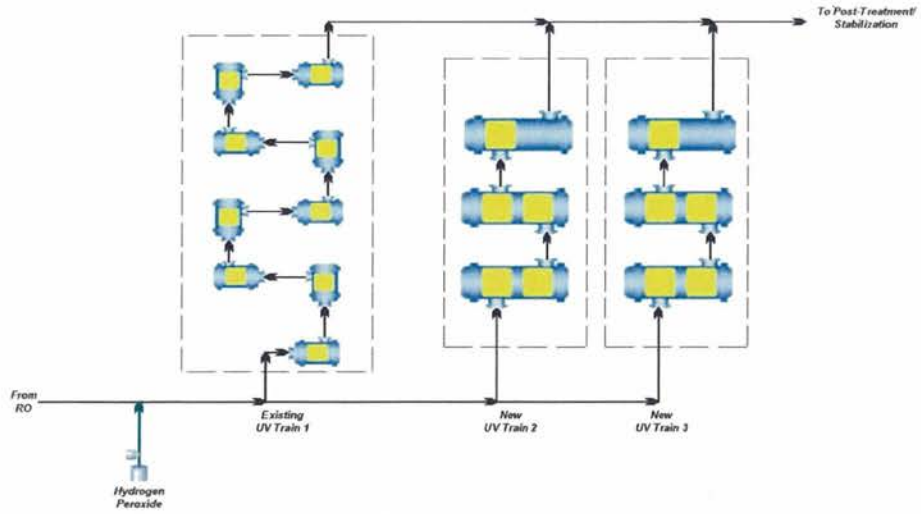


Figure 8: UV/AOP System Configuration

The expansion will add two new trains of three stacked D72AL75 Trojan UVPhox™ reactor chambers, where the third reactor chamber in each train is redundant and includes only one (1) 72-lamp reactor zone. The capacity of the entire UV system will increase to 8 mgd. Hydrogen peroxide will be added in the expansion to enable advanced oxidation treatment. The proposed system will provide a 2.146 log NDMA and 0.5 log 1,4-dioxane removal.

Finished Product Water Pump Station (PWPS) & Stabilization

The PWPS will be modified to add additional pumps for the expansion. A new stabilization chemical system will be added since blending with imported water for stabilization will be discontinued with the proposed 100% recycled water being conveyed to the recharge wells. Calcium chloride and sodium hydroxide will be added to provide corrosion protection and pH control. A chloramine residual will be provided for the water delivered to off-site injection wells.

Waste Discharges.

Waste discharges from the MF Backwash Treatment System will be neutralized and CIP systems will be discharged to an on-site process waste equalization tank before being pumped to the existing plant waste equalization tank. RO concentrate from the RO systems will be conveyed directly to the plant waste equalization tank. Pumps will be added to the tank to control the flows to the sewer. Emergency tank overflows will be discharged to sewer via Parshal flume meter. Redundant alarms and shut-offs will be provided to minimize the overflows.

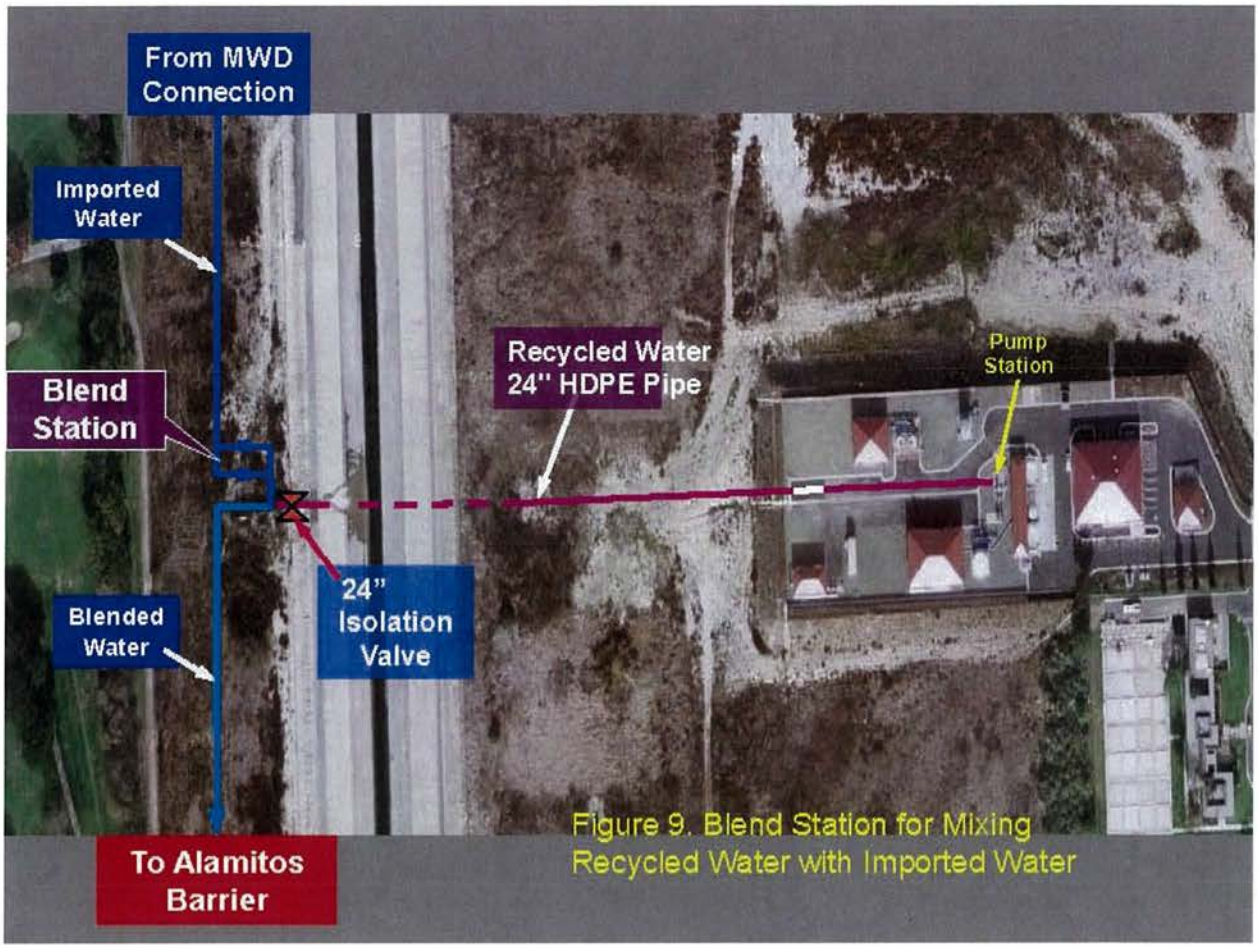
Recycled Water Conveyance Pipeline

Currently, the product water is discharged to a 24-inch high density polyethylene (HDPE) force main, shown in Figure 9 with an aerial map with pipe connections, to convey the product water off-site to the blend station. The HDPE conveyance pipeline is adequately sized for 8.0 mgd capacity, and no modifications will be made as part of the expansion project.

Blend Station

The Barrier Blend Station is the point where the advanced treated recycled water from LVLWTF currently mixes with the potable water from MWD on its way to the barrier injection system as shown in Figure 9. The MWD delivery system will continue to be protected by the above grade backflow prevention system installed in the LACDPW potable water feed lines as a method of in-line protection. The goal of operations of LVLWTF is to provide 100 percent recycled water to the barrier after the expansion. However, the potable water from MWD will still be used, if needed, as a backup supply to the barrier injection in the event that the LVLWTF is operating at partial production capacities or is shut down entirely. The backflow prevention consists of two identical parallel pipe trains with two check valves in series. A butterfly valve is installed upstream and downstream of the double check valves to isolate the system for maintenance. An air release valve is installed at the highest point in the pipe train. A sampling point is also provided. The blending station will be protected in place and no modifications will be made as part of the expansion project.

Figure 9 – Blend Station for Mixing Recycled Water with Imported Water



2.7.2 Water Quality

Table 2 shows average source water quality of the source water as well as the water quality objectives of the product water. The water quality objectives are more stringent than the water quality requirements established by the ABP injection permit issued by the RWQCB. These objectives were developed to comply with the permit, as well as meet injection water quality objectives established by the Los Angeles County Department of Public Works, who operates and maintains the barrier facilities.

Table 2 Water Quality Objectives		
	Average Water Quality	
Parameter (mg/L)	Source Water	Objectives
TOC	6.7	<0.5
Turbidity (NTU)	0.48	<0.1
TDS	703	<500
pH	7.9	8.0 – 8.5
Alkalinity	213	<100
Total Nitrogen	9	<3
Nitrate (as N)	6	<3
Ammonia	1.5	<0.5
NDMA (ng/L)	291 (25 - 1,000)	<10
1,4 Dioxane (ug/L)	1.8	<1

3. Evaluation Criteria

3.1 Water Supply (Criterion 1)

3.1.1 Stretching Water Supplies (Subcriterion 1a)

The current Project has produced recycled water that has replaced imported potable water in the total quantity of 13,537 acre feet from October 1, 2005 through September 30, 2013. Upon completion of the Project's expansion in fall of 2014, up to 8,000 acre feet will be saved annually by the Project over a 30-year project life.

The current Project has reduced the development of new nonrecycled water supplies by 13,537 acre feet through September 30, 2013. Upon completion of the Project's expansion in fall of 2014, the nonrecycled water source will be completely eliminated. The Alamitos Seawater Barrier will be replenished 100 percent with recycled water.

The demand on existing Federal water supplies from the Colorado River and the California Bay Delta will be entirely replaced. The Project will generate up to 8,000 acre feet per year of reclaimed water upon completion of the expansion, exceeding its current demand.

By increasing the local water supplies, this Project will help to reduce the region's reliance on the California State Water Project, which draws water from the California Bay-Delta, and on the Colorado River. The reduction will be up to 8,000 acre feet per year. The maximum historical annual injection to the Alamitos Seawater Intrusion Barrier is 7,400 acre feet. The expanded Project will supply up to 8,000 acre feet per year of recycled water for injection, offsetting diversions from these natural water courses by greater than 100 percent of current withdrawal.

The quantity of recycled water produced and injected into the Alamitos Seawater Intrusion Barrier will be metered and quantified in acre feet. The actual benefit, as quantity of recycled water injected, is recorded and published annually.

3.1.2 Contributions to Water Supply Sustainability (Subcriterion 1b)

Demands in the Southern California region are met heavily by imported water that is becoming increasingly less reliable and more costly due to environmental issues in the California Delta, prolonged drought and the impacts of climate change on the Colorado River Basin and the California Bay-Delta.

As described in the Public Policy Institute of California's November 2008 report, Adapting California's Water Management to Climate Change, "The most certain changes are accelerated sea level rise and increased temperatures, which will reduce the Sierra Nevada snowpack and shift more runoff to winter months. These changes will likely cause major problems for flood control, for water supply reservoir operations, and for the maintenance of the present system of water exports through the fragile levee system of the Sacramento-San Joaquin Delta."

Local Supply Reliability

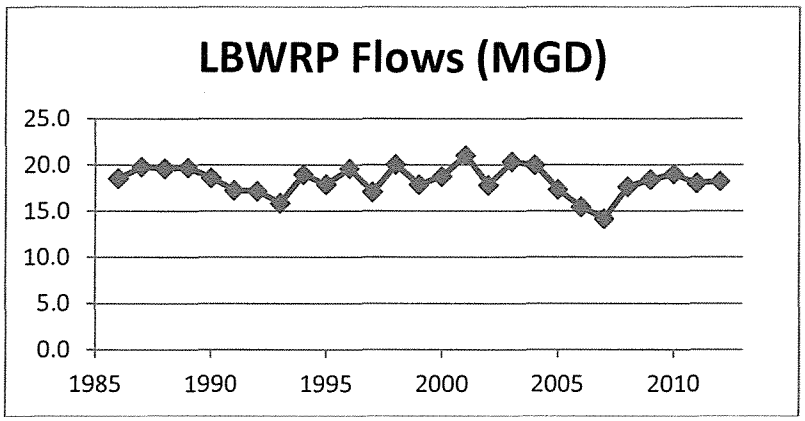
The Project will generate up to 8,000 acre feet per year of recycled water (new supply), greatly reducing reliance on imported water and improving groundwater reliability in the local basin. This improved reliability in the local groundwater basin will also reduce imported water demands from local purveyors.

Regional Supply Sustainability

In addition, up to 8,000 acre feet per year "freed up" by this project will be available for the Metropolitan Water District of Southern California (MWD) to supply to other uses; therefore, alleviating competition for limited water supplies in the Southern California region.

Drought Resistance

The source water for this Project is tertiary wastewater effluent from LACSD's LBWRP. The LBWRP has been in operations since the 1970's, and its production has been within a consistent range, even through periods of severe drought. The chart below shows the annual production flows from the LBWRP from 1986 through 2012. The LBWRP has plenty of capacity to supply source water to operate the 8-mgd recycled water plant. As a result, the Project provides a highly reliable supply for injection to the Alamitos Barrier.



Improvement to Groundwater Quality

The Project produces highly purified recycled water with state-of-the-art advanced treatment technologies. The injection of the recycled water significantly improves the water quality of the local groundwater basins, and consequently the reliability and sustainability of the local groundwater supplies.

Prevention of Saltwater Contamination

Compared to the alternative imported water supply which is increasingly unreliable, developing a locally available recycled water resource for barrier injection significantly improves the reliability of protection of the local groundwater basins against seawater intrusion.

3.2 Status of Project (Criterion 2)

3.2.1 Progress Toward Completion of an Authorized Title XVI Project (Subcriterion 2a)

Section 1628 of Title XVI, Public Law 102-575, authorizes the USBR to provide financial assistance to "Treatment of Effluent from the Sanitation Districts of Los Angeles County through the City of Long Beach." There are two components for the water reclamation projects in the Long Beach area. One is the Long Beach Expansion Project (Agreement R00AC35051) owned by the Long Beach Water Department (LBWD); the other is the Alamitos Barrier Project administered by WRD. The full Federal funding level authorized for the Long Beach Area Water Reclamation Projects is $20 million, which is equally allocated to LBWD and WRD each with a ceiling of $10 million.

As of September 30, 2013, the total Title XVI Reclamation Grant obligation for the Alamitos Barrier Project is $8,965,031.96. The total expenditure is $8,557,763.85. The remaining balance to the $10 million ceiling of funding for the Alamitos Barrier Project is $1,034,968.04. The table below shows the breakdown of obligations and expenditures for the Project through Federal fiscal year 2013.

WRD Alamitos Barrier Project Federal Reclamation Funding as of September 30, 2013			
Funding Agreement	**Activities**	**Obligations**	**Expenditures**
Agreement 00-FC-30-0008	Initial Phase	$4,950,813.19	$4,950,813.19
Agreement R11AC35299	Design	$550,572.36	$550,572.36
ARRA Agreement R10AC35R19	Predesign	$238,803.11	$238,803.11
Agreement R12AC35346	Expansion Construction	$1,305,000.00	$1,005,000.00
Agreement R12AC35346 (FOA)	Expansion Construction	$1,710,000.00	$1,633,731.03
Admin Costs	USBR Admin.	$140,914.28	$140,914.28
FOA Admin Costs	USBR Admin.	$2,646.86	$2,646.86
ARRA Admin Costs	USBR Admin.	$35,283.02	$35,283.02
FOA Unobligated Balance		$30,999.14	
Totals for WRD		$8,965,031.96	$8,557,763.85
Balance to Ceiling for WRD	$1,034,968.04		
Balance to Ceiling for Long Beach Area	$3,419,043.83		
Total Remaining for Long Beach Area	**$4,454,011.87**		

For the Long Beach Expansion Project owned by LBWD, the remaining balance to the $10 million ceiling is $3,419,043.83. The total remaining Title XVI grant for the Long Beach Area Projects is $4,454,011.87.

Federal Funding Necessary to Fully Satisfy the Authorized Federal Cost Share

As documented in Section 3.5 (Criterion 5), the total Alamitos Barrier Project cost is estimated at approximately **$58,237,000**. Twenty-five percent total project cost is approximately $14,459,000. The total Federal funding necessary to satisfy the authorized Federal cost share would be $13,419,043.83 (=$10 million WRD share plus $3,419,043.83 remaining for LBWD).

WRD hereby requests **$4 million** supplemental funding assistance through the FY 2014 WaterSMART Title XVI Program to partially fund the cost of constructing the LVLWTF facility expansion, subject to approval by LBWD and the USBR for water reclamation projects in the Long Beach Area.

Will the Funding Requested under this FOA satisfy the Federal Cost Share?

If WRD is allowed to use the LBWD's remaining share, the requested total federal cost share would be $4,454,011.87 (=$1,034,968.04 WRD remaining share + $3,419,043.83 LBWD remaining share). This requested amount is higher than the FOA's maximum at $4 million per project.

3.2.2 Readiness to Proceed (Subcriterion 2b)

The CEQA process for the expansion Project was completed on June 6, 2012. On May 7, 2012, the Notice of Determination (NOD) was filed with the State Clearinghouse (SCH

#2012021051) and the Los Angeles County Clerk's office. No further comments or objections were received during the subsequent 30 days between May 8 and June 6, 2012. Therefore, the Project has completed the notification and review process required by CEQA.

The NEPA for the expansion Project was completed by the USBR under Categorical Exclusion No. 12-SCAO-005-CX dated July 31, 2012.

A construction contract was awarded by the WRD to a contractor on October 5, 2012. A Notice-to-Proceed for the construction was issued on November 13, 2012. The expansion construction was about 48 percent complete as of September 30, 2013. The construction is estimated to be complete by fall 2014.

The reuse of recycled water for groundwater recharge is carefully regulated under several state laws and regulations to ensure protection of public health and water quality. The regulatory oversight of groundwater recharge projects is carried out by the California Department of Public Health (CDPH), Los Angeles Regional Water Quality Control Board (LARWQCB), and the State Water Resources Control Board (SWRCB). Under the existing federal regulations for the Underground Injection Control (UIC) program, injection wells, such as those used for the Project, are "authorized by rule," which means they do not require a permit from the U.S. Environmental Protection Agency (EPA) if they do not endanger underground sources of drinking water and comply with other UIC program requirements.

The Project has an existing permit under the LARWQCB Order No. R4-2005-0061. However, the Project expansion will necessitate a reissuance of a Waste Discharge Requirements/Water Recycling Requirements (WDR/WRR) permit, which is anticipated to be issued to WRD in Spring 2014 by the LARWQCB.

Additional details about permitting requirements and schedule are presented in Section 5, Required Permits or Approvals, in the Technical Proposal.

3.3 Environment and Water Quality (Criterion 3)

Improvement of Efflent and Groundwater Water Quality

The Alamitos Barrier Recycled Water Project will improve both effluent discharge and groundwater qualities. The proposed advanced treatment facility will reclaim up to 8,000 acre-feet per year of effluent water, currently discharged to the ocean from the LACSD's Long Beach Water Reclamation Plant via the San Gabriel River, for use as an alternate supply to fully replace the imported water used at the Alamitos Barrier.

Advanced treatment processes improve significantly the Long Beach Water Reclamation Plant's effluent discharge quality to beyond the quality of the imported potable water historically used for barrier injection. Use of this high-quality effluent for injection at the Alamitos Barrier will provide drought-proof protection against saltwater contamination and also improve the groundwater quality in the basin by reducing concentrations of water quality parameters in reference to Basin Standards for the Central Basin (established by the Los Angeles Regional Water Quality Control Board) and the injection water quality objectives established by the Los Angeles County Department of Public

Works. These water quality parameters are shown in Section 2.7.2.

Benefit to Nonlisted Species

By eliminating the Alamitos Barrier's imported water demand of 8,000 acre-feet annually, this project will provide a sustained offset to diminish southern Los Angeles County's dependence on water exported from the Colorado River and the Sacramento Bay-Delta. All of that water supply will be restored at its origin for maintaining in-stream flows and restoring or enhancing habitat in the Colorado River and Bay Delta ecosystems.

Water has traditionally been exported in unsustainable quantities to meet Southern California's demands via the Colorado River Aqueduct and the State Water Project. Developing a locally-sourced water supply for the seawater barrier system will increase WRD's capability for sustainable water resources management within its southern Los Angeles County service area, thereby helping to alleviate statewide and regional supply challenges.

Actions to reduce external stressors are critical to achieving long-term sustainability of the Colorado River and Delta ecosystems. Beneficially using reclaimed water to improve the efficiency and reliability of groundwater basin management in southern California's high-demand export service area is an environmentally responsible approach that will make more water available to protect the species that depend on the same limited water supply.

Benefit to Federally Listed Species

WRD historically purchases imported water from MWD for injection at the Alamitos seawater intrusion barrier. MWD historically imports this water from the Colorado River through its Colorado River Aqueduct and from the Bay Delta via the State Water Project. However, the supplies from these sources have been unavailable and increasingly challenged over recent years. This condition of limited supply will continue – until resolution is found for the sustainability issues confronting these natural water sources.

WRD is pursuing water reuse opportunities to accomplish its mission of sustainably replenishing and protecting the groundwater basins of southern Los Angeles County, by eliminating Southern Los Angeles County's dependence on imported replenishment water. Developing locally sustainable supplies for barrier recharge in our high-demand service area is an environmentally responsible approach that will restore the availability of water to support the fish and bird species that depend on the limited supplies in the Delta and the Colorado River.

This project will supply recycled water to the Alamitos Barrier to eliminate the Barrier's import demand (8,000 acre-feet annually) in its entirety from the environmentally sensitive Bay Delta and Colorado River ecosystems.

A sustained 8,000 acre-feet annually will be available, instead, to support federally endangered and protected fish species in the Delta (Delta Smelt, Chinook Salmon), and to improve the habitat of the threatened or endangered species that reside in the Colorado River (Bonytail Chub, Razorback Sucker, Colorado Pikeminnow, Humpback Chub, Roundtail Chub, and others).

3.4 Renewable Energy and Energy Efficiency (Criterion 4)

The Project does not include generation of renewable energy nor does facilitate power generation in the water delivery system. However, its implementation will result in a significant reduction in energy consumption compared to the current imported supply option.

Current imported water supply from MWD expends significant energy for transporting from the Colorado River and Bay Delta, in addition to energy related to treatment and distribution. Based on information contained the California Energy Commission's 2005 California Water – Energy Relationship report, typical Southern California urban water systems use approximately 10,200 kilowatt hours per million gallons (kWh/MG), or approximately 3,320 kilowatt hours per acre-foot (kWh/AF). This value consists of average-intensity Water Supply and Conveyance (State Water Project and Colorado River), Water Treatment and Water Distribution components as listed below.

- Water Supply and Conveyance – 8,900 kWh/MG or 2,900 kWh/AF. This value is based on the average intensity of the SWP's East and West Branch.

- Water Treatment – 100 kWh/MG or 33 kWh/AF. Typical water treatment processes are estimated at between 100 and 250 kWh/MG, and can be as high as 500 kWh/MG. In the Study, 100 kWh/MG was adopted as the prototypical and conservative water treatment energy intensity

- Water Distribution – 1,200 kWh/MG or 390 kWh/AF. Based on information contained in the Study, there was little variation in the amount of energy required to treat and distribute water. As such, 1,200 kWh/MG was adopted as the prototypical water distribution system energy intensity.

The LVLWTF's actual electrical energy usage is 1,163 kWh/AF. This usage is calculated based on total facility power usage divided by the actual facility water production in acre feet from January 2009 through August 2012. The total power consumed within the period is 9,179,830 kWh, and the total recycled water produced within the period is 7,895 acre feet.

The project implements the following components to reduce energy consumption:

- Without the Project, up to 8,000 AFY of imported water would be used for groundwater replenishment through injection at Alamitos Barrier. Based on CFC's energy consumption factor of 3,320 kWh/AF for imported water, the energy cost for using the imported water is 26,560,000 kWh. With the project, the energy to supply 8,000 AFY of recycled water (based on actual energy usage of 1,163 kWh/AF) is 9,304,000 kWh, resulting in an annual **energy savings of 17,256,000 kWh per year** compared to the imported water option.

- Microfiltration (MF) backwash wastewater is treated onsite with a low-energy consumption dissolved air flotation process in lieu of discharge to a sewer that will require downstream full advanced wastewater treatment using more energy intensive pure oxygen oxidation processes at LACSD's Joint Water Pollution Control Plant (JWPCP) in Carson, California. The annual recovery of the MF backwash wastewater would reduce sewer discharge to the LACSD's JWPCP by 520 AFY. At 250 kWh/MG or 82 kWh/AF additional energy consumption via sewer discharge, the estimated annual **energy savings is 43,000 kWh per year** for MF

backwash wastewater recovery.

- Third-stage reverse osmosis (RO) is added to increase recovery and cut down waste of RO by 50%. The annual recovery of the RO wastewater would reduce sewer discharge to the LACSD's JWPCP by 680 AFY. At 250 kWh/MG or 82 kWh/AF additional energy consumption via sewer discharge, the estimated annual **energy savings is 56,000 kWh per year** for recovery enhancement by third-stage RO.

- The third-stage RO and treatment of MF backwash waste components will reduce the use of LVLWTF source water by approximately 15% (1200 AFY), conserving approximately **1,395,600 kWh per year** that would be expended to transport, treat, and distribute this volume of water from the Colorado River and Bay Delta.

- Interstage RO pumps are added to optimize RO pumping by eliminating compounding of headlosses experienced when conventional RO feed pumps are used.

- Canopies are used for process areas in lieu of buildings to save air conditioning, ventilation, and lighting energy costs.

- Premium efficiency motors with variable frequency drives are used to optimize pumping systems to save energy.

3.5 Cost per Acre-Foot of Water and Other Project Benefits (Criterion 5)

(a) Total Estimated Construction Costs

The construction of the initial phase occurred from 2001 through 2005 for a construction cost of approximately $17,030,000. The construction was partially funded by the Reclamation Grant via USBR Assistance Agreement No. 00-FC-30-008.

For the expansion project, the construction will occur from 2012 through 2014. The construction is partially funded by the Reclamation Grant via USBR Assistance Agreement No. R12AC35346.

The estimated construction costs by year are provided below.

	Calendar Year	Construction Cost
1	Initial Phase	$17,030,000
2	2012	$3,040,000
3	2013	$21,200,000
4	2014	$11,000,000
	Total	$52,270,000

(b) Costs to Plan and Design the Project

The estimated total cost to plan and design the entire project is $5,967,000. The table below shows a breakdown of the planning and design costs for the initial phase and the expansion phase, including Reclamation funding agreements.

Planning & Design	Cost	Reclamation Funding
Initial Phase	$2,773,000	00-FC-30-0008
Preliminary Design	$570,000	R10AC35R19
Final Design	$2,179,000	R11AC35299
Project Administration	$445,000	
Subtotal Expansion Phase	*$3,194,000*	
TOTAL	**$5,967,000**	

The total Alamitos Barrier Project cost is estimated at approximately **$58,237,000**.

(c) Average Annual Operation and Maintenance Costs

The estimated annual operation and maintenance costs after completion of the project expansion are shown in the following table.

Projected Annual Operations & Maintenance Costs		
Category	**Annual Cost**	**Cost/AF**
O&M Labor	$1,050,000	$162
Power	$1,086,000	$167
Repairs	$400,000	$62
Chemicals	$470,000	$72
Membrane & UV Replacement	$770,000	$118
Sewer Discharge	$200,000	$31
Water Quality Analysis	$200,000	$31
Water Purchase Cost	$700,000	$108
Total	**$4,876,000**	**$750**

(d) Schedule to Deliver Recycled Water

The existing LVLWTF has been producing recycled water since October 2005. The expansion of the LVLWTF is expected to be completed by the second half of 2014, and the expanded facility is expected to produce additional recycled water starting in the second half of 2014.

(e) Project Life

The project is expected to last for 39 years since recycled water delivery began in 2005.

(f) Estimated Replacement Costs by Year

The replacement costs by year are presented in the table below. The replacements are for major equipment and consumables for the operations of the facility.

	Description of Replacement Requirement	Year	Cost
1		2006	
2		2007	
3	UV Lamps	2008	$53,779
4	Reverse Osmosis Membranes Stage 2; UV Lamps and Water Level Sensors	2009	$236,539
5	UV Lamps	2010	$79,384
6	Microfiltration Membranes; Reverse Osmosis Membranes Stage 1; UV Lamps, sleeves, and Light Sensors	2011	$968,123
7		2012	
8	UV Lamps	2013	$84,243
9		2014	

10	UV Lamps	2015	$233,724
11		2016	
12	UV Lamps	2017	$243,166
13		2018	
14	Reverse Osmosis Membranes; UV Lamps	2019	$1,430,676
15		2020	
16	UV Lamps	2021	$263,211
17	Microfiltration Membranes	2022	$2,320,965
18	UV Lamps	2023	$273,844
19	Reverse Osmosis Membranes	2024	$1,300,261
20	UV Lamps	2025	$284,908
21	RO Feed Pumps, Product Water Pumps, RO Transfer Pumps	2026	$1,000,000
22	UV Lamps	2027	$296,418
23		2028	
24	Reverse Osmosis Membranes; UV Lamps	2029	$1,743,986
25	Microfiltration Membranes	2030	$2,719,381
26	UV Lamps	2031	$308,393
27		2032	
28	UV Lamps	2033	$320,852
29	Reverse Osmosis Membranes	2034	$1,585,011
30	UV Lamps	2035	$333,815
31		2036	
32	RO Feed Pumps, Product Water Pumps, RO Transfer Pumps; UV Lamps	2037	$1,590,675
33	Microfiltration Membranes	2038	$3,186,188
34	Reverse Osmosis Membranes; UV Lamps	2039	$2,125,909
35		2040	
36	UV Lamps	2041	$361,332
37		2042	
38	UV Lamps	2043	$375,930
39	Reverse Osmosis Membranes	2044	$1,932,119

(g) Maximum Volume of Water will be Produced

The current project has a maximum production capacity of 3,000 acre-feet per year. Upon completion of the project expansion, the project will be capable of producing up to 8,000 acre-feet per year.

As of September 30, 2013, a total volume of 13,537 acre feet of recycled water has been produced. Upon completion of the expansion project in fall 2014, the facility will produce a maximum of 8,000 acre-feet per year for 30 years, yielding a future maximum recycled water production of 240,000 acre-feet in 30 years.

Cost Comparisons of Project (Recycled Water) to Alternative (Imported Water)

The table below shows the actual cost of imported water for that Alamitos Barrier for years 2005-2013. The estimated cost of imported water for years 2014-2043 is projected on historic MWD rate increases.

Year	Cost ($/AF)	Year	Cost ($/AF)	Year	Cost ($/AF)
2005	$448	2018	$1,217	2031	$2,593
2006	$458	2019	$1,290	2032	$2,748
2007	$483	2020	$1,367	2033	$2,912
2008	$513	2021	$1,449	2034	$3,086
2009	$584	2022	$1,536	2035	$3,270
2010	$706	2023	$1,628	2036	$3,466
2011	$749	2024	$1,725	2037	$3,674
2012	$889	2025	$1,828	2038	$3,894
2013	$954	2026	$1,938	2039	$4,218
2014	$965	2027	$2,054	2040	$4,375
2015	$1,023	2028	$2,177	2041	$4,638
2016	$1,084	2029	$2,308	2042	$4,916
2017	$1,149	2030	$2,447	2043	$5,211

The historic and projected rates for imported barrier water shown in the table above are based on the Metropolitan Water District of Southern California's (MWD) treated Tier 1 rates. This is the lowest cost potable water currently available. Not included in the projected rates are the possible impacts of being required to purchase more expensive Tier 2 water or penalties associated with MWD's Water Supply Allocation Plan (WSAP). As such, the projected rates shown above are conservative.

MWD provides a limited quantity of annual Tier 1 water to its member agencies. Once this allocation has been reached, water is sold at the Tier 2 rate, which is currently costs $126 per acre-feet (or approximately 14%) more than Tier 1.

In 2008, MWD adopted its WSAP which provided guidance for allocation of limited water supplies to its member agencies should the need arise. During periods when the WSAP is in effect, generally during a drought, monetary penalties for exceeding allocation are severe (up to 4 times the Tier 2 rate). The impact of these penalties is not included in the projected water rates in the table above, however, it is likely that the District would be subject to them over the next 30 years of this Project's life.

3.6 Reclamation's Obligations and Benefits to Rural or Economically Disadvantaged Communities (Criterion 6)

3.6.1 Legal & Contractual Water Supply Obligations (Subcriterion 6a)

The Project does not involve Reclamation's legal or contractual obligations such as providing water for Indian tribes, water right settlements, river restoration, minimum flows, legal court orders, or other obligations.

3.6.2 Benefits to Rural or Economically Disadvantaged Communities (Subcriterion No. 6b)

WRD replenishes and protects the groundwater supply of the Central and West Coast Basins of southern Los Angeles County. These groundwater basins are two of the most heavily utilized in California, providing over 40 percent of the total water demand for the region. The District serves approximately 4 million people (10 percent of the State's population) residing in 43 cities. 51% of the population in our service area is considered disadvantaged per the State's criteria – household income less than 80% of statewide median (MHI of $47,493) with additional breakdown as follows:

- 12% is less than 50% of MHI
- 29% is between 50% and 70% of MHI
- 10% is between 70% and 80% of MHI

Disadvantaged communities (DAC) served include the cities of: Bell, Bell Gardens, Commerce, Compton, Cudahy, Hawthorne, Huntington Park, Inglewood, Los Angeles, Lynnwood, Maywood, Montebello, Paramount, Vernon, and others.

The Project directly benefits DAC's in our service area by protecting water resources (supply and quality) available to these communities and maintains a lower-cost sustainable water supply by reducing their reliance on imported water.

- Supply of recycled water will protect the Central Groundwater Basin against seawater intrusion and increase the quantity of water recharged to the Los Angeles basins at relatively low cost, compared to other replenishment supply options.
- Increasing the use of advance treated recycled water will improve the quality and reliability of water supplied to the basins and improve local water supply sustainability (long-term reduction of imported water demand).

3.7 Watershed Perspective (Criterion 7)

This Project is part of WRD's Water Independence Now (WIN) Program to eliminate reliance on imported water for groundwater replenishment. WIN includes projects to increase the use of stormwater and recycled wastewater for indirect potable use by means of groundwater recharge and seawater intrusion prevention. These multi-benefit projects will use water that would otherwise be discharged to the ocean for beneficial uses, develop local water infrastructure to sustain potable supply, and protect water quality in the area basins. Developing locally sustainable replenishment supplies will convert the Central and West Coast Basins into self-sustaining, self-sufficient groundwater basins.

Implementation of the Project is consistent with integrated resources management goals, regional planning priorities and statewide planning strategies, and promotes collaboration between Federal, State and local entities as described below.

Integrated Regional Water Management Goals

The Project is consistent with the Greater Los Angeles County IRWM Plan (IRWM Plan) in that it addresses five out of the six water management goals identified in the IRWM Plan. The water management goals addressed by the Project are:

1. Optimize the use of local water resources to reduce the Region's reliance on imported water;
2. Assist the Region in complying with water quality regulations, including Total Maximum Daily Loads (TMDLs), by improving the quality of urban runoff, stormwater, and wastewater;
3. Protect and improve groundwater and drinking water quality;
4. Protect, restore, and enhance natural processes and habitats; and
5. Maintain and enhance public infrastructure related to flood protection, water resources, and water quality.

Consistency with Regional Planning Priorities

The goal of the Project is to develop a new, sustainable, and drought-resistant supply of advanced treated recycled water to minimize seawater intrusion, recharge groundwater and increase the reliability of potable water supply in southern Los Angeles County. The Project objectives that address the IRWM Plan goals are as follows:

- Construct reclamation facility to supply advanced treated recycled water to fully replace imported water supplies used at the Barrier;
- Protect the Central Groundwater Basin from seawater intrusion thus improving groundwater quality;
- Develop local water infrastructure to sustain potable water supply and reliably protect water quality; and
- Reduce waste of recycled tertiary treated municipal water and thereby reduce discharges of effluent to the Pacific Ocean.

Statewide Program Preferences and Resource Management Strategies

The Project addresses the following IRWM / California Water Plan (2009 Update) resource management strategies:

- **Recycled Municipal Water:** The Project will increase the supply of advanced treated recycled water to fully replace imported water currently used at the Barrier.
- **Matching Quality to Use:** The Project will implement water treatment technologies that convert wastewater to advanced treated recycled water. The quality of the advanced treated recycled water is appropriate for future use as an indirect source of potable water.

- **Salt and Salinity Management:** The Project will provide a more reliable groundwater supply by preventing degradation of the region's groundwater quality from seawater intrusion.

This Project accomplishes several Proposition 84 Program Preferences in the following ways:

- Meets the CALFED Bay-Delta Program Water Supply objective of reducing the demand for imported Bay-Delta water by increasing local water supplies;
- Integrates projects within a hydrological region, allowing agencies to increase utilization of recycled water flows produced in the Region to reduce dependence on imported water; and
- Addresses the Statewide Priorities of drought preparedness, use and reuse of water more efficiently, climate change response actions, and protection of groundwater quality

Stakeholder Coordination

Groundwater basin stakeholders support the concept of using 100 percent recycled water at seawater intrusion barriers, which this project will achieve. The Project has been presented at numerous public meetings and has obtained the conditional support of the District Technical Advisory Committee, which is composed of groundwater pumpers from the Central and West Basin Water Associations.

WRD jointly implements and sponsors programs and studies to improve groundwater reliabiilty in partnership with State and Federal agencies (California Department of Water Resources, California Department of Health Services, US Geological Survey, US Environmental Protection Agency, Regional Water Quality Control Board, Central and West Basin Watermasters).

The District works regularly and closely with local agencies and groups with overlapping service areas and planning interests (County of Los Angeles Flood Control District / Public Works, County Sanitation Districts of Los Angeles County, Metropolitan Water District of Southern California, Council for Watershed Health, community environmental groups), adjacent groundwater management agencies (Orange County Water District and Main San Gabriel Basin Watermaster), and the 43 cities it serves in southern Los Angeles County.

4. Environmental Compliance

4.1 Project Impact to the Surrounding Environment

The proposed project would expand the existing Leo J. Vander Lans Water Treatment Facility (LVLWTF), a state-of-the-art water treatment facility located in the City of Long Beach, California. The LVLWTF's main role is to produce recycled water through advanced treatment of wastewater. Presently, the LVLWTF's existing plant effluent capacity is 3 million gallons per day (mgd), but was designed to accommodate future expansion to 8.0 mgd. The proposed project would implement this expansion of the production capacity to 8 mgd to produce more water for recharge and reduce the

need for potable water to be blended prior to injection. The proposed expansion would occur within the existing LVLWTF property. The project site is fully developed and, except for small areas of ornamental plantings, is completely paved with asphalt. It is anticipated that a majority of the existing landscaping would not be affected by the proposed project, with the exception of the area of the proposed influent equalization tank, which would be installed on the berm, which is an unpaved disturbed area that is not occupied by sensitive habitat or sensitive species.

The proposed project would require minimal grading and disturbance. Construction activities include installation of equipment on the existing building pad, grading and excavation for installation of the new influent storage tank on the western boundary of the site, and grading and trenching to extend existing electrical lines and pipelines to the new systems/equipment. Site excavation and disturbance is expected to involve approximately 2,500 cubic yards of material.

An Initial Study was prepared to assess the proposed project's potential effects on the environment and the significance of those impacts. Based on the analysis presented in the initial study, the will not have a significant impact on the environment and a Negative Declaration was adopted for the proposed project on April 20, 2012. Potential soil (erosion and dust) impacts are anticipated to be minimal and related primarily to short-term activities during construction. Best management practices (BMPs) would be implemented to minimize the potential for soil (erosion and dust), which would insure that impacts associated with soil are less than significant.

As it relates to air quality, construction and operational emissions would be less than the South Coast Air Quality Management District (SCAQMD) significance thresholds for determining whether projects have significant adverse air quality impacts; therefore the project would not violate any air quality standard or contribute substantially to an existing or projected air quality violation. In addition, construction activities would be in compliance with the applicable SCAQMD regulations and required emission controls.

Water used for dust control and soil compaction during construction would be minimal (less than one acre disturbed) and not expected to result in discharge. A Stormwater Pollution Prevention Plan (which includes BMPs) would be implemented to minimize the potential for construction to impact surface water runoff and quality. Additionally, the project would not alter the existing drainage pattern of the site. Therefore, the proposed project would not violate any water quality standards nor substantially alter drainage.

The site is currently paved and developed with a water treatment facility, and no threatened, endangered, or rare animal species occur on the site. Additionally, no protected species would be impacted because the site is not occupied by any habitat, including stands of shrubs or trees that would provide potential nesting or roosting sites. The unpaved area on site consists of a small amount area of ornamental landscaping, and no special-status plant species are located on the project site. The influent equalization tank would be installed on the berm, which is an unpaved disturbed area that is not occupied by sensitive habitat or sensitive species. The perimeter of the project site is surrounded by a locked chain link fence. The fence creates a barrier that would block any movement of large mammals, such as coyotes, dispersing between Coyote Creek and the San Gabriel River corridors through the site. The fence is not a barrier to birds or small rodents, however, those species would be more likely to traverse the open space located to the south and north rather than the project site, which is primarily paved and occupied by existing buildings and unenclosed equipment. These conditions would not change with construction or operation of the proposed project. No substantial

disturbance to animals or habitats is expected during construction or operations and no impact would occur.

For all environmental resource areas, the Initial Study/Negative Declaration found that potential impacts associated with implementation of the project were either "no impact" or "less than significant."

4.2 Critical Habitat in the Project Area

No threatened, endangered, or rare animal species occur on the site. The unpaved area on site consists of a small amount area of ornamental landscaping, and no special-status plant species are located on the project site. The influent equalization tank would be installed on the berm, which is an unpaved disturbed area that is not occupied by sensitive habitat or sensitive species. The site is in the vicinity of disturbed open space, including a power line easement. To the north of the site, the El Dorado Natural Center is located to the north of the site opposite Willow Street. The San Gabriel River and Coyote Creek adjacent to the project site are channelized and thus do not have notable riparian or wetland habitat. A search of the California Natural Diversity Database (CNDDB) shows occurrences of the 10 plant species and 10 animal species within the U.S. Geological Survey (USGS) Los Alamitos Quadrangle that have been listed, or are candidates for listing, by the state or federal government as rare, threatened or endangered. Given the disturbed nature of the site and the lack of appropriate habitat, no species have the potential to be located at the project site. Three bat species, including two California Species of Concern (western mastiff bat [Eumops perotis californicus] and western yellow bat [Lasiurus xanthinus]) could potentially roost in mature trees in the vicinity (i.e, El Dorado Regional Park). However there are no reports of sightings. In conclusion, no direct or indirect impacts associated with implementation of the project are expected to occur related to biological resources.

4.3 Wetlands or other Surface Waters

There are no jurisdictional wetlands or drainage features on the project site; therefore, no impact to wetlands or other surface water features would occur.

4.4 Archeological Sites

The project site is a previously disturbed site with no native soils that could contain intact archeological resources. The existing water treatment facility was constructed on disturbed land within a flood basin in 1998. There are no historic or potentially historic features located on or adjacent to the project site. Therefore, the proposed project is not expected to cause a substantial adverse change in the significance of a historical or archaeological resource as defined in Section 15064.5 and the National Historic Preservation Act.

4.5 Low Income and Minority Populations

The project site is currently developed with an existing water treatment plant. The site is bordered by San Gabriel River to the west, a four-lane street (Willow Street) to the north, Coyote Creek and access road to the LBWRP to the east, and the existing LBWRP to the south. The

proposed expansion project would be located within boundaries of the existing site and would not impact low-income or minority communities.

4.6 Impacts on Tribal Lands

The project site and much of the surrounding area has been previously graded and developed and is not located on or near Indian sacred sites or tribal lands.

4.7 Noxious Weeds or Non-native Invasive Species

The project site is fully developed for public infrastructure use, and except for small areas of ornamental plantings, is completely paved with asphalt. There are no known noxious weeds or non-native invasive species known at the project site or adjacent area. Because the site is completely paved or will become impervious (area of the tank), it is not anticipated that the majority of the existing landscaping would be affected by the proposed project or that the project would introduce any noxious weeds or non-native invasive species to the site or area.

5. Required Permits or Approvals

The reuse of recycled water for groundwater recharge is carefully regulated under several state laws and regulations to ensure protection of public health and water quality. The regulatory oversight of groundwater recharge projects is carried out by the California Department of Public Health (CDPH), Los Angeles Regional Water Quality Control Board (LARWQCB), and the State Water Resources Control Board (SWRCB). Under the existing federal regulations for the Underground Injection Control (UIC) program, injection wells, such as those used for the Project, are "authorized by rule," which means they do not require a permit from the U.S. Environmental Protection Agency (EPA) if they do not endanger underground sources of drinking water and comply with other UIC program requirements.

The Project has an existing permit under the LARWQCB Order No. R4-2005-0061. However, the Project expansion will necessitate a reissuance of a Waste Discharge Requirements/Water Recycling Requirements (WDR/WRR), which accompanies a Title 22 Engineering Report, because the expansion will involve a change in design or operation and an increase in the quantity of recycled water to be applied at the Alamitos Barrier.

WRD filed a permit application for WDR/WRR on October 22, 2012, and submitted a Title 22 Engineering Report to the LARWQCB and the CDPH for review. The Title 22 Engineering Report has documented all regulatory requirements described above and how they are addressed by WRD through execution of the Project.

The WRD is expected to obtain the WDR/WRR permit for the expansion Project is Spring 2014 from the LARWQCB. Milestone dates for the permitting process are presented below.

October 2012	WRD submitted permit application for WDR/WRR to the RWQCB, including the Title 22 Engineering Report for the Project.

January 2013	CDPH/RWQCB provide comments on draft Title 22 Engineering Report.
February 2013	WRD resubmits revised Title 22 Engineering Report to RWQCB and CDPH.
April 2013	CDPH/RWQCB approve Title 22 Engineering Report.
June 2013	Public Hearing (Led by WRD and with cooperation of CDPH)
July 2013	CDPH forwards Finding of Facts & Conditions to RWQCB.
August 2013	RWQCB initiates WRR permit.
Winter 2013/14	RWQCB issues tentative WRR permit.
Spring 2014	RWQCB adopts WRR permit.

6. Funding Plan

The following table summarizes non-federal and federal funding sources for the Alamitos Barrier Recycled Water Project. The estimated total expenditure for the Project is $58,237,000 for work to be completed by September 30, 2016. The non-federal funding includes California Proposition 84 Integrated Regional Water Management (IRWM) Grant and bond proceeds of the WRD. The only federal funding is the Title XVI Water Reclamation and Reuse Grant. These non-federal and federal sources are described in more detail in the paragraphs below.

Table - Summary of Non-Federal and Federal Funding Sources

Funding Sources	**Funding Amount**
Non-Federal Entities	
1. California Proposition 84 IRWM Grant	$4,676,040
2. WRD Bond Proceeds	$39,106,948
Non-Federal Subtotal	$43,782,988
Other Federal Entities	
1. None	
Other Federal Subtotal	$0
Requested Reclamation Funding*	$14,454,012
Total Project Funding	***$58,237,000***

*The WRD has received a total amount of obligations through the Reclamation Funding at $8,965,031.96 as of September 30, 2013. WRD is in discussions with LBWD to obtain remaining share of Title XVI funding for the Long Beach Area.

California Proposition 84 IRWM Grant

On February 14 of 2013, WRD executed an agreement with the Los Angeles County Flood Control District, through the California Department of Water Resources (DWR), to receive Proposition 84 Integrated Regional Water Management Implementation funding for the Greater Los Angeles County Region. This funding agreement includes $4,676,040 for the LVLWTF Expansion.

WRD Bond Proceeds

The WRD issued $69,195,000 in Water Revenue Certificates of Participation in August 2011. Due to the WRD's sound financial structure, both Standard and Poor's and Fitch Ratings have recognized the WRD's efforts with AA+ ratings from both agencies. A portion of these proceeds will be used by the WRD to expand the production capacity of the LVLWTF to provide high-quality recycled water for the Alamitos Seawater Intrusion Barrier and replace 100% of the barrier's imported water needs. The true interest rate for the 2011 Water Revenue Certificates of Participation is 4.7%. The WRD is expected to utilize these funds no later than 2014. There are no other restrictions or timelines.

Reclamation Title XVI Funding

Federal funding for the Project has been provided through the Title XVI Water Reclamation and Reuse Program. The following table summarizes the obligations and expenditures as of September 30, 2013 for the various activities of the Project. As of September 30, 2013, the total obligation for the Project is $8,965,031.96. The total expenditure is $8,557,763.85. The remaining balance to the ceiling of funding for the Alamitos Barrier Project is $1,034,968.04.

For the entire Long Beach Area projects, however, the remaining balance to the ceiling of funding is $4,454,011.87. The funding for the Long Beach Area projects is described in more details in Section 3.2.1 of this proposal.

WRD Alamitos Barrier Project
Federal Reclamation Funding as of September 30, 2013

Funding Agreement	Activities	Obligations	Expenditures
Agreement 00-FC-30-0008	Initial Phase	$4,950,813.19	$4,950,813.19
Agreement R11AC35299	Design	$550,572.36	$550,572.36
ARRA Agreement R10AC35R19	Predesign	$238,803.11	$238,803.11
Agreement R12AC35346	Expansion Construction	$1,305,000.00	$1,005,000.00
Agreement R12AC35346 (FOA)	Expansion Construction	$1,710,000.00	$1,633,731.03
Admin Costs	USBR Admin.	$140,914.28	$140,914.28
FOA Admin Costs	USBR Admin.	$2,646.86	$2,646.86
ARRA Admin Costs	USBR Admin.	$35,283.02	$35,283.02
FOA Unobligated Balance		$30,999.14	
Totals for WRD		$8,965,031.96	$8,557,763.85
Balance to Ceiling for WRD	$1,034,968.04		
Balance to Ceiling for Long Beach Area	$3,419,043.83		
Total Remaining for Long Beach Area	**$4,454,011.87**		

7. Budget Proposal

The initial phase of the Project was completed in 2005 when the WRD received the permit and started operations of the LVLWTF. The expansion phase of the Project started in 2010 with preliminary design and environmental evaluation for the expansion of the LVLWTF. The expansion of the Project is expected to be finished in 2014 with the completion of construction for the plant expansion. The table below describes the expenditures of the planning, design, and construction activities that are planned through September 2016.

Project Expenditures Through September 2016			
Activity	**Cost**	**Reclamation Funding**	**Duration**
Initial Project Phase	**$19,803,253**	Agreement 00-FC-30-0008	1998-05
Project Expansion			
Preliminary Design, CEQA/NEPA	$570,000	Agreement R10AC35R19	2010-11
Final Design, Permit	$2,179,000	Agreement R11AC35299	2011-12
Construction Management	$1,998,000		2012-14
Construction Engineering Support	$880,000		2012-14
Construction Contract	$31,820,000	Agreement R12AC35346	2012-14
Project Administration	$987,000		2010-14
Subtotal Project Expansion	***$38,434,000***		*2010-14*
Total Project Expenditures	**$58,237,000**		2000-16