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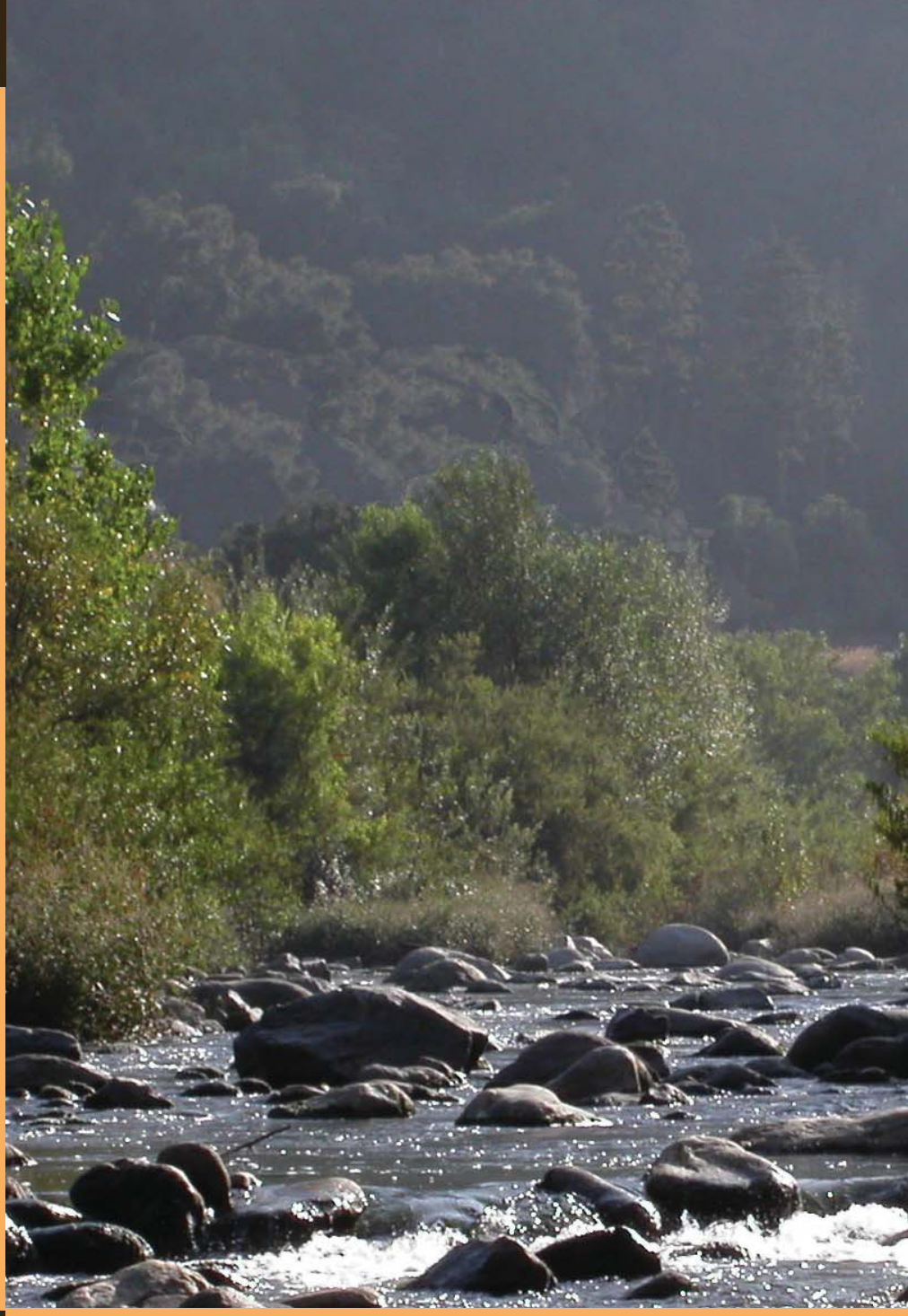
Surface Water Quality Management Strategy



Technical Memorandum
May 15, 2006

Integrated Regional Water Management Plan For the Greater Los Angeles County Region

BROWN AND CALDWELL

Technical Memorandum for the Integrated Regional Water Management Plan for the Greater Los Angeles County Region prepared in partnership with:

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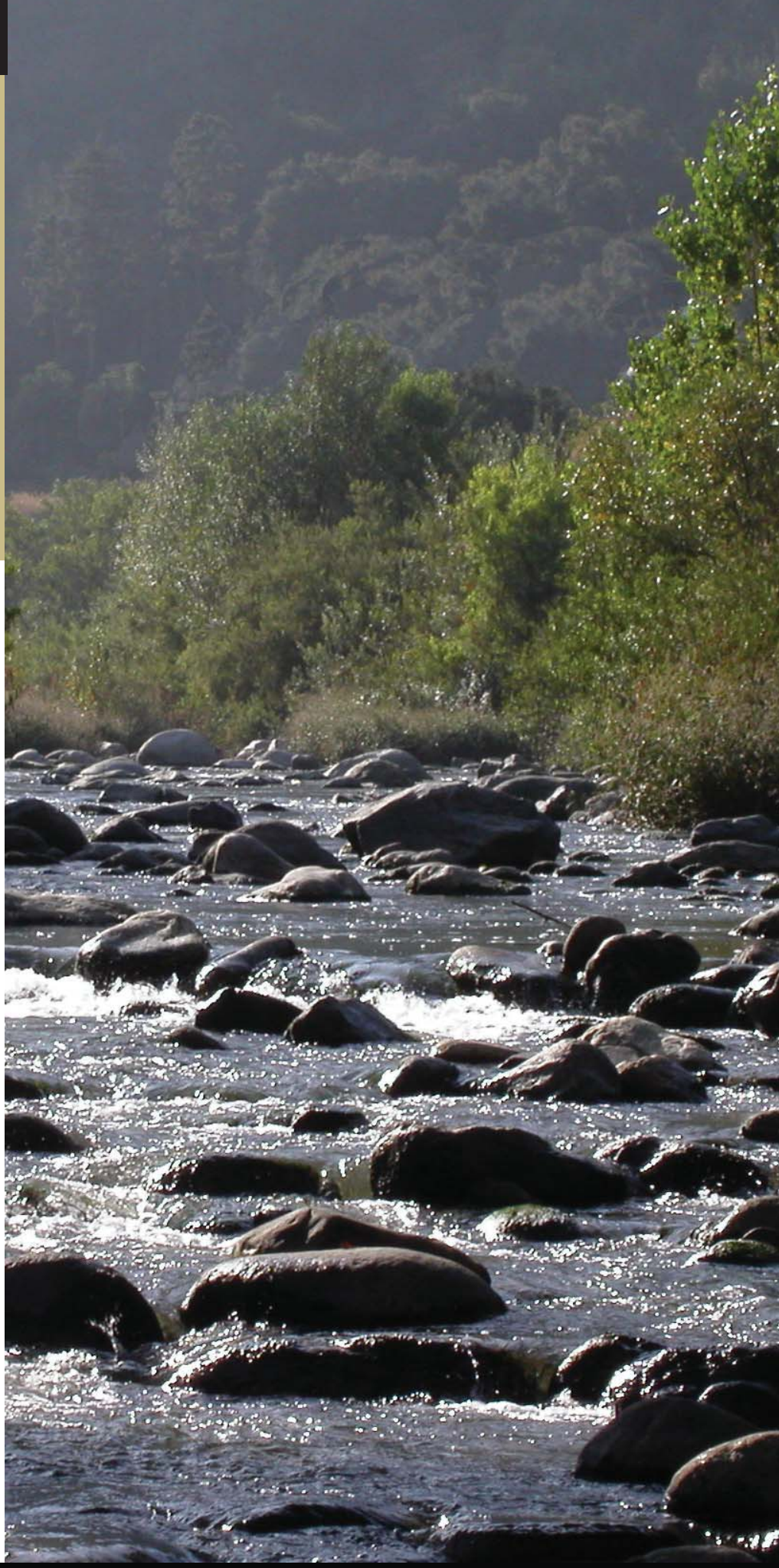

SURFACE WATER QUALITY TECHNICAL MEMORANDUM

Prepared for

Leadership Committee of Greater Los Angeles
County Integrated Regional Water Management Plan

May 15, 2006

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ACRONYMS

ASBS	Area of Special Biological Significance
ASCE	American Society of Civil Engineers
BASINS	Better Assessment Science Integrating Point and Nonpoint Sources
BCWTF	Ballona Creek Watershed Task Force
BHC	Benzene Hexachloride (a pesticide)
BMP	Best Management Practice
CCA	Critical Coastal Area
CDS	Continuous Deflective Separation
CEQA	California Environmental Quality Act
cfs	Cubic Feet per Second
CORVA	California Off-Road Vehicle Association
DDT	Dichloro-Diphenyl-Trichloroethane (a pesticide)
DWR	Department of Water Resources
EIR	Environmental Impact Report
EPA	United Stated Environmental Protection Agency
ESA	Endangered Species Act
ET	Evapotranspiration
FMD	Flood Maintenance Division
GIS	Geographic Information System
GOPR	Governor's Office of Planning and Research
Integrated TM	Integrated Water Management Technical Memorandum
IRP	Integrated Resources Plan
IRWM	Integrated Regional Water Management
IRWMP	Integrated Regional Water Management Plan
JWPCP	Joint Water Pollution Control Plant
LABOS	Los Angeles Bureau of Sanitation
LACDA	Los Angeles County Drainage Area
LACDPW	Los Angeles County Department of Public Works
LACFCD	Los Angeles County Flood Control District
LACSD	Los Angeles County Sanitation District
LADPW	City of Los Angeles Department of Public Works,
LADWP	Los Angeles Department of Water and Power
LANI	Los Angeles Neighborhood Initiative
LAR	Los Angeles River
LAWC	Lincoln Avenue Water Company
LAX	Los Angeles International Airport
LVMWD	Las Virgenes Municipal Water District

Metropolitan	Metropolitan Water District of Southern California
mgd	Million Gallons per Day
MOD-FLOW	Modular Three-Dimensional Ground-Water Flow Model
MRCA	Mountains Recreation and Conservation Authority
MS4	Municipal Separate Storm Sewer System
MWD	Municipal Water District
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
NPS	Nonpoint Source
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
POTW	Publicly Owned Treatment Works
REC-1	Water Contact Recreation
Region	Greater Los Angeles County Region
RMC	Rivers and Mountains Conservancy
RWQCB	Regional Water Quality Control Board
SCAG	Southern California Association of Governments
SCE	Southern California Edison
SDWA	Safe Drinking Water Act
SGMRC	San Gabriel Mountains Regional Conservancy
SGVMWD	San Gabriel Valley Municipal Water District
SMBRC	Santa Monica Bay Restoration Commission
SMMC	Santa Monica Mountains Conservancy
SQMP	Stormwater Quality Management Plan
SUSMP	Standard Urban Stormwater Mitigation Plan
SWPPP	Stormwater Pollution Prevention Program
SWRCB	State Water Resources Control Board
TBT	Tributyltin
TM	Technical Memorandum
TMDL	total maximum daily loads
USC	University of Southern California
USGVMWD	Upper San Gabriel Valley Municipal Water District
UV	Ultra-Violet
UWMP	Urban Water Management Plan
VOC	Volatile Organic Compound
WBMWD	West Basin Municipal Water District
WEF	Water Environment Federation
WMD	Watershed Management Division
WMI	Watershed Management Initiative
WQ	Water Quality
WQO	Water Quality Objective
WRP	Water Reclamation Plant

1. INTRODUCTION

This chapter contains information about the purpose of this Technical Memorandum (TM) and background information on the existing conditions of the major watersheds within the Greater Los Angeles County Region (Region) relating to water quality and flood management. Information contained within this TM is supported by the Integrated Water Management Technical Memorandum (Integrated TM). Please refer to the Integrated TM for further background information such as the Integrated Regional Water Management Plan (IRWMP) process, Region description, context for this TM, and list of stakeholders within the Region.

1.1 Purpose

The purpose of this TM is to:

- Describe the existing conditions of the major watersheds in the Region as they pertain to surface water quality and flood management;
- Develop quantifiable planning objectives that will be used as a tool to measure progress towards overall Regional goals and needs;
- Identify issues, constraints, opportunities; and
- Develop water management strategies and opportunities for integration.

The identified water management strategies will discuss integrated regional solutions that restore, sustain, and enhance water quality in the Region's waterbodies; as well as other beneficial uses of treated wastewater and runoff such as water conservation/recycle and habitat enhancement within the Region, while maintaining adequate levels of flood protection. Ultimately, this TM provides a framework for IRWMP development.

1.2 Background

Beaches, rivers, and creeks are important recreational, cultural, and economic assets to the Region's residents, and constitute the environment within which the Region's ecosystems have flourished for millennia. Over the past several decades, their recreational, economic, and habitat values have been degraded by pollutants such as trash, bacteria, nutrients, metals, and toxic pollutants and other constituents in wastewater, dry-weather runoff, and stormwater (wet-weather) runoff. As urban development progresses, it can exacerbate water quality problems and can also challenge the effectiveness of existing flood control features by increasing volumes and accelerating the timing of peak flood flows.

For the purposes of the IRWMP, the protection and improvement of water quality includes the quality of potable water, the quality of groundwater, and the quality of urban stormwater and dry-weather runoff. This TM addresses the issues of stormwater and dry-weather runoff. The Water Supply TM addresses potable water and groundwater.

Many plans and studies have been conducted to better understand water quality and flood management issues and to develop implementation plans. The primary driving force for water quality protection and improvement is attaining designated beneficial uses and preventing further degradation. Implementation of

strategies can also be achieved through the use of existing tools and activities such as the Federal and State regulating programs, for example, National Pollutant Discharge Elimination System (NPDES) Permits (Federal), Waste Discharge Requirements (State), and Total Maximum Daily Loads (TMDLs).

One of the current driving forces to improve water quality throughout the entire Region is the comprehensive program to reduce stormwater pollution that has been established by the Municipal Stormwater NPDES permit (Order No. 01-182, NPDES No. CAS004001) that covers 84 cities and a majority portion of the unincorporated areas of Los Angeles County (County). The permit regulates the discharge of runoff from municipal separate storm sewer systems (MS4s), or storm drains and prohibits non-stormwater discharges into the storm drain system and limits any discharges to receiving waters that would cause or contribute to a violation of water quality standards. The permit requires implementation of a Stormwater Quality Management Plan (SQMP) that includes the use of Best Management Practices (BMPs) to reduce the amount of pollutants in stormwater and dry-weather runoff. The SQMP is broken up into six separate programs. These programs include Public Information and Participation, Industrial/Commercial Facilities, Development Planning, Development Construction, Public Agency Activities, and Illicit Connection/Illicit Discharge. Details of the SQMP programs are presented in Appendix A.

Strategies for management of stormwater runoff and nonpoint source pollution have been implemented since adoption of the amendments to the Clean Water Act in 1987. The County and its 88 cities have identified and implemented comprehensive stormwater management program ranging from educational outreach to installation of BMPs to clean and capture stormwater, as well as diversion of dry-weather urban runoff to sewage treatment plants. Although significant efforts have been made to implement stormwater management programs to achieve compliance with the goal of "Maximum Extent Practicable," many surface waters remain impaired. Studies are now suggesting that a combination of non-structural and structural solutions will be necessary to make significant progress towards water quality goals in receiving waters (e.g., Santa Monica Bay Bacteria TMDL Regional Board Staff Report and the University of Southern California [USC] study).

Stakeholders in the Region have collaboratively produced a number of comprehensive documents related to surface water quality and flood management issues. Important planning documents include Santa Monica Bay Bacteria TMDL Implementation Plans, Ballona Creek Watershed Management Plan, Dominguez Watershed Master Plan, City of Los Angeles Integrated Resources Plan for the Wastewater Program, North Santa Monica Bay White Paper, Common Ground, Los Angeles River Master Plan, Sun Valley Watershed Master Plan, Rio Hondo Watershed Management Plan, San Gabriel River Mater Plan, and Guiding Principles Watershed and Open Space Plan. A comprehensive list of existing plans and studies is presented in Appendix B.

Within this TM, existing conditions, issues, constraints, and opportunities have been addressed on a watershed basis. Figure 1-1 on the following page identifies the four major watersheds within the Region (outlined in purple), including the Los Angeles River, San Gabriel River, Dominguez Channel, and Santa Monica Bay watersheds, as described in the Watershed Management Initiative (WMI). The WMI has been prepared by the Regional Water Quality Control Board (RWQCB) for the Los Angeles Region to integrate various surface and groundwater regulatory programs while promoting cooperative, collaborative efforts within a watershed to focus limited resources on key issues.

Figure 1-1 also shows the five shaded sub-regions defined in the IRWMP process. These five sub-regions were created in the Step 1 IRWMP Application process based on agency jurisdiction. The quantifiable planning objectives for water quality have been calculated by sub-region and will be used for future gap analysis and identification of integrated regional projects.

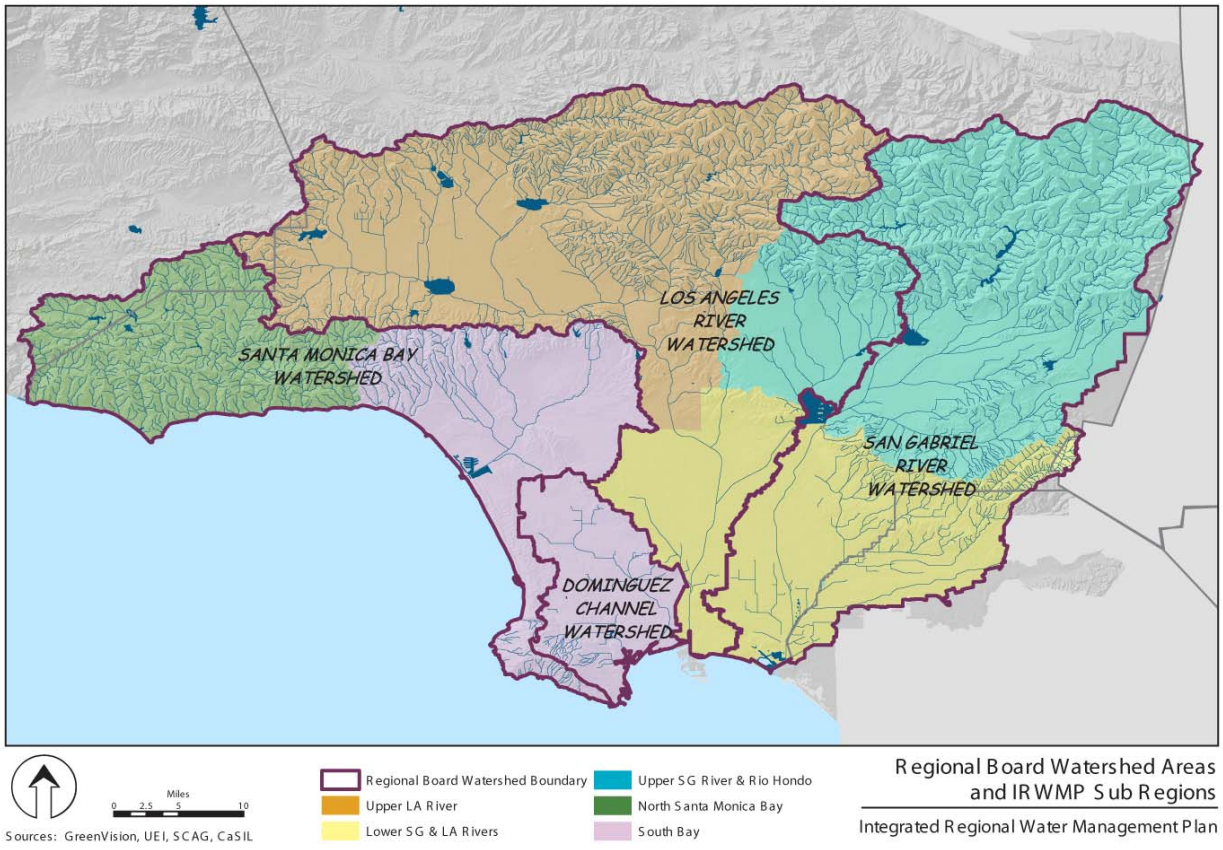

Figure 1-1. Four Watershed Management Areas as Defined by the Regional Water Quality Control Board and Five Sub-Regions (shaded areas) Defined in Step 1 IRWMP Process Region

1.3 Existing Conditions in the Region's Watersheds

This section provides a general overview of each of the four watersheds in the Region, including land characteristics and use, features, sources of water, and pollution.

1.3.1 Los Angeles River Watershed

The Los Angeles River watershed drains approximately 824 square miles and has very diverse land use patterns. Approximately 324 square miles of the watershed, primarily the upper watershed, are covered by forest or open space (Los Angeles Regional Water Quality Control Board, 2004). The rest of the watershed is highly developed. The river flows through the San Fernando Valley past heavily developed residential and commercial areas. From the Arroyo Seco to the confluence with the Rio Hondo, the river flows through industrial and commercial areas and is bordered by railyards, freeways, and major commercial and government buildings. From the Rio Hondo to the Pacific Ocean, the river flows through industrial, residential, and commercial areas, including major refineries and petroleum products storage facilities, major freeways, rail lines, and rail yards serving the Los Angeles and Long Beach harbors. About 32 percent of the watershed is covered with impervious surfaces (The Los Angeles and San Gabriel Rivers Watershed Council, 2001). Residential and industrial use make up approximately 37 percent and 6 percent of the watershed's land

use, respectively; while 8 percent is devoted to commercial uses and public buildings, and about 5 percent is devoted to transportation and utilities (County of Los Angeles Department of Public Works, 2005).

Historically, the Los Angeles River provided a year-round water supply, but it also overflowed, and created wetlands and swampy areas. After several devastating floods in the 1930s, concrete flood control channels were constructed along the main stem of the river. As a result, most of the main stem of the Los Angeles River (40 of its 51 miles) and many of its tributaries are lined with concrete except for soft-bottom, vegetated stretches within the Sepulveda Basin, the Glendale Narrows area, and the lower estuary area south of Willow Street. The natural areas of the Sepulveda Basin are allowed to flood during large storm events, and provide flood protection for downstream urban areas. The Glendale Narrows area was left unlined due to groundwater inflow that did not allow for a stable bottom lining. The lower estuary is a natural bottomed transition to the harbor area. These soft-bottom, vegetated areas provide valuable habitat and water quality enhancement for the river by removing constituents such as nutrients and by adding oxygen to the water via aeration (Los Angeles and San Gabriel Rivers Watershed Council, 2001).

Major flood control dams are located in the upper watershed. They are Big Tujunga, Pacoima, Lopez, Hansen, Devil's Gate, and Sepulveda. Significant tributaries include Pacoima Wash, Tujunga Wash, Burbank Western Channel, Verdugo Wash in the San Fernando Valley, Arroyo Seco starting above Pasadena, Rio Hondo, and Compton Creek near the estuary. The river is hydraulically connected to the San Gabriel River watershed by the Rio Hondo through the Whittier Narrows Reservoir.

The County and other agencies operate 3,361 acres of spreading grounds and soft-bottom channel spreading areas to augment local water supply. Most of them are in the Los Angeles and San Gabriel River watersheds. These spreading grounds are used to percolate local stormwater, imported water, and recycled water into the ground for storage in the underlying aquifers. The water in these aquifers is later pumped out for drinking, irrigation, and industrial uses. In most of the Los Angeles River, spreading basins have been placed in the San Fernando Valley where groundwater recharge available storage capacity is greater. Figure 1-2 on the following page shows the dams, reservoirs, and spreading grounds within the Region.

The Los Angeles River's flow historically originated from groundwater inflow from the San Fernando Valley groundwater basin. Now, much of that groundwater is drawn into wells for use as municipal water supply and little supplies the river. Also, much of the river's natural flow, originating in the mountain headwaters areas, is now diverted in a series of dams, reservoirs, and other structures that provide both flood control and water storage. The small amount of natural water that makes its way into the system is augmented by groundwater seepage from a few springs in the upper reaches. During the dry season, water in the river primarily comes from point source discharges and dry-weather runoff, along with limited groundwater seepage. During the wet season, huge volumes of stormwater augment river flows.

The RWQCB controls pollution in the Los Angeles River by issuing permits to point source dischargers. Currently, the WMI Chapter lists the following dischargesrs within the watershed:

- 144 NPDES discharges including 7 major NPDES dischargers (4 Publicly Owned Treatment Works [POTWs]); 23 minor individual permits; 114 dischargers covered by general permits;
- Numerous minor permits that cover miscellaneous wastes such as groundwater dewatering, recreational lake overflow, swimming pool overflow, and groundwater seepage. Other permits that are for discharge of treated contaminated groundwater, noncontact cooling water, and stormwater;
- Two municipal stormwater permits;
- 1,336 dischargers covered under industrial stormwater permits; and
- 456 dischargers covered under construction stormwater permits.

Many ongoing studies are relevant to development of integrated water management strategies for this subregion. The following project is representative of current onging studies that are being evaluated as a part of this IRWMP. A description of other studies is included in Appendix B. The City of Los Angeles is currently developing the Los Angeles River Revitalization Plan. This planning process will look at improvements along the project area all aimed towards celebrating neighborhoods, protecting wildlife, promoting the health of the river, and leveraging economic development. By the end of the planning process, a 20-year blueprint for development and management of the Los Angeles River will be developed for implementation by the City of Los Angeles. A draft report on project concepts and potential sites or nodes along the river for revitalization opportunities will be produced in late 2006. There is a unique opportunity during the development of the IRWMP in 2006 to coordinate with the City's planning and visioning process for the River, and to integrate solutions that achieve the city's goals of a revitalized river while evaluating opportunities to achieve progress with the quantifiable objectives to be outlined in the IRWMP. Opportunities to integrate project concepts promoted by this planning effort will be incorporated into subsequent IRWMP tasks.

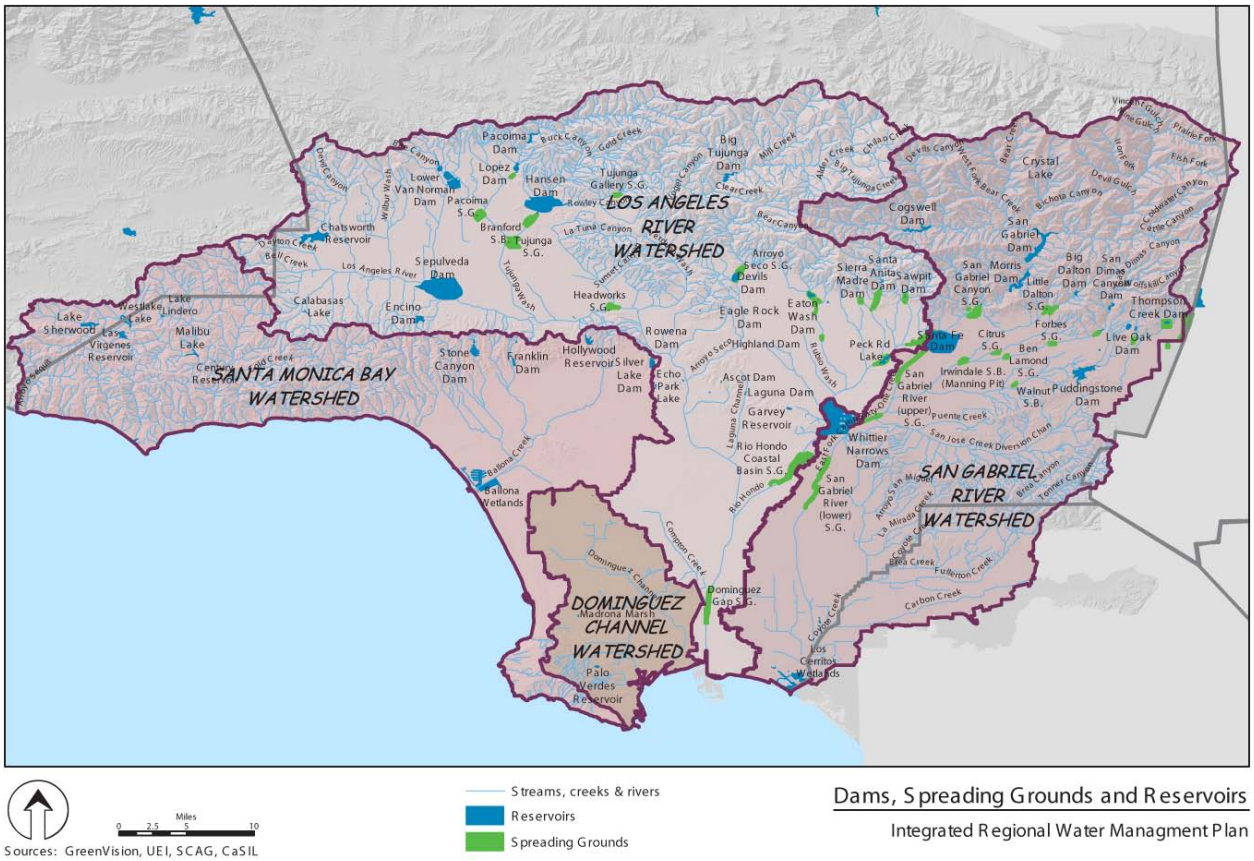

Figure 1-2. Dams, Spreading Grounds and Reservoirs within the Region

1.3.2 San Gabriel River Watershed

The San Gabriel Watershed drains approximately 689 square miles, covering a large portion of eastern Los Angeles County (Los Angeles Regional Water Quality Control Board, 2004). The main stem of the San Gabriel River runs 58 miles from its headwaters in the San Gabriel Mountains to the ocean (Los Angeles and

San Gabriel Rivers Watershed Council, 2001). The upper watershed consists of areas of open space, undisturbed riparian, woodland habitats and heavy recreation; about 49 percent of the watershed is vacant land and open space. The middle and lower areas are mostly urbanized with residential (30 percent), industrial (6 percent), commercial (8 percent), and transportation (4 percent) uses across the entire watershed. About 29 percent of the San Gabriel River Watershed is covered with impervious surfaces (Los Angeles County Department of Public Works, 2005). Also large electrical power poles are located along the river in the lower watershed with nurseries, stables, and a large poultry farm in the area.

Twenty-two creeks, washes, and streams drain into the river (Los Angeles and San Gabriel Rivers Watershed Council, 2001). Major tributaries include Walnut Creek and San Jose Creek in the upper watershed and the concrete-lined Coyote Creek in the lower watershed. The semi-natural estuary runs approximately 4.5 miles upstream of the San Gabriel-Coyote Creek confluence in the City of Long Beach and empties into Alamitos Bay, approximately 6 miles east of the mouth of the Los Angeles River.

Five major dams and structures in the upper watershed serve flood management and water supply purposes: Morris Dam, San Gabriel Dam, Cogswell Dam, Big Dalton Dam, and Puddingstone Reservoir. The U.S. Army Corps of Engineers operates two major flood control basins: the Santa Fe Flood Control Dam, about one-third of the way downstream from the headwaters, and the Whittier Narrows Dam and Basin, about halfway downstream. Both serve as multipurpose facilities, providing groundwater recharge and water capture/storage pools that fill when inflow exceeds recharge capacity (U.S. Army Corps of Engineers Los Angeles District, 2004) as well as recreational opportunities and wildlife habitat (Los Angeles and San Gabriel Rivers Watershed Council, 2001). Whittier Narrows Dam and Basin covers 2,470 acres, spans the San Gabriel River and the Rio Hondo River, and controls flow to both rivers.

Much of the water released to the Rio Hondo is used for groundwater recharge in large spreading basins. Additionally, smaller spreading grounds dot the watershed, often occupying old sand and gravel quarries. From the mouth of the canyon to just below Whittier Narrows Dam, 20,000 feet of porous, gravel-rich sediment underlying the San Gabriel Valley allows water to readily percolate into aquifers; for in the upper watershed, the San Gabriel River has natural or soft-bottomed channels bordered by levees. Along the lower coastal plain downstream of the Whittier Narrows Dam the river is generally concrete-lined (Los Angeles and San Gabriel Rivers Watershed Council, 2001).

The San Gabriel River differs from the Los Angeles River in that much of the natural flow in the river is dammed in the upper canyons, and as much as 90 percent is used for groundwater recharge. Two major power plants, the Alamitos and Haynes power generating stations, have historically been the largest dischargers in the watershed, discharging about 1,250 million gallons per day (mgd) and 1,000 mgd of cooling water into the estuary, respectively. The Haynes plant was permanently retired in 2004 (California State Energy Commission, http://www.energy.ca.gov/electricity/inactive_plants.html). The Whittier Narrows, San Jose Creek, and Pomona water reclamation plants produce reclaimed water for groundwater replenishment in the Rio Hondo and San Gabriel spreading grounds, irrigation, and industrial use. About 60 percent of the reclaimed water is discharged into the river (Los Angeles and San Gabriel Rivers Watershed Council, 2001).

The RWQCB controls pollution in the San Gabriel River by issuing permits to point source dischargers. Currently, the WMI Chapter lists the following dischargers within the watershed:

- 79 NPDES discharges including 6 major NPDES dischargers (4 POTWs), 18 minor permits, 55 discharges covered under general permits;
- 2 municipal stormwater permits;
- 606 dischargers covered under an industrial stormwater permit; and
- 247 dischargers covered under a construction stormwater permit.

Many ongoing studies are relevant to development of integrated water management strategies for this subregion. The following project is representative of current onging studies that are being evaluated as a part of this IRWMP. A description of other studies is included in Appendix B. The Los Angeles County Department of Public Works has prepared a Master Plan for the San Gabriel River which provides a shared, comprehensive vision of the river corridor, from the mountains to the ocean. It integrates the multiple goals of enhancing habitat, recreation and open space, while maintaining and enhancing flood protection, water supply and water quality. The Master Plan identifies priorities, provides guidance, and helps coordinate over 130 independently sponsored enhancement projects. Opportunities to integrate project concepts promoted by this planning effort will be incorporated into subsequent IRWMP tasks.

1.3.3 Santa Monica Bay Watershed

The 414-square-mile Santa Monica Bay Watershed reaches from the crest of the Santa Monica Mountains and the Ventura-Los Angeles County line on the north to downtown Los Angeles. From there, it extends south and west across the Los Angeles plain to include the area east of Ballona Creek and north of the Baldwin Hills. The area includes several sub-watersheds. The largest are Malibu Creek in the north and Ballona Creek in the south (Los Angeles Regional Water Quality Control Board, 2004). The 109-square-mile Malibu Creek sub-watershed and smaller northern watersheds contain mostly undeveloped mountain areas, large acreage residential properties, and many natural stream reaches. The Malibu Creek Sub-Watershed is 81 percent vacant land. Only 11 percent of the land is developed for residential use, and 8 percent of the land is covered by impervious surfaces, making this area one of the least urbanized in the County. Nevertheless, recreational reservoirs and agriculture have significantly modified the northern portion of the Santa Monica Bay Sub-Watershed. On the other hand, the 130-square-mile Ballona Creek Sub-Watershed is highly developed, with 52 percent residential, 12 percent commercial and public buildings, and 4 percent industrial land uses. Only 26 percent of the sub-watershed is vacant land or open space. Approximately 40 percent of the land is covered by impervious surfaces, and Ballona Creek is channelized for most of its length (Los Angeles County Department of Public Works, 2005).

Until the 20th century, Ballona Creek and its tributaries were largely unconstrained. Creeks often swelled and changed course with winter rains, flooding farms, homes, and businesses. As urban development moved west of downtown Los Angeles, various tributaries were channelized or filled in while impervious surfaces expanded. As a result, the impact of flooding became progressively more severe, and various agencies, including the U.S. Army Corps of Engineers, the City of Los Angeles, and the Los Angeles County Flood Control District responded with an ever more elaborate system of dredged channels, walls, and levees.

Today, most of the drainage network in the Ballona Creek Sub-Watershed is controlled by structural flood control measures, including debris basins, storm drains, underground culverts, and open concrete channels. Ballona Creek is a 9-mile flood protection channel designed for a 50-year frequency storm event, and drains the Los Angeles basin from the Santa Monica Mountains on the north, the Harbor Freeway (Interstate 110) on the east, and the Baldwin Hills on the south (Ballona Creek Watershed Task Force, 2004). The creek remains underground in the eastern portion of the watershed, becoming an open channel near Venice Boulevard and Pickford Street before continuing to Santa Monica Bay. The estuarine portion is soft-bottomed. Major tributaries to Ballona Creek include Centinela Creek, Sepulveda Canyon Channel, Benedict Canyon Channel, and numerous storm drains, and only a few of them remain open for major portions of their length. The Ballona wetlands are now connected to the creek by four concrete and metal culverts and receive no tidal flow. The natural drainage area south of Ballona Creek is a narrow strip of wetlands between Playa del Rey and Palos Verdes.

In the northern area of the Santa Monica Bay Watershed, Malibu Creek, which has not been channelized, drains into Malibu Lagoon, fed by the Las Virgenes Creek, Triunfo Creek, and Cold Creek. This area of the watershed also includes several smaller coastal canyon creeks such as Solstice Creek, Topanga Creek, and

Tuna Canyon Creek. Since the 1880s, six dams have been built on Malibu Creek including Eleanor in 1881, Sherwood in 1904, Crags in 1913, Malibu in 1923, Rindge in 1925, and Westlake in 1965. Malibu Lagoon was much larger prior to the 20th century, during which much of the area was filled in. Today the lagoon and wetland occupies about 92 acres. Restoration of the lagoon in 1983 included removing construction rubble, excavating channels, increasing the depth of the main lagoon area, creating an island, and planting native vegetation. In the 1990s, the endangered tidewater goby was reintroduced and excavation of tidal channels in the previously restored marsh increased tidal circulation, created additional bird islands, and expanded habitat for the goby. Nevertheless, the pattern of lagoon formation and breaching has changed with increased flow from Malibu Creek. High summer water levels now periodically require artificial breaching of the tidal barrier to maintain water quality. Topanga Creek, whose flows are seasonal and intermittent, is natural for most of its length; however, in the developed lower reaches, the bed has been lined with boulders and concrete, and the banks sandbagged (Santa Monica Bay Hydrologic Unit Profile, 2001). A portion of the Malibu Creek Sub-Watershed is designated as an Area of Special Biological Significance (ASBS) where any discharge of waste is prohibited.

With the introduction of imported water and extensive landscaping, runoff from irrigation has created year-round flows in most channels in the Ballona Creek Sub-Watershed and increased flows in the northern Santa Monica Bay Watershed, all of which were historically dry for much of the year. Additionally, the current extent of impervious surface has resulted in more runoff entering the Ballona Creek system much faster than before the area was developed. Groundwater in this area is replenished by percolation of rainfall and stream flow from the Santa Monica Mountains to the north and the Baldwin Hills to the south. However, the permeable land area has shrunk substantially. Historically, high groundwater levels in some areas resulted in marshes and surface springs. Most of these surface springs have ceased or been capped. However, natural springs still exist at various locations in the Santa Monica Mountains and at a few locations on the coastal plain, and high groundwater levels persist in some historical locations, including West Hollywood, La Cienega, Venice, and portions of Culver City (Ballona Creek Watershed Task Force, 2004). Once seasonal, Malibu Creek now flows largely year-round. Sources include 2.2 to 2.7 mgd runoff from homes and irrigation, and an estimated 0.45 mgd of septic tank seepage into the lagoon. Malibu Creek also receives the treated wastewater of Malibu Creek watershed residents via the Tapia Water Reclamation Facility during the winter/spring months (Santa Monica Bay Hydrologic Unit Profile, 2001).

The RWQCB controls pollution in the Santa Monica Bay watershed area by issuing permits to point source dischargers. Currently, the WMI Chapter lists the following dischargers within the watershed:

- 158 NPDES dischargers including seven major NPDES permit discharges, three POTWs (two direct ocean discharges), one refinery, and three generating stations;
- 21 minor discharges;
- 87 dischargers covered by industrial stormwater permits, mostly in the cities of Los Angeles and Santa Monica including maintenance yards, recycling facilities, and electronics; and
- 220 dischargers covered by a construction stormwater permit, many in the Malibu Creek and Ballona Creek Sub-Watersheds which are fairly evenly divided between commercial and residential. About one-half are 5 acres or larger; two in the Ballona Creek drainage area are more than 1,000 acres.

Many ongoing studies are relevant to development of integrated water management strategies for this subregion. The following project is representative of current onging studies that are being evaluated as a part of this IRWMP. A description of other studies is included in Appendix B. The Los Angeles County Department of Public Works is currently researching, evaluating, and compiling existing structural and non-structural solutions as well as developing new solutions tailored to the North Santa Monica Bay Watersheds to address Bacteria TMDLs, NPDES permit requirements, and AB885 septic system requirements. This study is called the Regional Watershed Implementation Plan and is identifying potential treatment requirements,

technologies, and management options. It is also investigating and identifying potential sites for the structural solutions within the North Santa Monica Bay Watersheds. Qualitative criteria for ranking the potential of proposed structures to be constructed at any of the sites are being developed and identified sites will be ranked in terms of the potential for proposed structures to be constructed at these sites. Criteria being considered include property ownership (public vs. private), location in the watershed, location relative to major storm drains, current property use, general environmental conditions of the property and suitability and the ease of adapting the property for structural solution implementation. Technical memoranda and an interim Regional Watershed Implementation Plan document will be available in May and June, 2006. Opportunities to integrate project concepts promoted by this planning effort will be incorporated into subsequent IRWMP tasks.

1.3.4 Dominguez Channel and Los Angeles/Long Beach Harbors Watershed

The Dominguez Channel and Los Angeles/Long Beach Harbors Watershed encompasses approximately 110 square miles of southern Los Angeles County (Los Angeles Regional Water Quality Control Board, 2004). Approximately 96 percent of the watershed is developed with 13 percent of the land devoted to transportation and utilities alone, including Los Angeles International Airport (LAX), and the Long Beach and Los Angeles Harbor complex (Los Angeles County Department of Public Works, 2005). LAX, located in the northernmost portion of the watershed, is third in the world for number of passengers and tonnage of air cargo handled. Long Beach Harbor includes more than 7,600 acres of wharves, state-of-the-art cargo terminals, roadways, rail yards, and shipping channels. Los Angeles Harbor includes 29 major cargo terminals. Its six modern container facilities handle more than four million cargo containers annually. The Los Angeles and Long Beach Harbor complex is one of the largest and busiest ports in the world (The River Project, 2006). Six and eight-lane freeways crisscross the watershed, and nearly all of the land not used for transportation is developed for residential use (41 percent), industrial use (17 percent), commercial use, and public buildings (14 percent). Impervious surfaces cover 59 percent of the watershed's area, the highest percentage of any watershed in the Los Angeles Region. Vacant land and open space comprise only 7 percent of the watershed's area (Los Angeles County Department of Public Works, 2005).

Historically, the area that now serves as the Los Angeles and Long Beach harbors consisted of marshes and mudflats with a large marshy area. Around the turn of the 20th century, channels were dredged, marshes filled, wharves constructed, the Los Angeles River diverted, and a breakwater constructed in order to allow deep draft ships to be directly offloaded and products swiftly moved. The Dominguez Slough was completely channelized in the mid-1900s to provide flood protection to much of the South Bay area (The River Project, 2006). Now Dominguez Channel, the 15-mile defining feature of the watershed, drains approximately 62 percent of the watershed. It begins at 116th Street in the City of Hawthorne and continues generally southwest, passing through the cities of Gardena, Torrance, Carson, and Los Angeles, to empty into the Consolidated Slip of Los Angeles Harbor (Dominguez Watershed Management Master Plan, 2004).

Remaining land areas within the watershed that do not drain to the channels drain to several debris basins and lakes or directly to the Los Angeles and Long Beach harbors (The River Project, 2006). The Wilmington Drain runs for approximately 1.8 miles and drains into Machado Lake, which receives runoff from 19.5 square miles of the watershed. Fed by underground storm drains that collect runoff from roughly 3.5 square miles, the Walteria Lake Retention basin, terraced with vegetated sides, measures roughly 300 feet wide by 1,200 feet long. Another roughly 1.4 square miles of the Dominguez Watershed drains to local retention basins similar to but much smaller than the Walteria Retention basin.

The RWQCB controls pollution in the Dominguez Channel Watershed area by issuing permits to point source dischargers. Currently the WMI Chapter lists the following dischargers within the watershed:

- 60 discharges covered by general permits including nine major NPDES discharges, one POTW, two generating stations, and five refineries;
- 48 minor discharges;
- 399 dischargers enrolled under a general industrial stormwater permit, mostly along Dominguez Channel in the cities of Gardena, Wilmington, Torrance and Carson including trucking and warehousing, auto wrecking, and metal plating businesses; and
- 134 sites enrolled under a construction stormwater permit. Most are along Dominguez Channel and include residential, commercial and industrial sites. About one-half are 5 or more acres. Larger parcels up to 500 acres are mostly located in the ports.

The Dominguez Watershed also contains two Superfund National Priority Location sites: the 13-acre Montrose Chemical Corporation site in the City of Torrance where the company manufactured DDT and BHC (pesticides) from 1947-1982, and the 280-acre Del Amo Facility site, 600 feet east of the Montrose site, where a synthetic rubber manufacturing facility operated from the 1940s-1970s. Numerous Brownfields also occur throughout the watershed. Additionally, there are three airports in the watershed.

Many ongoing studies are relevant to development of integrated water management strategies for this subregion. The following project is representative of current onging studies that are being evaluated as a part of this IRWMP. A description of other studies is included in Appendix B. The Los Angeles County Department of Public Works has prepared the Dominguez Watershed Management Master Plan in 2004. This comprehensive document assists stakeholders in the protection, enhancement, and restoration of the environment and beneficial uses of the Dominguez Watershed, provides overview of current conditions within the watershed, identifies and addresses watershed problems and issues, provides an action plan of recommended measures and projects, and identifies potential funding opportunities to assist with implementation of the plan. Opportunities to integrate project concepts promoted by this planning effort will be incorporated into subsequent IRWMP tasks.

2. ISSUES, CONSTRAINTS AND OPPORTUNITIES

The watersheds in this Region range over large areas that are highly diverse. A Designated Wilderness Area or ASBS may occur in one part of a watershed while extensive development dominates another part of the watershed. This results in a great diversity of issues in any particular watershed and the need to balance priorities among stakeholders. The following summarizes significant watershed issues in the Region based on a review of the literature, interviews with members of the Leadership Committee and Steering Committees, and stakeholders within the five sub-regions.

2.1 Issues

2.1.1 Surface Water Quality Regulations

The protection of surface water quality (e.g., in the rivers, creeks, and storm drains) is regulated by the RWQCBs, via the applicable Basin Plan, which identifies surface and groundwater bodies, designates applicable beneficial use classifications to each water body, establishes general and water body-specific water quality objectives, and suggests an implementation plan for maintaining or restoring the water quality objectives. The RWQCBs utilize NPDES permits and Waste Discharge Requirements to limit the discharge of contaminants and protect surface water quality.

Under federal regulations, waterbodies are categorized for various designated beneficial uses. A designated use is the legally applicable use, such as water contact recreation, specified in a water quality standard for a waterbody or segment of a waterbody. Waterbodies in the Region have the following designated beneficial uses listed in Table 2-1.

Table 2-1. Beneficial Uses within the Region

Estuary	Above Estuary
Industrial Service Supply	Groundwater Recharge
Contact & Noncontact Water Recreation	Contact & Noncontact Water Recreation
Navigation	Warmwater Habitat
Commercial & Sportfishing	Wetland Habitat
Protection of Rare & Endangered Species	Protection Of Rare & Endangered Species
Wildlife Habitat, Marine Habitat	Wildlife Habitat
Migration of Aquatic Organisms	
Spawning	
Terrestrial, Aquatic, and Marine Environments	

Many of the above beneficial uses within the Region are considered impaired due to a variety of point and nonpoint sources. The 2002 303(d) list implicates trash, bacteria, nutrients, metals, toxic pollutants (i.e., pesticides, volatile organics, and other synthetic compounds), and other constituents for a total of 489 individual impairments (reach/constituent combinations) (WMI Chapter, 2004). Some of these constituents are of concern throughout the length of a waterbody while others are of concern only in certain reaches.

The Clean Water Act requires TMDLs be developed for all impaired waterbodies as defined by the 303(d) list. TMDLs allocate allowable loadings from point sources and nonpoint sources to protect the beneficial uses of waterbodies. The waterbodies in the Region where TMDLs have been or will be developed include the Los Angeles River, the San Gabriel River, Ballona Creek, Malibu Creek, Santa Monica Bay, Marina Del Rey, and the Dominguez Channel/Los Angeles Harbor. TMDL development for these waterbodies must be completed by year 2012 as mandated in a 1999 court-ordered consent decree between the U.S. Environmental Protection Agency (EPA) and a number of environmental organizations.

As of January 2006, U.S. EPA has approved the following TMDLs listed in Table 2-2. Figures 2-1 and 2-2 on the following pages show the locations of impairments within the Region related to trash, bacteria, nutrients, metals, and toxic pollutants.

Table 2-2. 2006 U.S. EPA Approved TMDLs in the Region

Watershed	TMDLs
Los Angeles River	
• Los Angeles River	Trash, Nutrients (Nitrogen), Metals
Santa Monica Bay	
• Ballona Creek	Trash, Metals
• Santa Monica Bay Beaches	Bacteria (both dry- and wet-weather)
• Ballona Creek Estuary	Toxic Pollutants
Dominguez Channel	
• Marina Del Rey Harbor	Bacteria
• Los Angeles Harbor	Bacteria

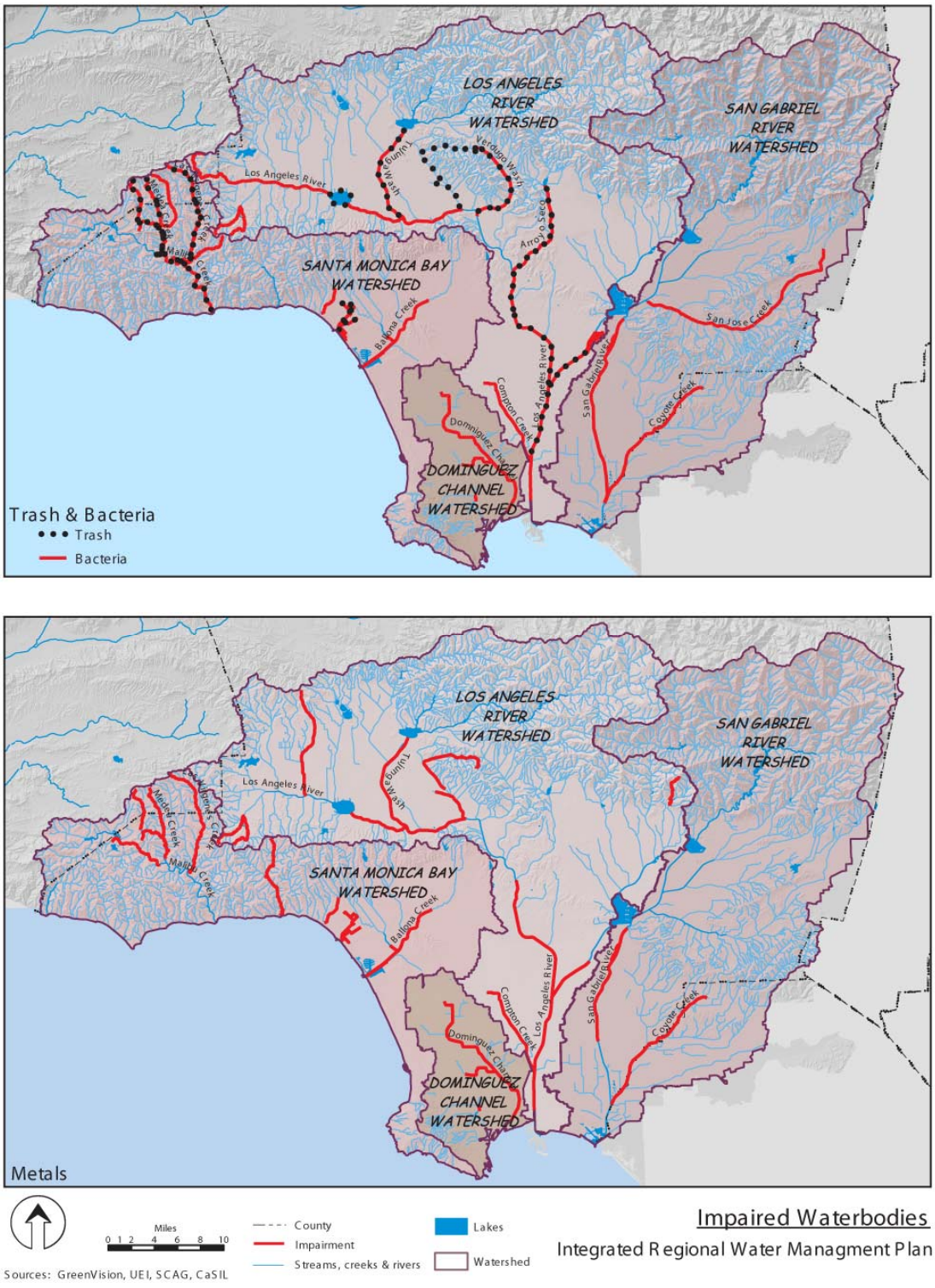

Figure 2-1. Impaired Waterbodies from Trash, Bacteria, and Metals within the Region

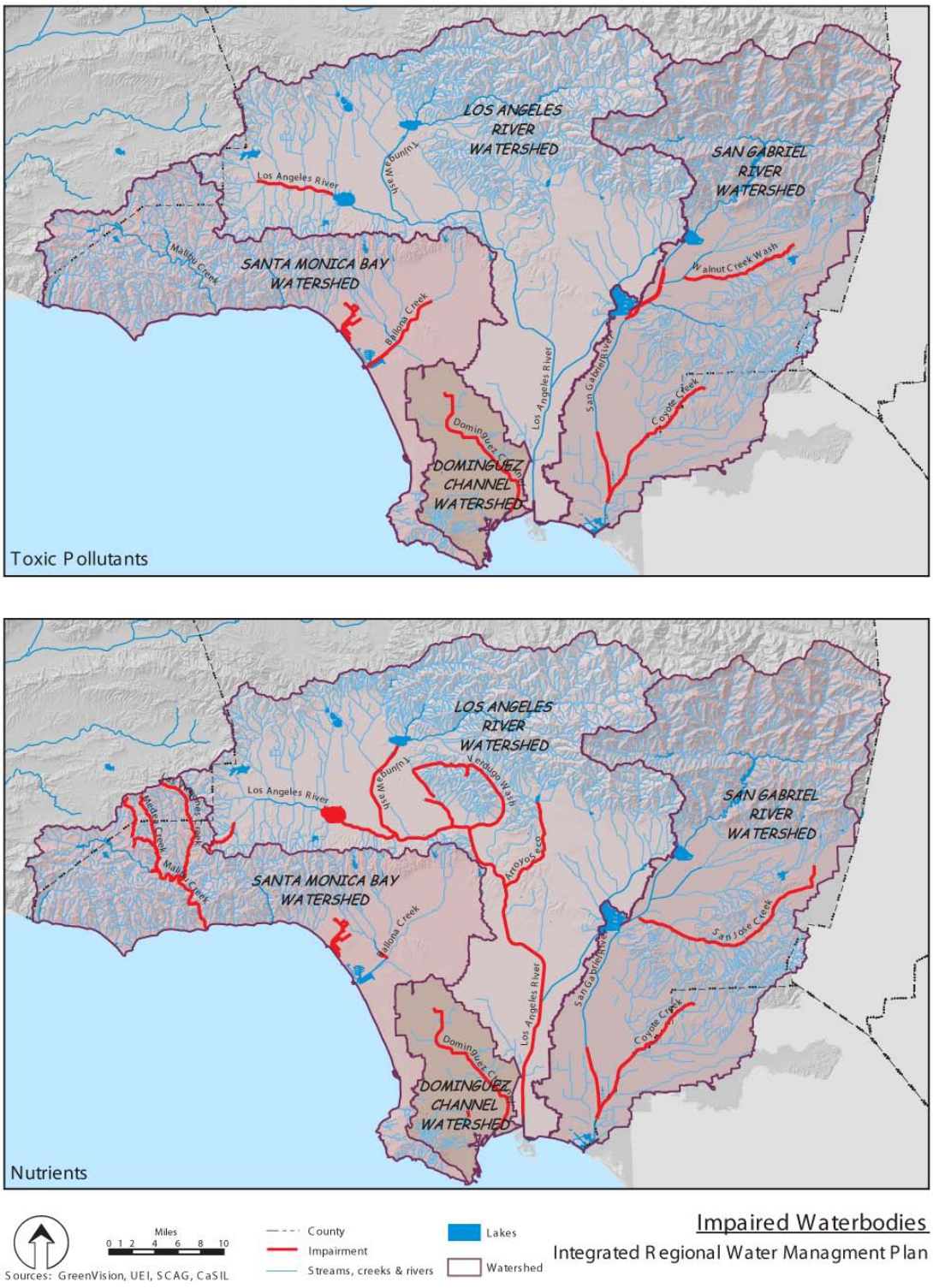

Figure 2-2. Impaired Waterbodies from Nutrients and Toxic Pollutants

Other TMDLs, including those for bacteria, metals, sediments, pesticides, Polychlorinated Biphenyl (PCBs), Polycyclic Aromatic Hydrocarbon (PAHs), Tributyltin (TBT), Volative Organic Carbon (VOCs), and other organics are anticipated to be developed for the Los Angeles River, the San Gabriel River, Ballona Creek, and Dominguez Channel/Los Angeles Harbor in the coming years. Table 2-3 lists some of the TMDLs that are scheduled to be developed within the Region.

Table 2-3. TMDLs to be Developed

Watershed	TMDLs
Los Angeles River	Toxic pollutants
San Gabriel River	Bacteria, nutrients, metals, toxic pollutants
Dominguez Channel	Bacteria, nutrients, metals, toxic pollutants
Santa Monica Bay	Bacteria, nutrients, metals, toxic pollutants

Following the adoption of a TMDL, an implementation plan is required to be developed for the watershed areas to identify the needed activities and facilities to achieve the goals of the TMDL over the established regulatory time period for compliance. The proposed activities, facilities, or control measures would be enforced through various mechanisms for point source discharges such as municipal stormwater NPDES permits. Nonpoint source pollution, such as deposition (fallout from air pollution), runoff from forested areas, or flow from septic tanks at individual homes is not regulated in California at this point, although voluntary prevention and cleanup efforts are encouraged.

As TMDL implementation plans are completed, it is likely that there will be more frequent maintenance on existing structural BMPs such as catch basins, addition/replacement of catch basin screens, maintenance and repair of diversion structures, all of which would entail additional resources to implement.

New structural/non-structural BMPs such as additional diversion structures, retention basin, etc. may result from evaluation or pilot studies. All of these would require more financial resources for maintenance and operation.

2.1.2 Wastewater Management

The treatment of wastewater in the Region is governed by provisions of the federal Clean Water Act; the California Porter-Cologne Water Quality Control Act; the California Toxics Rule; the Policy for Implementation of Toxics Standards for Inland Surface Waters, Enclosed Bays, and Estuaries of California, the Water Quality Control Plan for the Los Angeles Region (and Santa Ana Region); NPDES discharge permits; and individual Waste Discharge Requirements for wastewater treatment plants established by the RWQCBs. Wastewater treatment services within the Region are currently provided by (1) Los Angeles County Sanitation District, (2) City of Los Angeles Department of Public Works, Bureau of Sanitation, (3) the Las Virgenes Municipal Water District (under a joint partnership with Triunfo Sanitation District); (4) the City of Burbank, and (5) the Los Angeles County Department of Public Works. Various other entities operate small treatment facilities (e.g., less than 0.2 mgd) or onsite package plants. Overall, there are currently 13 main wastewater treatment plants within the Region and 2 tertiary treatment/advanced treatment plants operated by West Basin Municipal Water District (treating secondary effluent from Hyperion Treatment Plant).

The Integrated Resources Plan for the Wastewater Program (CH:CDM, 2004), conducted extensively with stakeholders over several years, has taken an integrated approach to dealing with water resources and wastewater/biosolids collection, treatment, recycling, and disposal practices through the year 2020. Water

suppliers, Los Angeles Bureau of Sanitation (LABOS), and the Los Angeles County Sanitation District are primarily responsible for providing water treatment adequate to protect human and environmental health. Water reclamation plant and delivery system upgrades, use of recycled water, and identification of demonstration projects to better manage water resources, are all part of this comprehensive plan, developed specifically for the LABOS service area.

2.1.3 Flood Management

Flood management in the Region is the responsibility of the Los Angeles Flood Control District (whose responsibilities are now performed by the Los Angeles County Department of Public Works), the Orange County Flood Control District, and the U.S. Army Corps of Engineers. The Los Angeles Flood Control District was formed in 1915 in response to a devastating flood in 1914, while the Orange County Flood Control District was formed in 1927. In 1936, federal legislation gave specific flood protection duties to the U.S. Army Corps of Engineers.

Despite the extensive network of flood management structures and channels, which the counties monitor, flooding or drainage problems persist in a number of areas in the Region. Information is reported by the cities or through individual complaints, or directly to each county in unincorporated areas. Unmet drainage needs have been identified throughout the Region, but mostly in localized urban areas. If the situation requires a new drainage structure, the counties, sometimes in conjunction with the U.S. Army Corps, will do a study to determine the best solution and implement appropriate projects. The recently completed Los Angeles County Drainage Area project, which enhanced flood protection on the Los Angeles River, is one such example.

Most urbanized areas within the Region have adequate flood protection with facilities in place able to manage the 100-year flood (which occurs on average once every 100 years or has a 1 percent probability of occurrence) or even rarer events. However, the potential for increased runoff arising from new development and changing climate could reduce flood protection to unacceptable levels in some areas. Finally, a growing public sentiment favoring naturalization of local rivers and creeks presents a significant challenge from the perspective of flood management, since natural systems are much more complex to maintain in a condition that provides predicable performance during flood events.

2.1.4 Aging Infrastructure

Several flood control facilities such as debris basins, underground storm drains, and concrete-lined channels, have exceeded their 50-year design life span. As a result, many have signs of structural strains, or are showing deterioration or other aging effects. Results of years of channel and underground inspections and safety concerns have prompted the County to monitor and perform immediate repairs to several channels and drains with walls that have been leaning progressively, inverts with extreme cracking, failed underground reinforced concrete pipe, failed subdrainage systems, and structural joints that have failed or are continuing to fail.

The seawater barriers projects and pump plants have also exceeded their 50-year design life span and are showing serious signs of aging. It is now apparent that these facilities require very costly overhaul or replacement with newer systems to ensure that they function as designed. Over the years, maintenance on these facilities has been quite a challenge since most of the replacement parts are obsolete. Many reaches of the barrier water supply pipelines are vulnerable to corrosion failure. The installation of corrosion protection systems is urgently needed to stop further pipeline corrosion. Many seawater barrier injection wells are no longer in service due to irreparable well casing failures and blockages. Injection capacity has been lost to varying degrees at all wells over the years and is no longer recoverable through well redevelopment. This has resulted in less than the needed injection capacity at various locations along the barrier. Replacements of

injection wells with newer models will be needed to ensure adequate injection capacity along the seawater barriers.

Finally, and probably the most costly form of needed repair, is the replacement and rehabiltation of deteriorated and aged asphalt paved access roads on both sides of channel reaches. To date, a large percentage of access roads within the channels has not been replaced or repaved since the channels were first constructed. Other constraints hindering progress in repairing these access roads include right-of-way issues such as easement boundaries and encroachment, access road conditions requiring additional soil investigations and tests, and lack of channel access. Resolving these constraints can considerably add to costs and delays in repairing and replacing these access roads.

The County has been working with its Flood Management Division and its Design Division to provide solutions to aging infrastructure issues. However, due to budget and resource constraints, many of these issues have not yet been resolved.

2.1.5 Demands for Additional Multi-Use Facilities

In an effort to comply with beneficial use requirements set by the RWQCB and to meet the growing environmental awareness of County residents, the Los Angeles County Watershed Management Division (WMD) has been taking the lead to implement and convert some flood control facilities into multi-use facilities. Examples of these multi-use projects include Los Angeles River beautification project, where annual Earth Day activities are conducted within the channel right-of-ways; existing field yards, where trees and other landscaping features are planted by the public and maintained afterwards by Flood Maintenance Division (FMD) staff; replacement of chain link fencing with non-standard, more decorative fencing; opening channel right-of-ways to public access; constructing park-like setting and benches within the channel right-of-ways; and constructing and developing bike and horse trails.

2.1.6 Sediment Management

Los Angeles County Department of Public Works performs sediment cleanout at reservoirs, debris basins, and channels to ensure that facilities function as designed, to maintain the facility's design capacity before and after each storm, to remove ponded water and vegetation for vector and algae control, and to protect downstream properties from damages from overflowing mud and debris. Steep slopes within the local mountains, combined with the potential for heavy rains, can result in substantial soil erosion or debris flows which may affect downstream drainage facilities. Frequency in sediment removal has increased due to the major firestorms in the last five years and the recent high intensity rainstorms.

2.1.7 Funding of New BMP Maintenance

In compliance with RWQCB requirements for the trash TMDL, the Los Angeles County Flood Control District has been actively coordinating internally among other divisions such as Watershed Management and Construction to evaluate, maintain, monitor, and operate new structural BMPs such as Continuous Deflective Separation (CDS) units, catch basin inserts, low flow diversion systems, and end-of-pipe treatment plants. Maintenance on these new structural BMPs requires additional annual funding to ensure compliance. Proposed implementation requirements of the RWQCB's Santa Monica Bay Beaches TMDL may also require the District to construct additional structural BMPs and perform costly, frequent maintenance of BMPs to ensure compliance.

2.1.8 Degraded Habitat

Wildlife habitat in the Region has been severely impacted by the steadily increasing human population. Existing habitat is comprised of unpaved waterways, wetlands, riparian areas, associated uplands, and the bays and beaches of the coastline. Much habitat has been lost due to development, both from the direct effects of fill and paving, and the indirect effects of altered hydrology and poor water quality. There is a building consensus among stakeholders in the Region that increased and improved wildlife habitat is necessary for the quality of life of future generations as well as for the wildlife directly affected.

2.1.9 Runoff Quantity

As noted in the previous section, runoff quantity and timing are directly affected by upstream development. As development spreads further into the hills surrounding the Los Angeles coastal plain, downstream areas will experience increased stormwater runoff that will challenge the efficacy of existing flood management facilities. Increased flood flows could also endanger riparian habitat and further complicate habitat restoration.

2.1.10 Stream Channelization and Modification

Many of the stream and river channels in the Region have been extensively modified. Flood modifications begun in the 1930s have created concrete trapezoidal channels out of natural streambeds. While providing efficient removal of storm flows, these channels provide little in the way of habitat and water quality improvement. Additionally, along most of these channelized watercourses, there has been development right up to the edges of the concrete channel, complicating and making more expensive the development of adjacent habitat and/or increased flood flow capacity.

2.2 Constraints

There are a number of pressing water quality and flood management challenges in both the short- and long-term. Constraints are described in more detail below.

2.2.1 Regulatory Environment

Even though the Region has significantly reduced pollutants that are discharged to its waterbodies from individual point sources since the Clean Water Act was established, most of the major rivers and waterbodies are considered impaired due to trash, bacteria, nutrients, metals, and toxic pollutants. The quality of many waters continues to be degraded from pollutants discharged from diffuse and diverse nonpoint sources and from the cumulative impacts of multiple point sources. Consequently, during the next 10 years, more than 90 TMDLs are scheduled to be developed to achieve Region's water quality goals, and they will be implemented by hundreds of dischargers and 80 or more cities in the Region. These TMDLs will impose increasing regulatory constraints on wastewater reclamation plant discharges and stormwater runoff.

2.2.2 Institutional Barriers

Institutional barriers to improving water quality and flood protection exist at many levels of public and private institutions. While many State priorities and RWQCB priorities are the same, there are Federal and State mandated activities that can redirect scarce resources away from Region priorities. Additionally, there are historical, political, and functional barriers that can inhibit collaborative working relationships among municipalities, counties, and agencies.

2.2.3 Funding Shortages

Severe funding shortages exist in both the regulation and implementation of necessary water quality improvements. Federal and State funding are insufficient to fully meet the needs of the WMI activities or staffing needed to implement them. Highest priority needs have little or no funding. These needs include:

- Non-point source management;
- California Environmental Quality Act (CEQA) review;
- Monitoring and assessment;
- Basin planning;
- 401 certification;
- Stormwater; and
- NPDES pretreatment, enforcement, compliance, and monitoring report review.

Several estimates in the range of $10 billion have been offered by credible sources, including University of Southern California, as the revenue needed for TMDL compliance alone (USC, 2002). However, there are only limited dedicated revenue sources and lands available to address water quality improvements and increasing flood management needs. New funding mechanisms will need to be implemented to begin to address the funding shortfall.

2.2.4 Land Availability and Acquisition Costs

Constraints to the expansion of flood management programs include the lack of undeveloped land within the urbanized portions of the Region which could be used for flood management improvements. Infrastructure to attain water quality improvements will require additional dedicated land. This is true whether this infrastructure consists of traditional BMPs or the integrated solutions envisioned in this document. Land in many areas is not available without loss of existing housing, and acquisition of this land would require innovative solutions to address housing. Additionally, land costs in the Region are extremely high, ranging from $1 million to $3 million per acre.

2.2.5 Barriers to the Capture and Use of Stormwater and Reclaimed Water

Historically, concerns about the quality of urban stormwater runoff have limited the willingness of water supply agencies to consider it as an additional source of local water supply (although much of the water recharged in many spreading grounds in southern California over the past 40+ years is generated from increasingly more urbanized areas and much of groundwater quality remains high). As all water supplies become increasingly limited, increasing attention is being placed on our local supplies, including both stormwater runoff and reclaimed water. There are many years when hundreds of thousands of acre-feet of stormwater and high-quality reclaimed water are lost to the ocean from the Region's watersheds. This is water which could recharge local aquifers and which now must be imported at an estimated cost of $100 million annually. Some of this water is lost through lack of means for collection, while some reclaimed water is not recycled because of regulatory limits on recharge. One effort that could help to overcome these barriers is being conducted by the Los Angeles and San Gabriel Rivers Watershed Council. The Water Augmentation Study, a long-term research project, is exploring the potential to increase local water supplies and reduce urban runoff pollution by increasing the upstream infiltration of stormwater runoff.

2.2.6 Infrastructure for Flood Control

As noted above, existing flood management infrastructure is generally adequate, but factors such as increasing development, climate change, and aging infrastructure will challenge effectiveness in the future. It is very probable that flood events will exceed the capacity of current facilities and/or that failures of aging infrastructure will occur at some future date.

2.3 Opportunities

2.3.1 Collaborative Funding Efforts

Stakeholders across the Region are working collaboratively to develop local, state and federal funding. Many agencies have started rising to the challenges by avoiding operating as single-purpose agencies and by creating opportunities to develop integrated, multi-purpose cost-shared solutions with stable, long-term funding sources for both capital improvement and operations and maintenance of water infrastructure. For example, the American Society of Civil Engineers (ASCE) formed the ASCE Los Angeles Regional Watershed Infrastructure Funding Workgroup made up of leaders representing federal, state, regional, county, and municipal organizations along with representatives from university, city council, and environmental organizations.

2.3.2 Federal Funding

Emerging stormwater regulations and TMDLs are causing stormwater management agencies to consider major capital improvements to collect and treat stormwater runoff. Although the costs of stormwater treatment facilities and associated land acquisition are significant, as noted above, agencies are evaluating the potential to attract funding partners. If solutions provide flood control, habitat restoration, or water supply, they may be eligible for significant funding through federal agencies such as the U.S. Army Corps of Engineers and the U.S. Bureau of Reclamation. Locally, the U.S. Army Corps of Engineeers has indicated that between 50 and 65 percent federal funding may be available for multipurpose capital improvement projects which provide habitat restoration along major water bodies such as the Los Angeles and San Gabriel Rivers.

2.3.3 Inactive Gravel Pits

Large inactive gravel pits in several sub-regions offer significant opportunities to capture, store, and manage significant quantities of local dry-weather runoff. Future gravel quarry land reclamation may provide additional open space for recreation and habitat in conjunction with other economic development opportunities on these sites. These quarries are private property and, therefore, further investigation would be needed to determine the viability of these opportunities. Some quarries, such as the Durbin Quarry and United Rocks Product Quarry #3, offer valuable commercial and industrial areas for recycled water opportunities. Local cities are extremely interested in property development that would improve their tax base. Proposals to set aside any portions of these properties for open space will need to account for these economic realities.

2.3.4 Utility Easements

As outlined in the San Gabriel River Master Plan, open space within existing power line easements adjacent to the San Gabriel River and throughout the Region offer one of the most significant opportunities to manage stormwater runoff and implement integrated, multipurpose projects. There is precedent for utility corridors being considered in this manner. For example, in Sun Valley, the Los Angeles Department of

Water and Power (LADWP) easements are being considered for stormwater management to assist local cities in meeting water quality regulatory requirements.

Regulatory and fiscal challenges will have to be addressed if this open space vision is to become a reality. As one example, Southern California Edison (SCE) will need a safe harbor agreement to protect its operations if endangered species take up residence in newly established habitat areas within the right-of-way. Safe harbor agreements are available under Section 10 of the Endangered Species Act (ESA). But public entities with activities in waters of the United States or U.S.-owned property are subject to Section 7 of the ESA, which may not allow safe harbor agreements. Further research is recommended. Legislative action may be needed to make these agreements an option. In addition, these easements are time-limited opportunities, as this real estate is rapidly being leased and developed for other purposes.

2.3.5 Pooling Financial Resources

There is growing recognition that limited financial resources must be pooled for projects with multiple benefits. Agencies are recognizing that there are opportunities to develop projects which may have historically been cost-prohibitive when evaluated solely within a single agency's single purpose mission and budget constraints. Projects that provide multiple benefits and multiple uses of land may become cost-effective when evaluated within missions and budgets of mutliple agencies. For example, the cost of land may be prohibitive when a wastewater agency is evaluating a project to construct wetlands for polishing of effluent. If that agency considers the use of these wetlands for treatment of stormwater runoff during the wet season, and the pooling of financial resources to acquire this land, the project may become cost-effective. Additional research is required on a site-by-site basis to evaluate the potential financial benefits to multipurpose projects.

2.3.6 Projects that Provide Tangible Community Benefits

Land acquired for multipurpose projects can be used to provide water quality improvement, habitat restoration, open space, and recreational needs. Naturalized streams and rivers will improve stormwater quality as well as improve quality of life. The public is increasingly demanding solutions that provide recreational amenities such as trails and habitat as well as community benefits such as river restoration and community redevelopment. Funding for many of these projects will likely require local support for local funding measures, as well as state and federal funding. Any significant local funding will likely require the vote of the public and, therefore, projects must demonstrate tangible community benefits so that the electorate would be willing to vote yes on an increase in fees or taxes. Other communities have packaged solutions to achieve objectives for NPDES permit compliance, stormwater capture, and flood control solutions in a manner that achieved public support for tax increases (Napa County, Los Angeles City Proposition "O"), even under the strict requirements of California State Proposition 218, which requires a two-thirds-majority vote.

3. PLANNING OBJECTIVES

The overarching objectives for the IRWMP are to identify means for augmenting water supply and meeting Basin Water Quality objectives and TMDL requirements, while also providing for other beneficial uses such as habitat and recreational opportunities. Although not addressed directly here, the need to retain some minimum flows in the Los Angeles Region receiving waters and freshwater discharge to estuaries to support aquatic habitat would limit the degree to which flows could be fully reused for drinking water supply or other uses.

As noted previously, many TMDLs are in process for the Los Angeles Region. However, overall load and wasteload allocations for point and nonpoint sources and/or treatment objectives are still being developed through the regulatory framework. The IRWMP planning effort is not meant to circumvent or replace the regulatory process, but rather to acknowledge potential future impacts of TMDL implementation plans on the capture and treatment of stormwater flows and reduction or treatment of dry-weather flows. TMDLs could also require greater levels of treatment for wastewater.

In this section, quantifiable objectives for a 20-year time frame (the year 2026) have been developed for the following:

- Potential volume of reclaimed wastewater available for recycle;
- Future dry-weather runoff volume, which may require capture and treatment or reduction; and
- Stormwater runoff that may require capture and treatment (defined by design storm volume) and the associated annual volume that could be used to augment water supply.

The purpose of setting quantifiable objectives is to provide guidance for proposed strategies and projects in the future IRWMP. These objectives will also be used in future gap analysis to identify multi purpose projects within each sub-region to fill the gaps. Therefore, to the extent possible, the objectives have been calculated on a sub-regional basis.

No quantifiable objectives have been developed for flood management, but it is clear that there will be significant needs in the future to expand existing facility capacity to address increased urban development and to repair and/or replace aging infrastructure. It would be valuable to develop some quantifiable or qualitative objectives to reflect future flood management needs so that project contributions toward meeting the needs can be recognized.

Some example flood protection goals to initiate dialogue include:

- Repair and replace a specified portion (to be determined) of the aging infrastructure each year over the next 20 years; and
- Limit the need to expand flood management capacity to the degree possible by capturing and treating flows in upstream reaches and reducing existing flood flows.

3.1 Assumptions, Methods and Estimates

In order to meet existing and future TMDL requirements, the Region will likely be required to provide enhanced treatment of wastewater discharges, to capture and treat or reduce dry-weather runoff, and capture and treat a significant portion of stormwater runoff. This section presents the rationale, sources, methodology, and assumptions used to develop quantifiable objectives. These quantifiable objectives are

planning level estimates and would need to be refined for future more detailed assessments or design of specific projects.

3.1.1 Water Reclamation Plant Discharges

Many water reclamation plants (WRP) currently recycle a portion of their treated discharge in the form of groundwater recharge, irrigation, and/or cooling water. Reclaimed water not yet recycled may be available for future water supply augmentation, possibly subject to further treatment. The following equation was used to calculate estimates of available reclaimed water.

Available Reclaimed Water = Future Flow – Current Recycled Water

Where:

- Available Reclaimed Water was estimated to be the projected annual average dry-weather quantity of treated effluent that could be available for recharge and reuse in the year 2026 cubic feet per second ([cfs] and acre-feet).
- Future Flow was defined as the average annual dry-weather flow for 2026 (cfs).
- Current Recycled Water was estimated as the amount of treated effluent going to groundwater recharge or being reused for irrigation or cooling in 2006 (cfs).

This estimate is based on several assumptions, with associated limitations:

- For the purpose of estimating future flows in 2026, it was assumed that any increases in flow due to population growth would be offset by reductions due to water conservation (i.e., future flow = current flow). It is possible that this estimate could be high if water conservation actually reduces future flows or could be low in areas of greater growth, which may produce wastewater flows that approach or even exceed existing WRP design capacity.
- Existing WRPs that discharge into waterbodies within the study area were included in the estimate. These include Burbank, Tillman, and Glendale, which discharge into the Los Angeles River and tributaries, and San Jose Creek, Pomona, Los Coyotes, Long Beach, and Whittier Narrows, which discharge into the San Gabriel River and tributaries. Tapia, which discharges into Malibu Creek, was included for the rainy season only (November 15 – April 15).
- Plants with ocean discharge (Terminal Island and Hyperion WRPs and the Joint Water Pollution Control Plant) were also included, although it is less likely that these flows will be affected by TMDL implementation requirements. A portion of the flow from these facilities may already be earmarked for recycling (e.g., use in maintaining West Basin and/or Dominguez Gap seawater intrusion barriers).

As shown in Table 3-1, approximately 107 mgd is currently recycled out of the 920 mgd of total reclaimed water. Estimates of the volume of reclaimed water that is not currently recycled and could be available for future water supply augmentation total approximately 813 mgd or 910,000 acre-feet/year, with approximately 150 mgd coming from WRPs that discharge to inland waters and approximately 684 cfs from ocean discharges. Figure 3-1 shows the locations of the major WRPs within the Region and individual plant design capacities in mgd.

The quantifiable objective for reclaimed water is to recycle 80 percent of the total volume reclaimed in the Region each year. This is consistent with the Los Angeles Integrated Resources Plan (IRP) goal to "beneficially reuse approximately 80 percent of the 'recyclable' water in the system" (CH:CDM, 2004). As shown in Table 3-1, about 107 mgd is currently recycled, or about 12 percent of the total volume of reclaimed water produced. To achieve the 80 percent objective would require recycling an additional 629 mgd or 705,000 acre-feet/year. Currently, approximately 225 mgd out of the 920 mgd total reclaimed water receives

tertiary or advanced treatment (see Water Supply TM). To achieve the recycled water objective could require additional treatment, beyond secondary, of up to another 510 mgd of reclaimed water.

Table 3-1. Projected Available WRP Water for Recycle

Sub-Region	Water Reclamation Plant (WRP)	Future Flow (mgd)	Current Recycled Flow (mgd)	Projected Reclaimed Water Available for Recycle (mgd)	Projected Reclaimed Water Available for Recycle (acre-feet/year)
South Bay Watersheds	None	0	0	0	0
North Santa Monica Bay Watersheds	Tapia WRP[a]	7	4	3	3,300
Upper Los Angeles River Watershed	Tillman WRP[b]	52	25	27	30,200
	Burbank WRP[c]	6	1	5	5,600
	Subtotal	58	26	32	35,900
Lower Los Angeles and San Gabriel Rivers Watersheds	Los Coyotes WRP[d]	32	5	27	30,500
	Whittier Narrows WRP[e]	7	5	2	2,200
	Glendale WRP[f]	15	1	14	12,600
	Long Beach WRP[g]	21	5	16	18,200
	Subtotal	75	16	59	63,500
Upper San Gabriel River and Rio Hondo Watersheds	San Jose Creek WRP	83	28	55	61,600
	Pomona WRP	9	8	1	1,200
	Subtotal	92	36	56	62,900
Ocean	Hyperion Treatment Plant	350	21	329	392,100
	Terminal Island Treatment Plant	16	4	12	13,700
	Joint Water Pollution Control Plant	322	0	322	360,700
	Subtotal	688	25	663	766,500
	Total	920	107	813	932,000

a Las Virgenes Municipal Water District Urban Water Management Plan (UWMP), 2005.

B LADWP UWMP, 2005.

c Burbank UWMP, 2005.

d 15th Annual Status Report on Recycled Water Use, 2004.

e El Segundo receives secondary treatment water from Hyperion and provides tertiary and advanced treatment. Since this water is already counted under Hyperion, it does not show in future flow column. All of the water that receives tertiary and advanced treatment is recycled. West Basin UWMP, 2005.

f Future flow (current reclaimed flow) from City of Los Angeles Sanitation web page. Current recycled flow from City of Los Angeles, personal communication.

g Totals may vary slightly due to rounding.

3.1.2 Dry-weather Runoff

Dry-weather runoff typically derives from sources such as landscape irrigation return flows from over-watering, car washing, pavement washing, and fire system flows. Dry-weather runoff in much of the Region

could be captured and treated and/or prevented from reaching waterways to meet water quality requirements. It is also possible that dry-weather runoff could be used to augment water supplies in certain circumstances. For the purposes of this TM, the objective for dry-weather runoff is to reduce, capture, infiltrate, and/or treat the 50th to 90th percentile dry-weather urban runoff flow.

Because dry-weather runoff cannot be measured directly, it has been estimated using methodology previously developed for the Los Angeles and Tributaries Metals TMDL (Los Angeles Regional Water Quality Control Board, 2005), as summarized in the equation below.

Dry-weather Runoff = Instream Flow – WRP Net Discharge

Where:

- Dry-weather Runoff is the total estimated quantity of dry-weather flow in the year 2026, which could require capture and treatment or reductions to meet TMDLs (cfs and acre-feet/year).
- Instream Flow is the 50th (median) and 90th percentile flow measured at the nearest gauging station just downstream of relevant WRPs (cfs).
- WRP Net Discharge is the estimated or reported quantity of treated wastewater currently discharged to receiving waters (cfs and acre-feet/year), which is equal to the estimated reclaimed water available (Table 3-1).

This estimate is based on several assumptions, with associated limitations:

- See assumptions for Wastewater Reclamation (above).
- Use of 50th and 90th percentile instream flows and average annual dry-weather net WRP discharge provides a range of dry-weather flows that could reasonably be reduced and/or captured and treated to meet TMDL and other water quality requirements.
- Other direct discharges (e.g., cooling water, industrial, or treated groundwater) were not considered specifically, which would lead to the implicit inclusion of these flows in the dry-weather flow estimate.
- Groundwater inflows/outflows were not addressed because of data limitations. The impact of groundwater on stream flow is expected to be relatively negligible due to the significant amount of channel lining within the Region.
- Evaporation and other gains or losses were not included.
- Any dry-weather discharges not entering a waterway upstream of the available gauging stations (e.g., discharges directly to the bay or downstream of gauges) were not included in the estimate, which could underestimate dry-weather flows.

Table 3-2 shows values for 50th and 90th percentile flows at the most downstream gauges available for major rivers and creeks within the Los Angeles IRWMP area. Table 3-3 incorporates the estimates from Tables 3-1 and 3-2 to calculate a range for dry-weather runoff using both the 50th and 90th percentile gauging station flows. As shown in Table 3-3, a total of about 177,000 to 331,000 acre-feet/year (245 to 457 cfs) of dry-weather flow could require capture and treatment and/or elimination. For comparison, the Los Angeles Integrated Resources Plan (IRP) which covers approximately 25 percent of the Los Angeles IRWMP planning area (464 square miles out of 2,044 total) has established a goal to prevent 38 mgd (approximately 57 cfs) of dry-weather flow from entering receiving waters by the Year 2020 (CH:CDM, 2004). The Los Angeles IRP goal is on the same order of magnitude as the 50th percentile dry-weather flow objective (i.e., about 25 percent of the 50th percentile objective of 245 cfs for the entire Los Angeles IRWMP area).

Table 3-2. Gauging Station Locations and Flows

Sub-Region	Location	Flow (cfs)[a]	
		50th percentile	90th percentile
South Bay Watersheds	Ballona Creek above Sawtella	18	40
	Dominquez Channel at Artesia Blvd[b]	23	46
	Subtotal	41	86
North Santa Monica Bay Watersheds	Malibu Creek below Cold Creek	5	11
Upper Los Angeles River Watershed	Los Angeles River above Arroyo Seco	121	160
Lower Los Angeles and San Gabriel Rivers Watersheds	Los Angeles River Below Wardlow	138	178
	San Gabriel above Spr. St.	160	246
	Coyote Creek below Spr St	12	48
	Subtotal	311	472
Upper San Gabriel River and Rio Hondo Watersheds	San Gabriel below San Gabriel River Pkwy	27	72

a Calculated from average daily flow values for June-August for years 1998-2003, website: http://www.ladpw.org/wrd/runoff

b Gauging station data were not available online. Using a 42 cfs avg flow found in the Dominguez Channel Mstr Plan Table 2.3-12, 50th and 90th percentile flows were estimated by comparing the ratios of average to 50th and 90th percentile flows at other stations.

Table 3-3. Estimated Dry-Weather Runoff

Sub-Region	Estimated Dry-Weather Flow Range	
	Cubic feet per second	Acre-feet per year
South Bay Watersheds	41 to 86	29,700 to 62,300[a]
North Santa Monica Bay Watersheds[b]	5 to 11	3,600 to 8,000
Upper Los Angeles River Watershed	71 to 110	51,700 to 80,000
Lower Los Angeles and San Gabriel Rivers Watersheds	127 to 249	92,200 to 180,500
Upper San Gabriel River and Rio Hondo Watersheds[c]	0	0
Total Dry-weather Flow	245 to 457	177,200 to 330,800

a Range based on 50th percentile and 90th percentile instream flows, respectively.

b Since there is normally no discharge from the Tapia WRF to Malibu Creek from April 15 to November 15, dry-weather flow equals the gauge flow.

c In the Upper San Gabriel River calculated net discharge exceeds 50th and 90th gauge flow, hence estimated dry-weather flow is zero.

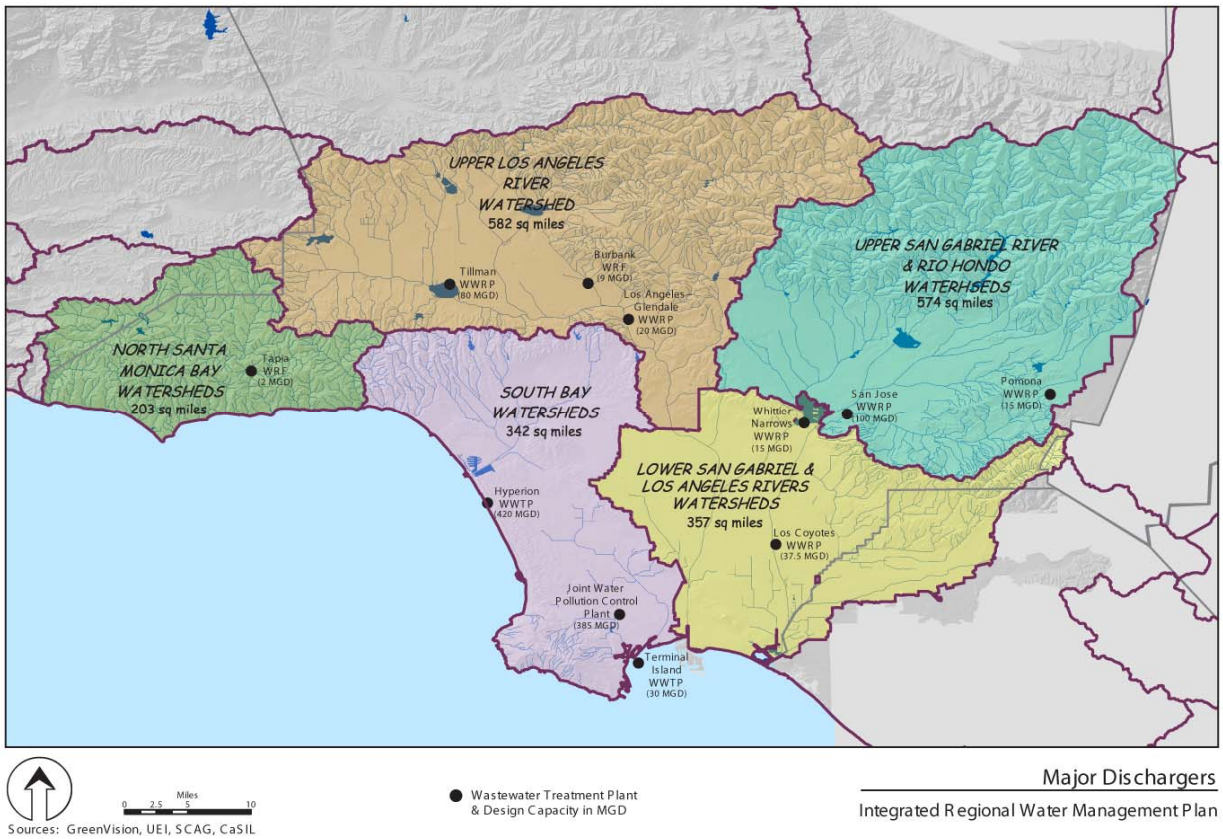

Figure 3-1. Major Water Reclamation Plants and Design Capacities within the Region: One Million Gallons/Day (mgd) = 1.547 Cubic Feet/Second (cfs)

3.1.3 Stormwater Runoff

The major driving forces for stormwater capture and management are two-fold: (1) compliance with TMDL regulations; and (2) recognition that capturing and effectively using rainfall now lost to the ocean is critical to regional sustainability. Strategies for capturing stormwater runoff have been implemented for many years in this Region. The Los Angeles County Flood Control District operates a series of stormwater recharge facilities throughout the San Gabriel and Los Angeles Rivers Watersheds to capture and recharge stormwater runoff primarily from the national forests and to a lesser extent urban runoff. Quantifiable objectives for the capture and treatment of stormwater flows have been defined for the volume of urban stormwater runoff that may ultimately need to be captured and treated to meet TMDL requirements, both in terms of a design storm and an annual total, by sub-region.

3.1.3.1 Design Storm

The volume of stormwater runoff associated with the design storm was estimated to help define future needs for capture and treatment facilities (capacity and cost). Stormwater runoff volume was calculated using a weighted Simple Method equation, as applied in the Los Angeles County 1994-2005 Integrated Receiving Water Impacts Report, and summarized below.

$$V = PAC$$

Where:

V = stormwater runoff volume (acre-feet/storm)

P = precipitation (feet)

A = area (acres)

C = runoff coefficient, equals (0.8) x imperviousness + 0.1

This estimate is based on several assumptions, with associated limitations:

- It was assumed that capture and treatment of design storms ranging from the 70th percentile to the 85th percentile event from the entire Los Angeles area will be required to meet TMDLs by the year 2026.
- The low end of the range reflects the design storm (70th percentile or 0.5 inch storm) applied by the USC study to estimate potential costs required to meet new and emerging stormwater regulations in the Los Angeles area (USC, 2002).
- The high end of the range (85th percentile or 0.75 inch storm) is loosely based on the Los Angeles RWQCB Urban Stormwater Mitigation Plan for Los Angeles County (SUSMP). This assumption reflects an extrapolation of the SUSMP which requires capture and treatment of the 85th percentile storm event for areas of new development or significant re-development (Los Angeles RWQCB, 2002).
- In the Region, the 85th percentile 24-hour runoff storm event translates to approximately 0.75 inch of precipitation over a 24-hour period (Los Angeles RWQCB, 2002). The Los Angeles design storm event has been calculated based on methods and recommendations set forth by the ASCE and Water Environment Federation (WEF) in their design manual (ASCE/WEF: Urban Runoff Quality Management, 1998). For detailed design, storm intensity and rate of runoff would also need to be considered in addition to volume of runoff.
- For comparison, the State of Washington has adopted a 6-month, 24-hour water quality design storm that represents a theoretical 91 percent of total annual rainfall and is defined as the 1.5-inch storm event in Seattle (Washington State Department of Ecology Water Quality Program, 2005).
- Only urban stormwater runoff must be captured and treated to meet water quality requirements, therefore only developed areas were considered. Upstream, more pristine areas were not considered.
- The percent impervious area for each land use type was estimated based on guidelines for Los Angeles County published in the Department of Public Works Hydrology Manual (Los Angeles County, 1991).
- The source for land use types and areas derived from Southern California Association of Governments (SCAG, 1997). Figures 3-2 through 3-6 on the following pages show the land use within each sub-region.

As shown in Table 3-4, the total volume of stormwater runoff associated with the 85th percentile (0.75 inch) storm event is approximately 25,800 acre-feet/design storm event over the entire 1,151 square miles of developed area in the Los Angeles Region. For a 70th percentile (0.5 inch) storm event, the volume of runoff from the developed area would be approximately 17,200 acre-feet/design storm event (estimated as two-thirds of the volume from the 0.75 inch event). As noted above, it was assumed that only urban stormwater runoff from developed areas would need to be captured and treated to meet water quality requirements. For context, runoff was also estimated for the total 2,044 square miles of both developed and undeveloped land (approximately 29,400 acre-feet for the 85th percentile storm and 19,600 acre-feet for the 70th percentile storm - see Appendix C for detailed calculations). For comparison, the USC study estimated a total runoff of 22,289 acre-feet for the 70th percentile design storm over approximately 2,660 square miles of developed and undeveloped area (USC, 2002).

Table 3-4. Design Storm Runoff (85th Percentile or 0.75-inch, 24-hour storm)[d]			
Sub-Region	Total Area (sq. mile)	Developed Area (sq. mile)	Developed Area Runoff (acre-feet)
South Bay Watersheds	330[a]	278	6,300
North Santa Monica Bay Watersheds	203	30	600
Upper Los Angeles River Watershed	545[b]	249	5,400
Lower Los Angeles and San Gabriel Rivers Watersheds	392[c]	358	8,300
Upper San Gabriel River and Rio Hondo Watersheds	574	236	5,100
Total	2,044	1,151	25,800[e]

a Adjusted from 342 square miles in IRWMP sub-region to account for bay area.

b The GIS measured area in the IRWMP sub-region is 582 square miles. The difference between this value and the SCAG data shown above is not resolved.

c The GIS measured area in the IRWMP sub-region is 357 square miles. The difference between this value and the SCAG data shown above is not resolved.

d See Appendix C for details of runoff calculations.

e Totals discrepancy due to rounding.

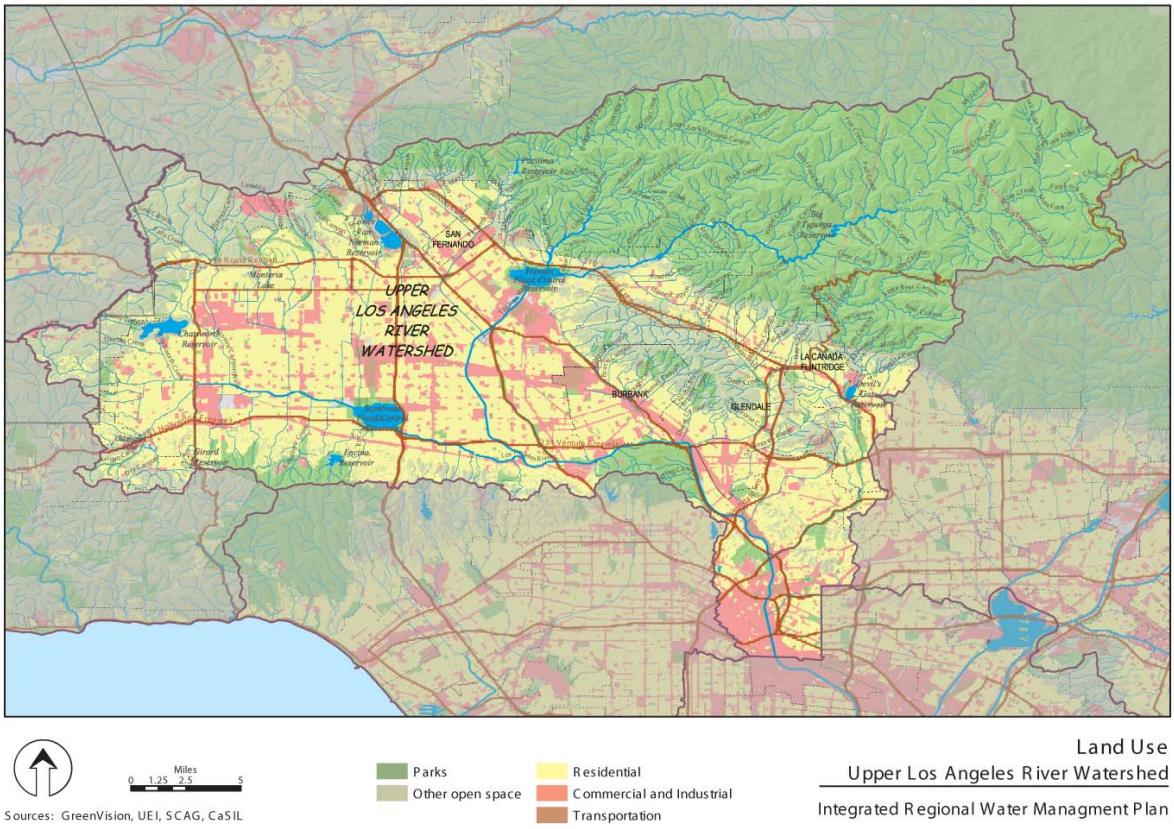

Figure 3-2. Land Use within Upper Los Angeles River Watershed

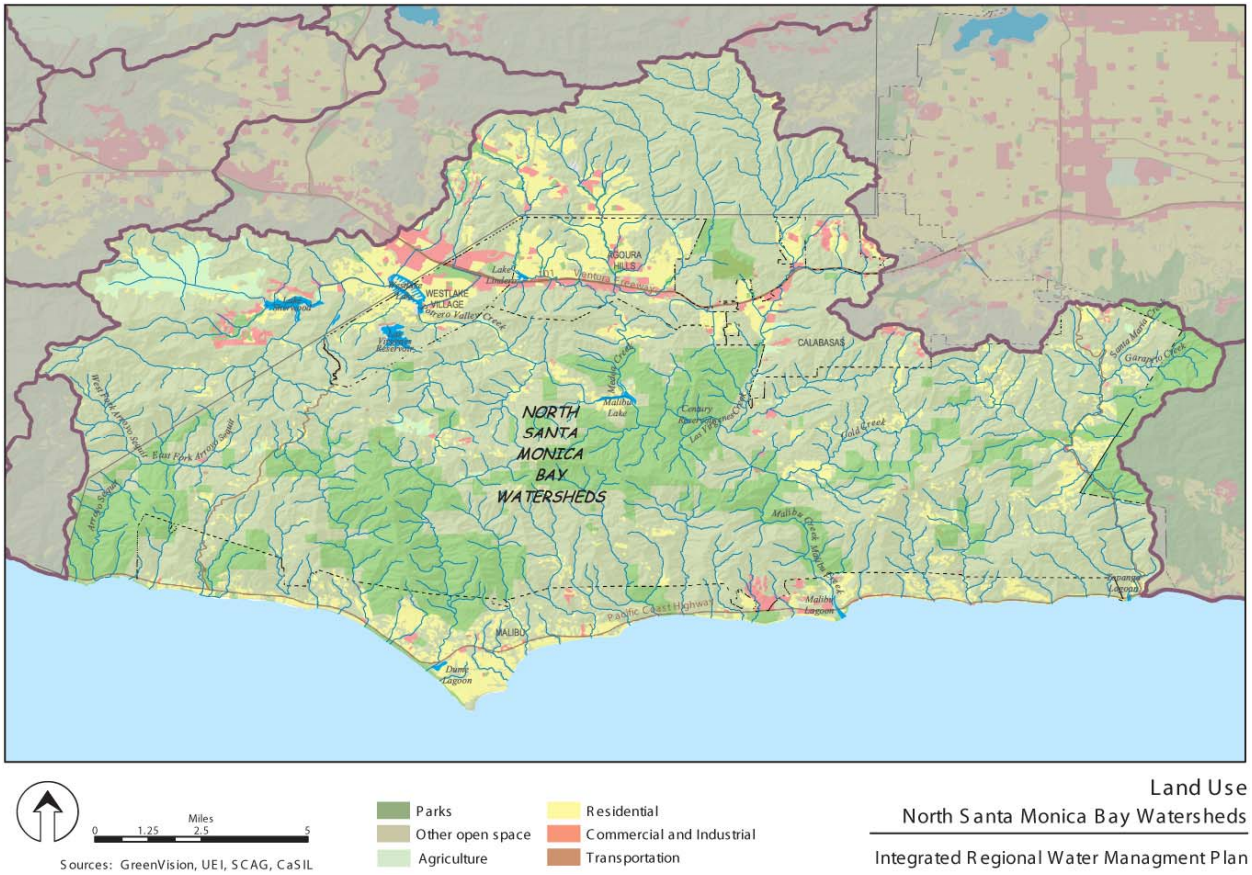

Figure 3-3. Land Use within North Santa Monica Bay Watersheds

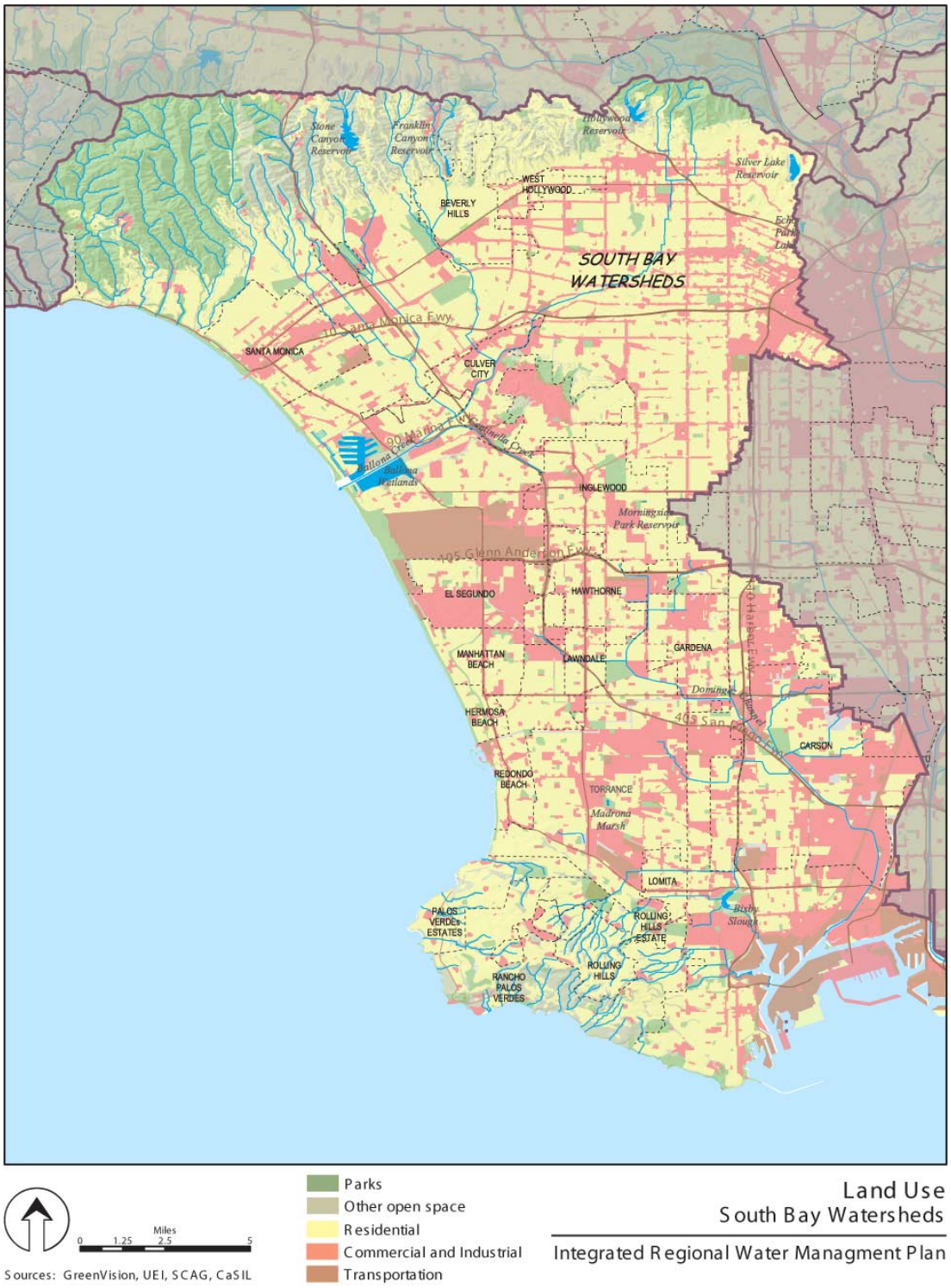

Figure 3-4. Land Use within South Bay Watersheds

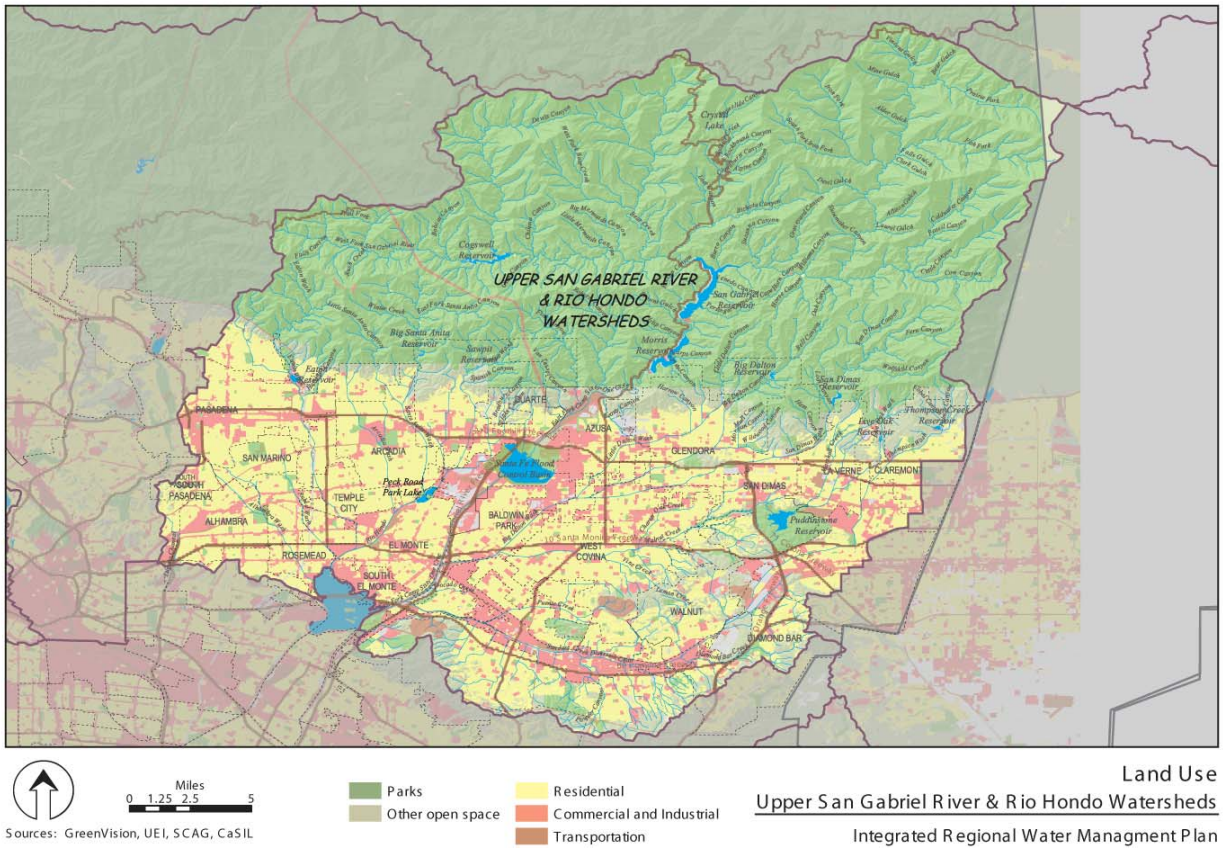

Figure 3-5. Land Use within Upper San Gabriel and Rio Hondo Watersheds

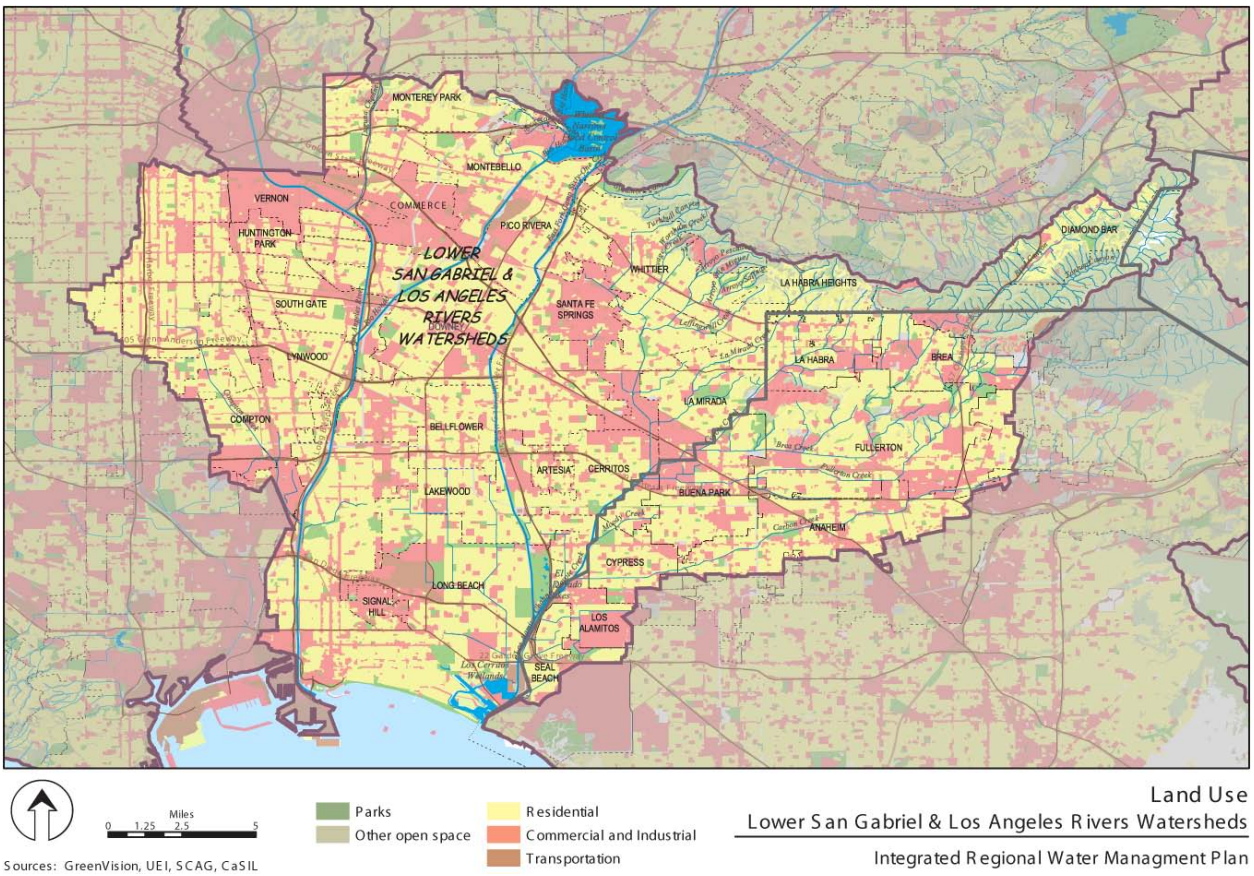

Figure 3-6. Land Use within Lower San Gabriel and Los Angeles Rivers Watersheds

3.1.3.2 Annual Stormwater Runoff

A quantifiable objective for the total annual volume of captured and treated stormwater runoff was estimated to define the volume that could be available to augment water supplies in the future. Average annual stormwater runoff was estimated using annual rainfall data and the equation used to calculate design storm runoff, as presented above, and the quantifiable objective was defined by the range of 50 percent to 85 percent of the total annual estimated runoff volume. Average annual rainfall for each sub-region is summarized in Table 3-5.

This estimate is based on several assumptions, with associated limitations, as described below:

- The low end of the range reflects the stated goal of the Los Angeles IRP to "capture and beneficially reuse approximately 50 percent of the annual average wet weather urban runoff" (CH:CDM, 2004). Fifty percent of the total annual runoff is less than the 70th percentile design storm event would produce, but it may not be possible to recycle the total annual volume of treated stormwater, particularly because the timing of availability may not coincide with the timing of recycled water needs.
- Capture and treatment of the 50th and 85th percentile storms translates to roughly 50 percent to 85 percent of the total annual runoff volume. The total volume captured over a year from the design storms can be approximated by taking a percentage of the total runoff, estimated by using annual average rainfall. This should be approximately equivalent to the sum of runoff captured by the total number of design storms in a year. A more detailed hydrologic assessment would be needed to refine this planning level estimate.

- These estimates incorporate measurements from more than 45 rain gauges located within these areas, which are available through the Los Angeles County Department of Public Works webpage (http://ladpw.org/wrd/precip/index.cfm).
- Values of "seasonal rainfall normal" for each rain gauge were assumed to represent the average annual rainfall.
- For each sub-region, the rain gauges falling within the sub-region or immediately adjacent to it were averaged using an arithmetic mean to obtain average annual rainfall values. The use of arithmetic mean to calculate average rainfall, while valid, may not be as accurate as the use of Thiessen polygons, but is appropriate for the purposes of this TM.
- Rain gauge locations were approximated based on a map available on the Los Angeles County Department of Public Works webpage (http://ladpw.org/wrd/Precip/index.cfm). In some cases, data from one rain gauge were used in several sub-regions if the gauge is located close to the dividing line between the sub-regions.

Table 3-5. Average Annual Rainfall

Sub-Region	Average Annual rainfall (inches)	
	Developed	Undeveloped
South Bay Watersheds[a]	15.8	15.8
North Santa Monica Bay Watersheds[b]	19.7	19.7
Upper Los Angeles River Watershed	17.6	21.5
Lower Los Angeles and San Gabriel Rivers Watersheds	13.9	13.9
Upper San Gabriel River and Rio Hondo Watersheds	16.9	27.2

a South Bay and the Lower Los Angeles River and San Gabriel River are largely developed. Rainfall data were not differentiated by undeveloped area.

b North Santa Monica Bay is largely undeveloped. Rainfall data were not differentiated by developed area.

As shown in Table 3-6, the total estimated average annual stormwater runoff is approximately 545,000 acre-feet for developed land across the entire Los Angeles IRWMP planning area. The volume of treated stormwater runoff that could be available for water supply augmentation is estimated to range from 50 percent to 85 percent of the average annual storm runoff from developed areas (approximately 272,000 to 465,000 acre-feet/year). For comparison, the Los Angeles IRP goal is to capture and beneficially reuse 50 percent of the annual wet-weather urban runoff (CH:CDM, 2004).

Table 3-6. Annual Runoff by Sub-Region		
Sub-Region	Run-off (acre-feet)	
	Developed	Undeveloped
South Bay Watersheds	132,800	4,800
North Santa Monica Bay Watersheds	15,800	18,300
Upper Los Angeles River Watershed	126,800	34,200
Lower Los Angeles and San Gabriel Rivers Watersheds	154,300	2,700
Upper San Gabriel River and Rio Hondo Watersheds	115,200	49,700
Total	544,900	109,600

3.2 Objectives Summary

Based on available information and the assumptions described in this section, the following quantifiable objectives have been defined for a 20-year time frame (the year 2026).

- **Recycled Water.** To recycle an additional 629 mgd of reclaimed water or approximately 705,000 acre-feet/year (over and above the 120,000 acre-feet/year or 107 mgd of recycle currently occurring). This corresponds to an overall goal of 80 percent recycling for the total volume of wastewater reclaimed in the Region, which is consistent with the Los Angeles IRP goal to beneficially reuse approximately 80 percent of the "recyclable" water in the system (CH:CDM, 2004). This increase in recycled water would likely require adding tertiary treatment for up to another 510 mgd (over and above the 225 mgd currently occurring).
- **Dry-weather Runoff.** To reduce, eliminate, capture and/or treat approximately the 50th to 90th percentile dry-weather runoff flow (180,000 to 330,000 acre-feet/year or 250 to 450 cfs). For comparison, the Los Angeles IRP goal is to prevent approximately 38 mgd (57 cfs) of dry-weather runoff from entering receiving waters (CH:CDM, 2004), which is the same order of magnitude as the estimated 50th percentile flows for that fraction of the area.
- **Stormwater Runoff Capture and Treatment.** To reduce, capture, infiltrate and/or treat stormwater runoff from the 70th percentile, or 0.5 inch storm to the 85th percentile, or 0.75 inch storm for developed lands within the entire Los Angeles IRWMP planning area (approximately 17,000 to 26,000 acre-feet per design storm). The primary driver for capture and treatment of stormwater runoff is to improve water quality and meet TMDLs. The low end of the range, or 70th percentile event, is based on the design storm used for the USC study (USC, 2002) and the high range, or 85th percentile, is loosely based on the Los Angeles SUSMP (Los Angeles RWQCB, 2002). A portion or all of this treated stormwater could be applied to augment water supplies, as noted below.
- **Treated Stormwater for Water Supply Augmentation.** To apply 50 percent to 85 percent of the average annual storm runoff from developed areas (treated to meet water quality requirements) to augment water supplies (approximately 300,000 to 500,000 acre-feet/year). For comparison, the Los Angeles IRP goal is to capture and beneficially reuse 50 percent of the annual wet weather urban runoff (CH:CDM, 2004).

One purpose of the IRWMP is to determine integrated, multi-objective projects that can achieve these goals. Projects identified in the Step 1 application process that could help to meet these objectives are listed in Appendix D.

4. WATER MANAGEMENT STRATEGIES

Meeting water quality and flood management needs, water supply needs, and habitat and recreation goals over the next 20 years will require strategic planning, creative thinking, and significant new sources of funding. The Region is projected to grow significantly over these years, placing limits on water supply that will contribute to the overall difficulty of meeting the needs and goals of the future. In today's funding environment, it is probably unlikely that all of the required projects can be completed as single purpose projects. However, there is an alternative. With planning, cooperation, and vision, one can integrate many projects so that multiple goals can be achieved. For example, wetlands and habitat projects can provide water quality, groundwater recharge, flood management, and recreational opportunities. Integrated projects that include multiple management strategies are more valuable and therefore, are more likely to be selected for funding from the funding agencies.

4.1 Water Quality Protection and Improvement, Stormwater Capture and Management, and Nonpoint Source Pollution Control

4.1.1 Background

The Region's rivers, streams, oceans, and beaches are some of its most prized assets and many plans and studies have been conducted to better understand water quality issues and to develop implementation plans. The primary driving force for water quality protection and improvement is attaining designated beneficial uses and preventing further degradation.

Within most of the portion of the Region within Los Angeles County, a comprehensive program to reduce stormwater pollution has been established by the Stormwater and Urban Runoff NPDES permit, which prohibits non-stormwater discharges into the storm drain system, limits discharges to receiving waters that would cause or contribute to a violation of water quality standards, and requires implementation of a SQMP. In addition, in response to the identification of water quality impairments (via the 303(d) list), the RWQCBs have begun to establish TMDLs for contaminants including trash, bacteria, nutrients, metals, and toxic pollutants. Water quality protection and improvement and compliance with stormwater and TMDL requirements will require stormwater capture and management, NPS pollution control, and some enhancement of wastewater treatment.

4.1.2 Opportunities for Strategy Improvement and Integration

Opportunities for improvement and integration of strategies to improve water quality, expand stormwater capture and management, and provide Nonpoint Source pollution control include the following:

- **Develop multipurpose TMDL solutions.** Coordinate with regulatory agencies to establish and implement science-based TMDLs and reasonable schedules for implementation, which will encourage multipurpose solutions. Consider local and regional facilities to capture and treat stormwater as part of a TMDL compliance strategy. This could include package treatment plants to remove contaminants, filtration systems, or natural treatment systems such as constructed wetlands. In either case, it will be necessary to identify existing publicly-owned open spaces, or acquire/develop new open spaces downstream of urban runoff to retain the design storm proposed in this TM. Water cleansed by such

facilities could either be recharged to groundwater or stored for delivery to local uses, such as landscape irrigation.

- **Evaluate opportunities to share funding resources.** The funding for the installation and maintenance of single-purpose facilities (i.e., CDS units, catch basin inserts, low-flow diversion systems, and end-of-pipe treatment plants) is typically supported by single-purpose agencies. Evaluate opportunities to develop multipurpose solutions that allow for the sharing of funding resources among several partner agencies.
- **Retrofit existing publicly owned lands for stormwater capture.** Identify public lands, such as parks, schools, or power line easements that can be retrofitted to provide a secondary function of stormwater capture either above or below ground.
- **Develop joint use stormwater capture facilities.** Identify and acquire available land in heavily urbanized areas to be used for collection and treatment of polluted stormwater runoff for the short rainy season, and then as parks and recreational facilities for the remainder of the year. Potential partners may include parks departments and stormwater management agencies.
- **Expand river corridors to include more area for riparian habitat and stormwater storage.** Develop a policy to acquire lands over the next few decades adjacent to existing rivers and creeks to allow for:
  - Restoration of riparian habitat;
  - Reconfiguration of concrete channels to restore ecosystem functions;
  - Provision of stormwater storage;
  - Creation of parks along these improved facilities;
  - Conversion of existing urban land use to more densely developed urban land use adjacent to these facilities; and
  - Improvement of adjacent property values.

  Partners may include stormwater management agencies, redevelopment agencies, private developers, and the Department of Housing.
- **Develop joint use groundwater recharge facilities.** Consider packaging groundwater recharge facilities, which can require significant land acquisition, to provide treatment of influent urban runoff pollution for recharge as well as wildlife habitat and recreational features. Also, consider locating facilities in areas to provide recharge of wastewater effluent in the non-storm season. Partners may include water supply, stormwater management, wastewater management, parks, habitat, and open space agencies.
- **Coordinate with Water Supply TM strategies.** Expand water quality protection and improvement programs and projects, such as the Safe Drinking Water Act (SDWA) projects identified in the Water Supply TM, to address broader water quality issues. Also, coordinate with implementation of programs and projects to remediate groundwater contamination, as identified in the Water Supply TM.

4.2 Flood Management

4.2.1 Background

Most urbanized areas within the Region have adequate flood protection with facilities in place able to manage the 100-year flood or even rarer events. However, there are a number of areas in the Region where persistent flooding or drainage problems need to be addressed. In addition, the potential for increased runoff arising from new development and changing climate could reduce flood protection to unacceptable levels or require system expansions in some areas. Aging infrastructure will also require repair and/or replacement. Finally, a growing public sentiment favoring naturalization of local rivers and creeks may affect approaches to

maintaining adequate flood management. As flood management issues are addressed in the Los Angeles IRWMP planning area, there will be many opportunities to support water management strategies in a number of ways and integrate with other strategies to provide multiple benefits.

4.2.2 Opportunities for Strategy Improvement and Integration

- **Enhance flood management to provide multipurpose benefits.** Apply innovative, alternative approaches to enhance flood management facilities to provide multiple benefits. As one example, the Sun Valley Watershed Plan addresses an area of chronic flooding with alternative approaches to construction of a flood conveyance channel, such the use of gravel pits and underground drains below parkland to infiltrate runoff and thereby enhance groundwater recharge. If successful, the Sun Valley Plan can serve as a model for future localized flood management improvements.
- **Develop dual purpose storage and treatment facilities.** Evaluate opportunities to site and design constructed wetlands adjacent to existing rivers and streams to provide treatment of urban runoff during normal rainfall conditions and also to function in a manner that could provide off-channel storage, and increase the level of flood protection during infrequent flood events. These facilities could also be designed to provide riparian habitat along these water bodies. The U.S. Army Corps of Engineers may provide significant funding of these facilities. Also, consider other types of stormwater facilities that can serve the dual purpose of capture and treatment during normal rainfall conditions and flood storage during high flow conditions.
- **Expand aging infrastructure repair and replacement projects to provide multiple benefits.** As the flood control infrastructure continues to age and potentially exceed its design life span, there is an opportunity to evaluate the best use of future financial resources on the repair and replacement of these facilities. Evaluate opportunities to redesign flood control infrastructure to provide multiple benefits including stormwater pollution control, riparian habitat, trails, and recreation.

4.3 Water and Wastewater treatment

4.3.1 Background

This TM addresses the opportunities related to wastewater treatment strategies. The Water Supply TM addresses water supply strategies. There are currently 13 major WRPs within the Region and two tertiary treatment/advanced treatment plants, which are operated by West Basin Municipal Water District (treating secondary effluent from Hyperion Treatment Plant). Evolving TMDL requirements will likely require enhancement of wastewater treatment, particularly to reduce nutrients and metals levels. Population growth will also require expansion of some facilities. WRP enhancement and expansion offer opportunities to support water management strategies and integrate with multiple strategies.

4.3.2 Opportunities for Strategy Improvement and Integration

- **Evaluate opportunities for projects which provide multiple benefits with future WRP and WTP upgrades.** Opportunities to expand and/or enhance water and wastewater treatment include projects designed to meet SDWA requirements and recent and pending TMDLs. As enhancements for facilities throughout the Los Angeles IRWMP planning area are considered, evaluate opportunities for projects which provide multiple benefits to help treat dry-weather and/or stormwater runoff or to polish reclaimed water for recycling.
- **Develop joint use facilities for treatment of wastewater and stormwater.** Identify and acquire available land in heavily urbanized areas to be used for treatment/polishing of wastewater treatment plant effluent to meet expected future TMDLs for nutrients and metals. Evaluate the ability of these facilities to be designed to also provide treatment of polluted stormwater runoff for the short rainy season and

wastewater for the remainder of the year. Partners may include wastewater management and stormwater management agencies.

- **Coordinate efforts to expand river corridors for multiple uses (see water quality strategy section above).** Coordinate with stormwater management and development agencies to allow for development of treatment wetlands for wastewater treatment plant effluent along expanded river corridors and integration of these facilities with restoration of riparian habitat and reconfiguration of concrete channels to restore ecosystem functions.

4.4 Land Use Planning

4.4.1 Background

Land use planning applies broadly to all three TMs but has been summarized here in the Water Quality TM.

The California state constitution confers responsibilities for land use planning to the cities and counties (for unincorporated areas). The Government Code establishes requirements for the development of General Plans to guide land use decisions, which must include seven required elements: land use, circulation, housing, conservation, open space, noise, and safety. Because of this structure, water resources may be discussed within the conservation element (as it relates to water supply and stormwater management), the open space element (as it relates to water-based recreation or the use of lands that may protect water supply or enhance groundwater recharge), and the safety element (as it relates to flood protection). Thus, most jurisdictions' policies with respect to water resources and their management are typically fragmented throughout several elements. The State of California's General Plan Guidelines ([GOPR], 2003) describe the concept of an optional water resources element, which would combine: water supply and demand, water quality, wastewater treatment and disposal, watershed features and processes, flood management and stormwater management.

In 2001, two water supply planning bills were enacted that require greater coordination and more extensive data to be shared between water suppliers and local land use agencies for large development projects and plans. Senate Bill 610 (California Water Code §10631, §10656, §10910, §10912, §10915, §10657) requires a water supply assessment (as part of the CEQA review) for any development project or related land use plan of more than 500 housing units, 500,000 square feet of retail use, 250,000 square feet of office use, 500 hotel rooms, 40 acres, or 650,000 square feet of business park use or a mixed-use project with any combination equal to the scale noted above. Senate Bill 221 (Government Code §66410, et seq.) prohibits any land use agency from approving a subdivision map of more than 500 housing units unless there is written verification from a water provider that a sufficient and reliable water supply is available. Sufficient water supply is defined as adequate water to supply the new growth in normal, dry, and multiple dry years. As large portions of the Region are already developed and most of the remaining developable land is located in the foothills and mountains, few development projects in the Region exceed the thresholds identified in either bill. Thus, the preparation of Water Supply Assessments or written verifications has been somewhat limited in the Region.

Given the pervasive nature of some nonpoint source pollutants, land use planning, in the form of ordinances, could be used to reduce stormwater runoff volume and/or the discharge of pollutants from development or redevelopment sites. For those portions of the Region within Los Angeles and Ventura Counties, certain development (on sites 1 acre or greater in area; or automotive repair shops; retail gasoline outlets; restaurants; home subdivisions with 10 or more homes; parking lots with 25 or more spaces or are greater than 5,000 square feet in area; single-family hillside residences; and locations within or directly adjacent, or discharging to, environmentally sensitive areas) require the development of a SUSMP, to retain the runoff from storms of approximately 0.75 inches. Individual jurisdictions could extend these requirements to development or redevelopment on smaller sites or additional development types. Existing stream corridors, open spaces, or other valued watershed resources could be protected via ordinance, such as a stream protection ordinance. A

more comprehensive approach to natural resource management, which could provide corollary benefits to water resources, is provided by the City of Santa Monica's Sustainable City Plan, which promotes a well-maintained open space system that can support natural functions, wildlife habitat, passive and active recreation, and supports implementation of land use and transportation planning and policies that encourage compact development and mixed-use projects.

Constraints to the use of Land Use Planning to enhance the integrated management of water resources include the lack of fiscal resources to support development of optional general plan elements, the potential for disparities among local jurisdictions to subtly affect development patterns (as developers may choose those jurisdictions with less stringent requirements), and the absence of model programs to demonstrate the effectiveness of such measures.

4.4.2 Opportunities for Strategy Improvement and Integration

- **Expand land use planning to support water management strategies.** Opportunities to expand the use of land use planning in the integrated management of water resources include the adoption of natural resource protection measures (e.g., a stream protection ordinance), the preparation of Water Resource Elements in city and county General Plans, and the adoption of Sustainability Plans by jurisdictions, agencies, and organizations.

4.5 Watershed Planning

Watershed planning applies broadly to all three TMs but has been summarized here in the Water Quality TM.

4.5.1 Background

Numerous watershed plans have been prepared in the Region, including:

- The Arroyo Seco Watershed Restoration Feasibility Study;
- The Ballona Creek Watershed Management Plan;
- Common Ground;
- From the Mountains to the Sea;
- Compton Creek Watershed Management Plan;
- Dominguez Channel Watershed Management Master Plan;
- Malibu Creek Watershed Management Area Plan;
- Rio Hondo Watershed Management Plan;
- Sun Valley Watershed Plan; and
- The draft Upper San Gabriel River Watershed Management Plan.

Draft plans are under development for the Tujunga Wash and Coyote Creek. As noted by the 2005 update of the California Water Plan: "…Los Angeles County [is] the most productive county in the state in terms of watershed planning." (Department of Water Resources, 2005)

The primary focus of these plans has been improvement of surface water quality, with additional emphasis on preservation of open space, and the promotion of multi-purpose projects. Most of these efforts have been stakeholder-driven, so that the list of recommended actions reflects local concerns and priorities.

Constraints on the development of additional watershed plans include availability of funding, absence of established stakeholder groups for some of these areas, and a defined minimum scope to assure regional consistency.

4.5.2 Opportunities for Strategy Improvement and Integration

- **Incorporate water management strategies in new watershed plans.** Opportunities for the preparation of new watershed plans include the headwaters of the Los Angeles River, Burbank (east and west) Wash, Verdugo Wash, the mainstem of both the Los Angeles and San Gabriel Rivers (although the respective river Master Plans cover the river corridors and some adjacent lands), Los Cerritos Channel, and numerous smaller watersheds that drain directly to Santa Monica Bay and San Pedro Bay.

5. CONCLUSION

This heavily urbanized Region faces a number of pressing water quality and flood management challenges in both the short- and long-term. Even though the Region has significantly reduced pollutants discharged to its water bodies from individual point sources since the Clean Water Act was established, most of the major rivers and water bodies are considered impaired due to toxic pollutants and pathogens, and the quality of many waters continues to be degraded from pollutants discharged from diffuse and diverse nonpoint sources and from the cumulative impacts of multiple point sources. Consequently, during the next 10 years, more than 90 TMDLs are scheduled to be developed and they will be implemented by hundreds of dischargers and more than 80 cities in the Region.

Several estimates in the range of $10 billion have been offered by credible sources, including USC, as the revenue needed to address the Region's water quality and TMDL goals alone. At the same time, there are many years now when more than 200,000 acre-feet of stormwater is lost to the ocean from these watersheds, some of which historically recharged local drinking water aquifers, that must now be imported at a cost in excess of $100 million annually. In addition, very limited dedicated financial revenue sources in the Region to address stormwater pollution caused by stormwater and dry-weather runoff. Dedicated revenue sources currently exist for wastewater discharges and water supply are also limited.

In response to these issues, multiple agencies in this Region are recognizing the benefits of working together to address multiple objectives such that water quality goals described in this TM may be achieved by pooling financial resources. This TM has outlined the potential opportunities for improvement and integration of traditional single-purpose water management strategies utilized historically to address water resource issues. It is clear that there are opportunities for collaboration, cooperation and funding partnerships to integrate strategies and develop projects that provide multiple benefits.

For example, the projected additional water supply needed by the year 2025 is approximately 850,000 acre-feet/year as outlined in the Water Supply TM. As described in this TM, quantifiable objectives have been developed for several local sources (currently largely unused) of water supply including approximately 200,000 to 365,000 acre-feet/year of dry-weather runoff, and 180,000 to 330,000 acre-feet/year of urban stormwater runoff that could potentially address some portion of this need, if adequately treated and properly sited. In addition, a large quantity of reclaimed wastewater is available and a quantifiable objective has been established to recycle an additional 629 mgd or 705,000 acre-feet/year. It is also clear that there are significant benefits to considering regional water quality projects located near creeks and rivers because these projects provide the opportunity to achieve stormwater quality improvement while maximizing other community objectives (such as habitat, recreation, river revitalization, and groundwater recharge) while attracting significant federal funding partners.

6. LIMITATIONS

6.1 Report Limitations

This document was prepared solely for the Leadership Committee of Greater Los Angeles County Integrated Regional Water Management Plan in accordance with professional standards at the time the services were performed and in accordance with the contract between the Leadership Committee of Greater Los Angeles County Integrated Regional Water Management Plan and Brown and Caldwell dated May 15, 2006. This document is governed by the specific scope of work authorized by the Leadership Committee of Greater Los Angeles County Integrated Regional Water Management Plan; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by the Leadership Committee of Greater Los Angeles County Integrated Regional Water Management Plan and other parties and, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

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APPENDIX A

SQMP Program Details

SQMP PROGRAM DETAILS

Within the entire Region, there is a comprehensive program to reduce stormwater pollution that was established by the Stormwater and Urban Runoff NPDES permit presents one of the most prominent opportunities within the entire Region to improve water quality. Seven SQMP programs have been established to create a comprehensive program that will ensure water quality protection for the future. These programs are summarized below.

The Industrial/Commercial Facilities Control Program covers industrial and commercial facilities, including restaurants, automobile service facilities, retail gasoline outlets, automobile dealerships and other federally-mandated facilities.

The Development Planning Program requires implementation of a SUSMP for commercial developments on sites 1 acre or greater in area, automotive repair shops, retail gasoline outlets, restaurants, home subdivisions with ten or more homes, parking lots with twenty-five or more spaces (or are greater than 5,000 square feet in area), single-family hillside residences, and locations within, or directly adjacent, or discharging to, environmentally sensitive areas. In addition, substantial redevelopments (resulting in the creation of more then 5,000 square feet of impervious surface) are also subject to SUSMP requirements. The Development Planning Program and SUSMP requirements include the following:

- Minimize impacts of stormwater on natural drainages and water bodies;
- Maximize pervious surfaces to allow percolation of stormwater to the ground;
- Minimize the quantity of stormwater to impervious surfaces and the storm drain system;
- Provide appropriate permanent measures to reduce pollutant loads;
- Control post-development peak runoff to prevent erosion in natural drainages;
- Conserve natural areas; minimize pollutants of concern; protect slopes and channels;
- Provide storm drain stenciling and signage;
- Minimize pollution from parking lots using treatment control BMPs and good housekeeping practices;
- Proper design of storage areas, loading dock areas, repair bays, vehicle/equipment wash areas, gasoline fueling areas, and parking areas (to minimize conveyance of pollutants to storm drain systems);
- Proper design and maintenance of BMPs to reduce vector breeding (e.g., mosquitoes); and
- Require BMPs to meet design standards and/or numerical design criteria; and provide evidence of BMP maintenance.

In September 2002, the County of Los Angeles prepared a manual for SUSMP preparation entitled Development Planning for Stormwater Management, which is available online (refer to Chapter 8 References). In addition, the City of Los Angeles created a SUSMP manual entitled "Development Best Management Practices Handbook— Part B Planning Activities," which is also available on the Watershed Protection Division's website at www.lastormwater.org.

The Development Construction Program requires control of runoff from construction sites through a combination of BMPs, inspections, and for projects over one acre in area, preparation of a Stormwater Pollution Prevention Program (SWPPP), per the Construction Activities Stormwater General Permit (Order No. 99-08-DWQ). Depending on the site characteristics, the SWPPP may include measures to minimize disturbed areas, stabilize disturbed areas, protect slopes and channels, control the site perimeter, retain sediment on site, practice good housekeeping, and contain materials and wastes.

The Illicit Connections and Illicit Discharges Elimination Program requires the County and the cities to: track and map all illicit connections and discharges to the storm drain system; train employees in methods of identification, investigation, termination, cleaning of illicit connections and discharges; screen storm drain systems for illicit connections; investigate and determine sources, nature, and volume of discharge and responsibility for illicit connections; terminate illicit connections using enforcement authority; respond to illicit discharges with activities to abate, contain, and clean up within one business day of discovery; and investigate illicit discharges and take enforcement action, as appropriate during or following containment.

The Public Agency Activities Program consists of maintenance, inspection, and response to minimize stormwater impacts from public agency activities. These include management of sewerage systems (including overflow and spill prevention), construction activities, vehicle maintenance/material storage facilities/ corporation yards, landscape and recreational facilities, parking facilities, storm drains, streets and roads, and emergency procedures.

The Public Information and Participation Program requires measures to increase awareness, change behavior, and involve the public in mitigating the impacts of stormwater pollution. For many pollutants of concern, reducing pollutant discharge at the source (generally referred to as source control) may be a cost-effective method of reducing pollutant discharge.

The Countywide Monitoring Program requires measures to assess receiving water impacts, identification of sources of pollution, evaluation of BMPs, and measure of long-term trends in mass emissions.

As noted above, source control may be the most cost-effective method to reduce the discharge of pollutants, but requires personal action on the part of individuals. The proper disposal of hazardous materials and the use of alternative materials and less toxic substances have great potential to reduce water-borne contaminants. As trash remains a major contributor to poor water quality, incentives for product substitution (e.g., alternative packaging materials) may achieve substantive reductions in the pollutant discharge. For some pervasive pollutants, legislative action may be necessary, similar to the methods employed to improve air quality in the Region. The LACDPW has established the BMP Task Force to serve as an ongoing forum to facilitate the selection, implementation, and financing of effective BMPs through: data gathering, analysis, and exchange; stakeholder coordination; and outreach. The Task Force maintains a website that provides information about BMPs and the activities of the Task Force.

The California Stormwater Quality Association has developed four stormwater BMP Handbooks to provide general guidance for selecting and implementing BMPs to reduce pollutants in runoff from (1) new development & redevelopment sites, (2) construction sites, (3) industrial & commercial facilities, and (4) municipal operations. The handbooks describe planning techniques for stormwater pollution prevention and provide information on a wide range of BMPs, aggregated into various categories for each handbook, including erosion and sediment control, site and material management, source control, and treatment control measures.

APPENDIX B

Overview of Planning Documents by Sub-region

LIST OF PLANNING DOCUMENTS BY SUB-REGION

Table B-1. South Bay

Agency	Planning Document	Policies, Programs, and Projects
U.S. Army Corps of Engineers	Los Angeles County Drainage Area Water Conservation Supply Final Reconnaissance Report	
Ballona Creek Watershed Task Force (BCWTF)	Ballona Creek Watershed Management Plan, 2004	With a $200,000 grant from the State Water Resources Control Board, the project proposes to: • Establish a local watershed stakeholder organization; • Identify target areas for source control of pollutants; • Identify habitat/open space restoration potentials in the watershed, demonstrate their feasibility, evaluate their potential water quality benefits; • Develop measurable water quality improvement and habitat restoration goals; • Select and prioritize cost-effective Best Management Practices; • Develop a community-based watershed monitoring plan to track environmental conditions and evaluate plan implementation; and • Identify and obtain commitment from responsible parties to plan implementation. Coordinates water quality, habitat and open space improvement efforts in the watershed across jurisdictions; identifies actions to be implemented by individuals, neighborhoods, organizations, cities and local, state and federal agencies.
City of Culver City, California Coastal Conservancy and Community of Culver City	Ballona Creek and Trail Focused Special Study, December 2004	Develops a maintenance and operation strategy for the corridor, and identifies short, mid and long term Ballona Creek Trail improvement projects needed along the Ballona Creek corridor.
City of Los Angeles Department of Water and Power	Urban Water Management Plan, 2000 and Fiscal Year 2003-2004 Annual Update	Consistent with the California Urban Water Management Planning Act requirement that suppliers develop water management plans every five years, DWP prepared its current plan in 2000, issued the *Urban Water Management Plan Fiscal Year 2003-2004 Annual Updates*, and is preparing the 2005 Urban Water Management Plan. Though specific water quality information is not a general requirement of the Act, LADWP issues Annual Water Quality Reports throughout its service area pursuant to requirements of the State's Department of Health Services.
Heal the Bay	Beach Report Card, Summer 2004 and Report Card, October 28, 2004	Provides beachgoers with essential water quality information by grading 436 monitoring locations from Humboldt County to San Diego County. Grades are based on dry-weather water quality data provided by over 20 entities throughout California. Data presented in the Summer 2004 Report Card were collected between Memorial Day and Labor Day 2004. Heal the Bay's website, www.healthebay.org, is updated every Friday with weekly Beach Report Card grades for all sampling locations with data. Heal the Bay's Beach Report Card is based on weekly water quality monitoring data provided by dischargers and health agencies. Data is analyzed as soon as it is made available by these agencies. (Heal the Bay, 2004).

Table B-1. South Bay

Agency	Planning Document	Policies, Programs, and Projects
Los Angeles County Department of Public Works Watershed Management Division	Dominguez Watershed Management Master Plan, 2004	Comprehensive document that: • assists stakeholders in the protection, enhancement, and restoration of the environment and beneficial uses of the Dominguez Watershed; • provides overview of current conditions within the watershed; • identifies and addresses watershed problems and issues; • provides an action plan of recommended measures and projects; and • identifies potential funding opportunities to assist with implementation of the plan.
Metropolitan Water District	Urban Water Management Plan 2003 Annual Progress Report to the CA Legislature	First annual report to the legislature required under SB160. Details MWD's efforts and accomplishments in complying with its mandate, California law and the U*rban Watershed Management Plan*. Primarily reviewed past efforts at promoting efficient use and management of its water resources. Proposed a number of legislative recommendations, including a requirement for the Regional Urban Water Management Plan to include a discussion about the relationship of source water quality to supply reliability to focus attention on the need for source-water protection.
City of Los Angeles Department of Recreation and Parks and Palos Verdes/South Bay Audubon Society	Habitat Restoration and Lake Water Quality Improvement Design Development Report, Volume 1, Ken Malloy Harbor Regional Park, Sept. 2001	Conducted as the first step for achieving stated water quality improvement goals, the study attempts to characterize current environmental conditions in and around the lake but concludes that there insufficient water quality data. The report: • presents review of relevant literature and documents; • summarizes water quality monitoring results from 1977, and 1991-1993; and • presents findings from three lake water quality samples taken during the study in 2001. The report also presents a design concept of various recommended improvements at the Ken Malloy Harbor Regional Park.
City of Los Angeles Department of Recreation and Parks and Palos Verdes/South Bay Audubon Society	Ken Malloy Harbor Regional Improvement Program: Machado Lake Watershed Management Plan, Volume II, October 2001	Purpose: to identify the storm drainage boundary of the Machado Lake watershed and subdivide it into suitable sub-watershed areas, so that representative stormwater runoff sampling locations can be identified, so that runoff from each sub-watershed can be quantified. With the land use information of each sub-watershed area, these data are used to estimate pollutant loads attributable to water pollution of Machado Lake. Actual water quality sampling from each storm drain network was conducted three times during the course of this study, including one wet weather sampling and two dry-weather samplings. Pollutant loading from each sub-watershed was calculated by multiplying the volume of runoff with the average concentration of each pollutants of concern. This report recommends additional stormwater runoff and lake water quality sampling should be conducted during the wet weather season, especially during the first flush of the first storm event of the season.

Table B-1. South Bay

Agency	Planning Document	Policies, Programs, and Projects
Regional Water Quality Control Board, Los Angeles Region	Santa Monica Bay Wet Weather Bacteria TMDL Implementation Plans (Jurisdictions 2/3, 5/6)	These plans outline implementation of TMDL's for the respective Santa Monica Bay Watershed jurisdictions as required by the federal Clean Water Act of 1972 (CWA). The Act requires that states: • Develop a "303 (d) List" – a list of impaired waters and of their offending pollutants; • Establish a watershed-based pollutant specific TMDL to bring impaired water bodies into compliance with water quality standards necessary for their particular beneficial uses; and TMDL's are incorporated as amendments to the regional *Basin Plan*, requiring designated responsible jurisdictions and agencies to reduce their discharges to meet these waste load allocations.
Regional Water Quality Control Board, Los Angeles Region	Water Quality Control Plan, Los Angeles Region: Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties. (Basin Plan), 1994	The official water quality plan for the Los Angeles Basin, issued in 1994, designed to preserve and enhance water quality and protect the beneficial use of all regional waters. • Designates beneficial uses for surface and groundwaters, sets narrative and numerical objectives that must be attained or maintained to protect the designated beneficial uses and conform to state's anti-degradation policy. Describes implementation programs to protect all waters in the Region; • EPA "303d" list of impaired water bodies is updated every 3 years; and • As Total Maximum Daily Load (TMDL) criteria are announced, plan requirements are revised. Excellent reference for characterization of surface and groundwater; beneficial use designations and impairments to these uses by water body or stream reach; and current regional water quality regulations.
Regional Water Quality Control Board, Los Angeles Region	Water Management Initiative, October 2004 (Section 2.9 Dominguez Channel and Los Angeles/Long Beach Harbors Water Management Area & Section 2.10 Santa Monica Bay Water Management Area)	To protect water resources within a watershed context, the WMI is designed to: • respond to complex relationships among point and nonpoint source discharges, ground and surface water interactions, and water quality/water quantity; • integrate various surface and groundwater regulatory programs while promoting cooperative, collaborative efforts within a watershed; and • focus limited resources on key issues and use sound science.
Regional Water Quality Control Board, Los Angeles Region	Draft Use Attainability Analysis for Rec-1 Beneficial Uses of Ballona Creek and Water Quality Objective Change, April 2004	Discusses the California Regional Water Quality Control Board, Los Angeles Region's use attainability analysis concerning the current designation of Ballona Creek as REC-1. The Regional Board staff internally request removing or amending this designation, whish is discussed and proposed in the document.
SMBRC	Santa Monica Bay Epidemiological Study, March 2003	Cohort study investigating possible health risks associated with bathing in the Santa Monica Bay and assessing whether these risks were associated with urban runoff from storm drains. Exposures of primary interest were pathogens that produce acute illness.
SMBRC	State of the Bay, 2004	An update on the environmental health of the Bay based on 27 environmental indicators that measures progress towards achieving the goals of the *Bay Restoration Plan*. The previous update was in 1998.

Table B-1. South Bay

Agency	Planning Document	Policies, Programs, and Projects
SMBRC, Stolzenbach et al at the Institute of the Environment UCLA and Southern California Coastal Water Research Project	Final Report on Measuring and Modeling Atmospheric Deposition on Santa Monica Bay and the Santa Monica Bay Watershed. September 2001	Objectives: • Determine the total annual pollutant load from air deposition both Santa Monica Bay and the Bay watershed; • Compare the load to other sources; and • Determine spatially and temporal variations in the load.
State Water Resources Control Board	State Water Resources Control Board Order WQO, November 2004.	(Response to Draft Use Attainability Analysis for Rec-1 Beneficial Uses of Ballona Creek and Water Quality Objective Change.) In June 2004 the Regional Board rejected the proposal laid out in the Draft Use Attainability Analysis. Regional Board finds that it erred in rejecting the staff proposal to de-designate potential REC-1 pertaining to swimming related activities from the two reaches, not adopting Limited Rec-1 for Reach 2 and not adopting revised bacteriological objectives for Limited Rec-1 nor an order to adopt the changes.
UCLA, Michael K. Stenstrom, Ph.D., P.E.	Stormwater Impact, 1999	Details stormwater sources, runoff destinations, and runoff impact on beaches including closures relating to the Ballona Creek Watershed; details SMBRP, Los Angeles County Department of Public Works and Caltrans activities; and considers possible responses such as Best Management Practices to existing conditions, including public education, porous pavement, biomass injection, wetlands ponds and detention ponds, trash screens and racks, low flow diversions, street sweeping and catch basin cleaning, and product replacement and pollution prevention.
U.S. Army Corps of Engineers Los Angeles District	Los Angeles County Drainage Area Water Conservation and Supply Final Reconnaissance Report, 1994	Investigated alternatives to raising flood control levee walls in the lower Los Angeles River. Investigated additional storage capability at Hansen Dam, Lopez Dam, Santa Fe Dam, and Whittier Narrows Dam. Sepulveda Dam and Basin, already considered at capacity, were not included. Reported positive cost/benefit ratios for additional dam storage, but there was not enough capacity added; the lower Los Angeles River levee walls were raised. Report is valuable for characterization of the LACDA system and dam capacity, and economic analyses.
WRD	Strategic Plan, September 2003	The WRD, which manages groundwater for nearly four million residents in 43 cities of southern Los Angeles County, drawing from a service area that supplies nearly 40% of the total demand for water, ensures that a reliable supply of high quality groundwater is available through its clean water projects, water supply programs, and effective management principles.
	(Check with WRD for additional Water Quality Protection documents)	

Table B-2. North Santa Monica Bay

Agency	Planning Document	Policies, Programs, and Projects
City of Agoura	General Plan	Plan addresses a policies, goals, and implementation measures related to (not all included in list): • Land Use; • Conservation; • Parks and Recreation; • Water Quality; and • Stormwater Management.
City of Calabasas	A Creek Protection & Revitalization Plan for Las Virgenes Creek – Bradley Owens, Cal Poly	Plan has 3 components: • Creek protection; • Habitat linkage; and • Riparian greenway.
	Las Virgenes, Mc Coy and Dry Canyon Creeks Master Plan Restoration: Comprehensive Study	The Master Plan has several components: • Flow & WQ Monitoring Program -Habitat Restoration Assessment; • Education and Recreation Assessment -Source Control/BMPs; and • Non-calibrated BASINS model.
	Malibu Creek Watershed Monitoring Program	Identifies a monitoring program that provides water quality data for constituents that impact human and aquatic beneficial uses of Malibu Creek and its tributaries.
	General Plan	Covers a wide-swath of activities and policies related to IRWMP: • Habitat protection -Erosion control -WQ control measures; • Water conservation -Recycled water -Water supply/Development; • Stormwater mgmt -Flood mitigation -State & Fed coordination; and

Table B-2. North Santa Monica Bay

Agency	Planning Document	Policies, Programs, and Projects
City of Malibu	Flood Mitigation Plan	Flood mitigation plan includes: prevention, property protection, natural resource protection, emergency services, structural projects, & public information.
	Local Coastal Program 2002/2004	Extensive planning report in two pieces: (1) Land Use Plan, and (2) Local Implementation Plan. The two sections of the plan contain provisions for: • Stream protection & restoration; • Native tree preservation; • Wetlands protection; • New development restrictions based on water supply availability; • Water storage facilities; • On-site wastewater treatment facilities; • Non-point source pollution; • Erosion control; • Flood protection; and • Stormwater run-off.
	Risk Assessment of Decentralized Wastewater Treatment Systems in High Priority Areas – Malibu Civic Center	• Groundwater monitoring & modeling; • Water quality monitoring; and • Study of nutrient loading to Malibu Creek/Lagoon.
	Malibu Wetland Feasibility Study	• Assesses the feasibility of restoring a wetland in the Malibu Civic Center area at the Chili Cook-off Site Wetlands would provide treatment for runoff before in entered the Malibu Lagoon; and • Wetland would restore natural process and provide habitat.
	Malibu Civic Center Integrated Water Management Concept Plan – Questa Engineering	• Water quality improvements -Habitat protection; • Water conservation -Water recycling; and • Land acquisition -Public health & safety.
	General Plan	Lists planning policies and activities in the following areas: • Explains goals and priorities for development.
	Wastewater Management Plan (1992)	Describes planning for: • On-site wastewater systems; • Potential package plants; and • Non-point source pollution prevention.

Table B-2. North Santa Monica Bay

Agency	Planning Document	Policies, Programs, and Projects
Heal the Bay	Malibu Lagoon Alternatives Description	Identifies three lagoon restoration alternatives including: • Enhancement; • Enhancement and Restoration; and • Replumb (reengineering of lagoon to enhance water circulation and improve water level management.
	Malibu Creek Watershed – A Framework for Monitoring, Enhancement, & Action	Identifies alternative that: • Improve water quality monitoring; • Reduce impervious surfaces relative to stormwater runoff; • Improve stormwater treatment; • Conserve riparian habitat; • Reduce erosion; and • Reduce volume of imported water.
Los Angeles County	Dept. of Public Works Watershed Mgmt. Div. Implementation Plan for Santa Monica Bay Beaches Bacteria TMDL Jurisdictions 1 & 4 – Psomas/CH2M Hill	• Estimates and establishes baseline conditions; • Uses existing data to identify projects; • Prioritizes projects; • Identifies implementation considerations; • Identifies structural programs including small scale infiltration, retention grading, onsite storage and reuse, etc.; and • Identifies non structural programs related to public information and participation, land use planning, and public agency activities.
	Dept. of Public Works Watershed Mgmt. Div. Implementation Plan for Santa Monica Bay Beaches Bacteria TMDL Jurisdictions 1 & 4 – Psomas/CH2M Hill	• Estimates and establishes baseline conditions; • Uses existing data to identify projects; • Prioritizes projects; • Identifies implementation considerations; • Identifies structural programs including small scale infiltration; • Retention grading, onsite storage and reuse, etc.; and • Identifies non structural programs related to public information and participation, land use planning, and public agency activities.

Table B-2. North Santa Monica Bay

Agency	Planning Document	Policies, Programs, and Projects
Las Virgenes-Malibu Council of Governments	Watershed Management Area Plan for Malibu Creek Watershed	• Identifies goals that address water quality, water quantity, habitat restoration; • Addresses the impacts of urban and rural development on stormwater quality and diversion; and • Identifies ways to restore natural hydrologic processes within the watershed.
Malibu Creek Watershed Advisory Council – Lagoon Task Force	Lower Malibu Creek and Lagoon Resource Enhancement and Management – Drs. Ambrose, Orme.	Identifies watershed management alternatives that address: • Biological resources; • Reducing nutrient and pathogen inputs; • Implementing BMPs; • Reducing freshwater flows during dry season; • Eliminating and retrofitting septic systems; and • Retrofitting storm drain systems.
Natural Resources Conservation Services	Malibu Creek Watershed Natural Resources Plan	• Identifies priorities for implementation of plan; • Identifies subcommittee to set goals; • Identifies potential funding sources; • Initiates various monitoring programs; • Targets groups for education needs; and • Tracks programs success.
Regional Water Quality Control Board	Region 4 Watershed Management Initiative Chapter – December 2001 Version	Summarizes water quality problems and issues within the entire Santa Monica Bay Area including major issues of Malibu Creek Watershed. Lists past, current, near term, and long term water management activities in the Region including: • Watershed Management; • Wetlands protection and management; • NPS pollution; • Water Quality regulatory issues; • Water Quality monitoring; • Habitat Monitoring; and • Basin Planning.

Table B-2. North Santa Monica Bay

Agency	Planning Document	Policies, Programs, and Projects
Santa Monica Bay Restoration Commission	State of the Bay	• Reports on the health of the Bay and measures progress of achieving goals identified in the "Bay Restoration Plan"; • Addresses environmental impacts of pollutant loading on Bay health, human health, habitat, and recreational uses; and • Identifies environmental indicators.
	Making Progress: Restoration of the Malibu Creek Watershed which morphed into the "Top Ten Priorities" – 44 Action Items	44-point action plan for restoring Malibu Creek Watershed: • Protect beneficial uses, recreation, ecosystems; • Pollution source control, BMPs, erosion control; • Wetland/Lagoon restoration; • Habitat protection; • Coordination on a watershed basis; and • Watershed planning.
State Water Resources Control Board	Critical Coastal Areas Program	This plan focuses on protecting coastal areas from non-point source pollution. The plan IDs critical coastal areas (CCAs) along that coast that deserve special protection. The plan outlines future actions to protect these areas, such as: • -CCA pilot projects (WQ improvements); • -Watershed planning of CCAs; CCA Action plans; • -Secure funding; and • -Integration with other watershed programs.

Table B-3. Upper Los Angeles River

Agency	Planning Document	Policies, Programs, and Projects
California Coastal Conservancy	Arroyo Seco Watershed Restoration Feasibility Study, 2002	Establishes ecosystem health, physical and cultural characteristics of the watershed and makes recommendations for future studies and technical analyses. Proposed projects sorted by stream reach across a large range of costs. Identifies watershed goals and years to fulfill. Briefly discusses economics, governance structures.
City of Los Angeles Department of Water and Power	Urban Water Management Plan, 2000 and Fiscal Year 2003-2004 Annual Update	Consistent with the California Urban Water Management Planning Act requirement that suppliers develop water management plans every five years, DWP prepared its current plan in 2000, issued the *Urban Water Management Plan Fiscal Year 2003-2004 Annual Updates*, and is preparing the 2005 Urban Water Management Plan. Though specific water quality information is not a general requirement of the Act, LADWP issues Annual Water Quality Reports throughout its service area pursuant to requirements of the State's Department of Health Services.
City of Los Angeles	Wetlands Feasibility Study, 2000	Considers feasibility of filtering wastewater effluent from the Tillman Water Reclamation Plant through created emergent wetland habitats with intention of reducing concentration of nitratenitrogen prior to discharge to the Los Angeles River. The project also provided the opportunity to promote water reclamation, reuse, and alternative treatment processes to the public.
Mountains Recreation and Conservation Authority	Geomorphologic and Hydrologic Feasibility Study: Tujunga Wash Restoration Project, 2000	Purpose was to provide an independent geomorphologic and hydrologic assessment, and professional opinion on a set of stream restoration alternatives developed jointly by the Mountain Recreation and Conservation Authority and the Los Angeles County Department of Public Works. In particular, the goal was to verify the minimum stream width required under each of the five alternatives to maintain flood protection while simultaneously restoring habitat and adding recreational amenities.

Table B-3. Upper Los Angeles River

Agency	Planning Document	Policies, Programs, and Projects
The River Project	Hydrodynamic Study for Restoration Feasibility of the Tujunga Wash, 2002	Addresses planning for ecological rehabilitation and enhancement projects within the Los Angeles River system's reach. A MIKE11 computer-based hydrodynamic model of the system was created that can be linked with an existing model of the Los Angeles River built for the Taylor Yard feasibility study. The Tujunga Wash model has predicted the effects of potential physical changes to parts of the system, including the effects of proposed modifications in flood management strategies. It also developed a planning framework that included five major design concepts or strategies. The most severe technical criterion is the need to reduce the high flood flow velocities. Decisions on future dam operations, together with the use of the gravel pits and spreading grounds to reduce peak flood flow, were found to be critical to the potential for and success of enhancing channel and riparian areas downstream.
City of Los Angeles Department of Public Works Bureau of Sanitation and Department of Water and Power	Integrated Plan for the Wastewater Program, 2001 (IPWP Phase I) and Integrated Resources Plan for the Wastewater Program: Facilities Plan Vols 1-4, 2004	Two phases, first complete in 2001, second in 2004. Purpose: develop and implement an integrated resource planning process that addresses the City's water resources and wastewater/biosolids collection, treatment, recycling and disposal practices through the year 2020 through a comprehensive stakeholder process. • Phase I outlines a future vision of storm- and waste-water management in Los Angeles explicitly recognizing the complex relationships among the City's water resources activities and functions. • Phase II examines the need to expand and locate wastewater facilities, reclaimed water, and deal with stormwater runoff, has an extensive public outreach and feedback component, is an excellent source on current water inputs/outputs and uses and future projections, but only covers the City of Los Angeles. • Phase II Los Angeles River Recycled Water Optimization Study, Phase 1 Draft Report, begins to determine what may limit how much recycled water and dry-weather urban runoff can be diverted from the River and to identify potential adaptive flow management strategies for balancing the need for water in the River and elsewhere in the watershed.
U.S. Army Corps of Engineers Los Angeles District	Los Angeles County Drainage Area Water Conservation and Supply Reconnaissance Study, 1994	Investigated alternatives to raising flood control levee walls in the lower Los Angeles River. Investigated additional storage capability at Hansen Dam, Lopez Dam, Santa Fe Dam, and Whittier Narrows Dam. Sepulveda Dam and Basin, already considered at capacity, were not included. Reported positive cost/benefit ratios for additional dam storage, but there was not enough capacity added; the lower Los Angeles River levee walls were raised. Report is valuable for characterization of the LACDA system and dam capacity, and economic analyses.

Table B-3. Upper Los Angeles River

Agency	Planning Document	Policies, Programs, and Projects
Metropolitan Water District	Urban Water Management Plan 2003 Annual Progress Report to the CA Legislature	First annual report to the legislature required under SB160. Details MWD's efforts and accomplishments in complying with its mandate, California law and the *Urban Watershed Management Plan*. Primarily reviewed past efforts at promoting efficient use and management of its water resources. Proposed a number of legislative recommendations, including a requirement for the Regional Urban Water Management Plan to include a discussion about the relationship of source water quality to supply reliability to focus attention on the need for source-water protection.
U.S. Army Corps of Engineers	Reconnaissance Study of Arroyo Seco Watershed, 2002	An overview of the watershed, prepared to determine Federal interest in conducting a cost-shared feasibility study to develop information and analytical tools to define water problems and opportunities within the watershed. • Identified opportunities and possibilities for future projects and plans. • Concluded that the best potential for environmental benefits comes from environmental restoration projects. • Final recommendation was for the study to proceed to the feasibility phase, continuing investigation of environmental restoration, water quality, flood control and related issues.
City of Los Angeles	South Los Angeles Wetlands Park Concept Design, 2003	Provides a conceptual overview and feasibility assessment of the proposed park. The park would serve as a community resource of wetlands and riparian habitat in a densely populated urban area now covered in concrete, asphalt, and buildings. Grouped around the wetlands and riparian habitats would be many other public use facilities and amenities, including a water treatment facility.
County of Los Angeles Department of Public Works	Sun Valley Watershed Management Plan, 2003	Primary objective: solve the chronic local flooding problem with a multipurpose solution, acknowledging rainfall as a significant component of water supply. The Sun Valley Watershed Stakeholders Group has been meeting since late 1998 to address the flooding problem in Sun Valley under the leadership of the Watershed Management Division, County of Los Angeles Department of Public Works.
County of Los Angeles Department of Public Works	Sun Valley Watershed Park Project, 2002	Proposes to manage stormwater runoff via infiltration and remedy existing stormwater flooding issues in the vicinity of the park. The proposed project facilities are designed to capture flows generated by a 50-year storm, pre-treatment including settling and metals removal, all using below-ground facilities. Treated water would infiltrate into park grounds.

Table B-3. Upper Los Angeles River

Agency	Planning Document	Policies, Programs, and Projects
California Coastal Conservancy	Taylor Yard And The Los Angeles River Preliminary Groundwater And Surface Water Study, 2002	Documents the results of a preliminary groundwater and surface water study for the portion of the Los Angeles River along Taylor Yard in Los Angeles, California. Objectives: • evaluate the potential for offsite contribution to subsurface contamination of soil/groundwater; and • collect subsurface parameters to establish a baseline groundwater water flow model. First phase of the study is summarized in the Environmental Records Review, which includes an evaluation of the potential for offsite contribution to subsurface contamination at Taylor Yard. The second phase is summarized in Groundwater Model Presentation and Model Report, which includes results of a baseline MOD-FLOW groundwater model of the Taylor Yard site.
California Coastal Conservancy	Taylor Yard Multiple Objective Feasibility Study, Draft Report, 2002	Goal was to investigate possible flood management, habitat enhancement, parks, and recreational opportunities on 61 acres that were designated as railroad operating and maintenance facilities. Objectives related to flood control and water management included: • reviewing site historical development and existing conditions; • developing alternatives that provide a mixture of habitat types, recreational opportunities, and flood storage management; evaluating the environmental impacts; • estimating the construction cost for each alternative; • determining the number of restoration/flood storage improvement projects similar to Taylor Yard needed to obtain a significant improvement in flood storage along the Los Angeles River; and • to prepare recommendations for the Phase 2 study.
Los Angeles & San Gabriel Rivers Watershed Council	Water Augmentation Study Phase II Annual Monitoring Report, 2004	
Arroyo Seco Foundation	Water Budget for the Arroyo Seco Watershed, 2003	

Table B-3. Upper Los Angeles River

Agency	Planning Document	Policies, Programs, and Projects
California Regional Water Quality Control Board Los Angeles Region	Water Quality Control Plan Los Angeles Region: Basin Plan for the Coastal Watersheds of Los Angeles and Ventura Counties, 1994	The official water quality plan for the Los Angeles Basin, issued in 1994, designed to preserve and enhance water quality and protect the beneficial use of all regional waters. • Designates beneficial uses for surface and groundwaters, sets narrative and numerical objectives that must be attained or maintained to protect the designated beneficial uses and conform to state's anti-degradation policy. Describes implementation programs to protect all waters in the Region. • EPA "303d" list of impaired water bodies is updated every 3 years • As Total Maximum Daily Load (TMDL) criteria are announced, plan requirements are revised. • Excellent reference for characterization of surface and groundwater; beneficial use designations and impairments to these uses by water body or stream reach; and current regional water quality regulations.
California Coastal Conservancy	Wetlands of the Los Angeles River Watershed: Profiles and Restoration Opportunities, 2000	The strength of this report is its characterization of location, habitat, and water quality identified by specific project. It also has an excellent annotated bibliography of related resources. Describes restoration potential for the listed projects, but it does not attempt to scope the projects in terms of budget or construction.

Table B-4. Lower Los Angeles and San Gabriel Rivers

Agency	Planning Document
WRD	Water Replenishment District of Southern California
Los Angeles and San Gabriel Watershed Council	Water Augmentation Study
Main San Gabriel Watermaster Annual Report	Main San Gabriel Watermaster
U.S. Army Corps of Engineers, County of Los Angeles Dept. of Public Works	Los Angeles County Drainage Area Feasibility Study
RMC and SMMC	Common Ground from the Mountain to the Sea
California EPA, LKA Regional Water Quality Control Board	Watershed Management Initiative Chapter
County of Los Angeles Dept. of Public Works	San Gabriel River Corridor Master Plan
County of Los Angeles Dept. of Public Works	San Gabriel River Corridor Master Plan EIR
San Gabriel Mountains Regional Conservancy	Watershed Management Plan for the San Gabriel River Above Whittier Narrows
San Gabriel Mountains Regional Conservancy	Technical Report: Watershed Management Plan for the San Gabriel River Above Whittier Narrows
Rivers and Mountains Conservancy, San Gabriel Council of Governments	Rio Hondo Watershed Management Plan
County of Los Angeles Dept. of Public Works Summary of Coverage	Los Angeles River Master Plan
Metropolitan Water District of Southern California	Integrated Water Resources Plan, 2003
Los Angeles Regional Water Quality Control Board	Water Quality Control Plan: Los Angeles Region Basin Plan for the Coastal Watersheds of Los Angeles & Ventura County
Central Basin Municipal Water District	Urban Water Management Plan
SGVMWD	Urban Water Management Plan
USGVMWD	Urban Water Management Plan
Main San Gabriel Basin Watermaster	Five Year Water Quality Management Plan, Main San Gabriel Basin Watermaster
Three Valleys Water District	Three Valleys Water Management Plan
Orange County	OC Stormwater Program 2003 Drainage Area Management Plan
County of Los Angeles Dept. of Public Works to Regional Water Quality Control Board	County of Los Angeles Discharge Permits
City of Long Beach Dept. of Parks, Recreation, and Marine	Waste Discharge Requirements for Municipal Stormwater and Urban Runoff Discharges Within City of Long Beach
Sanitation District of Los Angeles County	Watershed-wide Monitoring Program for the San Gabriel River
U.S. Army Corps of Engineers and County of Los Angeles Dept. of Public Works	Hydraulic/Hydrologic Model of Los Angeles River and San Gabriel River Systems
State Coastal Conservancy	Southern California Wetlands Recovery Regional Strategy
California Coastal Conservancy	Wetlands of the Los Angeles River Watershed: Profiles and Restoration Opportunities

Table B-4. Lower Los Angeles and San Gabriel Rivers

Agency	Planning Document
U.S. Fish and Wildlife Service	Recovery Plan for the Arroyo Southwestern Toad
	Western Snowy Plover Pacific Coast Population Draft Recovery
	Recovery Plan for the Vernal Pools of Southern California
Amigos de Los Rios	Rio Hondo Vision Plan (Emerald Necklace Concept)
City of Los Angeles	Floodplain Management Plan
County of Los Angeles Dept. of Public Works	San Gabriel Canyon Sediment Management Plan: Draft Supplemental EIR
City of Long Beach Dept. of Parks, Recreation, and Marine	Long Beach Stormwater Management Plan
Los Angeles River Connection	The Los Angeles River: Reshaping the Urban Landscape
Vector Control District	Managing Mosquitoes in Stormwater Treatment Devices
Vector Control District	Managing Mosquitoes in Surface-Flow Constructed Treatment Wetlands
Independent Review	Toward a Sustainable Water Future: Water Supply and Management in the Los Angeles Area
County of Los Angeles Dept. of Public Works	Hydrology/Sedimentation Manual
Occidental College	Community and Ecological Revitalization
Orange County Watershed and Coastal Resources Division	Coyote and Carbon Canyon Creeks Watershed Feasibility Study
	DeForest Nature Center and Sixth Street Sites Wetland Feasibility Study: Summary Report

Table B-5. Upper San Gabriel and Rio Hondo River

Agency	Planning Document
San Gabriel Valley Municipal Water District	Urban Water Management Plan
Main San Gabriel Watermaster	Five-year Water Quality and Supply Plan
Los Angeles County Drainage Area Feasibility Study	Los Angeles County
Los Angeles Regional Water Quality Control Board	Water Quality Control Plan: Los Angeles Region Basin Plan for the Coastal Watersheds of Los Angeles & Ventura County
County of Los Angeles Dept. of Public Works	San Gabriel River Corridor Master Plan
County of Los Angeles Dept. of Public Works	San Gabriel River Corridor Master Plan EIR
Rivers and Mountains Conservancy, San Gabriel Council of Governments	Rio Hondo Watershed Management Plan
Metropolitan Water District of Southern California	Integrated Water Resources Plan, 2003, Update 2005
San Gabriel Valley Water Quality Authority	San Gabriel Basin Groundwater Quality Management and Remediation Plan
Amigos/ El Monte	Emerald Necklace Park Project
California State Polytechnic University Pomona, Graduate Department of Landscape Architecture-606 Studio, College of Environmental Design (June 2000)	Reconnecting the San Gabriel Valley: A Planning Approach for the Creation of Interconnected Urban Wildlife Corridor Networks
U.S. Army Corps of Engineers (July 2001)	Los Angeles and San Gabriel Rivers Watershed Feasibility Study
San Gabriel and Lower Los Angeles Rivers and Mountains Conservancy (RMC) and Santa Monica Mountains Conservancy (October 2001)	Common Ground: From the Mountains to the Sea
California State Polytechnic University Pomona, Graduate Department of Landscape Architecture-606 Studio, College of Environmental Design (June 2000)	San Gabriel Confluence Park: A River Based Urban Nature Network
USDA Forest Service-Angeles National Forest	Forest Master Plan Update v
U.S. Department of the Interior	San Gabriel River Watershed Special Resource Study
San Gabriel and Lower Los Angeles Rivers and Mountains Conservancy	Rivers/Tributaries Parkway Plan
San Gabriel Mountains Regional Conservancy	Watershed Management Plan for the San Gabriel River Above Whittier Narrows
San Gabriel Valley Council of Governments	Rio Hondo Watershed Management Plan
County of Orange, Public Facilities and Resources Department	Coyote and Carbon Creeks Watershed Management Plan
Upper San Gabriel Municipal Water District	San Gabriel River Watershed Non-Point Source Pollution Reduction Program
Southern California Coastal Water Research Project	Water Quality Assessment, Source Identification and Management Action Evaluation of the San Gabriel River
Los Angeles County Department of Public Works and California State Polytechnic University Pomona	Sediment Management Plan

APPENDIX C

Runoff Calculation Details

Table C-1. Landuse and Runoff Calculations

				Design Storm Runoff 0.75-in 24-hour storm			Annual Runoff (based on sub-regional rainfall averages)		
	SUM_ACRES	Sq Miles	Imp. (mi2)	Runoff (ac-ft)	Developed Runoff	% Dev/Area Dev (mi2)	Total Runoff (ac-ft)	Developed Runoff (ac-ft)	Undeveloped Runoff (ac-ft)
LANDUSE UPPER LOS ANGELES RIVER									
Agriculture	2183	3	0	14	0	46%	391		
Commercial and Services	17673	28	25	923	1	249	21,613		
Industrial	11468	18	16	593	1		13,891		
Mixed Commercial and Industrial	74	0	0	4	1		90		
Mixed Urban	33	0	0	1	1		24		
Open Space and Recreation	6945	11	1	61	1		1,422		
Residential	106491	166	83	3,328	1		77,890		
Transportation,Communication,Utilities	14412	23	11	450	1		10,542		
Under Construction(1993)	978	2	1	43	1		1,002		
Urban Vacant	1568	2	0	14	1		321		
Vacant	186173	291	0	1,164	0		33,304		
Water	995	2	0	21	0		495		
UNKNOWN	35	0	0	2	1		36		
Sub-region total		545	139	6,617	5,419		161,019	126,829	34,190
LANDUSE NORTH SANTA MONICA BAY									
Agriculture	1990	3	0	12	0	15%	326		
Commercial and Services	1746	3	3	91	1	30	2,394		
Industrial	231	0	0	12	1		314		
Mixed Commercial and Industrial	44	0	0	2	1		59		
No Data	22	0	0	1	1		18		
Open Space and Recreation	1995	3	0	17	1		458		
Residential	12994	20	10	406	1		10,655		
Transportation,Communication,Utilities	772	1	1	24	1		633		

				Design Storm Runoff 0.75-in 24-hour storm			Annual Runoff (based on sub-regional rainfall averages)		
	SUM_ACRES	Sq Miles	Imp. (mi2)	Runoff (ac-ft)	Developed Runoff	% Dev/Area Dev (mi2)	Total Runoff (ac-ft)	Developed Runoff (ac-ft)	Undeveloped Runoff (ac-ft)
Under Construction(1993)	886	1	1	39	1		1,017		
Urban Vacant	434	1	0	4	1		100		
Vacant	108076	169	0	675	0		17,724		
Water	476	1	0	10	0		265		
UNKNOWN	146	0	0	6	1		168		
Sub-region total		203	15	1,301	603		34,130	15,814	18,316
LANDUSE UPPER SAN GABRIEL & RIO HONDA RIVERS									
Agriculture	3602	6	0	23	0	41%	816		
Commercial and Services	20892	33	30	1,092	1	236	24,554		
Industrial	12511	20	18	647	1		14,563		
Mixed Commercial and Industrial	326	1	0	17	1		379		
Mixed Urban	48	0	0	1	1		34		
No Data	2	0	0	0	1		1		
Open Space and Recreation	10892	17	1	95	1		2,144		
Residential	91145	142	71	2,848	1		64,067		
Transportation,Communication,Utilities	11251	18	9	352	1		7,908		
Under Construction(1993)	838	1	1	37	1		824		
Urban Vacant	3129	5	0	27	1		616		
Vacant	209998	328	0	1,312	0		47,580		
Water	2754	4	1	59	0		1,317		
UNKNOWN	130	0	0	6	1		128		
Sub-region total		574	132	6,516	5,122		164,931	115,219	49,713
LANDUSE LOWER LOS ANGELES & SAN GABRIEL RIVERS									
Agriculture	2763	4	0	17	0	91%	320		
Commercial and Services	37203	58	53	1,944	1	358	35,974		

				Design Storm Runoff 0.75-in 24-hour storm			Annual Runoff (based on sub-regional rainfall averages)		
	SUM_ACRES	Sq Miles	Imp. (mi2)	Runoff (ac-ft)	Developed Runoff	% Dev/Area Dev (mi2)	Total Runoff (ac-ft)	Developed Runoff (ac-ft)	Undeveloped Runoff (ac-ft)
Industrial	32603	51	46	1,687	1		31,225		
Mixed Commercial and Industrial	315	0	0	16	1		302		
Mixed Urban	302	0	0	9	1		175		
Open Space and Recreation	10073	16	1	88	1		1,631		
Residential	128058	200	100	4,002	1		74,060		
Transportation,Communication,Utilities	17155	27	13	536	1		9,921		
Under Construction(1993)	519	1	1	23	1		421		
Urban Vacant	2921	5	0	26	1		473		
Vacant	18086	28	0	113	0		2,092		
Water	619	1	0	13	0		244		
UNKNOWN	114	0	0	5	1		92		
Sub-region total		392	216	8,480	8,336		156,929	154,274	2,655
LANDUSE SOUTH BAY									
Agriculture	1047	2	0	7	0	84%	138		
Commercial and Services	27780	43	40	1,452	1	278	30,540		
Industrial	19960	31	28	1,033	1		21,733		
Mixed Commercial and Industrial	179	0	0	9	1		194		
Mixed Urban	242	0	0	8	1		159		
Open Space and Recreation	8500	13	1	74	1		1,565		
Residential	105088	164	82	3,284	1		69,095		
Transportation,Communication,Utilities	12154	19	9	380	1		7,991		
Under Construction(1993)	764	1	1	33	1		704		
Urban Vacant	2975	5	0	26	1		548		
Vacant	30914	48	0	193	0		4,065		
Water	1233	2	1	26	0		551		
UNKNOWN	241	0	0	11	1		221		

				Design Storm Runoff 0.75-in 24-hour storm			Annual Runoff (based on sub-regional rainfall averages)		
	SUM_ACRES	Sq Miles	Imp. (mi2)	Runoff (ac-ft)	Developed Runoff	% Dev/Area Dev (mi2)	Total Runoff (ac-ft)	Developed Runoff (ac-ft)	Undeveloped Runoff (ac-ft)
Sub-region total		330	163	6,535	6,309		137,504	132,750	4,754
Region total		2044	665	29,449	25,789		654,514	544,887	109,627

Table C-2. Landuse, Percent Impervious, and Runoff Coefficients

Landuse	%imp[f]	C[e]
Agriculture	0.00	0.10
Commercial and Services	0.92	0.84
Industrial	0.91	0.83
Mixed Commercial and Industrial	0.91	0.83
Mixed Urban	0.50	0.50
Open Space and Recreation	0.05	0.14
Residential[a]	0.50	0.50
Transportation,Communication,Utilities[b]	0.50	0.50
Under Construction(1993)[c]	0.75	0.70
Urban Vacant	0.05	0.14
Vacant	0.00	0.10
Water	1.00	0.90
UNKNOWN	0.30	0.34
No Data	0.30	0.34

a assuming mixture of single family and multi-family
b freeway, local road, power line easement
c assuming land is stripped and ground compacted, no vegetation
d most likely to be tiny sliver of parcel
e C = 0.8 x (% imp) + 0.1 (LA County, Integrated Receiving Waters 1994-2000)
f Imperviousness interpreted from LA County, Dept of Public Works Hydrology Manual, App E-1 and F-1 (1991)

APPENDIX D

List of Step 1 Projects Identified by Sub Region

LIST OF STEP 1 PROJECTS IDENTIFIED BY SUB REGION

Table D-1. South Bay: Projects Planned for Short-Tem Implementation

Project Name	Lead Agency	Project Budget	Funds Requested	Flood Management	Stormwater Capture and Management	Water Quality Protection and Improvement	NPS Pollution Control	Water and Wastewater Treatment
JWPCP Marshland Enhancement	Sanitation Districts of Los Angeles County	$1,565,000	$500,000	X	X	X	X	
Large Landscape Conservation/Runoff Reduction Management Program	West Basin Metropolitan Water District	$3,755,250	$2,984,000			X	X	
16th Street Watershed Runoff	City of Santa Monica	$1,665,000	$830,000	X	X	X	X	X
Wilmington Drain Restoration Multiuse Project	LABOS WPD	$11,120,000	$10,000,000	X	X	X	X	
North Santa Monica Watershed Runoff–Stage One	LABOS WPD	$5,250,000	$4,725,000	X	X	X	X	
Dockweiler Watershed Runoff – Stage One	LABOS WPD	$2,100,000	$1,890,000	X	X	X	X	
Machado Lake Artificial Aeration & Circulation	City of Los Angeles, Department of Recreation and Parks	$95,300	$78,000			X	X	
Ozone Park Retrofit Runoff	City of Santa Monica	$1,145,000	$800,000	X	X	X	X	X
Freeway Runoff Infiltration	City of Santa Monica	$845,000	$600,000	X	X	X	X	
Madrona/PV Lateral	West Basin Metropolitan Water District	$27,402,787	$6,850,697			X		
Grand Blvd Trees Well	LABOS WPD	$420,000	$375,000	X	X	X	X	
Los Angeles Harbor Low Flow Diversion Program	LACFCD	$2,130,000	$1,038,725		X	X	X	
Peck Park Canyon	Los Angeles Neighborhood Initiative (LANI)	$2,554,653	$1,549,953	X	X	X		
Imperial Highway Sunken Median	LABOS WPD	$300,000	$270,000	X	X	X	X	
Culver City BMPs	City of Culver City	$1,612,000	$1,450,800	X	X	X	X	

Table D-1. South Bay: Projects Planned for Short-Tem Implementation

Project Name	Lead Agency	Project Budget	Funds Requested	Flood Management	Stormwater Capture and Management	Water Quality Protection and Improvement	NPS Pollution Control	Water and Wastewater Treatment
Stone Canyon Creek at UCLA	UCLA Institute of the Environment	$56,825	$44,325	X		X		
Lafayette Daylighting	LABOS WPD	$1,500,000	$1,350,000	X	X	X		
Goldsworthy Desalter	City of Torrance	$10,000,000	$4,750,000			X		
Lomita Integrated Storm to Vadose to Water Supply - Cypress Hill Reservoir	City of Lomita with WRD, West Basin Metropolitan Water District	$1,016,500	$906,500	X	X	X	X	X
Lomita Integrated Storm to Vadose to Water Supply - Oceanview Depression	City of Lomita with West Basin Metropolitan Water District	$951,000	$846,000	X	X	X	X	X
Ballona Bluff Vernal Pool Restoration	West Bluffs Conservancy	$5,235,000, plus $5,000,000 expected from other State funds	$50,000	X	X	X	X	
	SUBTOTALS	$80,719,315, plus $5,000,000 expected from other State Funds	$41,889,000					

Table D-2. South Bay: Projects with Long-Term goals, Not Ready to Proceed

Project Name	Lead Agency	Project Budget	Funds Requested	Watershed
Dominguez Channel Top Park	LACFCD	$6,240,000	$5,290,000	D
Memorial Park Runoff Treatment, Reuse & Infiltration Project	City of Santa Monica	$1,045,000	$700,000	SMB
South Santa Monica Watershed Runoff Treatment, Reuse, and Infiltration Project - Stage 1	LABOS WPD	$4,200,000	$3,780,000	SMB
Baldwin Hills to Ballona Trail BMPs (Baldwin Infiltration)	LABOS WPD	$3,200,000	$2,880,000	BC
Well No 7&8	City of Torrance	$9,923,000	$4,761,500	D
Mar Vista Park Retrofit	LABOS WPD	$9,100,000	$8,190,000	BC
Ballona Creek Street Retrofit	LABOS WPD	$300,000	$270,000	BC
Lomita Integrated Storm to Vadose to Water Supply - Robin Lane	City of Lomita with WRD, WBMWD	$971,500	$864,000	D
Lomita Integrated Storm to Vadose to Water Supply - Moon Ave School	City of Lomita with WRD, WBMWD	$860,500	$769,500	D
Lomita Integrated Storm to Vadose to Water Supply - Walnut Street	City of Lomita with WRD, WBMWD	$760,500	$679,000	D
Lomita Integrated Storm to Vadose to Water Supply - Lomita Park Subdivision	City of Lomita with WRD, WBMWD	$860,500	$769,500	D
Lomita Integrated Storm to Vadose to Water Supply - Madonna Subdivision	City of Lomita with WRD, WBMWD	$468,750	$417,750	D
Ballona Creek Disinfection	LABOS WPD	$4,000,000	$3,200,000	BC
	SUBTOTALS	$41,929,750	$32,571,250	

Table D-3. Upper Los Angeles River

Project Name	Lead Agency	Total Project Budget
Aliso - Limekiln Confluence	MRCA	$770,000
Arroyo Daylight	Los Angeles County Flood Control District	$1,280,000
Arroyo Seco Park	City of Los Angeles	$3,900,000
Arroyo Seco Alternative Stream	Los Angeles County Flood Control District	$6,400,000
Atwater Village	City of Los Angeles	$6,500,000
Bridge Stormwater Retrofit	City of Los Angeles Bureau of Engineering	
Burbank Greenway	Los Angeles County Flood Control District	$915,000
Confluence Park	City of Los Angeles	$1,600,000
Cornfields	City of Los Angeles	$19,800,000
Dorris Place	City of Los Angeles	$12,700,000
Downey Rec Center	City of Los Angeles	$404,000
Dry Canyon Creek	MRCA	$342,000
E SF Valley Greenway	City of Los Angeles	$16,500,000
Eastside Soccer Complex	City of Los Angeles	$78,500,000
Hansen Structural	Los Angeles County Flood Control District	$4,510,000
Hazard Park LAC	City of Los Angeles	$8,400,000
Hazard Park- NET	North East Trees	$208,620
Headworks LAC	City of Los Angeles	$5,100,000
Infiltration Demonstration	Los Angeles & San Gabriel Rivers Watershed Council	$7,360,000
Laguna Retention	Los Angeles County Flood Control District	$3,000,000
LAR Headwaters Phase 1	Los Angeles County Flood Control District	$7,292,000
LAR Headwaters Phase 2	Los Angeles County Flood Control District	$1,196,000
LAR Spreading Grounds Telemetry	Los Angeles County Flood Control District	$571,000
LAR Trash Rem	Los Angeles County Flood Control District	$7,640,000
Legion Lane Park	City of Los Angeles	$13,400,000
Los Feliz Bridge	City of Los Angeles	$2,000,000
Lower Tujunga Bikeway	City of Los Angeles	$14,100,000
Marsh Street Park	MRCA	$823,000
Montecito-Debs	City of Los Angeles	$6,900,000
Moorpark Park	City of Los Angeles	$3,300,000

Table D-3. Upper Los Angeles River

Project Name	Lead Agency	Total Project Budget
N Br Sycamore Daylighting I	City of Los Angeles	$2,000,000
Nichols Sediment	Los Angeles County Flood Control District	$1,390,000
North Atwater II	City of Los Angeles	$8,200,000
Pacoima - Parkside Drive	MRCA	$600,000
Pacoima - 8th Street Park	MRCA	$400,000
Plummer Street Restoration	MRCA	$720,000
River West Wetlands	City of Los Angeles	$6,100,000
Reseda Park	City of Los Angeles	$7,200,000
Rio Vista Blufftop	City of Los Angeles	$24,400,000
River Glen	City of Los Angeles	$4,500,000
Sepulveda Basin Wetlands	City of Los Angeles	$40,000,000
Sheldon Pit	Los Angeles County Flood Control District	$21,025,000
Silver Lake Res Replacement	Los Angeles Dept of Water and Power	$179,609,047
Strathern Pit	Los Angeles County Flood Control District	$20,730,000
Sun Val Mid School	Los Angeles County Flood Control District	$8,320,000
Sun Valley Powerline	Los Angeles County Flood Control District	$19,200,000
Taylor Yard	City of Los Angeles	$1,300,000
Tujunga Wash Restoration II	MRCA	$8,950,000
Valley Stream	Los Angeles County Flood Control District	$9,550,000
W SF Valley Greenway	City of Los Angeles	$3,600,000
Weddington Park	City of Los Angeles	$9,200,000
	SUBTOTALS	$612,405,667

Table D-4. Upper San Gabriel and Rio Hondo Rivers

Agency	Project Name	Project Description	Flood	WQPR	NPS	W & WW TR	Stormwater Management
San Gabriel Valley Municipal Water District	Spread Treated Water	Using MWD's Upper Feeder to spread treated imported water at the Sierra Madre and Eaton Spreading Grounds. Treated Replenishment Water costs less then full service MWD Treated Rate.		X			
	Capture of Additional Storm Runoff	Use recharge facilities (e.g. Santa Anita Dam) within the Raymond Basin to capture additional storm runoff. These activities could be coordinated with the current review to increase stormwater capture in the Eastern Unit of Raymond Basin					X
	Containment of Contamination of the LAWC	Cleanup Program operated within the Raymond Basin. Adjacent water purveyors such as the City of Pasadena could lease a portion of its Decreed Right to Lincoln Avenue Water Company (LAWC) and surplus water beyond LAWC's demand can then be made available to Pasadena or others in the area through interconnections		X	X		
	Small Recycled Water Systems at Schools and Shopping Centers	Retrofit schools and shopping centers by constructing underground storage facilities to capture runoff. All runoff can be channeled to underground storage facilities and pumped out for irrigation use. This will prevent runoff and trash and will decrease the need to purchase water.					X
	Capture of Additional Storm Runoff	Enhancement of recharge facilities (e.g. Santa Anita Dam) within the Raymond Basin to capture additional storm runoff. These activities could be coordinated with the current review to increase stormwater capture in the Eastern Unit of the Raymond Basin.	X	X	X	X	X
	Rubber Dams in Storm Channel	Installation of a series of small rubber dams to capture runoff in channels. The water stored can later be diverted to spreading basins for groundwater recharge.					
	Hanson Pi	Construct a rubber dam and concrete chute at Hanson Pit. Any stormwater or runoff can be put t into Hanson Pit and percolated for groundwater recharge					
	Divert Stormwater to Santa Gabriel River	Install diversion works and pipelines from storm channels to the Santa Fe Dam. Stored water in the Santa Fe Dam can be used further diverted to the San Gabriel River. Increase water in Santa Fe Dam and San Gabriel River will increase groundwater percolation and recharge.		X	X		X

Table D-4. Upper San Gabriel and Rio Hondo Rivers

Agency	Project Name	Project Description	Flood	WQPR	NPS	W & WW TR	Stormwater Management
San Gabriel Valley Municipal Water District	Rubber Dam below Santa Fe Dam and above Interstate 10	Install a rubber dam above the 10 Freeway to pond water for groundwater recharge. Water levels above the 10 Freeway in the San Gabriel River are low and increase the water levels will enhance percolation.		X	X		X
	Use of Water Hazardous at Golf Courses for Groundwater Recharge	Increase amount of water hazardous at golf courses for use as percolation basins. Water hazardous can store water for percolation and golf courses can use water for irrigation		X	X	X	X
County of Los Angeles Department of Public Works (LADPW)	Sediment Management Plan (Cogswell Reservoir)	Under the Sediment Management Plan, Cogswell Dam will be cleaned out about every 10 years via mechanical excavation. NEPA and CEQA reviews for the Sediment Management Plan were concluded in 1997 and 1998, respectively.	X	X			
West Fork Working Group	Long Term Management Plan: West Fork San Gabriel River	1989 plan that addresses West Fork management, including Cogswell Reservoir. Objectives include flood control, dam safety, water rights, fisheries optimization, recreation and land use management.	X	X			
U.S. Forest Service	Forest Master Plan Update	Updates to the Master Plans for the four southern National Forests address resource management, recreational access issues, habitat and other forest stakeholder concerns	X	X			
Azuza Canyon Off-Roaders Association (ACORA), California Off-Road Vehicle Association (CORVA), U.S. Forest Service	Off-Highway Vehicle Area Improvements	ACORA-proposed improvements to existing stream crossings and habitat restoration for the Santa Ana sucker to minimize impact from off-road vehicles while providing selected amenities for off-highway enthusiasts and other river visitors	X	X			
San Gabriel Mountains Regional Conservancy (SGMRC)	San Gabriel River Watershed Management Plan Above Whittier Narrows	Develop land use-based recommendations addressing water quality and supply, habitat, recreation and open space, and land and water stewardship opportunities in the Angeles National Forest and the lower urbanized sub-watersheds of San Jose and Walnut Creeks	X	X			
		SUBTOTALS	1	6	5	2	6

Table D-5. North Santa Monica Bay

Agency	Project Name	Project Description	Total Cost	Projected Funding Needs	Stormwater Management	Flood	WQ PR	NPS	W & WW TR
West Basin Municipal Water District	Large Landscape Conservation/ Runoff Reduction Management and Outreach Program	Through the installation and management of landscape weather-based irrigation controllers, an estimated 20%-50% of irrigated water will be conserved, thus reducing imported water needs. A major component of this program the development of "Ocean Friendly Garden" workshops designed to educate the public on water conservation and water quality.	$1,952,500	$1,757,000			X	X	
Las Virgenes Municipal Water District	Malibu Creek Watershed Urban Water Conservation and Runoff Reduction Project	Promotes indoor and outdoor water conservation by replacing low efficiency irrigation systems, clothes washers and toilets with more efficient systems.	$542,000	$271,000			X		
City of Malibu	Malibu Civic Center – Chili Cook-Off Land Acquisition	Proposed acquisition of 20 acres to improve water quality at Malibu Creek, Lagoon and Surfrider Beach by constructing vegetated retention basin/treatment wetland system and riparian habitat to tie in with City Stormwater Treatment Facility to increase disinfection of urban runoff nearly 10 times. Land also to be used for dispersal of Title 22 tertiary treated wastewater from a separate, offsite proposed centralized wastewater reclamation facility, which will replace aging onsite systems near the water bodies.	$25,350,000	$5,000,000	X	X	X	X	X
Las Virgenes Municipal Water District	Decker Canyon Recycled Water Line Extension	Extends recycled water service to golf course, replacing 200+ AF of imported water. Reduces nonnative flows and nutrient loading into Malibu Creek.	$7,550,000	$4,992,000			X		
Los Angeles County Flood Control District	Marie Canyon Stormwater Treatment Project	The completion of this project will improve the water quality of the Santa Monica Bay by ensuring that bacteria levels in dry and wet weather flows from Marie Canyon do not exceed the standards set within the Santa Monica Bay Beaches Wet-Weather Bacteria Total Maximum Daily Load. This goal will be achieved by constructing a multi-stage treatment system with ultra-violet (UV) disinfection.	$3,000,000	$2,675,000	X		X	X	
Santa Monica Bay Restoration Authority	North Santa Monica Bay Watersheds Onsite Wastewater Treatment System Improvement Grant Program	This program will provide grants to property owners to improve failing onsite wastewater treatment systems (septic systems) to comply with regulatory requirements.	$3,650,000	$3,250,000			X	X	X

Table D-5. North Santa Monica Bay

Agency	Project Name	Project Description	Total Cost	Projected Funding Needs	Stormwater Management	Flood	WQ PR	NPS	W & WW TR
Los Angeles County Flood Control District	Trancas Canyon Urban Runoff Biofiltration Project	The completion of this project will improve the water quality of the Santa Monica Bay and help protect an Area of Significant Biological Species from urban runoff. This goal will be achieved by constructing a series of approximately 30 catch basin biofiltration systems throughout an urbanized area to improve the quality of runoff being discharged to Trancas Canyon before it flows into the Bay	$1,680,000	$1,475,000	X		X	X	
Malibou Lake Mountain Club	Sewer and Road Project at Malibou Lake	Replacement of septic systems and connection of houses to sewer lines. Fosil Filters installed on stormwater outfalls to reduce runoff pollution.	$4,150,000	$3,440,000	X	X	X	X	X
City of Calabasas and Mountains Restoration Trust	Las Virgenes Creek Evaluation and Protection Study	The purpose of this study is to evaluate the health of Las Virgenes Creek and to develop opportunities for restoration.	$180,000	$150,000		X	X		
City of Westlake Village	City-wide Irrigation Controllers	Upgrade citywide irrigation system to produce a reduction in runoff and in total reclaimed water usage through the use of a central control station utilizing ET data and wireless technology	$310,000	$248,000			X	X	
City of Calabasas and Mountains Restoration Trust	Las Virgenes Creek Naturalization: Removal of Artificial Structures and Fish Barriers	One part of a larger creek restoration and rehabilitation vision. Improvement of canopy over stream, bio-engineering of stream banks to reduce erosion.	$990,000	$890,000			X		
National Park Service, Santa Monica Mountains National Recreation Area	Restoration of Southern Steelhead Habitat in Solstice Creek	Restoration of Southern Steelhead Habitat in Solstice Creek.	$238,366	$78,366		X	X	X	
City of Westlake Village	Triunfo Creek Trash Capture Screens	This project proposes to install a state-of-the-art trash capture device in this flood control channel at the "Foxfield Drain," a double box culvert that transmits the flows from the flood channel into the Lake. Trash, debris, oil/grease entering the Lake will be significantly reduced once the system is installed.	$62,000	$50,000			X	X	
		SUBTOTALS	$49,654,866	$24,276,366	4	4	13	9	3

Table D-6. Lower San Gabriel and Rio Hondo Rivers

Agency	Project Name	Project Description	Total Cost	Projected Funding Needs	Flood	WQ PR	NPS	W & WW TR	Stormwater Management
Central Basin Municipal Water District	Southeast Water Reliability Project, Phase 1 Water Recycling	Constructing a recycled water line from San Jose Creek WRP to distribute recycled water to users in Pico Rivera and Montebello	$15.2 M	$7.6 M		X		X	
Sanitation Districts of Los Angeles County	Whittier Narrows Water Reclamation Plant UV Disinfection Facilities	Modifying the process of tertiary treatment at the WNWRP from chloramination to UV disinfection	$6.6 M	$3.3 M		X		X	
City of El Monte/ Amigos de Los Rios	Peck Water Conservation Park	Enhancing Peck Park through an improved trails network, demonstration garden, native planting, improved access points, educational resources, etc.	$8.9 M	$8.0 M		X	X		
Los Angeles County Flood Control District	Morris Dam Water Supply Enhancement	Lower the operational pool behind Morris Dam by upgrading the dam's control structures to allow more water to be released for recharge at downstream spreading grounds	$12.8	$9.0 M	X	X			X
City of Long Beach Department of Parks, Recreation, and Marine	El Dorado Park Lakes Water Usage and Wetlands Restoration	Treating and utilizing reclaimed water for lakes, creating wetland habitat in detention basin, daylighting storm drain, native planting, etc.	$12.5	$11.2 M		X	X	X	X
Water Replenishment District	Whittier Narrows Conservation Pool	Increasing the water conservation pool behind Whittier Narrows Dam to conserve an additional 2,900 AF annually	$4.0 M	$3.6 M		X			X
LA/SG Rivers Watershed Council	Invasive Weed Control in Riparian Habitat	Arundo and exotic eradication at 4 locations in the San Gabriel Valley	$230,000	$200,000	X	X			
Central Basin Municipal Water District	Large Landscape Conservation / Runoff Reduction Management and Educational Program	Installing weather-based irrigation controllers at 500 locations in the watershed, establishing a rebate program, developing 5 demonstration gardens	$1.6 M	$1.2 M		X	X		
Sanitation Districts of Los Angeles County	Montebello Forebay Attenuation and Dilution Studies	Hydrogeologic studies examining the fate and transport of a disinfection byproduct, NDMA, as it mixes with surface and groundwater	$2.4 M	$1.2 M		X		X	
Los Angeles County Flood Control District	Full Capture Trash Removal Devices	Installing 2 full capture devices in Compton Creek watershed to comply with the LAR Trash TMDL	$3.6 M	$2.4 M		X	X		
		SUBTOTALS	$67.7 M	$47.7 M	2	10	4	4	3

APPENDIX E

Description of Major Dischargers within the Region

DESCRIPTION OF MAJOR DISCHARGERS WITHIN THE REGION

The following WRP descriptions were written based on information from the following websites: LA Sewers (http://www.ci.la.ca.us/SAN/lasewers/treatment_plants/about/index.htm); Sanitation Districts of Los Angeles County (http://www.lacsd.org/csdinfo.htm); Las Virgenes MWD (http://www.lvmwd.dst.ca.us/); and City of Burbank Public Works (http://www.ci.burbank.ca.us/PublicWorks/).

North Santa Monica Bay Watersheds

Tapia WRP is owned by TSD and LVMWD through a Joint Exercise of Powers Agreement, and serves residents living across 120 square miles of southeastern Ventura and western Los Angeles counties. Wastewater flows treated at Tapia currently average 7 million gallons per day (mgd). Tapia is capable of treating up to 16 mgd. The wastewater treatment process at Tapia duplicates and accelerates natural biological methods of cleaning wastewater. Advanced filtration and disinfection processes assure that the treated water meets the stringent water reuse standards and is environmentally safe for wildlife and vegetation. Tapia discharges to Malibu Creek from November 15 to April 15. Approximately 4 mgd of Tapia effluent is recycled.

Upper Los Angeles River Watershed

Tillman WRP was constructed in the San Fernando Valley's Sepulveda Basin. The Tillman Plant, named after the City Engineer, now retired, who conceived and developed the entire complex is located on a 90-acre site leased to the City by the U.S. Army Corps of Engineers for 50 years at a nominal cost of $100 per acre per year. The water reclamation process is permitted to treat up to 64 mgd and currently produces 52 mgd. Tillman discharges a portion of the treated effluent to the Los Angeles River and recycles approximately half of the current flow, or 25 mgd. Recycled water is distributed to Balboa Lake, the Wild Life Reserve, The Japanese Garden, Sepulveda Basin sprinkling system, and the Department of Water and Power pumping station.

Burbank WRP is a tertiary wastewater treatment plant that is permitted to treat 9 mgd and is currently treating about 6 mgd. The Burbank WRP was built in 1966 to meet the wastewater and sewer needs of the growing residential population and expanding commercial industries located in the City of Burbank. Before the WRP was built, the City of Burbank sent all of its wastewater to the City of Los Angeles for treatment and disposal. The plant was recently upgraded in 2000 to ensure that its meets new stringent regulations raising the quality of the cleaned wastewater it discharges after the treatment process. The plant was upgraded again in 2002 to remove ammonia from the wastewater. The Burbank WRP currently recycles about 1 mgd and discharges the remainder of the treated wastewater to the Los Angeles River, via the stormwater system.

Lower Los Angeles and San Gabriel River Watersheds

Los Coyotes WRP currently provides primary, secondary and tertiary treatment for 32 mgd and is permitted for up to 38 mgd. The plant serves a population of approximately 370,000 people. Approximately 27 mgd is currently discharged to the San Gabriel River. The remaining over 5 mgd of the purified water is recycled at over 200 sites. These include irrigation of schools, golf courses, parks, nurseries and greenbelts and industrial use at local companies for carpet dying and concrete mixing.

Whittier Narrows WRP was the first reclamation plant built by LACSD in 1962. It is permitted to provide primary, secondary and tertiary treatment for 15 mgd and currently treats 7 mgd. The plant serves a population of approximately 150,000 people. The bulk of the purified water is reused as groundwater recharge into the Rio Hondo and San Gabriel Coastal Spreading Grounds or for irrigation at an adjacent nursery.

Glendale WRP is strategically located to serve east San Fernando Valley communities that are both within and outside of the Los Angeles City limits. The plant's highly treated wastewater meets or exceeds the water quality standards for reclaimed water for irrigation and industrial processes. The plant is permitted for 15 mgd and currently operates at about 15 mgd. The Los Angeles-Glendale WRP currently recycles about 1 mgd and discharges the remainder of the reclaimed wastewater into the Los Angeles River. It is another regionally strategic facility within the City's overall wastewater system. By processing flows in the eastern San Fernando Valley, the plant is able to provide critical hydraulic relief to the City's major sewers downstream, which badly need the additional capacity to serve other portions of the City south of the Valley.

Long Beach WRP. The Long Beach WRP is designed to provide primary, secondary and tertiary treatment for 25 mgd and currently produces about 21 mgd. The plant serves a population of approximately 250,000 people. Almost 5 mgd of the purified water is reused at over 40 reuse sites, for irrigation of schools, golf courses, parks, greenbelts, and for re-pressurization of oil-bearing strata.

Upper San Gabriel River and Rio Hondo Watersheds

San Jose Creek WRP currently provides primary, secondary and tertiary treatment for 83 mgd and is permitted for up to 100 mgd. The plant serves a largely residential population of approximately one million people. Approximately 28 mgd of the purified water is reused at 17 different reuse sites. These include groundwater recharge and irrigation of parks, schools, and greenbelts. The remainder of the flow is discharged to San Jose Creek.

Pomona WRP currently provides primary, secondary and tertiary treatment for 9 mgd and is permitted for up to 15 mgd. The plant serves a population of approximately 130,000 people. Approximately 8 mgd of the purified water is reused at over 90 different reuse sites. Reuse includes irrigation of parks, schools, golf courses, landscaping and greenbelts, irrigation and dust control at the Spadra Landfill and industrial use by local paper manufacturers. The remainder of the purified water is put back into the San Jose Creek channel where it makes its way to the unlined portion of the San Gabriel River and much of the river water percolates into the groundwater.

Ocean Discharges

Hyperion Treatment Plant is the City's oldest and largest wastewater treatment facility. It is permitted to treat up to 450 mgd and currently produces 350 mgd, with about 21 mgd that is recycled. The plant has been operating since 1894. The plant has been expanded and improved numerous times over the last 100+ years. Today, leading edge technological innovations capitalize upon the opportunity to recover wastewater bio-resources that are used for energy generation and agricultural applications. In addition, air emission controls and odor management facilities are integrated in all improvements. More of these forward thinking strategies will become realities at Hyperion in the coming years to better protect our coastal environment and serve our communities.

Terminal Island Treatment Plant/Advanced Water Treatment Facilities are located 20 miles south of downtown Los Angeles in San Pedro and are permitted to treat 30 mgd. The plant currently treats about 16 mgd of wastewater from over 130,000 people and 100 businesses in the heavily industrialized Los Angeles Harbor area, including the communities of Wilmington, San Pedro, and a portion of Harbor City. The plant has recently become the third Los Angeles wastewater treatment plant to produce recyclable water and one of the few plants in the country that produce water using reverse osmosis. This exceptional quality water will soon be used as a potable water replacement in Harbor area industrial applications and as a barrier against seawater intrusion. The facilities currently recycle about 4 mgd. The plant also produces biosolids and biogas for beneficial reuse.

The Joint Water Pollution Control Plant (JWPCP) is the largest of the Los Angeles County Districts' wastewater treatment plants. It is permitted and currently provides advanced primary and partial secondary

treatment for about 320 mgd. The plant serves a population of approximately 3 1/2 million people. The treated wastewater is disinfected with chlorine and sent to the Pacific Ocean through a network of outfalls that extends two miles off the Palos Verdes Peninsula to a depth of 200 feet.