Many studies have been conducted and reports prepared within the Region. These studies and reports provide the basis to demonstrate the scientific and technical merit of the Proposal and support the statements made in the Proposal. Technical adequacy/feasibility and data gaps are discussed for each project in the Proposal. Electronic copies of the reports and studies listed in this section are included on a CD provided with the Proposal.

1. Central Basin Southeast Water Reliability Project

Table 8-1: References for Central Basin SWRP

#	Reference	Relevance
1-1	CBMWD Water Recycling Program Master Plan (ASL Consulting Engineers, August 2000)	This plan identifies and prioritizes areas in Central Basin's service area where recycled water can replace potable water. Findings of the study are utilized to develop conclusions and recommendations for implementation of facilities to expand Central Basin's Water Recycling Program and meet recycled water demands throughout the region.
1-2	Central Basin 2005 Urban Water Management Plan	This plan provides a comprehensive overview of the CBMWD goals for the future and identifies the current and planned programs and projects.
1-3	Montebello Loop Pipeline Alignment Study (Tetra Tech, Inc., April 2003)	This study provides a comprehensive analysis of the alignment and construction for the segment of pipeline connecting Central Basin's existing easterly most and westerly most distribution system. The analysis includes constructability, traffic impacts, railroad crossings, permit requirements, maintenance, customer demands, local impacts, and overall economics.

Technical Adequacy / Feasibility

The Central Basin Southeast Water Reliability Project (formerly known as "The Montebello Loop") was evaluated for economic viability during preparation of both **Reference 1-1** (Section IV, Pages 1-4) and **Reference 1-2**. Substantial information was gathered and analyzed to identify and prioritize areas in Central Basin's service area where recycled water can replace potable water. Background data gathered included local jurisdictional requirements, utility impacts, right-of-way requirements, permitting, customer demands, etc. Findings from Reference 1-1 were utilized to develop conclusions and recommendations for implementation of facilities to expand the Central Basin Water Recycling Program and meet recycled water demands throughout the region. Reference 1-2 analyzed specific pipeline alignments and developed an economic analysis of the alignments. Both studies concluded that the Central Basin Southeast Water Reliability Project was feasible for implementation.

Reference 1-3 (Section 8, Pages 8-5 – 8-6) discusses the project as a future system expansion and projects recycled water users as part of Central Basin's goal of expanding its recycled water distribution system.

The pipeline system for the Central Basin Southeast Water Reliability Project has been developed. Reference 1-1 documented the demand for recycled water in the Central Basin service area and is a reliable source in the determination of the target customers and area served. This project will improve hydraulic operation of the Central Basin's distribution system, enhance operational reliability, reduce pumping and energy costs, and complement future projects intended to interconnect localized recycled water systems into a regional recycled water distribution network.

Distribution capacity of Central Basin's Recycled Water System and overall service reliability will be improved by "looping" an existing transmission system that is currently limited in its ability to hydraulically serve existing and future customers. Looping of the recycled water system involves installation of major interconnecting transmission pipelines that tie together or "loop" portions of a system that are physical "dead ends" and susceptible to service disruptions. The interconnection removes the "dead end" situation and allows water supplies to be served from more than one source or location. Thus, the "loop" not only improves system capacity, but also provides necessary reliability in the event a water source or major transmission line is lost. In addition, the Central Basin's Recycled Water System will be expanded to serve irrigation and industrial sites throughout the Los Angeles Region.

Data Gaps

The remaining data gap is identification of the remaining 3,500 afy of recycled water users. This will be addressed by updating the CBMWD Water Recycling Program Master Plan. This effort is currently underway and the update should be complete in August 2006.

2. JWPCP Marshland Enhancement Project

Table 8-2: References for JWPCP Marshland Enhancement

#	Reference	Relevance
2-1	Joint Outfall System 2010 Master Facilities Plan Environmental Impact Report (Jones & Stokes, June 1995)	This report requires the preparation and implementation of a marshland management plan to restore and enhance the JWPCP marshland and initiate the JWPCP Marshland Enhancement Project.
2-2	Marshland Management Plan (Jones & Stokes, April 1996)	Feasibility and management plan for the JWPCP marshland in compliance with Mitigation Measure 11-2 of the Joint Outfall System 2010 Master Facilities Plan Environmental Impact Report.
2-3	Significant Native and Non-Native Vegetation Present Within the JWPCP Marshland (WRA, March, 2004)	This study led to the decision to enhance the marshland by removing the non-natives and the senescent natives and replace them with a more extensive and diverse pallet of natives.
2-4	Wildlife Habitat Assessment—JWPCP Marshland Enhancement Project, Carson, Los Angeles County, California (WRA, August 2005)	Habitat assessment to determine if existing conditions provided suitable habitat for special status wildlife species, and to identify species in the marshland. Showed that impacts to special status wildlife species were highly unlikely during the construction of this project.
2-5	Hydrological Analysis and Evaluation of the Pump Station and Outlet Weir for the JWPCP Marshland Enhancement Project (Noble, July 2004)	This report assisted in the design of the marsh and the development of an operational plan for the marsh.
2-6	Assessment of Best Management Practice (BMP) Effectiveness (Brown et al, September 2005)	Evaluation of BMP effectiveness of a wetland site similar to the JWPCP marshland site.

Technical Adequacy / Feasibility

The JWPCP Marshland Enhancement Project was identified in **Reference 2-1** (Section 11, pg. 11-19) as a mitigation measure based on proximity to new treatment plant facilities. It was hypothesized at that time that increased deposition of material from the adjacent facilities (digesters) would impact the marsh (wetland) and riparian habitats during construction. Therefore, Mitigation Measure 11-2 required preparation and implementation of a marshland management plan.

The project is taking place at the location of a remnant of Bixby Slough, a formerly extensive wetland area. In the 1970s Wilmington Drain was installed, cutting the JWPCP marshland off from the rest of

Bixby Slough. However, a pump was installed to lift water from the east branch of Wilmington Drain into this remnant wetland to keep it alive. Therefore, since the site has been a wetland for many years, it is logical that it can be restored and enhanced to provide better wetland characteristics. To make sure that the restoration and enhancement is successful, LACSD hired a consultant that has been involved in the restoration, enhancement, and construction of a number of similar wetlands.

The feasibility of enhancing the marshland was studied in **Reference 2-2** (Section 2, pp. 2-1 to 2-10). At that time it was determined that, with some minor changes, the marshland could be restored and enhanced. However, while wastewater treatment facilities (digesters) were being constructed next to the marshland, it was found that the site hydrology caused groundwater seepage into the excavations for the digesters. The LACSD responded to this situation by hiring a geologic consultant to evaluate the geologic/hydrologic properties of the digester and marshland site, including their interactions. The geologist determined that the marshland could be modified so that it did not impact the digesters as long as saturated areas were kept at least 100 feet away from the digesters. It was determined that a safety factor of two would be applied to this number; therefore, saturated areas of the marshland will be offset from the digesters by 200 feet.

Two background data gathering assessments were performed (and which consisted mainly of habitat assessments. The first assessment, **Reference 2-3** focused on the vegetative habitats at the marshlands, while the second assessment, **Reference 2-4** focused on the wildlife at the site.

Reference 2-3 results were:

- Marsh habitat present on site appeared to be healthy and dominated by a single native species (California tule);
- Riparian habitat present on site is co-dominated by native and non-native trees and shrubs;
- Native riparian community appears to be in senescence (no seedlings were observed); and
- Uplands were dominated by non-native annual species and non-native trees and shrubs.

This study was relevant to the project because it showed that the native vegetation, except for the tules, was not growing and reproducing or was dominated by non-natives. This study led to the decision to enhance the marshland by removing the non-natives and the senescent natives and replace them with a more extensive and diverse pallet of natives.

Reference 2-4 conclusions were:

- No special status wildlife species are likely to occur in the marshland due to poor habitat conditions and isolation from larger areas of suitable habitat;
- Proposed project is unlikely to impact special status wildlife species; and
- Several common wildlife species have been documented to occur in the marshland.

This study was relevant to the project to show that impacts to special status wildlife species were highly unlikely during the construction of this project.

Reference 2-5 was performed to ensure that the proposed hydrologic pathway could be successfully operated. The recommendations from this study include:

- Replace the outlet toggle gate because it is in disrepair;
- Use the inlet pump and toggle gate to provide water circulation in the marsh;

- Re-program the pump station to achieve the design water level; and
- Develop a monitoring plan to monitor the health of the marshland.

Typically, the most important asset that influences the success of a wetlands creation, restoration, or enhancement project is the availability of a consistent water supply. The project is assured of an adequate water supply because of the pump station at the marshland inlet that lifts water from Wilmington Drain into the marshland. Wilmington Drain is a concrete channel that collects runoff from the surrounding area. It rarely, if ever, runs dry at the location of the JWPCP marshland inlet pump station**.** Therefore, this project has a high probability of providing all of the benefits discussed in this Proposal.

Data Gaps

The project must address the data gap of analytical results for JWPCP marshland inlet and outlet. No data from the inlet or the outlet of the marshland have been collected. Data from the inlet would be much more useful at this point of the design because contaminant levels into the marshland would then be known. Outlet data are not as important because the hydrology and plant pallet will be significantly changed and enhanced as part of the project. However, since marshland plants are currently growing in the marshland, it can be assumed that the normal flow from Wilmington Drain is not toxic to these plants.

To address this gap, inlet and outlet data will be collected as part of the Monitoring Plan. Monitoring will commence after project work is completed in late 2007.

3. Large Landscape Water Conservation, Runoff Reduction and Educational Program

Table 8-3: References for Large Landscape Conservation

#	Reference	Relevance
3-1	The Residential Runoff Reduction Study (MWDOC & IRWD, July 2004)	This study provides scientific and technical merit to the water savings and runoff reduction attributed to WBICs.
3-2	Central Basin 2005 Urban Water Management Plan	This plan provides a comprehensive overview of the CBMWD goals for the future and identifies the current and planned programs and projects.
3-3	West Basin 2005 Urban Water Management Plan	This plan provides a comprehensive overview of the CBMWD goals for the future and identifies the current and planned programs and projects.

Technical Adequacy / Feasibility

Both Central Basin and West Basin have worked with HydroEarth Inc. to install WBICs in several large landscape areas located within their service areas. Central Basin and West Basin have a relationship built and the support of local cities, environmental groups, water agencies, non-profits and other stakeholders for this project.

As part of this project, WBICs will be installed in large landscape areas and rebates will also be provided to residents to encourage the purchase of smaller residential-sized WBICs which also use weather data for proper irrigation scheduling. The concepts and controller technology have been developed by HydroEarth. Starting in 2004, several HydroEarth controllers have been installed in several locations within Central Basin and West Basin as pilot sites. The concepts and systems have proven to be successful.

The use of weather-data to irrigate has been tested as described in **Reference 3-1** (Pages ES-1 – ES-6) and a study conducted on the reduction of urban runoff using WBICs. A comparison was made between pre-intervention and post-intervention. As stated in Reference 3-1, the technology is sound. This report, along with current installations, provides the needed scientific and technical support to garner state support and confidence in the project.

Reference 3-1 described tests on the effectiveness of WBIC technology in residential applications. After 40 such controllers were installed in the Westpark neighborhood of Irvine, California, water demand and runoff in the study area were measured. The resulting average water savings for this study were 37 gallons per day, or 7 percent of total household water use and 18 percent of irrigation water use.

Based upon the initial findings documented in Reference 3-1, IRWD and MWDOC partnered on new research, in which the number of site studies was increased. A baseline area where no changes were made was also included. This made Reference 3-1 one of the first studies to attempt to quantify the effectiveness of public education alone versus a technology-based plus education approach to reducing residential irrigation water usage.

Reference 3-1 had four primary purposes:

- To test the use of weather-based irrigation technology, also known as WBICs or ET controllers, to manage irrigation water for residential homes and large landscape areas;
- To evaluate the effectiveness of a targeted education program on residential homeowners;
- To determine the correlation between proper water application in landscape irrigation and the quantity and quality of urban dry-season runoff; and
- To gauge the acceptance of water management via the irrigation controller technology.

The following summarizes the study results:

- Water Conservation Savings: The net result was eight times more water savings than with the single-family residential controller, strongly indicating that the larger the landscape, the better the savings per controller.
- Dry Season Runoff Changes: The retrofit group experienced a 50 percent direct reduction in water runoff (pre- intervention runoff compared to post-intervention runoff) during dry season periods (Figure ES-5)
- Changes in Runoff Water Quality: It is probable that a reduction in total pollutant migration could be achieved by reducing total dry season urban runoff.
- Public Acceptance of Water Management: While there were some customer service-related issues, the retrofit group had a generally positive response to the ET controller, with 72 percent of participants indicating that they liked the controllers.

Reference 3-1 showed that weather-based irrigation controllers, which provide proper landscape water management, resulted in water savings of 41 gallons per day (gpd) in typical residential settings and 545 gpd for larger dedicated landscape irrigation accounts. The observed reduction in runoff from the retrofit test area was 50 percent when comparing pre-intervention and post-intervention periods and 71 percent in comparison to the control group. The education group saw reductions in water use of 28 gpd, and a reduction in runoff of 21 percent in comparison to the control group. Water quality parameters in both study areas were highly variable, and very few differences in the level of monitored constituents were detected. In terms of water savings per controller (and cost effectiveness), the study clearly indicated that

larger landscape areas (parks and street medians) should provide the initial targets for the expansion of similar programs.

References 3-2 (Section 6, Pages 6-5 – 6-6) and **Reference 3-3**(Section 6, Pages 6-7 – 6-8) identifies this project as meeting BMP #5- Large Landscape Conservation Programs and Incentives. This includes the Irrigation Controller Program (Reference 3-2) and the Ocean Friendly Gardens (Reference 3-3).

Data Gaps

Project design is complete, no data gaps are apparent.

4. Las Virgenes Creek Restoration Project

Table 8-4: References for Las Virgenes Creek Restoration

#	Reference	Relevance
4-1	Las Virgenes Gateway Master Plan (Dec 1998)	Provides guidelines for restoration of Las Virgenes Creek covering concrete removal, riprap, riparian vegetation and buffer zones.
4-2	Preliminary Design and Feasibility Analysis for Stream Restoration, Las Virgenes Creek , Calabasas, California (Questa Engineering Corporation, 2004)	This study investigated the existing stream conditions to develop and evaluate restoration alternatives for the project.
4-3	Las Virgenes, McCoy and Dry Canyon Creeks Master Plan for Renovation Phase 1: Comprehensive Final (EDAW, 2003)	Identifies the project as high priority

Technical Adequacy / Feasibility

In FY1999/2000, the City of Calabasas commissioned a feasibility study as a result of the Las Virgenes Gateway Master Plan (**Reference 4-1**) to consider alternatives to the existing concrete trapezoidal channel that would facilitate wildlife movement and provide native riparian habitat. The "Feasibility Study for Removal of Concrete Lining in Las Virgenes Creek Near Agoura Road," completed in February 2000, concluded that either a gabion structure or concrete block revetment liner would be feasible alternatives to the existing concrete. In 2003, Questa Engineering completed a detailed Feasibility Study that underwent a public and stakeholder review process, culminating in a City Council approved conceptual design.

The Las Virgenes Gateway Master Plan carried out the General Plan vision for this segment of Calabasas while providing more specific land use and development criteria. With regard to future creek restoration, the Narrative Vision Statement reads as follows (Reference 4-1, p. 2:2):

> The Agoura Road Village Shopping Center offers a variety of shops and services that cater to local residents' daily needs. Patrons of the Center arrive by car, foot and bicycles to enjoy the outdoor patios, terraces and creekside paths. The newly reclaimed creek is lush with willows and cattails that provide habitat for myriad of bird species. A meandering path along the creek provides a connection to adjacent neighborhoods and the commercial center. A portion of new development shall orient to the creek with outdoor patios, plaza area, or creekside park.

The narrative established the guiding vision for the future development of the creek (Reference 4-1, p. 2:5):

- A reclaimed creek that collects drainage for the area, provides control of flood waters as well as plant and animal habitat. This natural environment also provides a peaceful respite from urban experience.
- A multi-use trail along the creek corridor connects the southern residential areas to the Neighborhood Commercial Center and encourages local residents to walk or bike to their destinations.
- A linear park through the area links Malibu Creek State park to areas north of the freeway.

The Feasibility Study (**Reference 4-2**) examines existing geomorphic conditions, locates existing utilities, identifies right-of-constraints and thoroughly examines several potentially feasible options for concrete channel removal.

The Las Virgenes Creek Restoration Project must balance the goals of riparian habitat creation with the requirement of maintaining effective flood control. Reference 4-2 analyzed creek hydraulic conditions that guided the development of a restoration strategy that will achieve this balance.

The design of the project was chosen from alternatives developed through hydraulic computer models that quantified existing flow conditions. The study included examination of creek channel processes, including a geomorphic analysis of existing fluvial geomorphology and channel geometry. Existing facilities, bridge abutments, utility lines and fish passage conditions were all considered in the study. In addition, a detailed topographic survey of the site was completed. By accounting for all of these factors, an optimal design was obtained that will provide useful riparian habitat while simultaneously meeting flood control requirements.

The design of the habitat element of the project was supported through a biological database search for any special status wildlife and plant species within the area. The project design process has involved extensive regulatory agency review. This project has been reviewed and permitted by CDFG, SWRCB, the USFWS and USACE.

Reference 4-3 identifies the project as high priority. Page 119 of the Plan explains in details the importance of the project and estimated cost analysis of implementing concrete removal and naturalizing the creek.

Data Gaps

Reference 4-2, which addresses geomorphology, biology, hydrology and hydraulics, constraints and design issues, cost, public accessibility and alternatives to restoring the creek channel, is believed to be comprehensive and no data gaps are known at this time.

5. Malibu Creek Watershed Water Conservation, Runoff Reduction, and Native Flow Restoration Project

Table 8-5: References for Malibu Creek Watershed Conservation

#	Reference	Relevance
5-1	Residential End Uses of Water and Demand Management Opportunities (American Water Works Association Research Foundation, 1999)	Using data loggers installed in residential sites within the Malibu Creek watershed, this study identified the approach used in the project as providing the best opportunity to reduce imported water and runoff in Malibu Creek watershed: 1) irrigation system improvements, 2) low flush toilets and 3) high efficiency washers.
5-2	Alternative Irrigation Scheduling Methods – Final Report for Letter Agreement No. 19139 (Las Virgenes Municipal Water District, 2000)	Validates the efficacy of the project by identifying weather-based irrigation controllers as the optimal irrigation scheduling method for the project area and identified sources, causes and quantity of runoff from project area.
5-3	Making Progress: Restoration of the Malibu Creek Watershed (Santa Monica Bay Restoration Project, 2000)	Section III (Key findings) identified the reduction of excess flows into Malibu Creek as a priority action item for which minimal progress had been made. Provided impetus for accelerated efforts.
5-4	Total Maximum Daily Load for Nutrients, Malibu Creek watershed. (United States Environmental Protection Agency, 2002)	Identified irrigation runoff from developed lands as the largest annual non-point source of nutrients in the watershed (Fig. A11) and that reducing this source is necessary to meet the TMDL bacteria and nutrient targets.
5-6	NPDES permit CA0056014 for the Tapia Water Reclamation Facility (Los Angeles Regional Water Quality Control Board, 1997)	Section VI, Findings 1-5 identifies dry weather non-point runoff and discharges of treated wastewater as contributing to aseasonal breaching of Malibu Lagoon and attendant water quality problems at Surfrider Beach.
5-7	Urban Runoff Reduction Project for Malibu Creek – Agreement No. 03-167-554-0, quarterly progress reports (Las Virgenes Municipal Water District, 2005-06)	Documents and maps residential sources of urban runoff, providing potential targets for additional irrigation system improvements funded by this project.
5-8	Multi-family Ultra-Low Flush Toilet (ULFT) and Residential High Efficiency Clothes Washer (HECW) Rebate Program Urban Water Conservation Capital Outlay Grant Contract E67011, Final Report (Las Virgenes Municipal Water District, 2004)	Demonstrated cost effectiveness of project (LVMWD project elements) through pilot and site specific study.

Technical Adequacy / Feasibility

The proposed project is based on several scientific and technical studies of the Malibu Creek watershed, including one study that specifically addressed over-irrigation and runoff from the project site itself.

Reference 5-1 demonstrates that residential water conservation devices and irrigation system improvements are the best methods to reduce imported water and reduce urban runoff in the project area. The use of weather-based irrigation controllers (WBICs) in the project area was documented in **Reference 5-2**, which showed that WBICs were effective in both conserving water and reducing urban runoff.

Reference 5-3 identified the reduction of excessive runoff into Malibu Creek as a high priority. The proposed site for urban runoff reduction /outdoor conservation portion of the project was the focus of a study by Orton and Harris. The study found that turf planted street medians were good candidates for water savings. The study also found street medians had increased impact on urban runoff due to their proximity to gutters and storm drains. Both of these findings led to the selection of the project site proposed in this project. Other candidate locations for this project have been identified in the Urban Runoff Reduction Project for Malibu Creek study by LVMWD. This study mapped the specific residential parcels where irrigation runoff is persistent and proximate to storm drains, providing priority locations for implementing the irrigation system improvements proposed in this project.

The importance of the project's focus on residential landscaping was confirmed by **Reference 5-4** that identified dry weather residential runoff as the largest source of non-point nutrient loads into Malibu Creek. Site specific studies (Reference 5-1) also verified that residential landscaping is the largest source of such incidental loads.

The water quality and aquatic habitat benefits of the project are supported by Reference 5-4, which quantified the percentage of nutrients that enter Malibu Creek from urban runoff and concluded that reducing this major source is necessary to meet the TMDL bacteria and nutrient targets. The City of Westlake's runoff reduction / conservation element of the project is directly responsive to this finding, by focusing on over-irrigation of large landscaped areas irrigated with nutrient-laden recycled water adjacent to Westlake Lake and Malibu Creek's tributary streams. With respect to recreational and public health benefits, the Los Angeles Regional Water Quality Control Board has adopted findings (**Reference 5-5**) that excess non-native flows are contributing to beach closures at Surfrider Beach due to a seasonal breaching of Malibu Lagoon. **Reference 5-6** provided information about locations of residential sources of urban runoff that allowed irrigation controller sites to be determined for optimal effectiveness.

With respect to water supply benefits, Reference 5-1 showed that the project's residential outdoor conservation elements that will be used in the project are the most effective way to reduce the volume of imported water in the watershed, because the percentage of water used outdoors is among the highest in California due to an arid microclimate and a disproportionate percentage of large landscaped areas in comparison to more metropolitan areas.

Reference 5-7 performed pilot and site specific studies that demonstrated the cost-effectiveness of the project.

Data Gaps

No significant data gap has been identified at this time. The project is ready for funding and final implementation.

6. Morris Dam Water Supply Enhancement Project

Table 8-6: References for Morris Dam Water Supply

#	Reference	Relevance
6-1	U.S. Bureau of Reclamation – Equipment Inspection/ Evaluation Report, Morris Dam (U.S. Bureau of Reclamation, August 1998)	Study of existing condition of dam control system. Initiated interest for rehabilitation, improved safety and reliability, and for automation for operational efficiency.

6-2	Morris Dam River Intake Modification Study (Black and Veatch, April 2004)	Feasibility Study for Intake Structure Modification to mitigate operation problems associated with sediment build up and to improve water conservation capacity.
6-3	Morris Dam Inlet/Outlet Rehabilitation Report – Final Design Summary report (Black and Veatch, August 2004)	Description of the features associated with the rehabilitation of the control system.

Technical Adequacy / Feasibility

In 1998, the LACFCD contracted with the U.S. Bureau of Reclamation (USBR) to assess the technical adequacy of the control system at Morris Dam and to determine deficiencies in the control system which would impact the operation of Morris Dam for flood control and water conservation. Previous investigations for modification to Morris Dam included the initial USBR investigation (**Reference 6-1**). USBR determined that modifications to the valves and control system would be required to maintain future operation of Morris Dam (Reference 6-1; Introduction, pp. 1-8, Assessment of Electrical System).

Reference 6-2 analyzed the redesign options of the intake structure, which would involve abandonment of the existing intake elevation and trash rack and construction of a higher tower that would allow water to be taken from a higher elevation within the reservoir. Increasing the elevation where water from the reservoir is drawn and improving the valves to prevent damage due to sediment will allow the LACFCD to lower the reservoir pool. The amount of water that will be available for downstream use will vary from year to year, however the overall increase will be approximately 5,720 acre-feet of water captured (Reference 6-2; pp. 1-4).

Reference 6-3 was completed in August 2004 to describe features associated with the rehabilitation of the control system, including electrical system upgrade (pp. 1-1 to 1-6). The rehabilitation of the dam's valves will improve both safety and reliability and automation of the dam's outlet works will improve operational efficiency for downstream water conservation.

Data Gaps

No data gaps have been identified besides completion of the Final Design and approval of Division of Safety of Dams, as described in Attachment 5.

7. North Atwater Creek Restoration and Water Quality Enhancement Project

Table 8-7 References for North Atwater Creek Restoration

#	Reference	Relevance
7-1	LA River Revitalization Master plan Website (www.lariver.org) and Notice of Preparation/Notice of Intent for Environmental Impact Report/Environmental Impact Statement for the LA River Revitalization Master Plan, (City of LA, March 2006)	Provides the background for the greater effort of which this project is a component
7-2	LA River Master Plan (Los Angeles Country Department of Public Works, June 1996)	Adheres to plan objectives
7-3	North Atwater Creek Restoration & Water Quality Enhancement Project Workplan (City of LA, May 2006)	Provides the work plan for the project

Technical Adequacy / Feasibility

The proposed project is the first of a series of projects aimed at revitalization of the LA River. These efforts are coordinated as part of the LA River Revitalization Master Plan **(Reference 7-1).** This 18-month planning process will look at improvements along the LA River and will advance past efforts such as the guidance provided by the LA River Master Plan that was developed by the LACDPW in 1996 (**Reference 7-2).** By the end of the planning process, a 20-year blueprint for development and management of the LA River will be developed for implementation by the City of LA. This vision has the following goals:

- Improve water quality, improve water resources, and improve the ecological functioning of the LA River.
- Provide public access to the LA River.
- Provide significant recreation space and open space, new trails, and improve natural habitats to support wildlife.
- Preserve and enhance the flood control features of the LA River.
- Foster a growth in community awareness of the LA River, and pride in the LA River.

This plan is currently under development and is scheduled for completion by January 2007.

A project workplan was prepared (**Reference 7-3**) that discusses the current site conditions, the scope of work, the project configuration, and presents the maintenance requirements, project schedule, cost estimate, and preliminary layout.

The methodology for the pollution removal is presented here. The amount of pollution loads generated by the drainage area is calculated based on land use characteristics and generations rates that have been identified based on regional studies. The load amount of for the major pollutants of concern that will be present in the drainage area runoff (L-kg/yr) can be calculated as follows:

$$L = \sum_{i}^{n} RC_i AASV_i * C_i * G$$

Where RC_i = runoff/rainfall ratio for given land use (i)
C_i = anticipated concentration for given land use (mg/l)
G = unit conversion factor (10^{-6} kg/mg*28.3 l/cf)
$AASV_i$ = average annual storm volume for given land use (cf/yr)
$= P*A_i *F$ and where
P = annual rain fall = 15 in /yr
A_i= Drainage area for each land use
F = unit conversion factor (43,560sf/ac-1ft/12in)

The amounts of loads for zinc, copper and lead from the drainage area (L) are calculated in the table below.

Area (ac)	Area (ac)	$AASV_i$ (cf)	RC_i	Zn C_I mg/l	Zn L (kg/yr)	Cu C_I mg/l	Cu L (kg/yr)	Pb C_I mg/l	Pb L (kg/yr)
Residential	10	544,500	0.42	.080	0.5	.015	0.06	.010	0.04
Industrial	30	1,633,500	0.95	.566	24.9	.031	1.36	.015	0.68
Roadways	10	544,500	1.0	.280	4.3	.052	0.80	.009	0.14
Total	50	8,760,000			29.7		2.22		0.86

The concentration data is based on the monitoring by LACDPW as presented in the 1994-2000 Integrated Receiving Water Impacts Report.

The wetlands component of the project is anticipated to have 50% removal with respect to these metals or 15 kg, 1.1 kg, and 0.4 kg for zinc, copper and lead respectively. While this amount is marginal compared to the loadings into the LA River, the project will assist in demonstrating the use of projects that target multiple pollutants.

Data Gaps

Water quality data is needed to determine the constituent pollutants from the three water sources: runoff from the surrounding neighborhood, water entering from nearby equestrian facilities, and water from the Los Angeles River. This gap will be addressed through a water quality monitoring plan.

8. Pacoima Wash Greenway Project: 8th Street Park

Table 8-8: References for Pacoima Wash / 8th Street Park Project

#	Reference	Relevance
8-1	Pacoima Wash Greenway Master Plan (Dept. of Landscape Architecture, California State Polytechnic University, Pomona, June 2004)	Comprehensive master plan for Pacoima. Wash
8-2	Pacoima Wash: 8th Street Park Project, Conceptual Hydrologic Layout (Martin Kammerer, January 2006)	Hydrologic study of 8th Street Site.

Technical Adequacy / Feasibility

The project was chosen after a series of projects and opportunities were identified along Pacoima Wash. **Reference 8-1** studied potential recreational connections between the Angeles National Forest and the San Fernando Valley. It was the first document to propose a bikeway trail along the banks of Pacoima Wash and to also identify a number of potential sites for recreational development.

Reference 8-2 identifies a number of approaches to consider in addressing the problems of water quality and peak flow rates of run off from adjacent neighborhoods into the Pacoima Wash. Recommendations included exploring methods of incorporating BMPs into a park design that will create wildlife habitat and provide passive recreational opportunities as well as water quality and quantity improvements. Reference 8-2 confirms the selection of this project as the best alternative to achieve water filtration and retention technically and economically while additionally providing the community with open space.

Specific hydrologic calculations have been conducted for the project and were reviewed by the city engineer of the City of San Fernando. The water volumes are based on the modified rational method for surface runoff calculations following the Hydrology and Sedimentation Manuals for Los Angeles County. Area calculations were based on a topographic survey and a preliminary grading plan for the site.

In addition to hydrologic calculations, other data was obtained from the manufacturer of the Stormceptors and from commonly accepted Darcy-type calculations pertaining to infiltration rates associated with Austin-Type sand media filters.

Data Gaps

No significant data gaps have been identified.

9. San Gabriel Valley Riparian Habitat Arundo Removal Project

Table 8-9: References for San Gabriel Valley Arundo Removal

#	Reference	Relevance
9-1	Invasive Plants of California's Wildland, 2000, Edited by C. C. Bossard, J. M. Randall, M.C. Hoshovsky < www.cal-ipc.org >	Summary of impacts and control methods.
9-2	Environmental Assessment of the Santa Ana Watershed Program 2000-2002, December 2000, by Richard Zembal and Susan Hoffman, 2000	Summary of impacts and control methods
9-3	Noxious Wildland Weeds of California, C.Bossard, J. Randall, and M. Hoshavsky (eds).	Summary of impacts

Technical Adequacy / Feasibility

Using proven methods of Arundo removal, the proposed project will close the gaps in past Arundo control efforts in southern San Gabriel Valley, resulting in complete eradication of Arundo within most of the Whittier Narrows basin, where previous cleared areas are currently subject to future re-infestation from *Arundo* still growing a short distance upstream.

Feasibility of *Arundo* removal methods within proposed budget is proven by success of previous mitigation and grant-funded habitat restoration projects at Whittier Narrows since 2000.

Arundo displaces native riparian habitat, increases its flammability, constricts flood control channels, and consumes more water than native riparian vegetation. These negative impacts of Arundo invasion are summarized in **Reference 9-1 (**pp. 53-58) and **Reference 9-2** (pp. 65-74). In addition, *Arundo* negatively impacts native plants and associated animal wildlife, as summarized in **Reference 9-3**.

Data Gaps

Detailed mapping of Arundo on aerial photos will be conducted along San Gabriel River at Whittier Narrows, plus updated along crossover channel east of Rosemead Blvd. and along Rio Hondo north of San Gabriel Blvd.

10. Solstice Creek Southern Steelhead Habitat Restoration

Table 8-10: Reference for Solstice Creek Restoration

#	Reference	Relevance
10-1	Invasive Plants of California's Wildlands (Carla C. Bossard, John M. Randall, Marc C. Hoshovsky, 2000)	Reviews impacts of non-native invasive plants on wildlands. Gives information on control techniques for individual species. Used to develop control strategies for invasive plants in our project.
10-2	California Invasive Plant Inventory (California Invasive Plant Council, 2006)	Provides a ranking of non-native species based on their impact to wildland ecosystems. Used to prioritize species for control in this project.
10-3	Weed Control Methods Handbook: Tools and Techniques for Use in Natural Areas (Mandy Tu, Callie Hurd, John M. Randall, 2001)	Describes an integrated pest management approach and reviews available control methods with pros and cons of each. We use this information to select control methods and design our overall site plan.
10-4	The Weed Workers' Handbook (California Invasive Plant Council, 2004)	Provides detailed information about control options for specific species and used in conjunction with Reference 10-1 to develop control strategies.
10-5	Clumped Planting Arrangement Reduces Weed Establishment in Coastal Sage Scrub Restoration Experiment (C. Brigham, 2004)	This is the result of a study we did on planting arrangements. We use the information from this study to design the specifics of our restoration planting strategy.
10-6	Solstice Creek Steelhead Restoration Plan (USFWS, 2003)	Outlines eight steps to restore Solstice Creek for enhancement of habitat for federally endangered southern steelhead trout.

Technical Adequacy / Feasibility

Similar restoration work has taken place in Solstice Canyon, Zuma Canyon and other sites within the Santa Monica Mountains. The active and successful native plant nursery has been around since 2000 and can produce an average of 11,000 plants per year. Survivorship rates for previous restoration plantings at Solstice Canyon were 70% over a two year period.

The native plant nursery is fully capable of producing the plants for this study. A team of dedicated staff and volunteers have multiple years experience collecting seed, propagating plants, outplanting and maintaining restoration sites. They have conducted restoration plantings in remote and inaccessible areas, carrying all materials in by hand. Additionally, they have experience planting a wide variety of species and have worked with all of the species proposed in this project.

A preliminary map of invasive species infestations in Solstice Canyon has been created. This map will be updated as part of our project in order to document new invasions and confirm that infestations treated in 2001-2004 are still eradicated. The team has a great deal of professional knowledge of the native plants of the area and have species-specific survival rates for plants installed in Solstice Canyon in 2003.

The prior work and studies cited in the above references indicate that native species produce more environmental benefits than invasive species. Native species use less water, prevent soil erosion, and provide wildlife habitat.

The decision to remove non-native invasive species from the adjacent riparian area and plant native species is based on both published studies on the impacts of non-native species and also park research on the distribution and impacts of non-native species in the project area. The National Park Service (NPS) has a 2003 map of non-native invasive species in the Solstice Creek drainage that identifies 60 infestations of 7 non-native invasive plant species. 27 of these infestations were treated and restored during projects in 2001-2004. The remaining 33 infestations have subsequently grown and continued to spread. In addition, the barrier removal activities have disturbed native vegetation and created new non-native species infestations. The impact of non-native invasive plants on native habitats is clearly demonstrated in numerous references including **Reference 10-1**. This Reference also reviews available information for control of specific non-native invasive species. The species targeted for control are based on both Reference 10-1 and **Reference 10-2**.

Our use of integrated pest management and development of a detailed implementation plan is based on the approach outlined in **Reference 10-3** and **Reference 10-4** . In addition, NPS has conducted studies on control methods, restoration techniques, and impacts of non-native species in Solstice Canyon. NPS conducted a preliminary study on the effectiveness of mulching in 2003 (C. Brigham, unpublished data), and completed a study of planting arrangement on non-native species abundance (**Reference 10-5**). An NPS intern studied the impact of Euphorbia terracina (one of the more common non-native invasive species in Solstice Canyon) and found that Euphorbia had much lower insect diversity than native vegetation and showed no signs of insect or animal browsing (N. Beck, unpublished data). **Reference 10-6** identified specific tasks, organization and schedule and associated costs for Solstice Creek restoration activities.

Data Gaps

The first action item in the implementation plan is to update a map of invasive species infestations within the work area. This map must be completed in order to continue with the detailed implementation plan and restoration work.

11. South Los Angeles Wetlands Park Project

Table 8-11 South Los Angeles Wetlands Park References

#	Reference	Relevance
11-1	Los Angeles River Trash TMDL	Contributes to regulatory compliance
11-2	Los Angeles River Heavy Metal TMDL	Contributes to regulatory compliance
11-3	Common Ground - San Gabriel and Los Angeles Rivers Watershed and Open Space Plan (RMC & SMMC, October 2001)	Adheres to plan objectives
11-4	South Los Angeles Wetlands Park Concept Feasibility Report (City of Los Angeles CH2M HILL, April 2003)	Concept feasibility report
11-5	South Los Angeles Wetland Park, Conceptual Report, June 2006	Updated feasibility report
11-6	Supplemental Site Assessment (City of Los Angeles, June 2006)	Confirmed that there is no soil contamination concern
11-7	Letter from Councilwoman Jan Perry (June 2006)	Presents the status of land acquisition

Technical Adequacy / Feasibility

The South Los Angeles Wetlands Park Project will contribute towards compliance for trash and heavy metal TMDLs for the Los Angeles River that can be found in **References 11-1** and **11-2**. This project is also consistent with the regional plan cited in **Reference 11-3**.

The feasibility and the benefits of the project are greatly discussed and analyzed in **References 11-4** and **11-5**. Reference 11-4 provided the preliminary concept, while Reference 11-5 provides more detail information regarding its configuration, pollution loads, and sizing criteria and cost estimate, including a detail breakdown of construction costs.

Reference 11-6 provides a preliminary site assessment based on soil testing that was performed in 2004 and 2005 to identify subsurface contamination, if any. These tests determined that there are contaminants in the soil however the do not exceed the established Region 9 Preliminary Remediation Goals and calculated site specific soil screening levels. The former clarifiers on the site are a source of VOC impacts and based on these findings the DTSC has determined that the site is suitable for a wetlands park on the condition that the clarifiers are properly abandoned.

Reference 11-7 is a correspondence from City of Los Angeles councilwoman Jan Perry that summarizes the status of negotiations for the land acquisition, which is expected to be completed over the next two months.

Data Gaps

More information is needed regarding existing grading of the site, and identification of storm drains that will drain into the site. This will be addressed in the preliminary design phase of the project.

12. Whittier Narrows Water Reclamation Plant UV Disinfection Facilities Project

Table 8-12 References for Whittier Narrows WRP UV

#	Reference	Relevance
12-1	Pomona WRP NPDES Permit R4-2004-0099 (LARWQCB, June 2003)	NPDES permit that includes a discussion on NDMA and directs the UV disinfection project at the Whittier Narrows WRP for the decrease of NDMA levels.
12-2	San Jose Creek NPDES Permit R4-2004-0097 (LARWQCB, June 2003)	NPDES permit with similar relevance as Reference 1. Note that both Pomona and San Jose Creek WRPs discharge into the Montebello Forebay Groundwater Recharge Project with the Whittier Narrows WRP UV project.
12-3	Summary of Districts' Efforts Investigating and Reducing N-Nitrosodimethylamine (NDMA) Concentrations in Water Reclamation Plants (Conway (LACSD), April 2004, Letter to LARWQCB)	Documents LACSD's efforts to investigate and reduce NDMA concentrations in WRP effluents going to groundwater recharge. Discusses NDMA sources, influent and effluent levels, operational measures to reduce NDMA, research activities and the implementation of the Whittier Narrows WRP UV Disinfection Facilities Project
12-4	Can N-Nitrosodimethylamine Formation be Affected by Polymer Use During Advanced Wastewater Treatment (Neisess et al (LACSD), 2003, Paper presented at WateReuse 2003 Symposium)	Laboratory testing that identified the increased use of cationic polymer associated with NDN process as the cause of elevated NDMA levels. The NDMA formation potential of different polymers was investigated in this study.
12-5	Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse (NWRI and AWWARF Guidelines, May 2003)	Guidelines developed by UV experts that formulate minimum design requirements for UV disinfection and currently adopted by California DHS. Specifically discusses UV for water reuse and testing protocols.
12-6	Application of Ultraviolet Light for Inactivation of Adenovirus (Durance et al, February 2005, Disinfection Specialty Conference)	Discusses the application of multiple barriers (UV and chlorine) for adenovirus inactivation.
12-7	Sequential Disinfection of Adenovirus type 2 with UV-Chlorine -Chloramine (Journal AWWA) Ballester and Malley Oct 2004	Paper that examines different sequential strategies using UV and various types of chlorine disinfectants for inactivation of adenovirus.
12-8	N-Nitrosodimethylamine (NDMA) as a Drinking Water Contaminant: A Review (Mitch et al, 2003, Environmental Engineering Science, Vol. 20, No. 5)	Discusses the formation of NDMA via the chloramination pathway. Shows UV as a viable technology for NDMA destruction. Identifies photolysis by sunlight as a mode of NDMA destruction providing natural attenuation in water bodies.
12-9	Large-Scale UV Pilot Plant Study: Tertiary Effluent Disinfection and Effect on NDMA and Cyanide (Jalali et al (LACSD), October 2005, Paper Presented at WEFTEC)	Paper that discusses LACSD's testing of the Trojan pilot reactor to determine the level of NDMA destruction with a disinfecting dosage and to determine if cyanide levels would increase with UV disinfection.
12-10	Fate of NDMA in Tertiary Water Reclamation Plants (Huitric et al, October 2005, WEFTEC 2005)	Documents the presence of NDMA through out the treatment system, and discusses ways to control formation and destroy NDMA in WRPs.
12-11	Preliminary Design Report for the Whittier Narrows Water Reclamation Plant UV Disinfection Facilities (LACSD, November 2005)	Provides rationale for basis of UV facilities design and modification of existing chlorination systems following from previous microbiological testing and validation bioassay work.
12-12	Water Reclamation Requirements – Whittier Narrows Water Reclamation Plant Reuse Permit (Los Angele RWQCB, October 1988,	Whittier Narrows Water Reclamation Plant Reuse Permit contains the nonpotable reuse requirements for the Whittier Narrows WRP.

	Order No. 88-107, File No. 88-40)	
12-13	Reclamation Permit of the Rio Hondo and San Gabriel Coastal Basin Spreading Grounds, Montebello Forebay Area (Los Angeles RWQCB, September 1991, File No. 71-67, Order 91-100)	Reclamation requirements for Indirect Potable Reuse applicable to water for the Whittier Narrows, San Jose Creek, and Pomona WRPs.
12-14	Trojan 3000Plus UV Disinfection System with 4 in. Lamp Spacing (Sakaji (DHS), October 2005, Letter to Trojan)	DHS acceptance of the validation report of the pilot testing performed at Whittier Narrows WRP with LSI lamps. Specifies that UV system should be designed at a minimum to deliver the dose recommendations of the NWRI/AWWARF Guidelines.
12-15	Trojan 3000Plus UV Disinfection System with 4 in. Lamp Spacing (Sakaji (DHS), April 2006, Letter to Trojan)	DHS acceptance of the validation report of the pilot testing performed at Whittier Narrows WRP with Heraeus lamps. This letter also contains the acceptance of the end of lamp life factor for the Heraeus lamps.

Technical Adequacy / Feasibility

The Whittier Narrows Water Reclamation Plant UV Disinfection Facilities Project is needed because NDMA concentrations have increased in several of LACSD WRP effluents. This increase in NDMA was a result of modifications implemented at the WRPs over the last several years, which allowed operation in NDN mode. This was done in order to comply with newly applicable ammonia criteria. Subsequent to the NDN modifications and the awareness of increased NDMA levels, the NPDES permits for the Pomona and San Jose Creek WRPs (**Reference 12-1**, pp. 11-12 and **Reference 12-2**, pp. 13-14) were reissued by the LARWQCB and included the requirement that the Whittier Narrows WRP be used as a test facility for conversion to UV disinfection.

LACSD have investigated the NDMA issue thoroughly and have performed a series of assessments and studies over the last several years, while also implementing operational and discharge strategies (**Reference 12-3**, pp. 1-16). It was discovered that the most likely contributor to the increased levels of NDMA associated with the NDN process was the increased use of cationic polymer, which contained the NDMA precursor dimethylamine, coupled with the existing disinfection practice of chloramination (**Reference 12-4**, pp. 1-10). The proposed Whittier Narrows WRP UV Disinfection Facilities Project is designed to replace the existing chloramination disinfection system with a dual barrier system using free chlorine and UV**.** The use of ultraviolet light for disinfection of tertiary treated and filtered water is well documented and an accepted practice for water reuse (**Reference 12-5**, pp. 21-23). However, a limitation of only providing UV disinfection is that it does not achieve a 4-log inactivation of adenovirus at the normal required dosage for filtered effluent (100 mJ/cm^2**).** Therefore, a small amount of free chlorine will be used to inactivate adenovirus (**Reference 12-6**, pp. 5-9 and **Reference 12-7**, pp. 99-102). NDMA will not form in significant amounts because chloramination will be discontinued and filter backwash water containing high levels of NDMA precursors are no longer recycled back into the WRPs. NDMA disinfection formation pathways are described in **Reference 12-8** (pp. 392-398) and specifically by LACSD research in **Reference 12-9** (pp. 1-10) and **Reference 12-10** (pp. 1-13). Concurrently with UV disinfection, there will be measurable destruction of NDMA by UV photolysis. UV pilot testing performed by the LACSD's research staff and laboratory demonstrated that a measurable amount of NDMA destruction (30-40%) occurs with normal UV disinfection dosages (Reference 12-9, pp. 9-11 and Reference 12-10, pp. 1 and 13)**.** Additional LACSD research has demonstrated that unacceptable levels of NDMA and THMs will not be generated by a low dosage of free chlorine and that a low chlorine dose will result in non-detection of adenovirus (**Reference 12-11**, p. 31 and Appendix E).

The UV facilities in particular are being designed according to minimum requirements set forth by the National Water Research Institute (NWRI) Guidelines (Reference 12-5, pp. 21-36). The required Engineering Report and Field Commissioning Tests described in NWRI Guidelines (Reference 12-5**,** pp.

33-34) will be reviewed by DHS and LARWQCB prior to the discharge and reclamation of water to ensure that the system operate as designed. The UV equipment specifications will be written to provide for checkpoint bioassays to prove the disinfection dose is being achieved as validated. All existing permit conditions for disinfection and water quality for reuse, reclamation and discharge to receiving waters still apply to the Whittier Narrows WRP and must be monitored and met (**References 12-12** and **Reference 12-13** in their entirety).

Feasibility of the project, which was performed by an equipment supplier's third party consultant and sponsored by LACSD, has been verified by extensive pilot testing at the Whittier Narrows WRP facility. The pilot testing resulted in the UV systems being reconfigured to a wider lamp spacing for a more efficient and less capital-intensive system. This UV equipment validation work has recently been accepted by the DHS (**References 12-14**, pp. 1-3 and **Reference 12-15**, pp.1-4).

Background data gathering included the NDMA data of plant influent, chlorinated and unchlorinated effluent, monitoring wells, and production wells (Reference 12-3, pp. 1-6). In accordance with an agreed-upon work plan with the LARWQCB, NDMA attenuation and dilution studies of the receiving water and groundwater are currently being conducted (Reference 12-3, pp. 7-16). Transmissivity and flow data analyses for design purposes are described in the Preliminary Design Report **(**Reference 12-10, pp. 20-22, Appendix A and Appendix B).

Data Gaps

At this time, there are no data gaps and the project can go forward as currently planned. Data being gathered on Whittier Narrows WRP effluent with regard to the transmissivity of UVT is ongoing and will continue to be conducted along with incidental research to determine the best operating UVT analyzer for the most efficient operational control of the UV system.

13. Wilmington Drain Restoration Project

Table 8-13 References for Wilmington Drain

#	Reference	Relevance
13-1	Machado Lake Watershed Management Plan, LADRP, October 2001	Identities the tributary areas and examines the pollutants of concern for the larger watershed for which Wilmington Drain is part.
13-2	Machado Lake Assessment, City of LA, Watershed Protection Division, March 2004.	Examines applicable BMPs for the larger watershed.
13-3	Wilmington Drain Restoration Multiuse Project Feasibility Study	Defines project and presents the work plan for the project.

Technical Adequacy / Feasibility

Reference 13-1 provides a background for the pollutants of concern for the Machado Lake and Wilmington Drain. This report identifies that about two thirds of the Machado Lake watershed drains through the Wilmington Drain and provides a delineation of the drainage area. **Reference 13-2** provides an examination of stormwater pollution and control strategies for inputs into the Machado Lake, which is located directly downstream of the Wilmington Drain.

Reference 13-3 is the project feasibility study that provides the project components, including its work plan, cost estimates, schedules, park layout, trash capture system schematics, and trash loading data. This reference serves as a planning tool for the project.

Data Gaps

A thorough survey of the land and contours of the Wilmington Drain will be completed to determine accurately the surface area of Wilmington Drain that will need to be restored and replanted.